E: 5161.01.3.4.8

ESTES LANDFILL RI/FS
REMEDIAL INVESTIGATION REPORT

PART II

Volume V of V
Appendix L - P

Prepared for
Arizona Department of Environmental Quality

By

Environmental Science & Engineering, Inc.
A MACTEC COMPANY

APPENDIX M-1 **DATA VALIDATION ACCURACY, SENSITIVITY, & HOLDING TIMES RESULTS; LANDFILL SOIL BORING SAMPLES ESTES LANDFILL, PHOENIX, ARIZONA**

	ACCURACY								SENSITIVITY								HOLDING TIMES							
SAMPLE ID	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC
LABORATORY SAMPLE BATCH PIE00103 TO PIE00110																								
QST-B2-S/8	X	O	X	X	O	X	X	NA	O	O	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B2-S/65	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B3-S/45	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B3-S/75	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
TRIP BLANK B2	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
TRIP BLANK B3	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
LABORATORY SAMPLE BATCH PIE00761 TO PIE00772																								
QST-B8-S/45	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B8-S/35	O	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B7-S/55	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
QST-B7-S/37	O	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B33-GW/65 (RINSATE)	X	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
TRIP BLANK B8	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
TRIP BLANK B7	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
TRIP BLANK B33	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LABORATORY SAMPLE BATCH PIE01672 TO PIE01675																								
QST-B50-GW/45 (RINSATE)	X	X	X	X	X	X	X	NA	O	X	O	X	X	X	X	NA	X	X	X	X	X	X	X	NA
EW-24-S/40	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
EW-24-S/50	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
LABORATORY SAMPLE BATCH PIE01492 TO PIE01495																								
EW-26-S/40	X	NA	NA	NA	NA	NA	NA	X	O	NA	NA	NA	NA	NA	NA	X	X	NA	NA	NA	NA	NA	NA	X
EW-26-S/50	X	NA	NA	NA	NA	NA	NA	X	O	NA	NA	NA	NA	NA	NA	X	X	NA	NA	NA	NA	NA	NA	X
EW-25-S/35	X	X	X	X	X	O	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
EW-25/S-45	X	X	X	X	X	O	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

NOTES

X	Within acceptable range	OCP	Organochlorine Pesticides
O	Outside acceptable range	PCB	Polychlorinated Biphenyls
DUP	Field Duplicate	OPP	Organophosphorus Pesticides
VOC	Volatile Organic Compound	CH	Chlorinated Herbicides
SVOC	Semi-Volatile Organic Compound	TOC	Total Organic Carbon
MET	Total Metals		

APPENDIX M-1 **DATA VALIDATION ACCURACY, SENSITIVITY, & HOLDING TIMES RESULTS; LANDFILL SOIL BORING SAMPLES**
ESTES LANDFILL, PHOENIX, ARIZONA

	ACCURACY								SENSITIVITY								HOLDING TIMES							
SAMPLE ID	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC
LABORATORY SAMPLE BATCH PIE00259 TO PIE00263																								
QST-B5-S/20	X	X	X	O	O	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B5-S/43	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B6-S/36	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B6-S/55	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
LABORATORY SAMPLE BATCH PIE00322 TO PIE00327																								
QST-B14-S/50	O	O	X	O	O	X	X	NA	O	X	O	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B14-S/76	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B15-S/39	X	X	X	O	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B15-S/66	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA
LABORATORY SAMPLE BATCH PIE00350 TO PIE00354																								
QST-B17-S/15	X	O	X	O	O	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B17-S/65	X	O	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B16-S/26	X	O	X	O	O	X	X	NA	O	O	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B16-S/30 (DUPLICATE)	X	O	X	O	O	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B16-S/75	X	O	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
LABORATORY SAMPLE BATCH PIE00391 TO PIE00400																								
QST-B19-S/40	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B19-S/70	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
FIELD BLANK	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
QST-B18-S/40	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA
QST-B18-S/74	X	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
FIELD BLANK/B19	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	X	X	NA	O	X	X	X	X	X	X	NA	X	X	X	X	X	X	X	NA

NOTES

X	Within acceptable range	OCP	Organochlorine Pesticides
O	Outside acceptable range	PCB	Polychlorinated Biphenyls
DUP	Field Duplicate	OPP	Organophosphorus Pesticides
VOC	Volatile Organic Compound	CH	Chlorinated Herbicides
SVOC	Semi-Volatile Organic Compound	TOC	Total Organic Carbon
MET	Total Metals		

APPENDIX M-2 DATA VALIDATION PERCISION RESULTS; LANDFILL SOIL BORING SAMPLES ESTES LANDFILL, PHOENIX, ARIZONA

	PERCISION ANALYSES (RPD GOAL < 30%)							
SAMPLE ID	4,4-DDE	Chlorobenzene	1,4-DCB	Naphthalene	Fluoranthene	Barium	Cadmium	Chromium
QST-B16-S/26	93.00	240.00	200.00	690.00	4,400.00	95.00	2.90	26.00
QST-B16-S/30 DUP	50.00	100.00	140.00	320.00	2,400.00	85.00	2.00	20.00
RPD (%)	60	82	35	73	59	11	37	26

	PERCISION ANALYSES (RPD GOAL < 30%)						
SAMPLE ID	Copper	Lead	Manganese	Mercury	Nickle	Thallium	Zinc
QST-B16-S/26	99.00	78.00	240.00	0.29	29.00	5.50	200.00
QST-B16-S/30 DUP	40.00	30.00	190.00	0.40	15.00	5.00	260.00
RPD (%)	85	89	23	32	64	10	26

NOTES RPD Relative Percent Difference
DUP Duplicate

APPENDIX M-3 **RESULTS OF BLANK (REPRESENTATIVENESS) ANALYSES, LANDFILL SOIL BORING S ESTES LANDFILL, PHOENIX, ARIZONA**

ANALYTICAL BATCH IDENTIFICATION	TRIP BLANKS	RINSATE BLANKS	FIELD BLANKS	METHOD BLANKS
PIE00103 - PIE00110	ND	NA	NA	ND
PIE00761 - PIE00772	ND	D (VOC)	NA	ND
PIE01672 - PIE01675	ND	D (VOC)	NA	ND
PIE01492 - PIE01495	NA	NA	NA	ND
PIE00259 - PIE00263	ND	NA	NA	ND
PIE00322 - PIE00327	ND	NA	NA	ND
PIE00350 - PIE00354	NA	NA	NA	ND
PIE00391 - PIE00400	ND	NA	D (VOC)	ND

NOTES:

NA	Not Analyzed
ND	Below Method Detection Limit
D	Constituent(s) Detected

APPENDIX M-4 **RESULTS OF COMPARABILITY ANALYSES, LANDFILL SOIL BORING SAMPLES, ESTES LANDFILL, PHOENIX, ARIZONA**

ANALYTICAL BATCH IDENTIFICATION	DAILY FIELD LOGS	CHAIN-OF-CUSTODY	ANALYTICAL METHODS
PIE00103 - PIE00110	Yes	Yes	Yes
PIE00761 - PIE00772	Yes	Yes	Yes
PIE01672 - PIE01675	Yes	Yes	Yes
PIE01492 - PIE01495	Yes	Yes	Yes
PIE00259 - PIE00263	Yes	Yes	Yes
PIE00322 - PIE00327	Yes	Yes	Yes
PIE00350 - PIE00354	Yes	Yes	Yes
PIE00391 - PIE00400	Yes	Yes	Yes

NOTES:

Yes	Compare w/analytical standards
No	Does not compare to appropriate analytical standards

APPENDIX M-5

DATA VALIDATION ACCURACY, SENSITIVITY, & HOLDING TIMES RESULTS; GROUNDWATER SAMPLES
ESTES LANDFILL, PHOENIX, ARIZONA

SAMPLE ID	ACCURACY														SENSITIVITY								
	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC	CNS	ALK	MEE	S	CD	DOC	VOC	SVOC	MET	OCP	PCB	OPP	CH	TOC	CNS
LABORATORY SAMPLE BATCH PIF00940 TO PIF0094																							
EW-4-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-22-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-8-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	O	O	X	X	X	NA	X	X	NA	X	O	O	X	O	O	X	X	X	X
LABORATORY SAMPLE BATCH PIF01002 TO PIF0100																							
EW-5-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-30-GW (RINSATE)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-31-GW (DUPLICATE)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	O	X	X	X	NA	X	X	NA	X	O	O	X	O	O	X	X	X	X
LABORATORY SAMPLE BATCH PIF01040 TO PIF0104																							
EW-19-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	O	O	X	X	NA	X	X	NA	X	O	O	X	O	O	X	X	X	X
LABORATORY SAMPLE BATCH PIF01088 TO PIF0109																							
EW-26-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-32GW (RINSATE)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	O	O	X	X	NA	X	X	NA	X	O	O	X	O	O	X	X	X	X
LABORATORY SAMPLE BATCH PIF01201 TO PIF0120																							
EW-33-GW (DUPLICATE)	X	X	X	X	X	O	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-15-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	O	X	X	X	NA	X	X	NA	X	O	O	X	O	O	X	X	X	X
LABORATORY SAMPLE BATCH PIF01217 TO PIF0121																							
EW-PZ1-GW	X	X	X	X	X	O	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-34-GW (RINSATE)	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	X	O	X	X	X	NA	X	X	NA	X	O	O	X	O	O	X	X	X	X
LABORATORY SAMPLE BATCH PIF01461 TO PIF0146																							
EW-E-GW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	X	X	X
TRIP BLANK	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
EW-40-GW (RINSATE)	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	O	NA	NA	NA	NA	NA	NA	NA	NA
LAB BLANKS & SPIKES	X	X	X	X	O	X	X	X	X	NA	X	X	NA	X	O	O	X	O	O	X	X	X	X

NOTES

X	Within acceptable range	OCP	Organochlorine Pesticides	ALK	Total & Bicarbonate Alkalinity
O	Outside acceptable range	PCB	Polychlorinated Biphenyls	MEE	Dissolved Methane, Ethane, & Et
DUP	Field Duplicate	OPP	Organophosphorus Pesticides	S	Sulfide
VOC	Volatile Organic Compound	CH	Chlorinated Herbicides	CD	Carbon Dioxide
SVOC	Semi-Volatile Organic Compound	TOC	Total Organic Carbon	DOC	Dissolved Organic Carbon
MET	Total Metals	CNN	Chloride, Nitrate/Nitrite, Sulfate		

APPENDIX M-6 DATA VALIDATION PERCISION RESULTS; GROUNDWATER SAMPLES
ESTES LANDFILL, PHOENIX, ARIZONA

	PERCISION ANALYSES (RPD GOAL < 30%)								
SAMPLE ID	Benzene	Chlorobenzene	1,2-DCB	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Barium	Manganese	Alkalinity
EW-5-GW	2.50	26.00	26.00	120.00	2.90	230.00	0.61	3.30	430.00
EW-31-GW (DUP)	2.50	22.00	25.00	110.00	2.70	270.00	0.61	3.30	430.00
RPD (%)	0	17	4	9	7	16	0	0	0

	PERCISION ANALYSES (RPD GOAL < 30%)								
SAMPLE ID	Bi-Alkalinity	Carbon Dioxid	Chloride	Sulfate	D Methane	D Ethene	TKN	DOC	TOC
EW-5-GW	430.00	55.00	140.00	70.00	0.24	0.011	6.70	3.70	4.20
EW-31-GW (DUP)	430.00	95.00	150.00	69.00	0.31	0.012	9.50	3.90	4.30
RPD (%)	0	53	7	1	25	9	35	5	2

	PERCISION ANALYSES (RPD GOAL < 30%)									
SAMPLE ID	Chlorobenzene	1,2-DCB	cis-1,2-DCE	trans-1,2-DCE	Vinyl Chloride	Vinyl Chloride	Barium	Manganese	Alkalinity	Bi-Alkalinity
EW-15-GW	5.60	16.00	120.00	2.80	100.00	230.00	0.058	0.051	280.00	280.00
EW-33-GW (DUP)	6.10	18.00	160.00	3.30	120.00	270.00	0.063	0.05	290.00	290.00
RPD (%)	9	12	29	16	18	16	8	2	4	4

	PERCISION ANALYSES (RPD GOAL < 30%)								
SAMPLE ID	Carbon Dioxid	Chloride	Nitrate	Nitrate/Nitrite	Sulfate	TKN	DOC	D Methane	D Ethene
EW-15-GW	9.70	210.00	1.10	1.10	73.000	2.20	1.30	0.038	0.011
EW-33-GW (DUP)	17.00	220.00	1.50	1.50	73.000	2.80	1.30	0.041	0.0025
RPD (%)	55	5	31	31	0	24	0	8	126

NOTES

RPD	Relative Percent Difference	1,2-DCB	1,2-Dichlorobenzene
DUP	Duplicate	cis-1,2,-DCE	cis-1,2-Dichloroethene
TKN	Total Kjeldahl Nitrogen	trans-1,20DCE	trans-1,2-Dichloroethene
TOC	Total Organic Carbon		

APPENDIX M-7 **RESULTS OF BLANK (REPRESENTATIVENESS) ANALYSES, GROUNDWATER SAMPLE ESTES LANDFILL, PHOENIX, ARIZONA**

ANALYTICAL BATCH IDENTIFICATION	TRIP BLANKS	RINSATE BLANKS	FIELD BLANKS	METHOD BLANKS
PIF00940 - PIF00943	ND	NA	NA	ND
PIF01002 - PIF01007	ND	D (VOC & OTHERS)	NA	ND
PIF01040 - PIF01041	ND	NA	NA	ND
PIF01088 - PIF01091	ND	D (VOC & OTHERS)	NA	ND
PIF01201 - PIF01204	ND	NA	NA	ND
PIF01217 - PIF01219	ND	D (VOC)	NA	ND
PIF01461 - PIF01463	ND	ND	NA	ND

NOTES:

NA	Not Analyzed
ND	Below Method Detection Limit
D	Constituent(s) Detected

APPENDIX M-8 **RESULTS OF COMPARABILITY ANALYSES, GROUNDWATER SAMPLES, ESTES LANDFILL, PHOENIX, ARIZONA**

ANALYTICAL BATCH IDENTIFICATION	DAILY FIELD LOGS	CHAIN-OF-CUSTODY	ANALYTICAL METHODS
PIF00940 - PIF00943	Yes	Yes	Yes
PIF01002 - PIF01007	Yes	Yes	Yes
PIF01040 - PIF01041	Yes	Yes	Yes
PIF01088 - PIF01091	Yes	Yes	Yes
PIF01201 - PIF01204	Yes	Yes	Yes
PIF01217 - PIF01219	Yes	Yes	Yes
PIF01461 - PIF01463	Yes	Yes	Yes

NOTES:

Yes	Compare w/analytical standards
No	Does not compare to appropriate analytical standards

APPENDIX M-9 EVALUATION OF PERFORMANCE EVALUATION SAMPLES, ESTES LANDFILL, PHOENIX, ARIZONA

ANALYTICAL PARAMETER	ANALYTICAL METHOD	SPIKED CONCENTRATION (ug/l)	LABORATORY RESULTS (ug/l)	PERFORMANCE ACCEPTANCE LIMITS	RELATIVE PERCENT DIFFERENCE
Trichloroethene	8260	6.98	***4.3***	5.18 - 8.45	47.52
Cis 1,2,-Dichloroethene	"	15	9.6	9.21 - 20.5	43.90
Vinyl Chloride	"	45	30	27 - 63	40
Arsenic	6010B	70	58	52.5 - 82.6	18.75
Chromium	"	125	120	102 - 148	4.08
Pentachlorophenol	8270	14.5	***Detection limit too high***	4.51 - 18.2	Not applicable
Arcolor 1254	8082	2.61	2.9	1.56 - 3.28	10.53
Endosulfan	8081A	20.2	***0.1***	9.1 - 31.0	198.03
4,4'-DDE	"	15.4	***0.1***	8.95 - 19.2	197.42
Toxaphene	"	10	***4***	4.12 - 12.6	85.71
Dimethoate	8141A	7.95	***0.5***	Not Available	176.33
Fensulfothion	"	35.4	***2.5***	21.2 - 45.3	173.61
Chlorpyrifos	"	1.89	***0.5***	1.65 - 2.08	116.32

NOTES: Results in "Bold" exceeds performance acceptance limits.

Appendix _
Calculation of Retardation Factors for Vinyl Chloride, Cis-1,2-DCE and Trichloroethene in Units F1/F3 and F4

Fraction Organic Carbon Content (F_{oc})

Stratigraphic Unit	Average f_{oc} Content [(1)]
F-1/F-3	0.0017
F4	0.0009[(2)]

(1) F_{oc} values calculated from TOC analyses, June 1999.
(2) F_{oc} values <0.001 invalid for calculating retardation factor as other sorption processes predominate (i.e., sorption to mineral sites) at low organic carbon content (Karickhoff et al., 1979). Therefore, a retardation factor for Unit F4 was not calculated.

Retardation Factor (R_d)

$$R_d = 1 + \left[\frac{\rho_b + K_{oc} + f_{oc}}{\theta}\right]$$

where:
ρ_b = soil bulk density [g/cm^3]
K_{oc} = soil sorption coefficient [ml/g]
F_{oc} = fraction soil organic carbon
θ = soil porosity

Assumptions
1) Soil bulk density (ρ_b) of 2.65 g/cm^3 (Freeze and Cherry, 1979)
2) Soil sorption coefficient (K_{oc}): vinyl chloride = 2.45; cis-1,2-DCE = 49; TCE = 137 (USEPA, 1998)
3) Soil porosity (θ) = 0.3 (Freeze and Cherry, 1979)

Calculations

$$R_{d_{TCE}} = 1 + \left[\frac{(2.65)(0.0017)(137)}{(0.3)}\right] = 3.05$$

$$R_{d_{VC}} = 1 + \left[\frac{(2.65)(0.0017)(2.45)}{(0.3)}\right] = 1.04$$

$$R_{d_{cis-DCE}} = 1 + \left[\frac{(2.65)(0.0017)(49)}{(0.3)}\right] = 1.74$$

Contaminant Transport Velocity

Contaminant transport velocity (v_c) taking into consideration retardation factor is given by:

$$v_c = \frac{v_x}{R_d}$$

where:
v_c = retarded contaminant transport velocity
v_x = groundwater velocity due to advection

Advective groundwater velocity

$$v_x = -K\frac{\Delta h}{\Delta l}$$

where:
K = hydraulic conductivity
$\Delta h/\Delta l$ = hydraulic gradient

Assumptions:

1) Hydraulic conductivity of F1/F3 assumed to be 2.6 x 10^{-2} cm/s (7.3 x 10^3 ft/day) (HLA, 1997).
2) Representative mean hydraulic gradients calculated from low flow conditions: 0.008 ft/ft.

Calculations

Advective Groundwater Velocity

$$v_x = 7.3x10^3\ {}^{ft}/_{d}\,(0.008) = 58.4\ {}^{ft}/_{d}$$

Retarded Contaminant Transport Velocity

$$v_{cTCE} = \frac{58.4\ {}^{ft}/_{d}}{3.05} = 19.1\ ft/d$$

$$v_{cVC} = \frac{58.4\ {}^{ft}/_{d}}{1.04} = 56.2\ ft/d$$

$$v_{c\,cis\text{-}DCE} = \frac{58.4\ {}^{ft}/_{d}}{1.74} = 33.6\ ft/d$$

References

Freeze, R. A. and J. A. Cherry, 1979, Groundwater, Prentice-Hall Inc., 553 p.

Karickhoff, S., D. S. Brown and T. A. Scott, 1979. Sorption of Hydrophobic Pollutants on Natural Sediments, *Water Research*, 13: 241-248.

United States Environmental Protection Agency (USEPA), 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, EPA/600/R-98/128.

Human Health Risk Assessment
Estes Landfill
Phoenix, Arizona

Prepared for

City of Phoenix
Aviation Department
3400 Sky Harbor Boulevard
Phoenix, Arizona 85034-4420

HLA Project No. 32036 1.10

Richard Pesin, M.P.H.
Senior Toxicologist

Donald P. Hanson, R.G.
Associate Hydrogeologist

Teri Copeland, M.S.
Principal Toxicologistst

December 19, 1995

Harding Lawson Associates
Engineering and Environmental Services
30 Corporate Park, Suite 400
Irvine, CA 92714 - (714) 260-1800

CONTENTS

1.0 INTRODUCTION 1

2.0 SITE HISTORY AND CHARACTERIZATION 4
2.1 Site Description 4
2.2 Site History 4
2.3 Site Characterization 6
2.3.1 Hydrogeologic Characterization 6
2.3.2 Surface Soil Characterization 7
2.3.3 Soil Gas Characterization 7
2.3.4 Characterization of Chemical Concentrations in Groundwater 8

3.0 HAZARD IDENTIFICATION 9
3.1 Chemicals of Concern in Onsite Soils 9
3.2 Chemicals of Concern in Onsite Soil Gas 9
3.3 Chemicals of Concern in Onsite Groundwater 10
3.4 Chemicals of Concern in Offsite Groundwater 10
3.4.1 Selection of VOCs as Chemicals of Concern in Offsite Groundwater 11
3.4.2 Selection of Metals as Chemicals of Concern in Offsite Groundwater 11
3.4.3 Selection of Chemicals of Concern for the Bradley Production Well 11

4.0 TOXICITY ASSESSMENT 12
4.1 Noncancer Health Effects 12
4.2 Cancer Risk 12

5.0 EXPOSURE ASSESSMENT 15
5.1 Potential Exposure Scenarios 15
5.1.1 Current Potential Onsite Exposure 15
5.1.2 Current Potential Offsite Exposure 15
5.1.3 Potential Future Onsite Exposure 16
5.1.4 Potential Future Offsite Exposure 17
5.2 Exposure Pathways 17
5.2.1 Soil 18
5.2.2 Air 18
5.2.3 Groundwater 18
5.3 Dose Equations 19
5.3.1 Vapor Inhalation 20
5.3.2 Groundwater Ingestion 20
5.4 Deterministic Dose Estimates 21
5.4.1 Exposure Concentrations 21
5.4.2 Exposure Parameters 23
5.5 Probabilistic Dose Estimates 25
5.5.1 Groundwater Exposure Concentrations 26
5.5.2 Exposure Parameter Distributions 26
5.5.3 Model Runs 28

6.0 RISK CHARACTERIZATION 29
6.1 Noncancer Hazard 29
6.1.1 Potential Future Onsite Worker 29
6.1.2 Bradley Worker 30
6.1.3 Potential Future Offsite Worker 30

6.2 Cancer Risk 30
6.2.1 Potential Future Onsite Worker 31
6.2.2 Bradley Landfill Worker 31
6.3 Acceptable Risk 32
6.4 Conservatism in the Risk Assessment 33

7.0 REFERENCES 36

TABLES

1 Summary of Surface Soil Data
2 Selection Chemicals of Concern - Onsite Soil Gas
3 Selection of Chemicals of Concern - VOCs in Offsite Groundwater
4 Selection of Chemicals of Concern - Metals in Offsite Groundwater
5 Selection of Chemicals of Concern - Bradley Production Well
6 Toxicity Criteria for Chemicals of Concern
7 Deterministic Exposure Parameters for Future Onsite Worker and Bradley Landfill Worker
8 Deterministic Exposure Parameters for Future Offsite Worker
9 Representative Groundwater Concentrations to Evaluate Drinking Water Exposures to Offsite Workers
10 Estimated Air Concentrations - Future Onsite Worker
11 Representative Groundwater Concentrations - Bradley Worker
12 Estimated Air Concentrations - Bradley Worker
13 Exposure Parameter Distributions Used in Probabilistic Risk Assessment
14 Non-Cancer Hazard Summary for Average and RME Onsite Worker From Inhalation Exposure
15 Non-Cancer Hazard Summary for Average and RME Bradley Landfill Worker from Inhalation Exposure
16 Non-Cancer Hazard Summary for Average and RME Offsite Worker from Groundwater Ingestion
17 Cancer Risk Summary for Average and RME Onsite Worker from Inhalation Exposure
18 Cancer Risk Summary for Average and RME Bradley Landfill Worker from Inhalation Exposure
19 Cancer Risk Summary for Average and RME Offsite Worker from Groundwater Ingestion
20 Probabilistic Cancer Risk Estimates for the Future Offsite Worker

PLATES

1 Vicinity Map
2 Site Map with Groundwater Monitoring Locations

APPENDICES

A SOIL GAS DATA FROM PHASE I AND PHASE II INVESTIGATIONS
B ESTIMATION OF AIR CONCENTRATIONS FOR A FUTURE ONSITE WORKER FROM SOIL GAS DATA
C ESTIMATION OF AIR CONCENTRATIONS FOR BRADLEY WORKER BASED ON VOLATILIZATION OF GROUNDWATER
D SPREADSHEETS FOR DOSE ESTIMATES AND RISK CHARACTERIZATION
E PROBABILISTIC ASSESSMENT

DISTRIBUTION

1.0 INTRODUCTION

This baseline health risk assessment for the Estes Landfill has been prepared by Harding Lawson Associates (HLA) on behalf of the City of Phoenix (the City) and Bank One, N.A. The Estes Landfill (the Site), which is located in Phoenix, Arizona, consists of a former privately-owned landfill used by commercial trash haulers, septic tank haulers, and other users. Currently, the Site is vacant. The purpose of the risk assessment (RA) is to assess the nature and extent of potential human health risks associated with current conditions and future uses of the Site and adjacent areas.

The risk assessment has been prepared in a manner consistent with EPA's Risk Assessment Guidance for Superfund, Volume I (EPA, 1989a), and uses a very conservative approach to provide a large margin of safety in the estimation of potential human health risks. The Arizona Department of Health Services (ADHS) has also conducted a risk assessment for the Site as a component of the remedial investigation/feasibility study (RI/FS). A baseline RA is a multidisciplinary data interpretation tool used to evaluate potential threats to human health and the environment that may result from chemical releases. RAs generally proceed through a four-step process: hazard identification, toxicity assessment, exposure assessment, and risk characterization. In the hazard identification step, potentially toxic substances present at a site are identified as chemicals of potential concern. This step includes evaluation of site data, identification of toxic chemicals, and comparison of site concentrations with background (non-site related) concentrations. Following the identification of chemicals of potential concern, the subsequent steps of the RA evaluate whether the identified chemicals pose a potential health concern under reasonable potential exposure scenarios.

The second step of the RA is the toxicity assessment. In this step, the relationship between chemical dose (i.e., the amount of chemical absorbed in the body) and a specific health effect is characterized. The toxicity assessment considers (1) the types of adverse health effects associated with chemical exposure, (2) the relationship between the magnitude of exposure and adverse effects, and (3) related uncertainties (such as the weight of evidence that a particular chemical causes cancer in humans).

The third step, exposure assessment, is the process of estimating the frequency and duration of human exposure to a chemical currently present in the environment and/or estimating hypothetical exposures that might result from future site conditions. Conducting an exposure assessment involves identifying potentially exposed populations (e.g., future onsite and present and future offsite workers) and all reasonable potential pathways of exposure (e.g., ingestion and inhalation), estimating potential exposure concentrations based on sampling data and/or predictive chemical modeling, and estimating potential

chemical intake (dose) for each exposure pathway. By estimating potential chemical dose, the risk assessor can evaluate the possibility of adverse health effects.

Risk characterization is the final step of the RA process. In this step, the likelihood of potential adverse effects is estimated, based on the results of the toxicity and exposure assessments. Risk characterization includes the evaluation of noncancer hazard as well as incremental lifetime cancer risk associated with site-related exposures.

The remainder of this document is organized into the following sections:

- Section 2.0 Site characterization - the history of the Site and characterization of soil, groundwater, and soil gas data considered for the RA are presented.
- Section 3.0 Identification of chemicals of concern - chemical selection criteria for identifying chemicals of concern in soil and groundwater are presented.
- Section 4.0 Toxicity assessment - the toxicity values used to evaluate potential risks are discussed.
- Section 5.0 Exposure assessment - the exposure assumptions and equations used to assess chemical uptake are presented, including the fate and transport methodologies used to estimate air exposure concentrations.
- Section 6.0 Risk characterization - the toxicity and exposure assessments are summarized and integrated into quantitative and qualitative descriptions of risk.
- Section 7.0 References

A probabilistic evaluation was used to assess the risks associated with groundwater ingestion for the potential future offsite worker. EPA Risk Assessment Guidance for Superfund specifies that risk assessments should contain a separate discussion of the uncertainty in the exposure and risk estimates. This recommendation was intended to improve upon the "Reasonable Maximum Exposure (RME)" approach of characterizing risk, which is recognized to lead to significant overestimations in risk. In 1992, EPA revised its policies for performing exposure and risk assessments. This policy revision was announced by EPA Deputy Administrator Henry Habicht in a memorandum dated February 26, 1992 (EPA, 1992). EPA's revised policy identifies the need for a full and complete presentation of risk. It

states that numerical risk assessments should always be accompanied by a full characterization of the uncertainties, limitations, and assumptions in the risk assessment. These EPA guidelines endorse the use of a probabilistic approach to exposure assessment where appropriate data are available, and recognize that probabilistic evaluations provide a risk characterization data in a format which is most valuable for use by the risk manager. Under the 1992 guidelines, EPA endorses probabilistic risk assessment as an appropriate means of determining potential individual and population risks.

This Risk Assessment was prepared by using methods and assumptions developed by the EPA for use in the Superfund program. The methods are generally recognized to lead to overestimates in predicted health risks (rather than best estimates), which may actually be as low as zero (EPA, 1986). These assumptions and methods may not be appropriate in any other context.

2.0 SITE HISTORY AND CHARACTERIZATION

This section presents a review of the Site setting and conditions relevant to the risk assessment. The information presented is excerpted from the following reports prepared by HLA:

- Remedial Data Acquisition, Estes Landfill, Phoenix, Arizona, April 5, 1995
- Estes Landfill, Phase II Groundwater Quality Investigation, Draft Report, December 24, 1992
- Groundwater Database of Data from Quarterly Groundwater Monitoring Reports, September, 1988 through September, 1994
- Surface Soil Sampling, Estes Landfill, Phoenix, Arizona, March 17, 1995
- Characterization of Background Arsenic Groundwater Concentrations for Use in the Estes Landfill Human Health Risk Assessment, July, 1995

2.1 Site Description

The Site is located on the south bank of the Salt River between 40th and 45th Streets in Phoenix, Arizona (Plate 1). The Site presently occupies approximately 40 acres along the river in an area dominated by newer commercial developments and older light industrial properties. Most of the Site surface is relatively flat, with a slight westerly slope, and lies at an elevation between 1,120 and 1,130 feet above mean sea level. The relocated portion of the landfill (see Section 2.2 for description) lies at an elevation of between 1,150 and 1,160 feet above mean sea level.

Phoenix Sky Harbor International Airport is located to the north directly across the Salt River. The site is bordered to the south by the active Bradley Landfill and to the Southwest by the Waste Management Facility (Plate 2). Property to the east is presently vacant, although future State Route 153 will run in a north-south direction immediately to the east.

2.2 Site History

The Site was owned by various individuals until it was placed in trust with Valley National Bank of Arizona, predecessor to Bank One. In 1982, the Site was acquired through the exercise of eminent domain by the City of Phoenix (the City), which is the current owner of the property.

The Site property was privately operated by Garbage Service Company, a commercial refuse collection and disposal company, from the early 1950s until February 1972, when it was closed. The Site was used by commercial trash haulers, septic tank effluent haulers, and other users. Among the materials disposed at the Site were substances later defined as hazardous under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Portions of the landfill were also used for agricultural purposes for several years during the 1950s and 1960s.

From 1972 to 1982, the Site was inactive. In 1982, a partial landfill relocation effort was completed by the City in conjunction with several other state and local agencies to prevent future flooding problems along the Salt River (shown on Plate 2). Approximately 30 acres of the landfill, located in the riverbed, were excavated. Excavated materials were screened for RCRA hazardous constituents, and any hazardous wastes found were properly disposed of offsite. The nonhazardous materials were ultimately relocated onto the remaining portion of the original landfill property.

Between 1980 and 1982, groundwater contamination by volatile organic compounds (VOCs) was discovered in two industrial supply wells located near the Site, including the Bradley production well (BW-P, Plate 2) Under an agreement with the Arizona Department of Health Services (ADHS), the City installed four monitoring wells on and around the Site (EW-NE, EW-E, EW-W, and EW-NW) to further characterize groundwater quality.

Groundwater samples collected from these wells by ADHS between 1982 and 1986 revealed that elevated concentrations of vinyl chloride, 1,2-dichloroethene, as well as other VOCs, were present in groundwater beneath the Site.

Previous Investigations

Several investigations related to the area around the Estes and Bradley Landfills have been described elsewhere (HLA, 1990); excerpts from these reports that relate to the RA are described further.

In 1987, a Phase I groundwater quality investigation was initiated by the City to evaluate the magnitude and extent of groundwater contamination and to perform a preliminary assessment of potential source areas, both on and offsite. Six monitoring wells (EW-1 through EW-6) (Plate 2) were installed during the investigation. The results of the Phase I investigation confirmed the presence of groundwater contamination by VOCs above federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs), which have since been adopted as Aquifer Water Quality Standards (AWQS) in the State of Arizona. Vinyl chloride was detected above the AWQS of 2 micrograms per liter ($\mu g/l$) in wells at and near the

Site. Trichloroethene was also present above the current AWQS of 5 μg/l in select wells. Concentrations of some inorganics, such as iron, manganese, and total dissolved solids, were also detected above background levels in several wells.

Subsequent to these investigations, HLA has conducted several studies: a Phase II groundwater quality investigation (1992), quarterly sampling of groundwater monitoring wells (September, 1988 through September, 1994), a remedial data acquisition study (1995), and characterization of site surface soils (1995). Data from these studies were used in the RA and are described further in Section 2.3.

2.3 Site Characterization

A number of site investigations have been conducted at the Site. Site data relevant to the risk assessment are presented below.

2.3.1 Hydrogeologic Characterization

The Site is located on the eastern margin of the Western Salt River Valley Basin, an alluvial basin within the Basin and Range Physiographic Province. The Site and the local vicinity are underlain by alluvial sediments that range from 0 to 200 feet thick. Beneath these upper alluvial sediments is bedrock composed of either sedimentary or igneous rocks. Aquifer characteristics vary substantially within the alluvium and between the alluvium and bedrock sequences. Generally, the upper alluvium is characterized as having the highest horizontal hydraulic conductivity values (e.g., 180 to 1,700 ft/day [Brown and Pool, 1989]). Groundwater quality within the Salt River basin also varies significantly both areally and with depth.

Directly beneath the Site, the alluvium ranges from approximately 115 to 160 feet thick and is underlain by sedimentary sandstones, siltstones, and conglomerates. A low-permeability lens exists within the upper alluvium, which yields between 1 to 5 gallons per minute (gpm) to wells completed within it. This is in contrast to over several hundred gpm from wells completed in other portions of the alluvium beneath the Site. This layering effect causes a complex three dimensional hydrogeologic system beneath the Site. Depth to water ranges from 25 to 65 feet below ground surface and flows in a westerly direction. The depth to water, flow direction and water quality are strongly influenced by flow in the adjacent Salt River. Because of the natural complexity of the hydrogeologic system coupled with the sporadic but substantial effects of the adjacent Salt River, there is a relative degree of uncertainty with respect to the locations of contaminant sources both onsite and offsite and the transport mechanisms that affect contaminant migration.

2.3.2 Surface Soil Characterization

In 1994, HLA characterized the concentrations of chemicals in surface soils at the Site, the results of which are contained in Surface Soil Sampling, Estes Landfill, Phoenix, Arizona, March, 1995. Surface soil sample locations were randomly selected within a grid system and were analyzed for total metals (including antimony by EPA Test Method 7041, arsenic by EPA Test Method 7060, beryllium by EPA Test Method 7091, barium, boron, copper, manganese, and nickel by EPA Test Method 6010, cadmium by EPA Test Method 7131, chromium by EPA Test Method 7191, lead by EPA Test Method 7740, silver by EPA Test Method 7761, and thallium by EPA Test Method 7841), semivolatile organic compounds (SVOCs) (EPA Test Method 8270), organochlorine pesticides and PCBs (EPA Test Method 8080), and volatile organic compounds (EPA Test Method 8010/8020). Concentrations of SVOCs, organochlorine pesticides, and PCBs were very low to below detection. Concentrations of organochlorine pesticides and metals, with the possible exception of copper and lead, were consistent with background soil concentrations in Arizona (HLA, 1995; Earth Technology, 1991). The maximum copper and lead concentrations detected onsite were 258 mg/kg and 109 mg/kg, respectfully. VOCs were not detected in surface soils at the Site. The surface soil data are summarized in Table 1.

2.3.3 Soil Gas Characterization

HLA conducted a preliminary soil gas survey in 1991, the results of which were presented in Estes Landfill Phase II Groundwater Quality Investigation (HLA, 1992). There were 16 sampling locations on the western portion of the landfill, downgradient from the suspected source area at the southeast corner of the Site. Chemical analysis selection was largely based on groundwater quality data. Using EPA Method 502.2, samples were analyzed for vinyl chloride, cis 1,2-dichloroethene, 1,1-dichloroethene, trichloroethene, 1,2 dichlorobenzene, tetrachloroethene, benzene, and chlorobenzene. All analytes were detected in at least one sample. Concentrations of the VOCs ranged from less than 0.01 to 60 μg/l for 1,2-dichlorobenzene. The results of the Phase I soil gas survey are presented in Appendix A.

In 1994, HLA conducted a Phase II soil gas survey in order to evaluate areas outside the Phase I survey. Some of the areas sampled during the preliminary survey were resampled during the Phase II survey for comparison. Soil-gas concentrations were generally lower in the Phase II survey compared to the Phase I survey; the differences may have been related to a 16 foot decrease in the depth to groundwater at the time of the Phase II survey. Soil gas samples were collected at approximately 10 feet below ground surface (bgs) on the at-grade portion of the Site and at 25 to 30 feet bgs on the relocated refuse. The relocated refuse is approximately 25 to 30 feet above grade. A total of 46 soil gas locations were sampled and analyzed for halogenated and aromatic VOCs.

Concentrations of halogenated VOCs over the entire area surveyed were generally less than 1 μg/l. All results for carbon tetrachloride, chloroform, 1,2-dichloroethane, Freon 11, Freon 113, methylene chloride, tetrachloroethylene, and 1,1,1-trichloroethane were below detection. The highest concentrations of vinyl chloride and total 1,2-dichloroethylene were 2 μg/l, at locations near the northwest corner of the relocated refuse and near the pit area. The highest concentration of halogenated VOCs was reported at 38 μg/l for 1,1-dichloroethane. The highest soil gas concentrations reported were for methane, (<1,000 to 190,000 μg/l), suggesting that substantial methane production is occurring at the Site despite the age of the landfill. The results of the Phase II soil gas survey are summarized in Appendix A.

The results of the soil gas surveys suggest that aromatic VOCs are present in soil gas onsite as well as offsite. Concentrations of some of the constituents analyzed increased with proximity to the Bradley landfill. These results could indicate additional offsite sources, including the Bradley Landfill.

2.3.4 Characterization of Chemical Concentrations in Groundwater

HLA has conducted quarterly monitoring of wells located onsite and at adjacent offsite areas (Plate 2) from September, 1988 through the present (with the exception of June, 1993 and March, 1995). Validated data available for review were from September, 1988 though September, 1994. Samples from all groundwater wells were analyzed for volatile organic compounds (EPA Method 601/602). Samples from all groundwater wells, with the exception of South Bank (SB) wells, (Plate 2) were also analyzed periodically for metals using EPA Series 200/7000. Since the entire groundwater database is extensive, and has previously been released to ADHS, no full compilation of groundwater data is appended to this report. The database can be supplied electronically upon request.

3.0 HAZARD IDENTIFICATION

This section describes the selection of chemicals evaluated for defined exposure areas at the Site (i.e., onsite and adjacent offsite areas). All chemicals detected at the Site or in adjacent offsite areas were initially evaluated for inclusion in the RA. Hazard identification determines those chemicals that need to be evaluated further in the RA. The hazard identification process was conducted by evaluating the available data by media and location (e.g., onsite or offsite). Media and locations evaluated include:

- Onsite Soils
- Onsite Soil Gas
- Onsite Groundwater
- Offsite Groundwater

3.1 Chemicals of Concern in Onsite Soils

Portions of the landfill were used for agricultural purposes for several years during the 1950s and 1960s. Accordingly, surface soils at the Site were evaluated quantitatively for metals and chlorinated pesticides that may have been applied during the period of agricultural use. PCBs, metals and VOCs were also evaluated in soils. The concentrations of metals in soils were similar to Arizona native soil concentrations reported by Earth Technology (1991), with the possible exception of copper and lead (Table 1). The concentrations of metals, PCBs, and chlorinated pesticides were well below EPA Region IX Preliminary Remediation Goals[1] (PRGs) (EPA Region IX, 1995) for industrial soils, as shown in Table 1. Therefore none of the chlorinated pesticides, PCBs, metals, or VOCs were identified as chemicals of concern in Site soils.

3.2 Chemicals of Concern in Onsite Soil Gas

As discussed in Section 2.0 and summarized in Appendix A, various VOCs were detected in soil gas collected from onsite sampling locations. EPA Region IX guidance suggests that chemicals present in less than 5% of the samples from any one media or area can be eliminated from further assessment (EPA,

---

[1] Using PRGs as a screening method for identifying chemicals that do not pose a risk is an appropriate and valid method. A risk based PRG, as defined by EPA, is a concentration of a chemical in media (i.e., soil, water, or air) that would not result in adverse noncarcinogenic health effects or a cancer risk greater than 1×10^{-6} (one in one-million) under a set of defined (default) exposure assumptions. EPA Region IX has published PRGs based on conservative exposure assumptions associated with either residential or industrial uses of a property.

1989b). Accordingly, if a chemical was detected in less than 5 percent of samples, it was eliminated as a chemical of concern. Chemicals found in more than 5 percent of the samples were selected for evaluation in the RA and are shown in Table 2. The chemicals selected are benzene, chlorobenzene, 1,2-dichlorobenzene, 1,3/1,4-dichlorobenzene, 1,1-dichloroethane, 1,1-dichloroethene, total 1,2-dichloroethene, ethylbenzene, Freon 11, Freon 113, toluene, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, vinyl chloride, and total xylenes.

3.3 Chemicals of Concern in Onsite Groundwater

Onsite groundwater wells (i.e., at the Estes Landfill) have been sampled on a quarterly basis since 1988 and analyzed for VOCs and metals. Since it is highly unlikely that a drinking water well would ever be drilled on the Estes Landfill (EPA, 1989a; EPA, 1991a), chemicals of concern were not evaluated specifically for this location and medium. However, determination of chemicals of concern for offsite wells, especially metals, is highly dependent on whether the chemicals were detected in onsite wells and were therefore possibly site-related. Therefore, chemicals detected in onsite groundwater are among the criteria used to identify chemicals of concern in offsite groundwater. Additionally, VOCs in groundwater may migrate as vapor to the soil surface. This potential transport pathway was evaluated using soil gas data discussed in Section 3.2, which reflect movement of vapors from groundwater to soil.

3.4 Chemicals of Concern in Offsite Groundwater

Groundwater monitoring data collected by HLA during site investigations conducted from September, 1988 to September, 1994 were considered in the selection of chemicals of concern. Chemicals of concern were identified for evaluation in the RA for offsite groundwater potentially impacted by the Site at the nearest downgradient and crossgradient monitoring wells: EW-1, EW-4, EW-7, EW-10, EW-12, EW-13, EW-14, EW-17, EW-18, TW-1, TW-2, TW-3, TW-4, SB-4, SB-6, and production well TW-P. Chemicals were also evaluated for the Bradley production well (BW-P). The locations of these groundwater wells are shown in Plate 2. Initially, any chemical detected in these offsite wells was evaluated as a potential chemical of concern.

As discussed previously, the presence of a chemical in onsite groundwater was one criterion in selecting a chemical of concern in offsite groundwater. If a chemical detected in offsite wells was never detected in any onsite wells, it was eliminated as a chemical of concern in offsite wells. Additional criteria for selection of chemicals of concern are dependent on whether the chemical is a VOC or a metal. Since metals are naturally occurring constituents in environmental media, the selection of a metal as a chemical of concern requires a more extensive analysis than selection of VOCs (see below).

3.4.1 Selection of VOCs as Chemicals of Concern in Offsite Groundwater

If a VOC was detected in the evaluated offsite wells, and was also detected at least once in an onsite well, it was retained as a chemical of concern if detection frequency exceeded 5 percent. Table 3 exhibits the selection process, and identifies the selected VOCs of concern. These chemicals are benzene, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, Freon 11, Freon 113, methylene chloride, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and vinyl chloride.

3.4.2 Selection of Metals as Chemicals of Concern in Offsite Groundwater

Many metals occur naturally in groundwater. EPA risk assessment guidance suggests the elimination of naturally occurring chemicals that are not elevated due to anthropogenic sources (EPA, 1989a). Accordingly, screening criteria were used to identify metals which may have elevated groundwater concentrations potentially associated with a source at the Estes Landfill. Metals potentially associated with site-related impacts to groundwater were distinguished from naturally occurring metals using the following criteria. If a metal was detected in offsite wells and maximum concentrations in onsite wells exceeded maximum concentrations detected in offsite wells, and the detection frequency at offsite wells exceeded 5 percent, it was initially retained as a chemical of concern. If the concentrations of a metal in groundwater at the landfill were not higher than in the wells upgradient to the landfill, or the maximum offsite chemical concentrations did not exceed the EPA Region IX Preliminary Remediation Goals[2] for drinking water ingestion (EPA, 1995), the metal was eliminated as a chemical of concern. Table 4 presents the selection process for metals, and identifies the selected metals of concern as arsenic and manganese.

3.4.3 Selection of Chemicals of Concern for the Bradley Production Well

The Bradley production well (BW-P) is located on the Bradley landfill, near the boundary of the site property. As the only use of the Bradley well has been for dust control measures, chemicals of concern were selected based on this exposure scenario only (e.g., potential VOC volatilization during spray use) (see Section 5.1.2)[3]. All VOCs detected in the Bradley production well were considered chemicals of concern. Selected chemicals are presented in Table 5.

---

[2] The PRG for tap water is associated with a hazard index of 1.0 or a cancer risk of 1×10^{-6} based on ingestion of 2 liters per day over a course of 30 years.

[3] It should be noted that the Bradley production well is no longer used for any purpose.

4.0 TOXICITY ASSESSMENT

This section presents the toxicity assessment for the chemicals of concern evaluated in this RA. Toxicity assessment includes identification of the types of potential toxicities associated with each chemical of concern (e.g., cancer and/or noncancer toxicity) and the chemical-specific dose-response relationships. The dose-response relationship characterizes the relationship between the dose of a chemical and the probability of an adverse health effect in an exposed population. A summary of chemicals of concern for each exposure scenario is provided in Tables 2-5. Sections 4.1 and 4.2 discuss the basis for the noncancer and cancer toxicologic criteria, respectively.

4.1 Noncancer Health Effects

It is widely accepted that noncancer health effects from chemical substances occur only after a threshold dose is reached. For the purposes of establishing health criteria, this threshold dose is usually estimated by regulatory agencies from the non-observed adverse effect level (NOAEL) or the lowest-observed adverse effect level (LOAEL) determined from chronic (i.e., long-term) animal studies. The NOAEL is defined as the highest dose at which no adverse effects are observed, while the LOAEL is defined as the lowest dose at which adverse effects are observed.

Uncertainty factors or safety factors are applied to the NOAEL or LOAEL observed in animal studies or human epidemiologic studies to establish "reference doses" (RfDs). The RfD is an estimate of a dose level that is not expected to result in adverse health effects in persons exposed for a lifetime, even among the most sensitive members of the population. The RfDs for the chemicals of concern are listed in Table 6.

4.2 Cancer Risk

In contrast to noncancer effects, agents considered to be carcinogenic (i.e., cancer-causing) are treated by regulatory agencies as if any dose, no matter how small, is associated with some risk for developing cancer. In other words, the dose-response curve for carcinogens used for regulatory purposes only predicts zero risk when there is zero dose, thereby implying a non-threshold mechanism for all potential carcinogens. The dose-response curve used by regulatory agencies is derived using the linearized multi-stage (LMS) model, which extrapolates the response in animals (e.g., observed tumors) exposed to high doses of a chemical to a theoretical cancer risk to humans exposed to low doses, orders of magnitude lower than that administered to the laboratory animals.

The LMS model is considered highly conservative, for many reasons, including the following: 1) it does not allow for adjustments for metabolism or known DNA repair mechanisms that may prevent tumor

formation at low doses, thus providing a threshold for the carcinogenic effect, and 2) it does not account for species differences that may result in chemical carcinogenicity by a mechanism only relevant to the specific laboratory animal. The LMS model provides policymakers with an upper-bound risk estimate that assures them that the actual risks are likely to be lower. Accordingly, EPA acknowledges, that the estimates are likely to greatly overestimate cancer risks (EPA, 1986):

> "It should be emphasized that the linearized multistage procedure leads to a plausible upper limit to risk that is consistent with some proposed mechanisms of carcinogenesis. Such an estimate, however, does not necessarily give a realistic prediction of the risk. The true value of the risk is unknown, and may be as low as zero. The range of risks defined by the upper limit given by the chosen model and the lower limit which may be as low as zero, should be explicitly stated. An established procedure does not yet exist for making "most likely" or "best" estimates of risk within the range of uncertainty defined by the upper and lower limit estimates."

Cancer risks for exposure to carcinogens are defined in terms of probabilities. The probabilities identify the likelihood of a carcinogenic response in an individual who receives a given dose of a particular chemical (based on mathematical modeling of the animal or human data). These probabilities are expressed in terms of the slope factor (SF). The SF represents the probability of a carcinogenic response (per unit dose) and is usually expressed as $(mg/kg\text{-}d)^{-1}$. The slope factor, multiplied by the predicted chemical dose, provides an estimate of the upperbound incremental potential cancer risk.

An important component of the toxicity assessment is an evaluation of the weight of evidence for human toxicity of each chemical of concern. In assessing the carcinogenic potential of a chemical, the Human Health Assessment Group (HHAG) of EPA currently classifies the chemical into one of the following groups, according to the weight of evidence from epidemiologic and animal studies:

- Group A - Human carcinogen (sufficient evidence of carcinogenicity in humans)
- Group B - Probable human carcinogen (B1-limited evidence of carcinogenicity in humans; B2-sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)
- Group C - Possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)
- Group D - Not classifiable as to human carcinogenicity (inadequate or no evidence)

- Group E - Evidence of noncarcinogenicity for humans (no evidence of carcinogenicity in adequate studies).

Generally, quantitative carcinogenic RAs are performed for chemicals in Groups A and B and on a case-by-case basis for chemicals in Group C. The cancer slope factors and EPA classifications for chemicals evaluated in the RA are presented in Table 6.

5.0 EXPOSURE ASSESSMENT

Exposure assessment is the estimation of the timing (frequency and duration), route, and magnitude of exposure to chemicals. These factors determine the total chemical intake of the exposed populations. This section defines the nature of potentially exposed populations at the Site, discusses the relevant routes of exposure, and describes the methods used to estimate these exposures.

5.1 Potential Exposure Scenarios

Both onsite and offsite exposure scenarios have been developed for actual and potential receptors in this analysis. These exposure scenarios incorporate the relevant environmental transport media, point of potential human contact, and route of exposure necessary to demonstrate that the exposure pathways are complete.

5.1.1 Current Potential Onsite Exposure

The Site is currently vacant. Because Site access is restricted by a metal fence and a locked gate entrance, no individuals can trespass onto the Site. Accordingly, it is assumed that there are no current onsite receptors.

5.1.2 Current Potential Offsite Exposure

The area around the Site is used for commercial and light industrial purposes only. A review of the Arizona Department of Water Resources (ADWR) well inventory indicates that the two closest domestic use wells are located south of Van Buren Street and north of the Sky Harbor International Airport, approximately 1.5 miles north-northwest of the landfill, and between 22nd and 40th Streets between Broadway Road and Southern Avenue, approximately 2 miles south-southwest of the Site (HLA, 1995a). Neither of these wells is considered close enough to be impacted by chemicals associated with the Site. Accordingly, it is assumed that there are no current residential groundwater receptors in the immediate area. The gray shaded area in Plate 2 outlines the adjacent downgradient area evaluated in this risk assessment. This area was selected for the evaluation or potential offsite exposure as it is (1) immediately adjacent to, and downgradient from, the Estes Landfill (future exposure scenario for groundwater ingestion suggested by EPA (1989a) and (2) has groundwater characterization data which meets the data requirements for risk assessment. From the southwestern corner of the Site, the area extends approximately 1/2 mile south and west.

HLA conducted a survey of current industrial use of groundwater in the area near the Site. The only industrial use wells were found to be at the former Tanner facility site and the Bradley landfill. The well at the former Tanner facility site is inactive and as of September, 1994, has been officially listed as abandoned (S. Ramirez, Arizona Department of Water, 1995). The Tanner site itself is vacant (D. Hanson, HLA, 1995). There was an active industrial production well at the Bradley landfill, located adjacent to the Site. Although the well is not officially listed as abandoned, ADEQ has notified the City of Phoenix that the well is no longer in use (D. Hanson, HLA, 1995). The production well at the Bradley Landfill was installed prior to conversion of the site to a landfill. VOCs have been detected in groundwater at this well. The water did not serve as a drinking water source at the facility (the facility is connected to the City of Phoenix water supply and also receives bottled water) but served an industrial use. Specifically, the water has been pumped into a 5,000 gallon water truck and sprayed on roads at the landfill to suppress dust. Because the groundwater from the production well was used for dust suppression and not as a potable water source, ingestion of groundwater was excluded as a potential exposure pathway. However, VOCs may volatilize from water during spray activities. Accordingly, there was a potential for inhalation exposure for individuals at the Bradley landfill. Therefore, this worker was evaluated to estimate potential health risks associated with exposure to chemicals found in groundwater.

5.1.3 Potential Future Onsite Exposure

The Site is located in an area zoned for commercial, as well as light and heavy industrial use. The immediate surroundings of the Site consist of the currently operating Bradley Landfill, a waste transfer business, and the Phoenix Sky Harbor International Airport. An airport use map indicates that the Estes Landfill falls within a buffer zone for the proposed third runway, which limits the use to single story parking. Therefore, future residential use of the Site was not evaluated in the risk assessment. The decision not to evaluate residential exposure at the Site is supported by EPA guidance for Superfund (EPA, 1989a) which states, "future residential land use may not be justifiable if the probability that the site will support residential use in the future is exceedingly small."

It is extremely unlikely that the restriction associated with the airport buffer zone will be lifted, based on the likelihood of future airport expansion and the surrounding land uses. This restriction prevents the development of the Site as a commercial/industrial facility with buildings. Without a building, the Site would have limited industrial commercial uses (e.g., outdoor scenarios such as parking lot, salvage yard). Alternatively, the landfill may be converted to a park (not uncommon for former landfills). The most highly exposed individual in either of these scenarios would be a full-time outdoor worker at the Site. Accordingly, a future onsite worker scenario was evaluated in the risk assessment.

5.1.4 Potential Future Offsite Exposure

Current uses are commercial and light industrial. The area surrounding the landfill is zoned for commercial, as well as light and heavy industrial use. Based on existing zoning information, current land uses, proximity to the airport, and projected future development plans, no future residential use is anticipated for the evaluated area. Therefore, a future offsite residential receptor was not evaluated in the risk assessment, in accordance with EPA guidance (EPA, 1989). Although it is extremely unlikely, there is potential for installation of an offsite well by current or future businesses. Groundwater near the Site is part of an aquifer that has sufficient production capacity to support installation of a well. Analyses of groundwater in offsite monitoring wells have indicated that total dissolved solid (TDS) concentrations exceed the recommended secondary MCL of 500 milligrams per liter (mg/L), but are below the upper level for the secondary MCL (1,000 mg/L). Water containing less than 500 mg/L TDS is considered to be of good quality, and water containing above 500 mg/L but below 1,000 mg/L is considered to be acceptable (National Health and Medical Research Council, Australia, 1994). Because the level of TDS in offsite monitoring wells is considered acceptable, future potable use of groundwater was evaluated for an offsite worker.

5.2 Exposure Pathways

Pathways of exposure are the means by which an individual may come into contact with a chemical. Determinants of complete exposure pathways include environmental/geographic considerations, location(s) and activity patterns of the potentially exposed populations, and the potential for a chemical to move in the environment.

For an exposure pathway to be complete, each of the following components must be present (EPA, 1989):

- A source and mechanism for chemical release
- An environmental transport medium
- A point of potential human contact with the medium
- A route of exposure (e.g., inhalation, ingestion)

Each of these components will be discussed in the following sections in the context of exposure scenarios, which will combine the point of contact with the route of exposure.

5.2.1 Soil

If the Site remains unpaved, an individual at the Site may have direct contact with surface soil. If chemicals are present in soil, they may be absorbed through inadvertent soil ingestion, dermal contact with soil, or inhalation of particulates resuspended from site soils.

As noted in Section 3.0 (Hazard Identification), none of the chemicals detected in onsite surface soils were selected as chemicals of concern, based on comparison with background soil concentrations or comparison with EPA Region IX preliminary remediation goals for industrial land use (EPA, 1995). Therefore, exposure to onsite soils was not evaluated as an exposure pathway.

5.2.2 Air

The primary constituents detected in groundwater at the Site are VOCs. Additionally, VOCs may be present in solid waste and subsurface soils. These chemicals may volatilize from water, soil, and solid waste and migrate through solid waste and soil as vapor. Biodegradation of solid waste at a landfill results in the production of gases such as methane and carbon dioxide. Although these gases themselves are nontoxic, the presence of the gases may produce a convective flow that increases the emissions of VOCs at the Site. Accordingly, an individual at the Site may be exposed to VOCs present in air that originated from groundwater and/or soil. Nearby offsite populations could also be exposed to VOCs in air that originated from onsite sources. As discussed in Section 6.0, the health risks associated with vapor emissions onsite were negligible, and therefore characterization of offsite exposures to airborne chemicals (which would be considerably less) was deemed unnecessary.

5.2.3 Groundwater

Because the Site is a former landfill, it is unreasonable to assume that a production well will be installed at the Site. Even if chemicals were not detected in groundwater underlying the landfill, it would be highly unlikely that a production well would be installed, because other landfill components would impact groundwater at a landfill. The potential presence of pathogenic organisms (i.e., bacteria, viruses) and solid waste biodegradation products would result in water unacceptable for potable use. Landfills are a known source of enteric pathogens (Powelson and Gerba, 1995). The use of contaminated groundwater was responsible for 51 percent of all waterborne disease outbreaks in the U.S. from 1971-1982. (Craun, 1985)

EPA guidance also indicates that it is unreasonable for a well to be installed at a former landfill. For example, EPA (1989a) states that "in a few situations it may not be reasonable to assume that water will be drawn directly beneath a specific source (e.g., a waste management unit such as a landfill) in the future." Another EPA guidance document (EPA, 1991a), specific to conducting remedial investigations/ feasibility studies at landfill sites, also suggests that hypothetical future exposure to groundwater would not normally be evaluated in a risk assessment, as this pathway is highly unlikely.

Both current and future offsite exposures to groundwater were evaluated in the RA and are discussed in Sections 5.1.2 and 5.1.4.

5.3 Dose Equations

Dose is defined as the amount of chemical absorbed into the body over a given period of time. For noncarcinogenic effects, the dose is averaged over the period of exposure and is referred to as the average daily dose (ADD). For carcinogenic effects, the dose is averaged over a lifetime and is referred to as the lifetime average daily dose (LADD). The exposure concentrations are input into the dose equations to yield a dose estimate.

Consistent with EPA guidance, the following dose equation was used to assess uptake for each complete exposure pathway considered in this assessment:

$$ADD = \frac{C \times IR \times EF \times ED \times B}{BW \times AT}$$

Where:

ADD	=	Average daily dose (mg/kg-day)
C	=	Chemical concentration in environmental medium (mg/m^3, mg/l)
IR	=	Intake rate (m^3/day, mg/l)
EF	=	Exposure frequency (fraction of year exposed)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)

For noncarcinogenic effects, AT = exposure duration

For carcinogenic effects, AT = 70 years, and the dose calculated is a Lifetime Average Daily Dose (LADD)

Dose equations for each pathway evaluated are presented below.

5.3.1 Vapor Inhalation

Chemical uptake via inhalation of vapors is calculated according to the following equation:

$$\text{Dose} = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

Where:

C	=	Chemical concentration in air (mg/m^3) (modeled)
IR	=	Inhalation rate (Ave: 10 m^3/day, RME: 20m^3/day)
EF	=	Exposure frequency (8 hr/day, 250 days/yr)
ED	=	Exposure duration (Ave: 4.2 yr; RME: 25 yr)
BW	=	Body weight (70 kg)
AT	=	Noncarcinogen: ED; Carcinogen: 70 yr

5.3.2 Groundwater Ingestion

Chemical uptake via ingestion of groundwater is calculated according to the following equation:

$$\text{Dose} = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

Where:

C	=	Chemical concentration in groundwater (measured)
IR	=	Groundwater ingestion rate (Ave: 0.65 L/day; RME: 1 L/day)
EF	=	Exposure frequency (250 days/yr)
ED	=	Exposure duration (Ave: 4.2 yr; RME: 25 yr)
BW	=	Body weight (70 kg)
AT	=	Noncarcinogen: ED; Carcinogen: 70 yr

5.4 Deterministic Dose Estimates

The deterministic evaluation uses single point estimates for each of the input parameters to develop single point dose estimates for each scenario. Doses were calculated by using exposure parameters associated with reasonable maximum exposure (RME) and average exposure scenarios. This approach provides a crude measure of the range of potential risks. An RME, as defined by EPA, is the "highest exposure that is reasonably expected to occur" and is estimated by using upperbound values of human exposure factors (EPA, 1989). An average exposure scenario provides an estimate of the central tendency for exposure at the Site by using average or median values for human exposure factors. EPA has not provided guidance on estimating central tendency exposures in Superfund, but has been aware of the need to develop such guidance (EPA, 1992). In lieu of such guidance, the EPA Exposure Factors Handbook (EPA, 1990) was used to select appropriate values for the average exposure scenario. The exposure parameters used to calculate contaminant uptake via potential exposure pathways are described below and summarized in Tables 7 and 8. Spreadsheets showing calculations for dose estimates are provided in Appendix D.

5.4.1 Exposure Concentrations

Based on the exposure scenarios described above, exposure point concentrations were developed for groundwater and air.

5.4.1.1 Groundwater Exposure Concentrations

The only receptor assumed to be directly exposed to chemicals in groundwater is the potential future offsite worker. It is assumed that this worker will use groundwater as a source of drinking water. Offsite monitoring well data obtained downgradient and cross gradient to the Estes landfill, were used conservatively to characterize future concentrations of chemicals in groundwater. The monitoring wells were grouped to determine representative exposure concentrations based on EPA guidance, which states, "it generally should be assumed that water could be drawn from anywhere in the aquifer" (EPA, 1989a). The grouped wells consist of EW-1, EW-4, EW-7, EW-10, EW-12, EW-13, EW-14, EW-17, EW-18, TW-1, TW-2, TW-3, TW-4, TW-P, SB-4, and SB-6 (highlighted on Plate 2). Wells within the boundary of the Bradley Landfill were not included in the groundwater ingestion scenario because, as described above, it is inappropriate to assume that a groundwater production well would be installed at a landfill. Wells in the Salt River were also not included in the determination of representative exposure concentrations, as drinking water would not be drawn from below the river.

Groundwater characterization data obtained from 1988 to 1994 were used to estimate the average and 95 percent UCL concentrations of the arithmetic mean chemical concentrations that were employed to evaluate the average, and RME exposure concentrations, respectively. Field duplicates and laboratory duplicates were not included in the data set, as these data were considered only as part of the analytical laboratory quality control. Where a chemical was not detected in a sample, half the value of the detection limit was used in deriving the average and 95 percent UCL concentrations. Where half the sample detection limit exceeded the maximum concentration of a groundwater sample in the data set, the sample was excluded from the derivation of representative concentrations (EPA, 1989a). Based on EPA default guidance for deriving exposure concentrations, the one-tailed 95% UCL was calculated using the Student's t-distribution (EPA, 1989a). Representative groundwater exposure concentrations are summarized in Table 9.

5.4.1.2 Air Exposure Concentrations

It was assumed that the potential future onsite worker and the current Bradley landfill worker were exposed to air containing VOCs through inhalation. For estimation of chemical concentrations in air, conservative environmental fate and transport modeling was used. Environmental fate and transport models are often used to predict chemical concentrations in air, which may arise from volatile chemicals present in environmental media (e.g., water and soil).

Potential Future Onsite Worker

Environmental fate and transport modeling was used in this risk assessment to estimate the emissions of volatile chemicals from groundwater and soil at the Site. In estimating vapor emissions, the average and 95 percent upper confidence limit soil vapor concentration for each chemical was input into an EPA approved equation for estimating vapor emissions from soil vapor measurements obtained at a landfill (EPA, 1988). Where a chemical was not detected in a sample, half of the detection limit was used to derive average and 95 percent UCL concentrations. Where half of the detection limit exceeded the maximum concentration for any soil vapor sample, the value was excluded from the derivation of exposure concentration. Subsequently, estimated vapor emissions for each chemical were input into a simple air dispersion equation to estimate air concentrations in air above the Site.

A discussion of the data inputs and spreadsheets that were used to estimate air concentrations is presented in Appendix B. Air exposure concentrations for the future onsite worker are summarized in Table 10.

Current Offsite Worker (Bradley landfill)

Environmental fate and transport modeling was also used to estimate the emissions of volatile chemicals from groundwater used to suppress dust at the Bradley landfill. Estimates of emission rates were based on the use of representative exposure concentrations of VOCs that were found in groundwater at the Bradley landfill. Groundwater characterization data obtained from 1988 to 1994 were used to estimate the average and 95 percent upper confidence limit of the arithmetic mean of chemicals in the Bradley landfill production well. Where a chemical was not detected in a sample, half the value of the detection limit was used in deriving the average and 95 percent UCL concentrations. Where half of the detection limit exceeded the maximum concentration of the sample in groundwater, the sample was excluded from the derivation of representative concentrations.

Some proportion of chemicals detected in groundwater at the Bradley Production well may be related to sources at the Bradley landfill. Accordingly, risks associated with exposure to groundwater at the Bradley Landfill cannot be completely attributed to migration of chemicals from groundwater beneath the Estes Landfill. A review of the Bradley Landfill APP file suggests, with a high degree of confidence, that the landfill accepted domestic and liquid wastes prior to 1986 (HLA, 1995). These types of wastes often contain chlorinated organic compounds. Soil gas sampling conducted by SH&B at the Bradley Landfill in 1987 and 1988 found detectable concentrations of both halogenated and aromatic VOCs (HLA, 1995). These data suggest that the Bradley Landfill may be impacting groundwater.

A detailed description of the exposure scenario, the model, a summary of data inputs, and the spreadsheets used to estimate air concentrations are presented in Appendix C. Groundwater concentrations used to estimate air concentrations are presented in Table 11. Air exposure concentrations, derived from modeling, are presented in Table 12.

5.4.2 Exposure Parameters

5.4.2.1 Body Weight

The standard body weight given in EPA risk assessment guidance is 70 kilograms for adults (EPA, 1991). This value represents the average of the median (50th percentile) body weight for an adult male or female and was used to represent all adult workers.

5.4.2.2 Exposure Frequency

Exposure frequency represents the rate at which an individual may come into contact with chemicals in environmental media. For the purposes of this assessment, a working individual was assumed to be present at the worksite for 8 hours per day, 5 days per week, 50 weeks per year, during job tenure in both the RME and the average exposure scenarios.

5.4.2.3 Exposure Duration

Exposure duration is a measure of the length of time that an individual may be in contact with a contaminated medium. For the purposes of this assessment, occupational tenure for the RME and the average exposure scenarios was based on data from the Bureau of Labor Statistics (1987). These data indicate that the 90th and 50th percentile of job tenure with an employer is 25 years and 4.2 years, respectively.

5.4.2.4 Inhalation Rate

The Toxics Integration Board of Superfund (TIBS) calculated inhalation rates from time/use activity level data (EPA, 1985) to develop a RME for occupational settings. An analysis of the data by TIBS indicated that the highest daily inhalation rate for the workplace was 18 cubic meters per day (m^3/day). EPA risk assessment guidance (1991b) recommends the use of a 20 m^3 per day (2.5 m^3/hr) inhalation rate for an 8-hour workday, as this value represents a reasonable upperbound inhalation rate for the occupational setting. Because driving a water truck is light physical activity and would not be associated with high inhalation rates, this value was not used for the Bradley worker RME scenario. For the average onsite worker scenario and the Bradley RME scenario, an inhalation rate of 10 m^3/day (1.25 m^3/hr) was assumed. This value approximates the mean of the inhalation rates for adult males engaged in moderate activity (EPA, 1990). For the average Bradley scenario, an inhalation rate of 6.4 m^3/day (0.8 m^3/hr) was used. This value represents the mean of inhalation rates for adult males engaged in light activity (EPA, 1990).

5.4.2.5 Pulmonary Bioavailability

For this assessment, all the VOCs of concern were assumed to be 100-percent bioavailable via inhalation. This is a conservative assumption because significant percentages of inhaled vapors are immediately exhaled.

5.4.2.6 Groundwater Ingestion Rate

Exposure to groundwater chemicals for the potential offsite worker was evaluated deterministically to estimate risks associated with the EPA RME and average exposure scenarios. A probabilistic evaluation was also conducted to obtain a full distribution of risks based on scientifically defensible parameters and to provide a more complete description of the range and probability of occurrence of potential risks.

A tap water consumption rate of 2 liters per day for drinking water is currently used by the EPA Office of Water when setting drinking water standards. This value is close to the 90th percentile value for tap water consumption by adults (EPA, 1990). Tap water consumption, as defined in the study upon which this value is based, includes direct tap water (i.e., plain water consumed directly as a beverage) and indirect tap water (i.e., water added to foods and beverages during preparation). The 2 liters per day value was adopted by EPA as a default assumption for the residential RME. For the commercial/ industrial worker, EPA conservatively assumes that half of an individual's daily water intake occurs at work (8 hours per day at the workplace is half of the day's waking hours), which results in an estimate of a consumption rate of 1 liter per day for the RME worker. In this RA, it was assumed that the groundwater consumption rate for the average worker was 0.65 liters per day, which is half of the 50th percentile of daily water consumption for an adult resident in the western United States (Ershow and Cantor, 1989). Because food preparation activities are uncommon in the workplace, the assumption that half of the daily tap water intake is associated with the workplace is conservative.

5.4.2.7 Oral Bioavailability

For this assessment, all chemicals were conservatively assumed to be 100-percent bioavailable via ingestion.

5.5 Probabilistic Dose Estimates

A probabilistic dose estimate was developed to reduce uncertainty when estimating chemical exposure by future ingestion of offsite groundwater. Probability distributions were developed for the following industrial-based exposure parameters: groundwater exposure concentrations, groundwater (tap water) ingestion rate, exposure duration (job tenure), and body weight. Probabilistic dose estimates are presented in Appendix E.

5.5.1 Groundwater Exposure Concentrations

The arithmetic mean is a statistically unbiased estimator of the true mean, no matter what the underlying distribution may be (Gilbert, 1987). Accordingly, for the probabilistic analysis, arithmetic mean concentrations were initially calculated for each individual well that was included in the grouped well analysis. Then, for each chemical, a discrete probability distribution of the groundwater concentration was developed from the arithmetic mean concentrations for each well in the immediate offsite area. With a discrete uniform distribution, each input concentration has an equal probability. This approach to characterizing a representative exposure concentration is more accurate than assuming a data distribution, such as normal or lognormal.

The deterministic evaluation of the health effects associated with offsite groundwater consumption was initially used to identify chemicals that contributed most significantly to the potential health risk. Based on the results of the deterministic evaluation, arsenic and vinyl chloride were evaluated in the probabilistic analysis.

To account for possible associations (e.g., covariation) between the chemical concentrations, a correlation analysis (Spearman Rank test) was conducted prior to conducting the probabilistic analysis. The analysis revealed a non significant, weak positive correlation between vinyl chloride and arsenic ($r=0.24$). Accordingly, the correlation coefficient for vinyl chloride and arsenic was entered in the probabilistic program.

The exposure parameter distributions used to calculate contaminant uptake through potential exposure pathways in the probabilistic analysis are described below and summarized in Table 13.

5.5.2 Exposure Parameter Distributions

For the probabilistic analysis, probability distributions were developed for key exposure parameters. Distributions were developed by using data presented and referenced in EPA's Exposure Factors Handbook (EPA, 1990) to ensure consistency with EPA guidance. Some of the distributions have been applied to regulatory risk assessments and have been published elsewhere (Ershow and Cantor, 1989; Roseberry and Burmaster, 1992; Copeland et al., 1993, 1994; Finley et al., 1994).

5.5.2.1 Body Weight

Data obtained in the second National Health and Nutrition Examination Survey (NHANES II), which was conducted between 1976 and 1980, were utilized. In this study, 20,322 individuals, ranging in age from 6 months to 74 years, were examined. Cumulative distributions for adult body weights by sex from this study are presented in the EPA Exposure Factors Handbook (EPA, 1990). The American Industrial Health Council (AIHC) has combined the distributions to obtain a cumulative adult body weight distribution for both sexes (AIHC, 1994). This distribution was used in the assessment.

5.5.2.2 Exposure Duration

To calculate the lifetime average daily dose (LADD) for an occupational scenario, it is necessary to determine the distribution of the duration of time spent at a particular job location. The Bureau of Labor Statistics (BLS) provides recent data describing tenure for U.S. workers (U.S. Department of Labor, 1992). In this publication, years with current employer for workers older than 16 years are described in intervals of ≤ 1, 2-5, 6-9, 10-14, 15-19, and ≥ 20 years. Finley, et al. (1994) used this data to develop a cumulative distribution of exposure duration with an arithmetic mean of 7.3 years; the 50th and 95th percentiles of the distribution are 3.8 and 29 years, respectively. The authors note that the survey conducted by BLS did not provide information on the maximum length of time worked at one location, and suggest that a reasonable maximum worklife expectancy of 30 years be used. The peer-reviewed published distribution was used in the probabilistic analysis.

5.5.2.3 Groundwater (Tapwater) Consumption Rate

The probabilistic analysis used a modification of the distribution of tapwater consumption rates developed by Ershow and Cantor (1989). This analysis of tapwater consumption is based on the results of 30,000 interviews of individuals and provides the best characterization of tapwater consumption currently available. These data provide separate distributions based on age and gender, as well as geographic region. Western U.S. water consumption values were used in the probabilistic analysis as these best represent potential consumption rates in Arizona (western consumption rates are the highest regional rates).

The Ershow and Cantor study provided daily tapwater consumption rates which were not segregated as to home or workplace. For the commercial/industrial scenario, EPA provides a default assumption that half of an individual's daily water intake occurs at work. Accordingly, this assumption was used to modify the exposure distribution based on total daily intake of tapwater.

5.5.3 Model Runs

The Latin Hypercube sampling (LHS) method was used to generate possible values from probability distribution functions. LHS is a recent development in sampling technology designed to accurately recreate the input distribution through fewer iterations than with the traditional Monte Carlo method. Each simulation was conducted twice, with 5,000 iterations in each simulation. The software used to perform the simulations was @Risk, Version 3.1 (Palisade Corporation, 1995).

Input and output distributions obtained from the model runs were saved. Individual dose calculation iterations were also saved and QC/QA evaluated. Model simulation results are presented in Section 6.0.

6.0 RISK CHARACTERIZATION

This section of the RA provides an evaluation of the potential health risks posed by chemicals associated with the Site. Noncancer hazard and cancer risk were evaluated for each exposure scenario by using a deterministic analysis. Additionally, cancer risk associated with vinyl chloride and arsenic in offsite groundwater was evaluated by using a probabilistic analysis. Spreadsheets for the deterministic assessment are presented in Appendix D. Model output for the probabilistic assessment are presented in Appendix E.

6.1 Noncancer Hazard

A hazard quotient is calculated to evaluate each chemical individually, for each exposure pathway. The hazard quotient is the average daily chemical dose divided by the EPA reference (i.e., acceptable) dose. The hazard quotients are then added for all chemicals and all relevant pathways for each scenario evaluated. The sum of hazard quotients is referred to as the "hazard index" (HI). If the total is less than 1, there are no noncancer hazards for any potential receptor, including the most sensitive members of the population. At the same time, a hazard index greater than 1.0 does not mean that adverse effects are likely, since the reference dose contains a substantial measure of conservatism, because it is derived by applying multiple safety factors to a level at which no adverse effects have been observed or to the lowest level at which effects have been observed. Further, summing hazard quotients for all chemicals assumes that all chemicals affect the same target organ, which is not the case. In this assessment, if a total HI exceeded 1.0, then organ-specific (e.g., nervous system, skin) hazard indices were evaluated by chemical (EPA, 1989a).

6.1.1 Potential Future Onsite Worker

Inhalation of vapors released from soil gas into the atmosphere was considered the only route of exposure to chemicals for the future onsite worker. The estimated RME and average HIs associated with this pathway were 0.070 and 0.024, respectively (Table 14 and Appendix B). These values are 14 and 41 fold lower than the acceptable HI of 1.0. Accordingly, there is not a potential for adverse noncancer health effects for a full-time worker at the Site. Because there are no noncancer hazards associated with the hypothetical full-time worker, the Site would not present a noncancer hazard for intermittent use associated with recreational use or visits to a commercial establishment.

6.1.2 Bradley Worker

Workers at the Bradley landfill, located adjacent to the Site, used groundwater from a production well for dust suppression. Specifically, the water was pumped into a 5,000 gallon water truck and sprayed on roads at the landfill to suppress dust. [Use of groundwater from the production well has been discounted. However, this scenario was still evaluated in the risk assessment.] VOCs may volatilize from water during spray activities. Accordingly, the potential exposure to VOCs was evaluated for the individual driving the truck. The estimated RME and average HI values associated with this pathway were 0.094 and 0.032, respectively (Table 15 and Appendix C). These values are 10 and 32 fold lower than the acceptable HI of 1.0.

6.1.3 Potential Future Offsite Worker

The potential future offsite worker was assumed to work offsite of both the Bradley and Estes landfills, but within the adjacent downgradient area shown on Plate 2 (shaded area). It was assumed that the worker consumed untreated groundwater contained anywhere within the area, but not within the Estes or Bradley landfills. In the deterministic evaluation, the HI associated with the RME and average scenarios were 1.4 and 0.73, respectively. Manganese was found to account for 76 percent of the HI, and arsenic for 20 percent of the HI in the RME scenario. Where the hazard index exceeds 1.0, it is appropriate to segregate hazard indices for each potential target organ (EPA, 1989a). The EPA risk assessment database IRIS defines the most sensitive target organ for manganese as the central nervous system, whereas the most sensitive target organ for arsenic in relation to noncancer effects is the skin (hyperkeratosis). The RfD values are based on the toxicity associated with these target organs or tissues. Because manganese and arsenic exert primary toxic effects on different tissues, the hazard quotients for the two chemicals were segregated. When segregated, the HI associated with arsenic is 0.3, and the HI associated with manganese is 1.1 for the RME scenario (Table 16). The HI associated with manganese for the average exposure scenario is 0.54. It should be noted that EPA is currently reevaluating the RFD for manganese as it is not considered to be scientifically defensible, and potentially overestimates the potency of manganese.

6.2 Cancer Risk

For potential carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a chemical. For all evaluated scenarios, the LADD is multiplied by the chemical-specific slope factor to determine the incremental risk of cancer. For estimating total cancer risk for an identified scenario, the cancer risks for each chemical and each

exposure pathway are summed. The results of quantitative risk estimates for carcinogens are expressed as the additional risk, over the course of a 70 year lifetime, of contracting cancer above the background rate of 3 in 10. Because of the uncertainties associated with low dose extrapolation, the estimated risks are speculative; as noted by EPA, "the actual risks may be as low as zero" (EPA, 1986).

Incremental cancer risks (i.e., the risk above the normal background cancer incidence of one in three) were derived for the three scenarios by using standard deterministic methods. Additionally, a probabilistic risk characterization was conducted for arsenic and vinyl chloride in offsite groundwater to more accurately characterize risks associated with these two chemicals. Per EPA guidance, total incremental cancer risk associated with each scenario is expressed with one-significant digit. Discussions of the incremental cancer risks for each evaluated scenario are presented below.

6.2.1 Potential Future Onsite Worker

Inhalation of vapors released from soil gas into the atmosphere was considered to be the only route of exposure to potential carcinogens for the hypothetical onsite worker. The estimated RME and average cancer risks associated with this pathway were 1×10^{-5} (one in one-hundred thousand) and 8×10^{-7} (eight in ten-million), respectively (Table 17 and Appendix B). These values represent the acceptable range for cancer risk in the state of Arizona and by the EPA. Accordingly, there is not significant cancer risk for a full-time worker at the Site. Because there is not a significant cancer risk associated with the hypothetical full time worker over a duration of 25 years onsite, the Site would not present a hazard for intermittent use associated with recreational use or visits to a commercial establishment.

6.2.2 Bradley Landfill Worker

Workers at the Bradley landfill, which is located adjacent to the Site, used groundwater from a production well for dust suppression. The water was pumped into a 5,000 gallon water truck and sprayed on roads at the landfill to suppress dust. VOCs may volatilize from water during spray activities. Accordingly, the potential exposure to VOCs was evaluated for the individual driving the truck. The incremental cancer risk associated with the RME and average exposure scenarios were 4×10^{-5} and 3×10^{-6}, respectively (Table 18 and Appendix C). Because of the extremely conservative nature of the screening model used to estimate exposure to VOCs associated with spraying, it is likely that exposures to VOCs were overestimated for this worker by an order of magnitude or more.

6.2.3 Potential Future Offsite Worker

The potential future offsite worker was assumed to work offsite of both the Bradley and Estes landfills, but within the adjacent downgradient area shown on Plate 2 (shaded area). The worker was assumed to consume untreated groundwater contained anywhere within the area but not within the Estes or Bradley landfills. Because there is currently no potable use of groundwater within the area, this exposure pathway is incomplete for a current exposure scenario. In the deterministic assessment, the incremental cancer risks associated with the future RME and the average scenarios were 2×10^{-5} (two in one hundred thousand) and 3×10^{-4}, respectively (Table 19). Vinyl chloride contributed to 79 percent and arsenic to 18 percent of the total cancer risk (which account for a total of 97 percent of the risk) in the RME scenario. In the probabilistic analysis, the incremental cancer risks were 7×10^{-6} (seven in one million) for the 50th percentile individual, 6×10^{-5} for the 90th percentile individual, and 1×10^{-4} for the 95th percentile individual (Table 20).

6.3 Acceptable Risk

Regulatory agencies in the United States, including the EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA), adopted a cancer risk range of one in one-million (1×10^{-6}) to one in ten-thousand (1×10^{-4}) as *de minimis* or of negligible concern. ADEQ has recently identified this risk range as acceptable for risk-based cleanups (OTIC, 1995).

EPA guidance also supports a no action alternative when estimated risks exceed 10^{-4}. According to EPA guidance on using the baseline risk assessment for remedial decisions (EPA, 1991), the upper boundary of the risk range is not a discrete line at 1×10^{-4}. The guidance states, "A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks." Therefore, in certain cases EPA may consider risk estimates slightly greater than 1×10^{-4} to be protective.

In making risk management decisions, EPA relies on risk estimates associated with the 90th to 95th percentile value. For example, in setting criteria for drinking water, EPA relies on an assumed tap water consumption rate associated with the 90th percentile. While interim guidance for soil cleanup of Arizona target the 95th percentile risk reported in a probabilistic risk assessment, it should be recognized that the entire risk distribution (e.g., all data reported in the risk characterization) should be considered by the risk manger (EPA, 1992).

Travis et al (1987) examined the results of 132 decisions made by regulatory agencies throughout the country on the basis of site-specific risk assessments. For small populations (less than 1,000 potentially exposed individuals), regulatory action never resulted for a theoretical risk below 1×10^{-4} (one in ten-thousand). Above the risk level of 4×10^{-3} (four in one-thousand), federal agencies always acted to reduce risk.

6.4 Conservatism in the Risk Assessment

This risk assessment is based on the application of conservative methods and assumptions throughout the analysis. Because direct measurements were not used for many of the criteria upon which the risk estimates are dependent (e.g., air concentrations, human exposure parameters, and low dose toxicity criteria), conservative assumptions and methodologies were employed to eliminate the possibility of underestimating risk. Examples of some of the points of conservatism in this assessment are described below:

- All Potential Receptors

  The cancer slope factors used in this assessment are derived using one of the most conservative low-dose extrapolation models (i.e., the linearized multistage model) in terms of assumptions regarding proposed carcinogenic mechanisms. The model does not account for metabolic adjustments or known DNA repair mechanisms that may prevent tumor formation at low doses.

- Future Offsite Worker

  The highest incremental cancer risk and noncancer hazard were predicted for a hypothetical offsite receptor. The health risks associated with the offsite worker are based on hypothetical future exposure to impacted groundwater. This exposure is highly unlikely for the following reasons:

  - The area downgradient and crossgradient from the Estes landfill is fully developed, and there is no current groundwater use.

  - There is a municipal water supply in the area that provides potable water.

  - Municipal water is extraordinarily inexpensive for quantities associated with potable use.

- The costs associated with the installation of a well can be significant.

- At the workplace, the Safe Drinking Water Act would require the monitoring of drinking water quality. The costs associated with monitoring water quality are substantial.

- A workplace that installs such a well may be liable for any illness that may be associated with use of the groundwater.

Additionally, the reference dose for manganese is overly conservative. The value of the reference dose is expected to change soon (EPA, 1995), resulting in a lower hazard index than that calculated in this risk assessment.

- Bradley Landfill Worker

The conservative assumptions used for evaluating exposures for the Bradley worker were as follows:

- For the RME scenario, it is assumed that the same worker is assigned to drive the truck used to suppress dust for an average of three times per day over a period of 25 years.

- All VOCs present in water were assumed to immediately volatilize and become 100 percent available for inhalation once the water was released as spray.

- The air dispersion model employed to estimate airborne chemical concentrations assumed that the wind was always blowing in the direction of the driver. Additionally, it was assumed that the vehicle was stationary, rather than moving, which allowed for a significantly higher proportion of vapors to reach the driver.

- The use of groundwater from the production well has been discontinued, thus precluding any further exposure.

- Future Onsite Worker

The conservative assumptions used for evaluating exposures for the hypothetical future onsite worker were as follows:

- The landfill emissions model used in the risk assessment does not account for the reduced VOC emissions likely to be associated with the compacted soil at the Estes Landfill.

- The dose (and concomitant risk) for the onsite worker is based on a breathing rate associated with a high level of physical activity. It is highly unlikely that this level of activity would be sustained for a period of 8 hours.

- VOCs are conservatively assumed to be 100 percent absorbed by inhalation.

7.0 REFERENCES

@Risk (Version 3.1). 1995. *Risk analysis and simulation add-in for microsoft Excel. Palisade Corporation, Newfield, New York.*

American Industrial Health Council (AIHC). 1994. Exposure Factors Sourcebook.

Arizona Department of Environmental Quality (ADEQ). 1995. Cleanup Policy. Interim Rule A.R.S. SS 49-152.A.2

Brew and Baker. 1987. *Survey of Historical and Current Agricultural and Pesticide Use in Arizona, State of Arizona Agricultural Chemicals and Environmental Services Division.*

Brown, J.G. and D.R. Pool. 1989. *Hydrogeology of the Western Part of the Salt River Valley Area, Maricopa County, Arizona. U.S. Geological Survey Water-Resources Investigations Report 88-4202.*

Bureau of Labor Statistics. 1987. United States Department of Labor News, October 22.

Burmaster, D.E. and J.H. Lehr. 1991. "It's time to make risk assessment a science." *Ground Water Monitor. Rev: Editorial.* June 1 through 3.

Copeland, T.L.; D.J. Paustenbach; M.A. Harris; and J. Otani. 1993. Comparing the results of a Monte-Carlo analysis with EPA's reasonable maximum exposed individual (RMEI): A case study of a former wood treatment site. *Regul. Toxicol. Pharmacol.* 16:275.

Copeland, T.L.; A. Holbrow; J. Otani; K. Connor; and D. Paustenbach. 1994. Use of probabilistic methods to understand the conservatism in California's approach to assessing health risks posed by air contaminants, *Journal of Air & Waste Management Association*, Vol 44. December.

Craun, G.F. 1985. A summary of waterborne illness transmitted through contaminated groundwater. J. Environ. Health 48:122

Dragun, J. 1988. *The soil chemistry of hazardous materials.* Hazardous Materials Control Research Institute, Silver Spring, Maryland.

Earth Technology Corporation. 1991. *Evaluation of background metals concentrations in Arizona soils. Prepared for Arizona Department of Environmental Quality.* June

Environmental Protection Agency (USEPA). 1985. *Developmental of Statistical Distribution or Ranges of Standard Factors Used in Exposure Assessments.*

--- 1986. *Guidelines for cancer risk assessment.* 51 FR 33992. September 24.

--- 1988. *Guidance for establishing target cleanup levels for soils at hazardous waste sites. Office of Health and Environmental Assessment, Washington, D.C.* May.

--- 1989a. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A) Interim Final.*

--- 1989b. *Risk Assessment Guidance for Superfund. USEPA Region IX Recommendations.* Interim Final. December 15.

___ 1990. *Exposure Factors Handbook. EPA, Office of Health and Environmental Assessment, Washington, D.C.*

--- 1991. *Conducting remedial investigations/feasibility studies for CERCLA municipal landfill sites.*

--- 1991a. *Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual. Supplemental Guidance "Standard Default Exposure Factors".* Interim Final. March 25.

--- 1991b. *Conducting remedial investigations/feasibility studies for CERCLA municipal landfill sites.* February.

--- 1992. *Guidance on Risk Characterization for Risk Managers and Risk Assessors.* February 26.

--- 1994. Health effects assessment summary tables (HEAST).

--- 1995a. Integrated Risk Information System (IRIS). Online.

--- 1995a. Region IX preliminary remediation goals.

Finley, B.; Proctor, D.; Scott, P.; Harrington, N.; Paustenbach, D.; and Price. P. 1994. Recommended Distributions for Exposure Factors Frequently Used in Health Risk Assessment. *Risk Analysis, Vol. 14, No. 4.* p. 533-552.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Von Nostrand Reinhold. New York.

Hanson, D. 1995. Personal Communication from HLA to R. Pesin, HLA

Harding Lawson Associates. 1992. *Estes Landfill, Phase II groundwater quality investigation, Draft Report.* December 24.

--- 1994. *Groundwater database of data from quarterly groundwater monitoring reports.* September 1988 through 1994.

--- 1995. *Surface soil sampling, Estes Landfill, Phoenix, Arizona.* March 17.

--- 1995. *Remedial data acquisition, Estes Landfill, Phoenix, Arizona.* April 5.

--- 1995. *Characterization of background arsenic groundwater concentrations for use in the Estes Landfill Human Health Risk Assessment.* July.

Lynch, J. 1995. *Recognizing the impact of uncertainty on decision making.* AIHC Journal. Summer.

National Health and Medical Research Council. 1994. *Australian Drinking Water Guidelines.*

Powelson, DK and C.P. Gerba. 1995. Fate and Transport of Microorganisms in the vadose zone. In Handbook of Vadose Zone Characterization and Monitoring. Lewis Publishers

Ramirez, S. 1995. Personal Communication from Arizona Department of Water to R. Pesin, HLA. October 6.

Rosenberg, A.M. and D.E. Burmaster. 1992. Lognormal distributions for water intake by children and adults. Risk Analysis. 12(1):99-104.

Travis, C.C., S.A. Richter, C.E. Crouch, R. Wilson, and E.D. Klema. 1987. *Cancer Risk Management.* Environ. Sci. Technol. 21:415-420.

U.S. Department of Labor. 1992. *Employee Tenure and Occupational Mobility in the Early 1990s (Bureau of Labor Statistics, Washington, D.C., USDL 92-386).*

Table 1

Summary of Surface Soil Data

Chemicals	Range of Onsite[a] Concentrations (mg/kg)	Background[a] Sample Concentration (mg/kg)	Average Arizona[b] Soil Concentrations (mg/kg)	EPA Region IX PRG (mg/kg)
Metals				
Antimony	<0.3	<0.3	1.7	680
Arsenic	2.6 - 4.3	2.9	9.4	2.0
Barium	47.5 - 126	61.9	161	100,000
Beryllium	<0.3 - 0.38	0.25	1.1	1.1
Boron	<5	<5	NP	61,000
Cadmium	0.06 - 0.80	0.08	0.4	850
Chromium	2.6 - 9.7	4.3	17.5	1,600
Copper	11.3 - 258	9.5	16.6	63,000
Lead	7.9 - 109	5.3	7.7	1,000
Manganese	18.4 - 269	162	NP	8,300
Mercury	<0.1	<0.1	0.05	510
Nickel	8.1 - 18.1	15.4	18.2	34,000
Selenium	<0.3	<0.3	0.6	8,500
Silver	<0.03 - 0.14	<0.03	0.5	8,500
Thallium	<0.3	<0.3	0.7	140
Semi-Volatiles				
Beta-BHC	<0.005 - 0.038	<0.005	NA	1.1
4,4'-DDD	<0.01 - 0.06	<0.01	NA	7.9
4,4'-DDE	<0.01 - 0.7	<0.01	NA	5.6
4,4'-DDT	<0.01 - 0.6	<0.01	NA	5.6
Aroclor 1254	<0.03 - 0.08	<0.03	NA	19

Notes:

[a] Source: Surface soil sampling; HLA, 1995
[b] Earth Technology, 1991
[c] Commercial/Industrial use
NA Not applicable - Not found in native soil
NP Not provided

Table 2

Selection Chemicals of Concern - Onsite Soil Gas

Chemical	Frequency of Detection >5%?	Chemical of Concern?
Benzene	Yes	Yes
Carbon Tetrachloride	No	No
Chlorobenzene	Yes	Yes
1,2-Dichlorobenzene	Yes	Yes
1,3/1,4-Dichlorobenzene	Yes	Yes
1,1-Dichloroethane	Yes	Yes
1,2-Dichloroethane	No	No
1,1-Dichloroethene	Yes	Yes
1,2-Dichloroethene (mixed isomers)	Yes	Yes
Ethylbenzene	Yes	Yes
Freon 11	Yes	Yes
Freon 113	Yes	Yes
Methylene Chloride	No	No
Tetrachloroethene	Yes	Yes
Toluene	Yes	Yes
1,1,1-Trichloroethane	Yes	Yes
Trichloroethene	Yes	Yes
Vinyl Chloride	Yes	Yes
Xylenes	Yes	Yes

Table 3

Selection of Chemicals of Concern - VOCs in Offsite Groundwater

Chemical	Detected In Onsite Groundwater?	Frequency of Detection >5%? In Offsite Groundwater	Chemical of Concern?
Benzene	Yes	Yes	Yes
Bromodichloromethane	No	NA	No
Carbon Tetrachloride	Yes	No	No
Chlorobenzene	Yes	Yes	Yes
Chloroform	Yes	Yes	Yes
Chloromethane	Yes	No	No
1,1-Dichloroethane	Yes	Yes	Yes
1,2-Dichlorobenzene	Yes	Yes	Yes
1,4-Dichlorobenzene	Yes	Yes	Yes
1,2-Dichloroethane	Yes	Yes	Yes
1,2-Dichloroethene (cis)	Yes	Yes	Yes
1,2-Dichloroethene (trans)	Yes	Yes	Yes
Freon 11	Yes	Yes	Yes
Freon 12	Yes	Yes	Yes
Methylene Chloride	Yes	Yes	Yes
1,1,2,2-Tetrachloroethane	Yes	No	No
Tetrachloroethene	Yes	Yes	Yes
1,1,1-Trichloroethane	Yes	Yes	Yes
Trichloroethene	Yes	Yes	Yes
Vinyl Chloride	Yes	Yes	Yes

Note:

NA = Not further analyzed

Table 4

Selection of Chemicals of Concern - Metals in Offsite Groundwater

Metal	Detected Offsite?	Detected Onsite?	Are Onsite Concentrations Greater Than Offsite?	Frequency of Detection[a] >5%?	Upgradient Well Concentrations Exceeded?	Tap Water PRG Exceeded[a,b]?	Chemical of Concern?
Antimony	Yes	No	NA	NA	NA	NA	No
Arsenic	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Barium	Yes	Yes	Yes	Yes	Yes	No	No
Boron	Yes	Yes	Yes	Yes	Yes	No	No
Cadmium	Yes	Yes	No	NA	NA	NA	No
Chromium	Yes	Yes	Yes	No	NA	NA	No
Copper	Yes	Yes	No	NA	NA	NA	No
Lead	Yes	Yes	No	NA	NA	NA	No
Manganese	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nickel	Yes	Yes	Yes	No	NA	NA	No
Zinc	Yes	Yes	No	NA	NA	NA	No

Notes:

[a] Offsite downgradient wells
[b] At maximum concentration detected
NA = Not further analyzed

Table 5

Selection of Chemicals of Concern - Bradley Production Well

Chemical	Detection Frequency >5%	Chemical of Concern
Benzene	Yes	Yes
Chlorobenzene	Yes	Yes
Chloroform	Yes	Yes
1,2-Dichlorobenzene	Yes	Yes
1,1-Dichloroethene	Yes	Yes
1,2-Dichloroethene (cis)	Yes	Yes
1,2-Dichloroethene (trans)	Yes	Yes
Tetrachloroethene	Yes	Yes
Trichloroethene	Yes	Yes
Vinyl Chloride	Yes	Yes

Table 6

Toxicity Criteria for Chemicals of Concern

Chemical	USEPA Carcinogenic Classification	Slope Factor (SF) mg/kg-day[-1]			Reference Dose (RfD) mg/kg-day		
		Oral	Inhalation	Reference	Oral	Inhalation	Reference
Arsenic	A	1.5	1.5	IRIS, 1995	0.008	ND	IRIS, 1995
Benzene	A	0.029	0.029	IRIS, 1995	ND	ND	IRIS, 1995
Chlorobenzene	D	NA	NA	IRIS, 1995	0.02	0.0057	IRIS, 1995 HEAST, 1994
Chloroform	B2	0.0061	0.082	IRIS, 1995	0.01	0.01[a]	IRIS, 1995
1,2-Dichlorobenzene	D	NA	NA	IRIS, 1995	0.09	0.057	IRIS, 1995
1,3-Dichlorobenzene	NA	NA	NA	IRIS, 1995	NA	NA	IRIS, 1995
1,4-Dichlorobenzene	B2	0.024	0.024[a]	HEAST, 1994	0.23[a]	0.23	IRIS, 1995
1,1-Dichloroethane	D	NA	NA	IRIS, 1995	0.1	0.14	HEAST, 1994
1,2-Dichloroethane	B2	0.091	0.091	IRIS, 1995	ND	ND	IRIS, 1995
1,1-Dichloroethene	C	0.6	0.18	IRIS, 1995	0.009	0.009[a]	IRIS, 1995
1,2-Dichloroethene (trans)	D	NA	NA	IRIS, 1995	0.02	0.02	IRIS, 1995
1,2-Dichloroethene (cis)	D	NA	NA	IRIS, 1995	0.01	0.01	HEAST, 1994
1,2-Dichloroethene (mixed)	D	NA	NA	IRIS, 1995	0.009	0.009[a]	HEAST, 1994
Ethylbenzene	D	NA	NA	IRIS, 1995	0.1	0.29	IRIS, 1995
Freon 11	D	NA	NA	IRIS, 1995	0.3	0.2	IRIS, 1995 HEAST, 1994
Freon 12	D	NA	NA	IRIS, 1995	0.2	0.057	IRIS, 1995 HEAST, 1994
Freon 113	D	NA	NA	IRIS, 1995	30	8.6	IRIS, 1995 HEAST, 1994

Table 6 (continued)

Toxicity Criteria for Chemicals of Concern

Chemical	USEPA Carcinogenic Classification	Slope Factor (SF) mg/kg-day^{-1}			Reference Dose (RfD) mg/kg-day		
		Oral	Inhalation	Reference	Oral	Inhalation	Reference
Manganese	D	NA	NA	IRIS, 1995	0.005	0.000014	IRIS, 1995
Methylene Chloride	B2	0.0075	0.0016	IRIS, 1995	0.06	0.86	IRIS, 1995 HEAST, 1994
Tetrachloroethene (PCE)	B2-C	0.052	0.002	ECAO, 1995	0.01	0.01[a]	IRIS, 1995
Toluene	D	NA	NA	IRIS, 1995	0.2	0.11	IRIS, 1995 HEAST, 1994
1,1,1-Trichloroethane (TCA)	D	NA	NA	IRIS, 1995	0.09	0.09[a]	HEAST, 1994
Trichloroethene (TCE)	B2-C	0.011	0.006	ECAO, 1995	0.006	0.006[a]	ECAO, 1995
Vinyl Chloride	A	1.9	0.3	HEAST, 1994	ND	ND	IRIS, 1995
Xylenes	D	NA	NA	IRIS, 1995	2.0	0.2	IRIS, 1995 EPA REGION IX, 1995

Notes:

NA	Not applicable (not a relevant toxicological endpoint)
ND	No toxicity criteria derived
IRIS	Integrated Risk Information System Database
ECAO	EPA Environmental Criteria Assessment Office
HEAST	Health Effects Assessment Summary Tables
[a]	Route-to-route extrapolation; oral value used for inhalation
A	Human carcinogen (sufficient evidence of carcinogenicity in humans)
B2	Probable human carcinogen (sufficient evidence of carcinogenicity in animals with inadequate of lack of human data)
C	Possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate of lack of human data)
D	Not classifiable as to human carcinogenicity

Table 7

Deterministic Exposure Parameters For Future Onsite Worker and Bradley Landfill Worker

Parameter	Average Exposure	Reasonable Maximum Exposure (RME)
General Parameters:		
Body Weight (BW)	Value: 70 kg Rationale: USEPA, 1989	Value: 70 kg Rationale: USEPA, 1989
Exposure Time	Value: 8 hours/day Rationale: Standard workday	Value: 8 hours/day Rationale: Standard workday
Exposure Frequency (EF)	Value: 250 days/year Rationale: 5 days per week; 50 weeks per year	Value: 250 days/year Rationale: 5 days per week; 50 weeks per year
Exposure Duration (ED)	Value: 4.2 years Rationale: 50th percentile (Bureau of Labor Statistics, 1990)	Value: 25 years Rationale: 95th percentile (Bureau of Labor Statistics, 1990)
Averaging Time (AT)	Value: Carcinogenic Effects: 70 years (25,550 days) Noncarcinogenic Effects: AT = 4.2 years (1,530 days)	Value: Carcinogenic Effects: 70 years (25,550 days) Noncarcinogenic Effects: AT = 25 years (9,130 days)
Inhalation:		
Breathing Rate (BR)	Value: Onsite Worker - 10 m^3/day Bradley Worker - 6.4 m^3/day Rationale: Average inhalation rates for heavy and moderate activity (USEPA, 1989)	Value: Onsite Worker - 20 m^3/day Bradley Worker - 10 m^3/day Rationale: Upperbound inhalation rates for heavy and moderate activity (USEPA, 1991)
Absorption Factor (ABS)	Value: 1.0 Rationale: Maximum assumed	Value: 1.0 Rationale: Maximum assumed

Table 8

Deterministic Exposure Parameters For Future Offsite Worker

Parameter	Average Exposure	Reasonable Maximum Exposure (RME)
General Parameters:		
Body Weight (BW)	Value: 70 kg Rationale: USEPA, 1989	Value: 70 kg Rationale: USEPA, 1989
Exposure Time	Value: 8 hours/day Rationale: Standard workday	Value: 8 hours/day Rationale: Standard workday
Exposure Frequency (EF)	Value: 250 days/year Rationale: 5 days per week; 50 weeks per year	Value: 250 days/year Rationale: 5 days per week; 50 weeks per year
Exposure Duration (ED)	Value: 4.2 years Rationale: 50th percentile (Bureau of Labor Statistics, 1990)	Value: 25 years Rationale: 95th percentile (Bureau of Labor Statistics, 1990)
Averaging Time (AT)	Value: Carcinogenic Effects: 70 years (25,550 days) Noncarcinogenic Effects: AT = 4.2 years (1,530 days)	Value: Carcinogenic Effects: 70 years (25,550 days) Noncarcinogenic Effects: AT = 25 years (9,130 days)
Groundwater Ingestion:		
Ingestion Rate (IR)	Value: 0.65 L/day Rationale: Ershow and Cantor, 1989	Value: 1 L/day Rationale: EPA, 1991
Absorption Factor (ABS)	Value: 1.0 Rationale: Maximum assumed	Value: 1.0 Rationale: Maximum assumed

Table 9

Representative Groundwater Concentrations to Evaluate Drinking Water Exposures to Offsite Workers

Chemical Name	Mean (µg/l)	95% UCL (µg/l)
Arsenic	7.73	9.02
Benzene	1.04	3.56
Chlorobenzene	1.25	2.24
Chloroform	0.99	1.36
1,2-Dichlorobenzene	2.57	3.76
1,4-Dichlorobenzene	0.80	1.06
1,1-Dichloroethane	1.39	2.27
1,2-Dichloroethane	0.39	0.46
1,1-Dichloroethene	2.45	2.82
1,2-Dichloroethene (cis)	11.5	16.9
1,2-Dichloroethene (trans)	0.42	0.63
Freon 11	0.57	0.67
Freon 12	0.66	0.80
Manganese	424	566
Methylene Chloride	1.73	2.27
Tetrachloroethene	0.79	0.94
1,1,1-Trichloroethane	0.88	1.04
Trichloroethene	12.6	15.0
Vinyl Chloride	15.2	31.2

Table 10

Estimated Air Concentrations - Future Onsite Worker

Chemical	Average Air Concentration ($\mu g/m^3$)	95% UCL Air Concentration ($\mu g/m^3$)
Benzene	0.654	0.867
Chlorobenzene	1.05	1.45
1,2-Dichlorobenzene	0.973	1.51
1,3/1,4-Dichlorobenzene	1.28	2.26
1,1-Dichloroethane	0.289	0.701
1,1-Dichloroethene	0.0581	0.115
1,2-Dichloroethene (total)	0.105	0.153
Ethylbenzene	0.501	0.826
Freon 11	0.00247	0.00492
Freon 113	0.00289	0.00619
Tetrachloroethene	0.00639	0.00106
Toluene	0.163	0.264
1,1,1-Trichloroethane	0.0014	0.00227
Trichloroethene	0.0341	0.0595
Vinyl Chloride	0.271	0.374
Xylenes (total)	2.09	2.97

Table 11

Representative Groundwater Concentrations - Bradley Worker

Chemical	Mean (µg/l)	95% UCL
Benzene	0.27	0.30
Chlorobenzene	6.77	11.7
Chloroform	0.30	0.44
1,2-Dichlorobenzene	25.1	40.0
1,1-Dichloroethene	0.32	0.44
1,2-Dichloroethene (cis)	88.1	171.7
1,2-Dichloroethene (trans)	1.0	2.0
Tetrachloroethene	0.17	0.21
Trichloroethene	3.04	4.1
Vinyl Chloride	61.2	99.3

Table 12

Estimated Air Concentrations - Bradley Worker

Chemical	Air Concentrations for Average Worker (ug/m^3)	Air Concentrations for RME Worker (ug/m^3)
Benzene	0.0113	0.0126
Chlorobenzene	0.284	0.49
Chloroform	0.0126	0.0184
1,2-Dichlorobenzene	1.05	1.67
1,1-Dichloroethene	0.0134	0.0184
1,2-Dichloroethene (cis)	3.69	7.19
1,2-Dichloroethene (trans)	0.042	0.0825
Tetrachloroethene	0.00712	0.0088
Trichloroethene	0.127	0.171
Vinyl Chloride	2.56	4.16

Table 13

Exposure Parameter Distributions Used in Probabilistic Risk Assessment

Exposure Parameters	Distribution	Values	Study/Reference
Groundwater Concentration (μg/L)	Discrete Uniform	Arsenic: 4.58, 8.18, 6.23, 6.13, 6.81, 7.13, 6.08, 10.3, 12.3, 8.67, 6.00, 5.50, 5.17, 6.40 Vinyl Chloride: 1.52, 53.8, 0.40, 0.48, 0.10, 0.10, 13.0, 0.10, 390, 0.58, 0.22, 0.75, 5.80, 5.71, 4.57, 3.79	Based on site monitoring data
Body Weight (kg)	Cumulative	Min 44; Max 107; 5% 52.3; 15% 57.6; 50% 68.7; 85% 84.4; 95% 97	NHANES II: EPA, 1990; AIHC, 1994
Exposure Duration (yrs)	Cumulative	Min 0.01; Max 30; 5% 1; 10% 1; 25% 1; 50% 3.8; 75% 11; 90% 19; 95% 29	U.S. Dept. Labor, 1992; Finley et al., 1994
Groundwater Ingestion Rate (L/day[a])	Cumulative	Min 0.0565; Max 2.1; 1% 0.057; 5% 0.200; 10% 0.274; 25% 0.444; 50% 0.661; 75% 0.95; 90% 1.245; 95% 1.493; 99% 2.076	Modified from Ershow and Cantor, 1989; EPA, 1991

	Arithmetic Mean Concentration (μg/L)								
	EW-1	EW-4	EW-7	EW-10	EW-12	EW-13	EW-14	EW-17	EW-18
Arsenic	4.58	8.18	6.23	6.13	6.81	7.13	6.08	10.3	12.3
Vinyl Chloride	1.52	53.8	0.40	0.48	0.10	0.10	13.0	0.10	390

	Arithmetic Mean Concentration (μg/L)						
	SB-4	SB-6	TW-1	TW-2	TW-3	TW-4	TW-P
Arsenic	NA	NA	8.67	6.00	5.50	5.17	6.40
Vinyl Chloride	0.58	0.22	0.75	5.80	5.71	4.57	3.79

Note: a = at worksite

Table 14

Non-Cancer Hazard Summary for Average and RME Onsite Worker from Inhalation Exposure

Chemical	Average Worker	RME Worker
	Hazard Quotient	Hazard Quotient
Chlorobenzene	1.80×10^{-2}	4.98×10^{-2}
1,2-Dichlorobenzene	1.67×10^{-3}	5.18×10^{-3}
1,3/1,4-Dichlorobenzene	5.45×10^{-4}	1.92×10^{-3}
1,1-Dichloroethane	2.02×10^{-4}	9.8×10^{-4}
1,1-Dichloroethene	6.32×10^{-4}	2.50×10^{-3}
1,2-Dichloroethene (total)	1.14×10^{-3}	3.33×10^{-3}
Ethylbenzene	1.69×10^{-4}	5.57×10^{-4}
Freon 11	1.21×10^{-6}	4.81×10^{-6}
Freon 113	3.29×10^{-8}	1.41×10^{-7}
Tetrachloroethene	6.25×10^{-5}	2.07×10^{-4}
Toluene	1.45×10^{-4}	4.79×10^{-4}
1,1,1-Trichloroethane	4.72×10^{-7}	1.53×10^{-6}
Trichloroethene	5.56×10^{-4}	1.94×10^{-3}
Xylenes (total)	1.02×10^{-3}	2.91×10^{-3}
TOTAL HAZARD INDEX:	**0.024**	**0.070**

Table 15

Non-Cancer Hazard Summary for Average and RME
Bradley Landfill Worker from Inhalation Exposure

Chemical	Average Worker Hazard Quotient	RME Worker Hazard Quotient
Chlorobenzene	0.00314	0.00847
Chloroform	0.0000795	0.000181
1,2-Dichlorobenzene	0.00116	0.002898
1,2-Dichloroethene (cis)	0.0259	0.0787
Tetrachloroethene	0.0000449	0.0000867
Trichloroethene	0.00134	0.00281
Total Hazard Index:	0.032	0.094

Table 16

Non-Cancer Hazard Summary for Average and RME Offsite Worker from Groundwater Ingestion

Chemical	Average Worker Hazard Quotient	Percent Contribution	RME Worker Hazard Quotient	Percent Contribution
Arsenic	1.64×10^{-1}	22.5	2.94×10^{-1}	20.3
Chlorobenzene	3.98×10^{-4}	0.05	1.10×10^{-3}	0.08
Chloroform	6.30×10^{-4}	0.09	1.33×10^{-3}	0.09
1,2-Dichlorobenzene	1.82×10^{-4}	0.02	4.09×10^{-4}	0.03
1,4-Dichlorobenzene	2.21×10^{-5}	0.003	4.51×10^{-5}	0.003
1,1-Dichloroethane	1.20×10^{-4}	0.02	2.22×10^{-4}	0.02
1,1-Dichloroethene	1.73×10^{-3}	0.24	3.07×10^{-3}	0.21
1,2-Dichloroethene (cis)	7.31×10^{-3}	1.0	1.65×10^{-2}	1.14
1,2-Dichloroethene (trans)	1.34×10^{-4}	0.02	3.08×10^{-4}	0.02
Freon 11	1.21×10^{-5}	0.002	2.19×10^{-5}	0.002
Freon 12	2.10×10^{-5}	0.003	3.91×10^{-5}	0.003
Manganese	5.39×10^{-1}	74.1	1.11	76.4
Methylene Chloride	1.83×10^{-4}	0.03	3.70×10^{-4}	0.03
Tetrachloroethene	5.02×10^{-4}	0.07	9.20×10^{-4}	0.06
1,1,1-Trichloroethane	6.22×10^{-5}	0.01	1.13×10^{-4}	0.01
Trichloroethene	1.34×10^{-2}	1.8	2.45×10^{-2}	1.7
TOTAL HAZARD INDEX:	**0.73**	**100**	**1.45**	**100**

Table 17

Non-Cancer Hazard Summary for RME Offsite Worker

Chemical	Hazard Quotient	Percent Contribution
Arsenic	3.61 x 10-1	28
Bromodichloromethane	3.45 x 10-4	0.026
Chlorobenzene	5.62 x 10-4	0.044
Chloroform	1.22 x 10-3	0.095
1,2-Dichlorobenzene	2.81 x 10-4	0.02
1,1-Dichloroethene	2.73 x 10-3	0.21
1,2-Dichloroethene (cis)	1.13 x 10-2	0.88
1,2-Dichloroethene (trans)	1.73 x 10-4	0.013
Manganese	8.87 x 10-1	68.8
Methylene Chloride	3.83 x 10-4	0.03
Tetrachloroethene	8.77 x 10-4	0.07
1,1,1-Trichloroethane	1.16 x 10-4	0.009
Trichloroethene	2.17 x 10-2	1.7
TOTAL HAZARD INDEX:	**1.29**	**100**

Table 18

Cancer Risk Summary for Average and RME Onsite Worker from Inhalation Exposure

Chemical	Average Worker		RME Worker	
	Cancer Risk	Percent Contribution	Cancer Risk	Percent Contribution
Benzene	1.1×10^{-7}	13.2	1.76×10^{-6}	11.8
1,3/1,4-Dichlorobenzene	1.8×10^{-7}	21.6	3.79×10^{-6}	25.4
1,1-Dichloroethene	6.14×10^{-8}	7.4	1.45×10^{-6}	9.7
Methylene Chloride	2.02×10^{-10}	0.024	3.37×10^{-9}	0.023
Tetrachloroethene	7.5×10^{-11}	0.009	1.48×10^{-9}	0.010
Trichloroethene	1.2×10^{-9}	0.14	2.50×10^{-8}	0.17
Vinyl Chloride	4.77×10^{-7}	57.3	7.84×10^{-6}	52.6
TOTAL CANCER RISK:	8×10^{-7}		1×10^{-5}	

Table 19

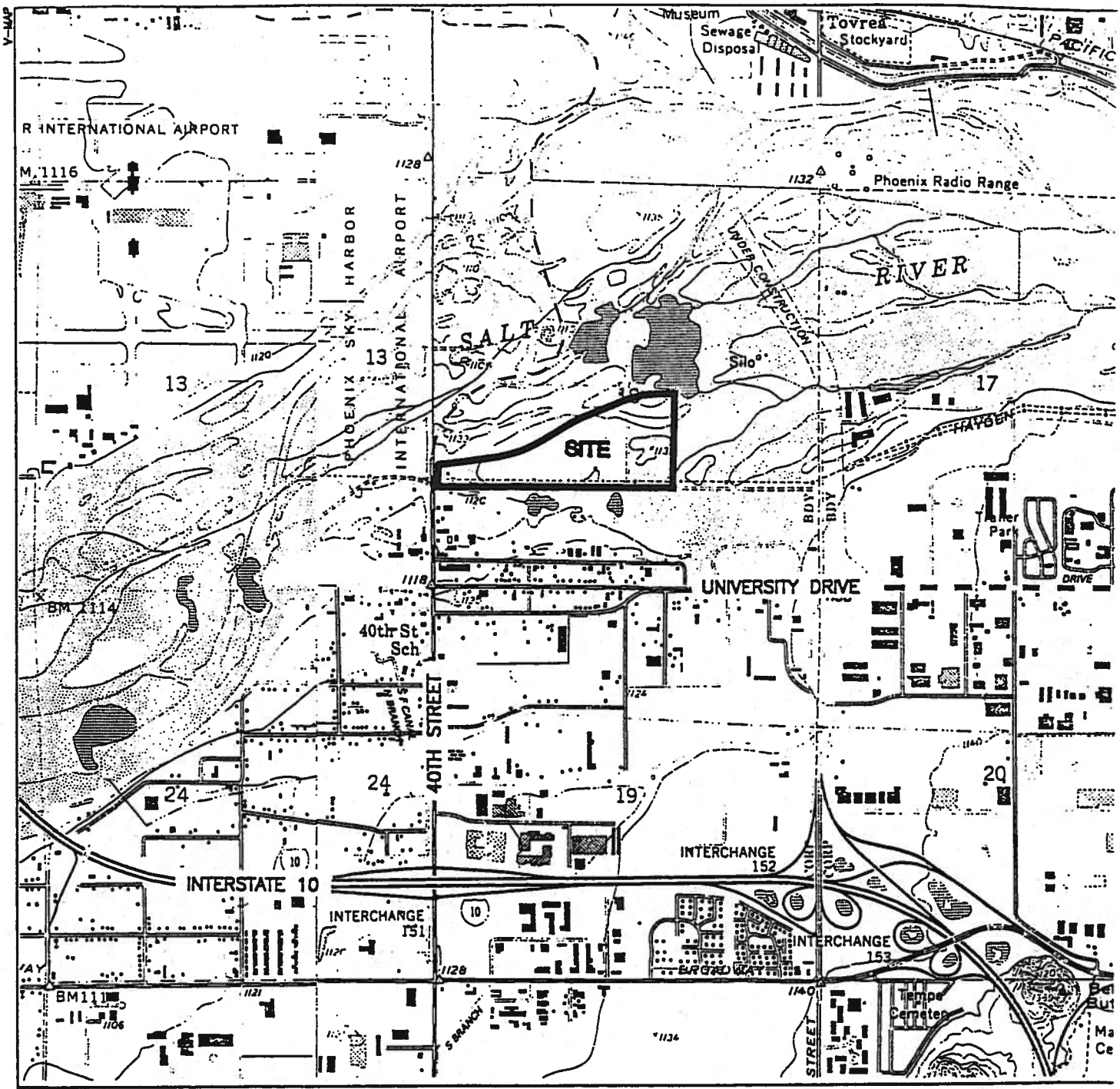
Cancer Risk Summary for the Average and RME Offsite Worker from Groundwater Ingestion (Deterministic)

Chemical	Average Worker Cancer Risk	Percent Contribution	RME Worker Cancer Risk	Percent Contribution
Arsenic	4.43×10^{-6}	27.5	4.73×10^{-5}	18.1
Benzene	1.15×10^{-8}	0.07	3.61×10^{-7}	0.14
Chloroform	2.30×10^{-9}	0.01	2.90×10^{-8}	0.01
1,4-Dichlorobenzene	7.33×10^{-9}	0.05	8.89×10^{-9}	0.03
1,2-Dichloroethane	1.35×10^{-8}	0.08	1.46×10^{-7}	0.06
1,1-Dichloroethene	5.61×10^{-7}	3.5	5.91×10^{-6}	2.3
Methylene Chloride	4.95×10^{-9}	0.03	5.95×10^{-8}	0.02
Tetrachloroethene	1.57×10^{-8}	0.10	1.75×10^{-7}	0.07
Trichloroethene	5.29×10^{-8}	0.33	5.77×10^{-7}	0.22
Vinyl Chloride	1.10×10^{-5}	68.4	2.07×10^{-4}	79.13
TOTAL CANCER RISK:	2×10^{-5}	100	3×10^{-4}	100

Table 20

Probabilistic Cancer Risk Estimates
for the Future Offsite Worker

	Percentile		
	50th	90th	95th
Total Cancer Risk	7×10^{-6}	6×10^{-5}	1×10^{-4}
Individual Cancer Risks:			
Arsenic	3×10^{-6}	2×10^{-5}	3×10^{-5}
Vinyl Chloride	1×10^{-6}	4×10^{-5}	1×10^{-4}



REFERENCE: USGS 7.5 MINUTE TEMPE & PHOENIX QUADRANGLE; PHOENIX, ARIZONA (photorevised 1982)

0 2000 4000 6000

SCALE IN FEET

N

Harding Lawson Associates
Engineering and Environmental Services

VICINITY MAP

Estes Landfill
Phoenix, Arizona

PLATE 1

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
DBS	32036-1.10	RP	7/95	

I-10\1095F5SES

PLOT 1 = 800 HDI

SKY HARBOR INTERNATIONAL AIRPORT

ARIZONA
AIR NATIONAL GUARD

Salt River

EW-11

EW-PZ4
/EW-16

EW-2

EW-NE

EW-3

EW-9

EW-PZ1

EW-15

EW-OE

EW-PZ6

EW-NW

EW-PZ5

EW-RW2

EW-8

EW-RW1

EW-1

TANNER COMPANY

TW-4

EW-5

EW-W

BW-P

EW-6

EW-E

EW-PZ2

EW-PZ3

BW-NE

TW-USGS

TW-3

EW-4

EW-18

TW-P

ARIZONA DESIGN
CENTER

WASTE
MANAGEMENT

BRADLEY LANDFILL

BW-W

BW-S

BW-SE

TW-2
(ABANDONED)

EW-12

EW-14

EW-7

HEWSON DEVELOPMENT

ADC-1

TW-1

Magnolia Street

HEWSON/SOUTHBANK
SB-4

EW-17

University Drive

ADC-4

ADC-2

SB-6

Winslow Avenue

EW-10

EW-13

Highway 143

ADC-3

SOUTHBANK LAKE

SOUTHBANK
DEVELOPMENT

SB-7

SB-3

University Drive

SB-5

To SB-2

SB-1

EXPLANATION

EW-2	Monitor Well (Shallow: ≤100')	— —	Estes Landfill, 1971 (Approximate)
EW-5	Monitor Well (Deep: >100')	- - - - -	Estes Landfill (Current)
TW-P	Production Well Location	.....	Excavated Area
EW-RW1	Recovery Well Location	———	Area of Relocated Refuse
EW-PZ4 /EW-16	Multiple Completion Well	EW-13	Groundwater Wells Evaluated in the Risk Assessment
	Area of evaluated offsite groundwater wells		Generalized Flow Direction (No River Flow)

N

800 0 800

SCALE IN FEET

HLA

HARDING LAWSON ASSOCIATES
Engineering and
Environmental Services

SITE MAP WITH GROUNDWATER MONITORING LOCATIONS
Estes Landfill
Phoenix, Arizona

PLATE
2

DRAWN	PROJECT-TASK NUMBER	APPROVED	DATE	REVISED DATE
JTL	32036-1.10	RP	10/95	

APPENDIX A

SOIL GAS DATA FROM PHASE I AND PHASE II INVESTIGATIONS

Table 1
Phase II Soil Gas Results
Estes Landfill

SAMPLE ID	SAMPLE DEPTH (FEET)	DATE SAMPLED	CH2CL2 UG/L	FREON 11 UG/L	1,1-DCE UG/L	1,1-DCA UG/L	TOTAL 1,2-DCE UG/L	CHCL3 UG/L	FREON 113 UG/L	1,2-DCA UG/L	TCA UG/L	CCL4 UG/L	TCE UG/L	PCE UG/L	BENZENE UG/L	TOLUENE UG/L	CHLORO--BENZENE UG/L	ETHYL BENZENE UG/L	TOTAL XYLENES UG/L	TVHC UG/L
SG-101	9.5	08/08/94	<0.02	0.001	<0.01	<0.1	<0.1	<0.0005	0.001	<0.05	<0.0002	<0.00007	0.001	0.0008	14	9	<0.3	20	66	1300
SG-102	9.5	08/08/94	<0.02	0.0006	<0.01	<0.1	<0.1	<0.0005	<0.0005	<0.05	<0.0002	<0.00007	0.009	0.004	2	2	<0.3	1	14	28
SG-103	9.5	08/08/94	<1	0.001	0.10	<0.1	2	<0.0005	<0.0005	<0.05	<0.0002	<0.00007	0.2	0.002	0.08	0.2	<0.3	0.8	<0.1	25
SG-104	9.5	08/08/94	<0.02	0.0004	0.01	0.5	0.2	<0.0005	<0.0005	<0.05	<0.0002	<0.00007	0.008	0.002	3	0.9	<0.3	5	3	30
SG-105	9.5	08/08/94	<0.02	0.1	<0.01	0.5	0.1	<0.0005	0.3	<0.05	<0.0002	<0.00007	0.04	0.02	16	1	2	22	10	73
SG-106	9.5	08/08/94	<0.02	0.003	<0.01	38	0.1	<0.0005	<0.0005	<0.05	0.05	<0.00007	0.02	0.08	0.5	2	<0.3	1	41	1600
SG-107	9.5	08/09/94	<0.05	0.2	<0.02	0.4	2	<0.001	0.04	<0.1	0.02	<0.0002	0.9	0.3	2	2	<0.8	3	5	25
SG-107A	9.5	08/11/94	<0.01	0.005	<0.2	0.2	<0.5	0.1	<0.002	<0.07	<0.003	<0.0004	0.8	0.01	<0.1	0.8	<1	<2	18	90
SG-107B	9.5	09/02/94	<0.1	<0.1	<0.1	0.3	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.1	2.0	1.0	<0.1	<0.1	2	<0.1
SG-108	9.5	08/09/94	<0.05	0.002	<0.02	<0.3	<0.3	<0.001	<0.001	<0.1	<0.0005	<0.0002	<0.001	0.002	0.4	0.5	<0.3	2	2	15
SG-108A	9.5	08/10/94	<0.2	<0.0003	<0.06	<0.5	<0.4	<0.002	<0.02	<2	<0.02	<0.004	0.02	0.002	<3	0.3	<3	<0.2	5	84
SG-109	9.5	08/09/94	<0.05	0.002	<0.02	<0.3	<0.3	<0.001	<0.001	<0.1	<0.0005	<0.0002	<0.001	0.001	<0.7	<1	<5	<1	<2	1
SG-109A	9.5	08/10/94	<0.2	<0.0003	<0.06	<2	<2	<0.007	<0.006	<0.6	<0.004	<0.001	0.01	0.03	<0.1	0.2	<0.3	0.5	11	15
SG-109B	9.5	08/10/94	<0.07	0.003	<0.02	<0.8	<0.6	<0.003	<0.002	<0.2	<0.002	<0.0004	<0.0006	0.02	<0.1	<0.2	<0.3	<0.2	<0.2	<0.2
SG-110	9.5	08/09/94	<0.02	0.0005	<0.01	<0.1	<0.1	<0.0005	<0.0005	<0.04	<0.0002	<0.00007	0.01	0.0003	<0.04	<0.08	<0.3	<0.07	5	21
SG-111	9.5	08/10/94	<0.07	<0.0005	<0.02	<0.8	<0.6	<0.003	<0.002	<0.2	<0.002	<0.0004	0.007	0.008	<0.1	<0.2	<0.3	<0.2	<0.2	<0.2
SG-112	9.5	08/10/94	<0.3	<0.0005	<0.1	<0.8	<0.6	<0.003	<0.002	<0.2	<0.002	<0.0004	0.07	<0.003	<0.1	<0.2	<0.3	2	<0.2	6
SG-113	9.5	08/14/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.1	0.008	1	<0.2	<3	<0.2	6	10
SG-114	9.5	08/14/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.02	0.003	0.8	<0.2	<3	<0.2	12	16
SG-115	9.5	08/14/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.07	0.004						
SG-116	9.5	08/11/94	<0.01	<0.0006	<0.1	<0.2	<0.5	<0.0003	<0.002	<0.06	<0.003	<0.0004	0.1	<0.001	<0.1	<0.2	<0.3	<0.2	1	3
SG-117	9.5	08/11/94	0.30	<0.001	<0.2	<0.2	<1	<0.0006	<0.004	<0.1	<0.005	<0.001	0.5	<0.003	<0.1	0.4	<0.3	2	0.9	14
SG-118	9.5	08/11/94	0.30	0.0003	<0.1	<0.1	<0.2	<0.0001	<0.001	<0.03	<0.001	<0.0002	0.6	0.008	<0.1		<0.3	2	0.9	17
SG-119	9.5	08/11/94	<0.01	<0.0006	<0.2	<0.2	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	<0.1	<0.001	<0.1	<0.2	<0.3	<0.2	<0.2	<0.4
SG-120	9.5	08/11/94	<0.01	<0.0006	<0.2	<0.2	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	5	0.03	<0.1	<0.2	<0.3	<4	2	9
SG-121	9.5	08/11/94	<0.01	0.001	<0.2	<0.2	<0.5	<0.0003	0.008	<0.07	<0.003	0.0005	<0.1	<0.001	<0.1	<0.2	<0.3	<0.2	<0.2	<0.4
SG-122	30	08/11/94	0.20	<0.0006	<0.1	<0.1	<0.2	<0.0001	<0.001	<0.03	<0.001	<0.0002	0.4	0.001	<0.1	<0.2	<0.3	<0.2	<0.2	2
SG-123	30	08/11/94	<0.01	<0.0006	<0.2	<0.2	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	<0.1	<0.001	4	<0.2	<0.3	<0.2	20	64
SG-124	30	08/12/94	0.10	0.002	<0.1	<0.1	<0.5	<0.0003	<0.002	0.07	0.04	<0.0004	0.02	0.01	<0.05	<0.8	<2	<1	<1	<1
SG-125	30	08/12/94	0.20	0.0008	<0.05	<0.06	<0.2	<0.0001	<0.001	<0.03	<0.001	<0.0002	0.02	0.002	4	<0.2	14	<0.2	<0.2	6
SG-126	30	08/12/94	0.20	<0.0006	<0.1	<0.1	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	0.02	0.004	9	<0.2	11	<0.2	2	20
SG-127	30	08/12/94	0.40	<0.0006	<0.1	<0.1	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	0.02	0.005	9	<0.2	21	<0.2	14	25
SG-128	25	08/12/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	<0.003	<0.001	<0.1	<0.2	<0.3	<0.2	<0.2	<0.2
SG-129	30	08/12/94	0.20	<0.0006	<0.1	<0.1	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	0.02	0.01	3	<0.2	<4	1	3	13
SG-130	25	08/12/94	0.20	<0.0006	<0.1	<0.1	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	<0.003	<0.001	13	<0.2	20	<0.2	10	21
SG-131	25	08/12/94	0.01	<0.0006	<0.1	<0.1	<0.5	<0.0003	<0.002	<0.07	<0.003	<0.0004	0.01	0.01	8	<0.2	26	<0.2	6	13
SG-132	25	08/13/94	<0.006	<0.0003	<0.05	<0.06	<0.2	<0.001	<0.001	<0.03	<0.001	<0.0002	0.007	0.003	29	<0.2	59	<0.2	5	24
SG-133	25	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.03	0.01	2	<0.2	6	0.5	12	22
SG-134	25	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.01	0.005	0.7	<0.2	1	0.5	3	4
SG-135	25	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.02	0.004	0.9	<0.2	0.6	<0.2	<0.7	1
SG-136	25	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.04	0.01	3	<0.2	4	3	10	21
SG-137	25	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.01	0.004	0.8	<0.2	8	3	15	23
SG-138	20	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	<0.003	<0.001	1	<0.2		<0.2	2	4
SG-139	25	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0005	0.02	0.005	1	<0.2	<0.3	<0.2	6	20
SG-140	25	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	0.02	0.02	0.4	<0.2	<0.3	<0.2	<0.2	24
SG-141	19	08/13/94	<0.01	<0.0006	<0.1	<0.1	<0.5	<0.003	<0.002	<0.07	<0.003	<0.0004	<0.003	<0.001	<0.1	<0.2	<0.3	<0.2	<0.2	<0.2
FB11MAR					<0.01		<0.01						<0.01	<0.01	<0.01		<0.01			
FB12MAR					<0.01		<0.01						<0.01	<0.01	<0.01		<0.01			
FB13MAR					<0.01		<0.01						<0.01	<0.01	<0.01		<0.01			
FB14MAR					<0.01		<0.01						<0.01	<0.01	<0.01		<0.01			
SG01-05					<0.01		<0.01						<0.01	<0.01	0.49		<0.01			
SG01-10					0.13		<0.01						<0.01	<0.01	1.6		0.72			
SG01-15					<0.01		<0.01						<0.01	<0.01	0.84		0.06			
SG01-20					0.20		0.1						<0.01	<0.01	0.98		1.03			
SG02-05					<0.01		<0.01						<0.01	<0.01	0.75		0.81			
SG02-10A					<0.01		<0.01						<0.01	<0.01	2.59		11.7			
SG02-10B					<0.01		<0.01						<0.01	<0.01	2.36		7.23			
SG02-15					<0.01		<0.01						<0.01	<0.01	3.18		9.77			
SG02-20					<0.01		0.05						0.03	<0.01	2.27		3.29			
SG03-10					<0.01		0.03						<0.01	<0.01	0.57		4.43			
SG04-10					1.22		<0.01						<0.01	<0.01	6.6		21.3			
SG05-10					11.20		0.07						<0.01	0.07	6.36		13.4			
SG06-10					1.35		8.36						0.27	0.22	0.87		0.72			
SG07-10					<0.01		0.77						<0.01	<0.01	1.6		5.36			
SG08-10					<0.01		<0.01						<0.01	<0.01	0.45		4.53			
SG09-10A							0.2						0.04	0.03	1.42		0.41			
SG09-10B					2.31		0.08						0.04	0.03	1.27		0.42			

Table 1
Phase II Soil Gas Results
Estes Landfill

SAMPLE ID	SAMPLE DEPTH (FEET)	DATE SAMPLED	CH2CL2 UG/L	FREON 11 UG/L	1,1-DCE UG/L	1,1-DCA UG/L	TOTAL 1,2-DCE UG/L	CHCL3 UG/L	FREON 113 UG/L	1,2-DCA UG/L	TCA UG/L	CCL4 UG/L	TCE UG/L	PCE UG/L	BENZENE UG/L	TOLUENE UG/L	CHLORO--BENZENE UG/L	ETHYL BENZENE UG/L	TOTAL XYLENES UG/L	TVHC UG/L
SG10-10					<0.01		0.74						0.06	<0.01	1.19		0.08			
SG11-10					0.37		4.57						0.14	<0.01	0.27		<0.01			
SG12-10					<0.01		<0.01						<0.01	<0.01	0.05		<0.01			
SG13-10					<0.01		<0.01						<0.01	<0.01	0.37		<0.01			
SG14-10A					<0.01		<0.01						<0.01	<0.01	0.1		<0.01			
SG14-10B					<0.01		<0.01						<0.01	<0.01	0.17		<0.01			
SG15-10A					<0.01		0.01						<0.01	<0.01	0.33		0.04			
SG15-10B ^					<0.01		<0.01						<0.01	<0.01			<0.01			
SG16-10A					<0.01		0.03						0.01	<0.01	0.86		0.43			
SG16-10B ^					<0.01		<0.01						<0.01	0.77			2.82			
SG17-10					<0.01		0.01						<0.01	0.04	1.34		2.9			
SG18-10					0.07		0.64						<0.01	<0.01	1.12		4			
SG19-10					<0.01		<0.01						0.01	<0.01	0.22		0.09			
SG20-10A					<0.01		0.02						<0.01	<0.01	0.9		0.75			
SG20-10B					<0.01		0.02						<0.01	<0.01	0.74		<0.01			
SG21-10A					0.04		1.51						0.35	<0.01	0.51		0.61			
SG21-10B					0.04		1.58						0.34	<0.01	0.48		0.47			
SG22-10					<0.01		<0.01						<0.01	<0.01	0.14		0.13			
SG23-10					<0.01		0.06						<0.01	<0.01	6.9		13.2			
SG24-10					<0.01		0.03						0.02	<0.01	0.51		0.06			
SG25-10					<0.01		0.11						0.03	<0.01	0.37		0.08			
SG26-10					0.04		1.14						0.18	<0.01	0.09		0.03			
SG27-10					<0.01		0.08						0.02	0.02	0.54		0.12			
SG28-10					<0.01		0.03						<0.01	<0.01	13.5		21.6			
SG29-10					0.17		0.01						<0.01	<0.01	0.58		6.23			
SG30-10					<0.01		0.12						0.02	<0.01	1.81		12.8			
SG31-10					0.02		0.22						0.2	<0.01	8.97		2.58			
SG32-10					<0.01		0.07						0.01	<0.01	0.93		4.27			
SG33-10					<0.01		0.21						0.09	<0.01	3.09		1.28			
SG34-10A					<0.01		<0.01						<0.01	<0.01	<0.01		<0.01			
SG34-10B					<0.01		<0.01						<0.01	<0.01	<0.01		<0.01			
SG35-10					<0.01		<0.01						<0.01	<0.01	<0.01		<0.01			
SG36-10					0.03		<0.01						<0.01	<0.01	<0.01		<0.01			
SG37-10					<0.01		0.21						0.01	<0.01	1.44		3.3			
Calculations																				
# of detected samples			10	16	16	6	36	1	4	1	3	1	55	43	72	13	51	17	31	37
% detected			22	35	16	13	36	2	9	2	7	2	54	43	73	30	52	38	69	82
# of samples (N)			46	46	100	46	101	46	46	46	46	46	101	101	98	44	99	45	45	45
Average			7.20E-02	8.28E-03	1.95E-01	9.69E-01	3.51E-01		9.68E-03		4.71E-03		1.14E-01	2.14E-02	2.19E+00	5.46E-01	3.54E+00	1.68E+00	7.02E+00	8.20E+01
t distr.			1.68E+00	1.68E+00	1.66E+00	1.68E+00	1.66E+00		1.68E+00		1.68E+00		1.66E+00	1.66E+00	1.66E+00	1.68E+00	1.66E+00	1.68E+00	1.68E+00	1.68E+00
standard deviation			1.17E-01	3.31E-02	1.15E+00	5.58E+00	9.88E-01		4.47E-02		1.17E-02		5.14E-01	8.46E-02	4.26E+00	1.40E+00	7.91E+00	4.36E+00	1.18E+01	3.01E+02
95% UPL			1.01E-01	1.65E-02	3.86E-01	2.35E+00	5.14E-01		2.08E-02		7.60E-03		1.99E-01	3.54E-02	2.91E+00	9.01E-01	4.86E+00	2.77E+00	9.97E+00	1.57E+02
Max.[]			5.00E-01	2.00E-01	1.12E+01	3.80E+01	8.36E+00		3.00E-01		5.00E-02		5.00E+00	7.70E-01	2.90E+01	9.00E+00	5.90E+01	2.20E+01	6.60E+01	1.60E+03
Ci (UG/L, mg/m3)			1.01E-01	1.65E-02	3.86E-01	2.35E+00	5.14E-01		2.08E-02		7.60E-03		1.99E-01	3.54E-02	2.91E+00	9.01E-01	4.86E+00	2.77E+00	9.97E+00	1.57E+02
Using 95% UCL:																				
Ei (mg/sec),(if V=1.63E-3 cm/sec, A=175950.5 m2)			2.89E-01	4.73E-02	1.11E+00	6.74E+00	1.47E+00		5.95E-02		2.18E-02		5.72E-01	1.02E-01	8.34E+00	2.59E+00	1.39E+01	7.94E+00	2.86E+01	4.51E+02
Ca(mg/m3), (if Vo=2.25m/s, MH=2m, LS=419.46m)			1.53E-04	2.50E-05	5.86E-04	3.57E-03	7.80E-04		3.15E-05		1.16E-05		3.03E-04	5.38E-05	4.42E-03	1.37E-03	7.38E-03	4.21E-03	1.51E-02	2.39E-01
Ca(mg/m3), (if Vo=2.25m/s, MH=10m, LS=419.46m)			3.07E-05	5.01E-06	1.17E-04	7.14E-04	1.56E-04		6.31E-06		2.31E-06		6.06E-05	1.08E-05	8.83E-04	2.74E-04	1.48E-03	8.42E-04	3.03E-03	4.78E-02
Using Average																				
Ei (mg/sec),(if V=1.63E-3 cm/sec, A=175950.5 m2)			2.07E-01	2.38E-02	5.59E-01	2.78E+00	1.01E+00		2.78E-02		1.35E-02		3.28E-01	6.15E-02	6.29E+00	1.57E+00	1.01E+01	4.82E+00	2.01E+01	2.35E+02
Ca(mg/m3), (if Vo=2.25m/s, MH=10m, LS=419.46m)			2.19E-05	2.52E-06	5.92E-05	2.94E-04	1.07E-04		2.94E-06		1.43E-06		3.48E-05	6.51E-06	6.66E-04	1.66E-04	1.07E-03	5.10E-04	2.13E-03	2.49E-02

Table 1
Phase II Soil Gas Results
Estes Landfill

SAMPLE ID	SAMPLE DEPTH (FEET)	DATE SAMPLED	1,3/1,4-DCB UG/L	1,2-DCB UG/L	VINYL CHLORIDE UG/L	METHANE UG/L
SG-101	9.5	08/08/94	10	<0.8	<0.02	61000
SG-102	9.5	08/08/94	<1	<0.8	<0.02	120000
SG-103	9.5	08/08/94	<1	<0.8	2	<1000
SG-104	9.5	08/08/94	<1	<0.8	0.6	42000
SG-105	9.5	08/08/94	<1	<0.8	0.3	44000
SG-106	9.5	08/08/94		<0.8	2	<1000
SG-107	9.5	08/09/94	<3	<2	0.6	26000
SG-107A	9.5	08/11/94	<0.3	<0.2	0.6	49000
SG-107B	9.5	09/02/94	<0.1	<0.1	<0.1	
SG-108	9.5	08/09/94	<1	<2	<0.02	32000
SG-108A	9.5	08/10/94		<0.2	1	29000
SG-109	9.5	08/09/94	<20	<25	<0.02	<2600
SG-109A	9.5	08/10/94	0.6	<7	0.3	22000
SG-109B	9.5	08/10/94	<0.3	<0.2	<0.02	<2600
SG-110	9.5	08/09/94	<1	<2	0.06	43000
SG-111	9.5	08/10/94	<1	<0.2	<0.02	<2600
SG-112	9.5	08/10/94		<0.2		
SG-113	9.5	08/14/94	<0.3	<0.2	0.4	46000
SG-114	9.5	08/14/94	<0.3	<0.2	0.2	46000
SG-115	9.5	08/14/94	<0.3	<0.2	<0.02	47000
SG-116	9.5	08/11/94	<0.3	<0.2	<0.02	<2600
SG-117	9.5	08/11/94	<0.3	<0.6	<0.02	120000
SG-118	9.5	08/11/94	3	0.8	<0.02	47000
SG-119	9.5	08/11/94	<0.3	<0.2	<0.02	<2600
SG-120	9.5	08/11/94	<6	<0.4	<0.02	20000
SG-121	9.5	08/11/94	<0.3	<0.2	<0.02	<2600
SG-122	30	08/11/94	<0.3	<0.2	0.07	64000
SG-123	30	08/11/94	<0.3	<0.2	0.2	66000
SG-124	30	08/12/94	<1	<1	0.04	50000
SG-125	30	08/12/94	34	48	0.1	32000
SG-126	30	08/12/94	<0.3	14	0.2	65000
SG-127	30	08/12/94	72	<0.2	0.04	57000
SG-128	25	08/12/94	<0.3	<0.2	<0.02	<2600
SG-129	30	08/12/94	20	17	0.2	73000
SG-130	25	08/12/94	<3	<2	<0.02	61000
SG-131	25	08/12/94	1	51	<0.02	50000
SG-132	25	08/13/94	<0.3	51	<0.02	37000
SG-133	25	08/13/94	<0.3	<0.2	<0.02	37000
SG-134	25	08/13/94	<0.3	34	<0.02	190000
SG-135	25	08/13/94	<0.3	7	<0.02	62000
SG-136	25	08/13/94			0.2	62000
SG-137	25	08/13/94	<12	<8	0.1	44000
SG-138	20	08/13/94		<0.2	<0.02	58000
SG-139	25	08/13/94	<12	<8	0.2	64000
SG-140	25	08/13/94	<0.3	<0.2	0.6	51000
SG-141	19	08/13/94	<0.3	<0.2	<0.2	<2600
FB11MAR				<0.01	<0.01	
FB12MAR				<0.01	<0.01	
FB13MAR				<0.01	<0.01	
FB14MAR				<0.01	<0.01	
SG01-05				<0.01		
SG01-10				0.22	4.76	
SG01-15				<0.01	1.73	
SG01-20				0.56	8.1	
SG02-05				<0.01	0.1	
SG02-10A				0.09	0.5	
SG02-10B				60.01	<0.01	
SG02-15				<0.01		
SG02-20				0.35	0.78	
SG03-10				0.59	0.69	
SG04-10				1.39	0.79	
SG05-10				0.81	10.11	
SG06-10				<0.01	3.85	
SG07-10				0.06	2.26	
SG08-10				<0.01	0.36	
SG09-10A				<0.01	9.04	
SG09-10B				<0.01	7.12	

Notes: CH2CL2 = ...YLENE
CHCL3 = CHLOROFOR
CCL4 = CARBON TETR

UG/L = MICROGRAMS PER LITER
INT = INTERFERENCE
NA = NOT ANALYZED

FB = FIELD BLANK
ND* NO DATA DUE TO INTEGRATION DIFFICULTIES
A,B DENOTE SERIAL DUPLICATES
^ DENOTS SAMPLES ANALYZED FOR THE 601 SUITE
NA = NOT PART OF THE 601 SUITE THEREFORE NOT ANALYZED

FUNCTIONS	
# of detected sample	=COUNT(C7:C108)
% detected	=(C110/C112)*100
# of samples (N)	=COUNTA(C7:C108)
Average .	=AVERAGE(D7:D108)
t distr.	=IF(C112<47,IF(C112<43,1.684,1.679),1.66)
standard deviation	=STDEV(D7:D108)
95% UPL	=C121+(C122*C123*(1/C120)^0.5)
Max.[]	=MAX(#REF!)
CI (UG/L)	=IF(AW20>AW19,AW19,AW20)
EI (mg/sec)	=AV21*0.00163*175950.5*0.01
Ca(mg/m3 (H=2m)	=AV22/(419.46*2.25*2)
Ca(mg/m3 (H=10m)	=BF18/(419.46*2.25*10)
Using Average	
EI (mg/sec),	=BF11*0.00163*175950.5*0.01
Ca(mg/m3)	=AY27/(419.46*2.25*10)

PARAMETERS
Area of Emission = 1,893,977.8494 ft2 = 175,950.5 m2
Mean Landfill Gas Velocity = 1.63 E-3 cm/sec.
Lenght of box (Square root of area of emissions) = 419.46 m
Box Height = 2 m or 10m
Average Wind Speed = 2.25 m/sec.

Table 1
Phase II Soil Gas Results
Estes Landfill

SAMPLE ID	SAMPLE DEPTH (FEET)	DATE SAMPLED	1,3/1,4-DCB UG/L	1,2-DCB UG/L	VINYL CHLORIDE UG/L	METHANE UG/L
SG10-10				<0.01	7.87	
SG11-10				<0.01	7.16	
SG12-10				<0.01	<0.01	
SG13-10				<0.01	<0.01	
SG14-10A				<0.01	<0.01	
SG14-10B				<0.01	<0.01	
SG15-10A				<0.01	<0.01	
SG15-10B ^				<0.01	<0.01	
SG16-10A				0.24		
SG16-10B ^				<0.01	<0.01	
SG17-10				0.03	<0.01	
SG18-10				0.12	2.13	
SG19-10				0.15	0.11	
SG20-10A				0.04	<0.01	
SG20-10B				0.05	<0.01	
SG21-10A				<0.01	0.64	
SG21-10B				<0.01	0.62	
SG22-10				0.1	<0.01	
SG23-10				0.54	<0.01	
SG24-10				<0.01	<0.01	
SG25-10				<0.01	1.45	
SG26-10				<0.01	0.12	
SG27-10				0.33	1.19	
SG28-10				1.03	0.97	
SG29-10				1.24	0.89	
SG30-10				4.18	0.84	
SG31-10				0.32	1.06	
SG32-10				0.36	0.25	
SG33-10				0.08	0.47	
SG34-10A				<0.01	<0.01	
SG34-10B				<0.01	<0.01	
SG35-10				<0.01	<0.01	
SG36-10				<0.01	<0.01	
SG37-10				0.21	1.57	
Calculations						
# of detected samples			7	33	52	34
% detected			17	33	54	77
# of samples (N)			41	100	97	44
Average			4.28E+00	3.26E+00	9.07E-01	4.38E+04
t distr.			1.68E+00	1.66E+00	1.66E+00	1.68E+00
standard deviation			1.25E+01	1.09E+01	2.06E+00	3.66E+04
95% UPL			7.58E+00	5.08E+00	1.25E+00	5.31E+04
Max.[]			7.20E+01	6.00E+01	1.01E+01	1.90E+05
Ci (UG/L, mg/m3)			7.58E+00	5.08E+00	1.25E+00	5.31E+04
Using 95% UCL:						
Ei (mg/sec),(if V=1.63E-3 cm/sec, A=175950.5 m2)			2.17E+01	1.46E+01	3.60E+00	1.52E+05
Ca(mg/m3), (if Vs=2.25m/s, MH=2m, LS=419.46m)			1.15E-02	7.71E-03	1.91E-03	8.07E+01
Ca(mg/m3), (if Vs=2.25m/s, MH=10m, LS=419.46m)			2.30E-03	1.54E-03	3.81E-04	1.61E+01
Using Average						
Ei (mg/sec),(if V=1.63E-3 cm/sec, A=175950.5 m2)			1.23E+01	9.35E+00	2.60E+00	1.26E+05
Ca(mg/m3), (if Vs=2.25m/s, MH=10m, LS=419.46m)			1.30E-03	9.91E-04	2.76E-04	1.33E+01

Notes: CH2CL2 = [illegible]YLENE
CHCL3 = CHLOROFOR
CCL4 = CARBON TETR

UG/L = MICROGRAMS PER LITER
INT = INTERFERENCE
NA = NOT ANALYZED

FB = FIELD BLANK
ND* NO DATA DUE TO INTEGRATION DIFFICULTIES

APPENDIX B

ESTIMATION OF AIR CONCENTRATIONS FOR A FUTURE ONSITE WORKER FROM SOIL GAS DATA

APPENDIX B

ESTIMATED AIR CONCENTRATIONS FOR A FUTURE ONSITE WORKER FROM SOIL GAS DATA

Emissions Characterization

Due to biogenic processes (anaerobic biodegradation) within a solid waste landfill, landfill gas (mostly CO_2, H_2, and CH_4) is produced and moves upward toward the surface. In these cases, the upward movement of the landfill gas becomes the significant controlling factor for organic vapor emissions, accelerating the upward migration and subsequent release to the atmosphere of the codisposed VOCs. Thibodeaux (1981) developed a method for estimating toxic vapor releases where volatile organic chemicals have been codisposed with solid wastes. Thibodeaux estimated convective velocity for three landfills. The average of the estimated values was 0.0016 meters per second. Although, this velocity was found to vary considerably with time, with location within the landfill, internal gas generation, with temperature, moisture content, and type and age of refuse in the landfill, EPA guidance recommends the use of this average value (EPA, 1988).

The following equation is recommended for estimating the volatilization of VOCs from codisposal landfills (EPA, 1988):

$$Ei = (Ci)(Vy)(A)$$

where:

Ei =	emission rate, g/sec
Ci =	concentration of compound in soil gas, g/cm^3
Vy =	mean landfill gas velocity, cm/sec
A =	area, cm^2

According to Thibodeaux, this equation is expected to overestimate the emissions of volatile compounds from a landfill because compacted soil and soil moisture will lower the actual emission rates. (It should be noted that the soil at the Site appears to be highly compacted.) Field studies have not been conducted to attempt to validate this model (Thibodeaux, 1981).

Estimated Air Concentrations From Volatile Emissions

To evaluate potential human exposure via inhalation, air concentrations for the chemicals of concern were determined from the emission rates. A "box model" was used to estimate air concentrations in a "breathing zone" for outdoor air.

A box model is a simple mass-balance equation that uses the concept of a theoretically enclosed space, or box, over the area of interest. The model assumes the emission of compounds into a box, with the dilution of the compounds based on wind speed. Airborne concentrations are calculated and used to represent onsite exposure concentrations in air. It is recognized that the box model fails to fully take into account the various processes of dispersion and leads to the prediction of relatively high exposure concentrations, even with relatively low emission rates. The exposure concentration in the theoretical box is calculated using the following equation:

$$Ca = \frac{E}{LS \times V \times MH}$$

Where:

Ca	=	concentration in air, mg/m^3
E	=	emission rate over Site (mg/sec) (from landfill emission model)
LS	=	length of box, perpendicular to the wind, meters (m)
V	=	average wind speed within the box (m/sec)
MH	=	mixing height (maximum vertical diffusion height of VOCs within the box)

In this assessment, the box was conservatively assumed to have an area equal to the total outdoor area of the Site. The length of each box was estimated as the square root of the area of the box. The site-specific model input parameters for estimating emissions and air concentrations are presented in Table B1.

TABLE B1

Estimation of Air Concentrations of VOCs (Average Concentrations)

Volatile emissions rate (mg/sec) = (Cg)(Vy)(A)

Chemical	Cg (ug/L)	Cg (gm/cm3)	Vy (cm/sec)	A (cm2)	Ji (gm/sec)	Ji (mg/sec)
Freon 11	8.28E-03	8.28E-12	1.60E-03	1.76E+09	2.33E-05	2.33E-02
1,1-Dichloroethene	1.95E-01	1.95E-10	1.60E-03	1.76E+09	5.49E-04	5.49E-01
1,1-Dichloroethane	9.69E-01	9.69E-10	1.60E-03	1.76E+09	2.73E-03	2.73E+00
1,2-Dichloroethene (total)	3.51E-01	3.51E-10	1.60E-03	1.76E+09	9.87E-04	9.87E-01
Freon 113	9.68E-03	9.68E-12	1.60E-03	1.76E+09	2.72E-05	2.72E-02
1,1,1-Trichloroethane	4.71E-03	4.71E-12	1.60E-03	1.76E+09	1.33E-05	1.33E-02
Trichloroethene	1.14E-01	1.14E-10	1.60E-03	1.76E+09	3.22E-04	3.22E-01
Tetrachloroethene	2.14E-02	2.14E-11	1.60E-03	1.76E+09	6.03E-05	6.03E-02
Benzene	2.19E+00	2.19E-09	1.60E-03	1.76E+09	6.17E-03	6.17E+00
Toluene	5.46E-01	5.46E-10	1.60E-03	1.76E+09	1.54E-03	1.54E+00
Chlorobenzene	3.54E+00	3.54E-09	1.60E-03	1.76E+09	9.96E-03	9.96E+00
Ethylbenzene	1.68E+00	1.68E-09	1.60E-03	1.76E+09	4.73E-03	4.73E+00
Xylenes (total)	7.02E+00	7.02E-09	1.60E-03	1.76E+09	1.98E-02	1.98E+01
1,3/1,4-Dichlorobenzene	4.28E+00	4.28E-09	1.60E-03	1.76E+09	1.21E-02	1.21E+01
1,2-Dichlorobenzene	3.26E+00	3.26E-09	1.60E-03	1.76E+09	9.18E-03	9.18E+00
Vinyl Chloride	9.07E-01	9.07E-10	1.60E-03	1.76E+09	2.55E-03	2.55E+00

Outdoor Air Concentration(OAC) = (Ji)/(w)(h)(u)

Chemical	Ji (mg/sec)	w (m)	h (m)	u (m/sec)	OAC (mg/m^3)
Freon 11	2.33E-02	419.46	10	2.25	2.47E-06
1,1-Dichloroethene	5.49E-01	419.46	10	2.25	5.81E-05
1,1-Dichloroethane	2.73E+00	419.46	10	2.25	2.89E-04
1,2-Dichloroethene (total)	9.87E-01	419.46	10	2.25	1.05E-04
Freon 113	2.72E-02	419.46	10	2.25	2.89E-06
1,1,1-Trichloroethane	1.33E-02	419.46	10	2.25	1.40E-06
Trichloroethene	3.22E-01	419.46	10	2.25	3.41E-05
Tetrachloroethene	6.03E-02	419.46	10	2.25	6.39E-06
Benzene	6.17E+00	419.46	10	2.25	6.54E-04
Toluene	1.54E+00	419.46	10	2.25	1.63E-04
Chlorobenzene	9.96E+00	419.46	10	2.25	1.05E-03
Ethylbenzene	4.73E+00	419.46	10	2.25	5.01E-04
Xylenes (total)	1.98E+01	419.46	10	2.25	2.09E-03
1,3/1,4-Dichlorobenzene	1.21E+01	419.46	10	2.25	1.28E-03
1,2-Dichlorobenzene	9.18E+00	419.46	10	2.25	9.73E-04
Vinyl Chloride	2.55E+00	419.46	10	2.25	2.71E-04

Cg = soil gas concentration
Vy = convective velocity, (Thibodeaux, 1981)
A = area of site
Ji = vapor flux emission rate
w = square root of site area
h = mixing height
u = average wind speed, Phoenix
OAC = estimated outdoor concentration

TABLE B1

Estimation of Air Concentrations of VOCs (95% UCL)

Volatile emissions rate (mg/sec) = (Cg)(Vy)(A)

Chemical	Cg (ug/L)	Cg (gm/cm3)	Vy (cm/sec)	A (cm2)	Ji (gm/sec)	Ji (mg/sec)
Freon 11	1.65E-02	1.65E-11	1.60E-03	1.76E+09	4.64E-05	4.64E-02
1,1-Dichloroethene	3.86E-01	3.86E-10	1.60E-03	1.76E+09	1.09E-03	1.09E+00
1,1-Dichloroethane	2.35E+00	2.35E-09	1.60E-03	1.76E+09	6.62E-03	6.62E+00
1,2-Dichloroethene (total)	5.14E-01	5.14E-10	1.60E-03	1.76E+09	1.45E-03	1.45E+00
Freon 113	2.08E-02	2.08E-11	1.60E-03	1.76E+09	5.84E-05	5.84E-02
1,1,1-Trichloroethane	7.60E-03	7.60E-12	1.60E-03	1.76E+09	2.14E-05	2.14E-02
Trichloroethene	1.99E-01	1.99E-10	1.60E-03	1.76E+09	5.61E-04	5.61E-01
Tetrachloroethene	3.54E-02	3.54E-11	1.60E-03	1.76E+09	9.97E-05	9.97E-02
Benzene	2.91E+00	2.91E-09	1.60E-03	1.76E+09	8.18E-03	8.18E+00
Toluene	9.01E-01	9.01E-10	1.60E-03	1.76E+09	2.54E-03	2.54E+00
Chlorobenzene	4.86E+00	4.86E-09	1.60E-03	1.76E+09	1.37E-02	1.37E+01
Ethylbenzene	2.77E+00	2.77E-09	1.60E-03	1.76E+09	7.80E-03	7.80E+00
Xylenes (total)	9.97E+00	9.97E-09	1.60E-03	1.76E+09	2.81E-02	2.81E+01
1,3/1,4-Dichlorobenzene	7.58E+00	7.58E-09	1.60E-03	1.76E+09	2.13E-02	2.13E+01
1,2-Dichlorobenzene	5.08E+00	5.08E-09	1.60E-03	1.76E+09	1.43E-02	1.43E+01
Vinyl chloride	1.25E+00	1.25E-09	1.60E-03	1.76E+09	3.53E-03	3.53E+00

Outdoor Air Concentration(OAC) = (Ji)/(w)(h)(u)

Chemical	Ji (mg/sec)	w (m)	h (m)	u (m/sec)	OAC (mg/m^3)
Freon 11	4.64E-02	419.46	10	2.25	4.92E-06
1,1-Dichloroethene	1.09E+00	419.46	10	2.25	1.15E-04
1,1-Dichloroethane	6.62E+00	419.46	10	2.25	7.01E-04
1,2-Dichloroethene (total)	1.45E+00	419.46	10	2.25	1.53E-04
Freon 113	5.84E-02	419.46	10	2.25	6.19E-06
1,1,1-Trichloroethane	2.14E-02	419.46	10	2.25	2.27E-06
Trichloroethene	5.61E-01	419.46	10	2.25	5.95E-05
Tetrachloroethene	9.97E-02	419.46	10	2.25	1.06E-05
Benzene	8.18E+00	419.46	10	2.25	8.67E-04
Toluene	2.54E+00	419.46	10	2.25	2.69E-04
Chlorobenzene	1.37E+01	419.46	10	2.25	1.45E-03
Ethylbenzene	7.80E+00	419.46	10	2.25	8.26E-04
Xylenes (total)	2.81E+01	419.46	10	2.25	2.97E-03
1,3/1,4-Dichlorobenzene	2.13E+01	419.46	10	2.25	2.26E-03
1,2-Dichlorobenzene	1.43E+01	419.46	10	2.25	1.51E-03
Vinyl chloride	3.53E+00	419.46	10	2.25	3.74E-04

Cg = soil gas concentration
Vy = convective velocity, (Thibodeaux, 1981)
A = area of site
Ji = vapor flux emission rate
w = square root of site area
h = mixing height
u = average wind speed, Phoenix
OAC = estimated outdoor concentration

APPENDIX C

ESTIMATION OF AIR CONCENTRATIONS FOR BRADLEY WORKER BASED ON VOLATILIZATION OF GROUNDWATER

APPENDIX C

ESTIMATION OF AIR CONCENTRATIONS FOR BRADLEY WORKER BASED ON VOLATILIZATION OF GROUNDWATER

Model Description

The SCREEN2 dispersion model (EPA, 1992) was used to conservatively estimate volatile emissions from production well water sprayed for dust control at the Bradley landfill. This EPA-approved model has the capability of simulating dispersion from single point sources, as well as from area and volume sources.

The model uses a matrix of 54 combinations of wind speed and atmospheric stability to provide a range of worst-case meteorological conditions. The model assumes that the wind is blowing toward the receptor for the duration of the simulation.

Model Input Parameters

For the release (stack) height, a value of 3 feet (0.9144 meters) was used. This value is the estimated height of release of water from the truck. Based on site-specific information, it was assumed that all water is released from the back of the truck. A value of 8 feet (2.44 meters) was used as the receptor height, which represents the approximate height of the driver from the ground. The downwind distance to the receptor of 20 feet (6.096 meters) represents the approximate distance from the driver to the point of release of water. The values for the exit velocity (0.5 meters per second) and stack diameter (0.25 meters) were chosen as a best approximation to source conditions as they have been adapted to this modeling scenario. An emission rate of 1.0 gram per second was used so that model results could be multiplied by actual chemical emission rates to estimate airborne chemical concentrations at the receptor.

Results

The output of the SCREEN2 modeling is provided in the appendix. Using the emission rate of 1 gram per second, a maximum downwind concentration of 19,220 micrograms per cubic meter of air was calculated by the model. This concentration was then multiplied by the actual emission rates of the chemicals present in the water to determine airborne concentrations of chemicals at the receptor.

Model Application and Scenario Description

The purpose of this model is to estimate the concentration of chemicals that might be found in the air over the landfill as a result of the spraying of groundwater on the dirt roads of the landfill for dust suppression. For dust control purposes, a 5,000 gallon water truck is filled with groundwater. Filling the truck takes approximately 15 to 20 minutes. This truck is fitted with front and rear sprayers which apply the water to the ground surface. For the purpose of this assessment, it is assumed that the sprayers consist of a single line approximately 20 ft wide. The rate of application can be varied, so the range of the truck is unknown. However, dust control may be performed 4 to 6 times a day during the summer. During the winter, the spraying operations may only be performed 1 to 3 times per day.

It has been estimated that to spread and refill one truckload of water would take no more than one hour. Since filling the truck takes approximately 15 to 20 minutes, a conservative estimate of the time that the truck is actually spreading the water would be 40 minutes. In the assessment, it was conservatively assumed that 100 percent of the volatile organic compounds present in the water would immediately volatilize when released as spray.

Weighted average exposure concentrations (for an 8-hour workday) in air were generated based on average and 95 percent UCL concentrations of organic compounds detected in groundwater at the Bradley production well. The calculational spreadsheet used to derive exposure concentrations is presented in this appendix.

Computer Printout:

Air Dispersion Model

07/26/95
09:34:38

*** SCREEN2 MODEL RUN ***
*** VERSION DATED 95178 ***

ESTES LANDFILL - WATER TRUCK MODELING

SIMPLE TERRAIN INPUTS:
SOURCE TYPE = POINT
EMISSION RATE (G/S) = 1.00000
STACK HEIGHT (M) = .9144
STK INSIDE DIAM (M) = .2500
STK EXIT VELOCITY (M/S)= .5000
STK GAS EXIT TEMP (K) = 293.0000
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = 2.4400
URBAN/RURAL OPTION = RURAL
BUILDING HEIGHT (M) = .0000
MIN HORIZ BLDG DIM (M) = .0000
MAX HORIZ BLDG DIM (M) = .0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .004 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
6.	.1922E+05	1	1.0	1.0	320.0	.79	2.14	.99	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED

DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	.1922E+05	6.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

Air Concentration Spreadsheet

RME

mg/m3 = ((mg/L x gal/40 min x L/gal)/sec/40 min)*gm/mg *mg/m3/gm/sec

Compound	Conc (ug/L)	CF (10-3)	Conc (mg/L)	Spray (gal/40 min)	CF (l/g)	CF (sec/40 min)	CF (gm/mg)	Ratio mg/m3 per gram/sec	Conc (mg/m3)	Weighting Factor (u)	Avg Conc (mg/m3)
1,1-Dichloroethene	0.44	1.00E-03	4.40E-04	5,000	3.875	2400	1.00E-03	19.22	6.83E-05	0.27	1.84E-05
1,2-Dichlorobenzene	39.98	1.00E-03	4.00E-02	5,000	3.875	2400	1.00E-03	19.22	6.20E-03	0.27	1.67E-03
1,2-Dichloroethene (cis)	171.7	1.00E-03	1.72E-01	5,000	3.875	2400	1.00E-03	19.22	2.66E-02	0.27	7.19E-03
1,2-Dichloroethene (trans)	1.97	1.00E-03	1.97E-03	5,000	3.875	2400	1.00E-03	19.22	3.06E-04	0.27	8.25E-05
Benzene	0.3	1.00E-03	3.00E-04	5,000	3.875	2400	1.00E-03	19.22	4.65E-05	0.27	1.26E-05
Chlorobenzene	11.69	1.00E-03	1.17E-02	5,000	3.875	2400	1.00E-03	19.22	1.81E-03	0.27	4.90E-04
Chloroform	0.44	1.00E-03	4.40E-04	5,000	3.875	2400	1.00E-03	19.22	6.83E-05	0.27	1.84E-05
Tetrachloroethene	0.21	1.00E-03	2.10E-04	5,000	3.875	2400	1.00E-03	19.22	3.26E-05	0.27	8.80E-06
Trichloroethene	4.09	1.00E-03	4.09E-03	5,000	3.875	2400	1.00E-03	19.22	6.35E-04	0.27	1.71E-04
Vinyl chloride	99.3	1.00E-03	9.93E-02	5,000	3.875	2400	1.00E-03	19.22	1.54E-02	0.27	4.16E-03

Average

Compound	Conc (ug/L)	CF (10-3)	Conc (mg/L)	Spray (gal/40 min)	CF (l/g)	CF (sec/40 min)	CF (gm/mg)	Ratio mg/m3 per gram/sec	Conc (mg/m3)	Weighted Factor (u)	Avg Conc (mg/m3)
1,1-Dichloroethene	0.32	1.00E-03	3.20E-04	5,000	3.875	2400	1.00E-03	19.22	4.97E-05	0.27	1.34E-05
1,2-Dichlorobenzene	25.12	1.00E-03	2.51E-02	5,000	3.875	2400	1.00E-03	19.22	3.90E-03	0.27	1.05E-03
1,2-Dichloroethene (cis)	88.1	1.00E-03	8.81E-02	5,000	3.875	2400	1.00E-03	19.22	1.37E-02	0.27	3.69E-03
1,2-Dichloroethene (trans)	1.02	1.00E-03	1.02E-03	5,000	3.875	2400	1.00E-03	19.22	1.58E-04	0.27	4.27E-05
Benzene	0.27	1.00E-03	2.70E-04	5,000	3.875	2400	1.00E-03	19.22	4.19E-05	0.27	1.13E-05
Chlorobenzene	6.77	1.00E-03	6.77E-03	5,000	3.875	2400	1.00E-03	19.22	1.05E-03	0.27	2.84E-04
Chloroform	0.3	1.00E-03	3.00E-04	5,000	3.875	2400	1.00E-03	19.22	4.65E-05	0.27	1.26E-05
Tetrachloroethene	0.17	1.00E-03	1.70E-04	5,000	3.875	2400	1.00E-03	19.22	2.64E-05	0.27	7.12E-06
Trichloroethene	3.04	1.00E-03	3.04E-03	5,000	3.875	2400	1.00E-03	19.22	4.72E-04	0.27	1.27E-04
Vinyl chloride	61.2	1.00E-03	6.12E-02	5,000	3.875	2400	1.00E-03	19.22	9.50E-03	0.27	2.56E-03

APPENDIX D

SPREADSHEETS FOR DOSE ESTIMATES AND RISK CHARACTERIZATION

ONSITE WORKER

Estimated Hazard Index Associated with Inhalation of VOCs for an Onsite RME Worker

Chemical	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	Dose (mg/kg-d)	RfD (mg/kg-d)	HQ (u)
Benzene	8.67E-04	20	0.69	25	70	25	1.70E-04	ND	
Chlorobenzene	1.45E-03	20	0.69	25	70	25	2.84E-04	0.0057	4.98E-02
1,2-Dichlorobenzene	1.51E-03	20	0.69	25	70	25	2.96E-04	0.057	5.18E-03
1,3/1,4-Dichlorobenzene	2.26E-03	20	0.69	25	70	25	4.42E-04	0.23	1.92E-03
1,1-Dichloroethane	7.01E-04	20	0.69	25	70	25	1.37E-04	0.14	9.80E-04
1,1-Dichloroethene	1.15E-04	20	0.69	25	70	25	2.25E-05	0.009	2.50E-03
1,2-Dichloroethene (total)	1.53E-04	20	0.69	25	70	25	2.99E-05	0.009	3.33E-03
Ethylbenzene	8.26E-04	20	0.69	25	70	25	1.62E-04	0.29	5.57E-04
Freon 11	4.92E-06	20	0.69	25	70	25	9.63E-07	0.2	4.81E-06
Freon 113	6.19E-06	20	0.69	25	70	25	1.21E-06	8.6	1.41E-07
Tetrachloroethene	1.06E-05	20	0.69	25	70	25	2.07E-06	0.01	2.07E-04
Toluene	2.69E-04	20	0.69	25	70	25	5.26E-05	0.11	4.79E-04
1,1,1-Trichloroethane	2.27E-06	20	0.69	25	70	25	4.44E-07	0.29	1.53E-06
Trichloroethene	5.95E-05	20	0.69	25	70	25	1.16E-05	0.006	1.94E-03
Vinyl chloride	3.74E-04	20	0.69	25	70	25	7.32E-05	ND	
Xylenes (total)	2.97E-03	20	0.69	25	70	25	5.81E-04	0.2	2.91E-03
								Total	**6.98E-02**

Estimated Hazard Index Associated with Inhalation of VOCs for an Average Onsite Worker

Chemical	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	Dose (mg/kg-d)	RfD (mg/kg-d)	HQ (u)
Benzene	6.54E-04	10	0.685	4.2	70	4.2	6.40E-05	ND	
Chlorobenzene	1.05E-03	10	0.685	4.2	70	4.2	1.03E-04	0.0057	1.80E-02
1,2-Dichlorobenzene	9.73E-04	10	0.685	4.2	70	4.2	9.52E-05	0.057	1.67E-03
1,3/1,4-Dichlorobenzene	1.28E-03	10	0.685	4.2	70	4.2	1.25E-04	0.23	5.45E-04
1,1-Dichloroethane	2.89E-04	10	0.685	4.2	70	4.2	2.83E-05	0.14	2.02E-04
1,1-Dichloroethene	5.81E-05	10	0.685	4.2	70	4.2	5.69E-06	0.009	6.32E-04
1,2-Dichloroethene (total)	1.05E-04	10	0.685	4.2	70	4.2	1.03E-05	0.009	1.14E-03
Ethylbenzene	5.01E-04	10	0.685	4.2	70	4.2	4.90E-05	0.29	1.69E-04
Freon 11	2.47E-06	10	0.685	4.2	70	4.2	2.42E-07	0.2	1.21E-06
Freon 113	2.89E-06	10	0.685	4.2	70	4.2	2.83E-07	8.6	3.29E-08
Tetrachloroethene	6.39E-06	10	0.685	4.2	70	4.2	6.25E-07	0.01	6.25E-05
Toluene	1.63E-04	10	0.685	4.2	70	4.2	1.60E-05	0.11	1.45E-04
1,1,1-Trichloroethane	1.40E-06	10	0.685	4.2	70	4.2	1.37E-07	0.29	4.72E-07
Trichloroethene	3.41E-05	10	0.685	4.2	70	4.2	3.34E-06	0.006	5.56E-04
Vinyl chloride	2.71E-04	10	0.685	4.2	70	4.2	2.65E-05	ND	
Xylenes (total)	2.09E-03	10	0.685	4.2	70	4.2	2.05E-04	0.2	1.02E-03
								Total	**2.42E-02**

Estimated Cancer Risk Associated with Inhalation of VOCs for a RME Onsite Worker

Chemical	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	Dose (mg/kg-d)	SF (mg/kg-d)-1	Cancer Risk (u)
Benzene	8.67E-04	20	0.69	25	70	70	6.06E-05	2.90E-02	1.76E-06
1,3/1,4-Dichlorobenzene	2.26E-03	20	0.69	25	70	70	1.58E-04	2.40E-02	3.79E-06
1,1-Dichloroethene	1.15E-04	20	0.69	25	70	70	8.04E-06	1.80E-01	1.45E-06
Methylene chloride	3.01E-05	20	0.69	25	70	70	2.10E-06	1.60E-03	3.37E-09
Tetrachloroethene	1.06E-05	20	0.69	25	70	70	7.41E-07	2.00E-03	1.48E-09
Trichloroethene	5.95E-05	20	0.69	25	70	70	4.16E-06	6.00E-03	2.50E-08
Vinyl chloride	3.74E-04	20	0.69	25	70	70	2.61E-05	3.00E-01	7.84E-06
								Total	**1.49E-05**

Estimated Cancer Risk Associated with Inhalation of VOCs for a Average Onsite Worker

Chemical	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	Dose (mg/kg-d)	SF (mg/kg-d)-1	Cancer Risk (u)
Benzene	6.54E-04	10	0.685	4.2	70	70	3.84E-06	2.90E-02	1.11E-07
1,3/1,4-Dichlorobenzene	1.28E-03	10	0.685	4.2	70	70	7.52E-06	2.40E-02	1.80E-07
1,1-Dichloroethene	5.81E-05	10	0.685	4.2	70	70	3.41E-07	1.80E-01	6.14E-08
Methylene chloride	2.15E-05	10	0.685	4.2	70	70	1.26E-07	1.60E-03	2.02E-10
Tetrachloroethene	6.39E-06	10	0.685	4.2	70	70	3.75E-08	2.00E-03	7.50E-11
Trichloroethene	3.41E-05	10	0.685	4.2	70	70	2.00E-07	6.00E-03	1.20E-09
Vinyl chloride	2.71E-04	10	0.685	4.2	70	70	1.59E-06	3.00E-01	4.77E-07
								Total	**8.32E-07**

BRADLEY WORKER

RME Carcinogenic Effects

Compound	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)		Dose (mg/kg-d)	SF (mg/kg-d)-1	Cancer risk
1,1-Dichloroethene	1.84E-05	10	0.69	25	70	70		6.48E-07	0.18	1.17E-07
1,2-Dichlorobenzene	1.67E-03	10	0.69	25	70	70		5.88E-05		0.00E+00
1,2-Dichloroethene (cis)	7.19E-03	10	0.69	25	70	70		2.53E-04		0.00E+00
1,2-Dichloroethene (trans)	8.25E-05	10	0.69	25	70	70		2.90E-06		0.00E+00
Benzene	1.26E-05	10	0.69	25	70	70		4.44E-07	0.029	1.29E-08
Chlorobenzene	4.90E-04	10	0.69	25	70	70		1.73E-05		0.00E+00
Chloroform	1.84E-05	10	0.69	25	70	70		6.48E-07	0.082	5.31E-08
Tetrachloroethene	8.80E-06	10	0.69	25	70	70		3.10E-07	0.002	6.20E-10
Trichloroethene	1.71E-04	10	0.69	25	70	70		6.02E-06	0.006	3.61E-08
Vinyl chloride	4.16E-03	10	0.69	25	70	70		1.46E-04	0.3	4.39E-05
							Total			4.42E-05

RME Noncarcinogenic Effects

Compound	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)		Dose (mg/kg-d)	RfD (mg/kg-d)	HQ
1,1-Dichloroethene	1.84E-05	10	6.90E-01	25	70	25		1.81E-06	0.009	2.02E-04
1,2-Dichlorobenzene	1.67E-03	10	6.90E-01	25	70	25		1.65E-04	0.057	2.89E-03
1,2-Dichloroethene (cis)	7.19E-03	10	6.90E-01	25	70	25		7.09E-04	0.009	7.87E-02
1,2-Dichloroethene (trans)	8.25E-05	10	6.90E-01	25	70	25		8.13E-06	0.009	9.04E-04
Benzene	1.26E-05	10	6.90E-01	25	70	25		1.24E-06		
Chlorobenzene	4.90E-04	10	6.90E-01	25	70	25		4.83E-05	0.0057	8.47E-03
Chloroform	1.84E-05	10	6.90E-01	25	70	25		1.81E-06	0.01	1.81E-04
Tetrachloroethene	8.80E-06	10	6.90E-01	25	70	25		8.67E-07	0.01	8.67E-05
Trichloroethene	1.71E-04	10	6.90E-01	25	70	25		1.69E-05	0.006	2.81E-03
Vinyl chloride	4.16E-03	10	6.90E-01	25	70	25		4.10E-04		
							Total			9.43E-02

Average Health Risks

Ave Carcinogenic Effects

Compound	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	Dose (mg/kg-d)	SF (mg/kg-d)-1	Cancer risk
1,1-Dichloroethene	1.34E-05	6.4	0.69	4.2	70	70	5.07E-08	0.18	9.13E-09
1,2-Dichlorobenzene	1.05E-03	6.4	0.69	4.2	70	70	3.97E-06		0
1,2-Dichloroethene (cis)	3.69E-03	6.4	0.69	4.2	70	70	1.40E-05		0
1,2-Dichloroethene (trans)	4.27E-05	6.4	0.69	4.2	70	70	1.62E-07		0
Benzene	1.13E-05	6.4	0.69	4.2	70	70	4.28E-08	0.029	1.24E-09
Chlorobenzene	2.84E-04	6.4	0.69	4.2	70	70	1.07E-06		0
Chloroform	1.26E-05	6.4	0.69	4.2	70	70	4.77E-08	0.082	3.91E-09
Tetrachloroethene	7.12E-06	6.4	0.69	4.2	70	70	2.70E-08	0.002	5.39E-11
Trichloroethene	1.27E-04	6.4	0.69	4.2	70	70	4.81E-07	0.006	2.88E-09
Vinyl chloride	2.56E-03	6.4	0.69	4.2	70	70	9.69E-06	0.3	2.91E-06
							Total		2.92E-06

Ave Noncarcinogenic Effects

Compound	Ca (mg/m3)	IR (m3/day)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	Dose (mg/kg-d)	RfD (mg/kg-d)	HQ
1,1-Dichloroethene	1.34E-05	6.4	6.90E-01	4.2	70	4.2	8.45E-07	0.009	9.39E-05
1,2-Dichlorobenzene	1.05E-03	6.4	6.90E-01	4.2	70	4.2	6.62E-05	0.057	1.16E-03
1,2-Dichloroethene (cis)	3.69E-03	6.4	6.90E-01	4.2	70	4.2	2.33E-04	0.009	2.59E-02
1,2-Dichloroethene (trans)	4.27E-05	6.4	6.90E-01	4.2	70	4.2	2.69E-06	0.009	2.99E-04
Benzene	1.13E-05	6.4	6.90E-01	4.2	70	4.2	7.13E-07		
Chlorobenzene	2.84E-04	6.4	6.90E-01	4.2	70	4.2	1.79E-05	0.0057	3.14E-03
Chloroform	1.26E-05	6.4	6.90E-01	4.2	70	4.2	7.95E-07	0.01	7.95E-05
Tetrachloroethene	7.12E-06	6.4	6.90E-01	4.2	70	4.2	4.49E-07	0.01	4.49E-05
Trichloroethene	1.27E-04	6.4	6.90E-01	4.2	70	4.2	8.01E-06	0.006	1.34E-03
Vinyl chloride	2.56E-03	6.4	6.90E-01	4.2	70	4.2	1.61E-04		
							Total		3.20E-02

FUTURE OFFSITE WORKER

Estimated Hazard Index Associated with Groundwater Ingestion for an Average Hypothetical Future Offsite Worker

Chemical	Cs (mg/L)	IR (L/d)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	ADD (mg/kg-d)	RfD (mg/kg-d)	HQ (u)	Percentage (u)
Arsenic	7.73E-03	0.65	0.685	4.2	70	4.2	4.92E-05	0.0003	1.64E-01	22.51
Benzene	1.04E-03	0.65	0.685	4.2	70	4.2	6.62E-06	NA		
Chlorobenzene	1.25E-03	0.65	0.685	4.2	70	4.2	7.95E-06	0.02	3.98E-04	0.05
Chloroform	9.90E-04	0.65	0.685	4.2	70	4.2	6.30E-06	0.01	6.30E-04	0.09
1,2-Dichlorobenzene	2.57E-03	0.65	0.685	4.2	70	4.2	1.63E-05	0.09	1.82E-04	0.02
1,4-Dichlorobenzene	8.00E-04	0.65	0.685	4.2	70	4.2	5.09E-06	0.23	2.21E-05	0.003
1,1-Dichloroethane	1.89E-03	0.65	0.685	4.2	70	4.2	1.20E-05	0.1	1.20E-04	0.02
1,2-Dichloroethane	3.90E-04	0.65	0.685	4.2	70	4.2	2.48E-06	NA		
1,1-Dichloroethene	2.45E-03	0.65	0.685	4.2	70	4.2	1.56E-05	0.009	1.73E-03	0.24
1,2-Dichloroethene (cis)	1.15E-02	0.65	0.685	4.2	70	4.2	7.31E-05	0.01	7.31E-03	1.00
1,2-Dichloroethene (trans)	4.20E-04	0.65	0.685	4.2	70	4.2	2.67E-06	0.02	1.34E-04	0.02
Freon 11	5.70E-04	0.65	0.685	4.2	70	4.2	3.63E-06	0.3	1.21E-05	0.002
Freon 12	6.60E-04	0.65	0.685	4.2	70	4.2	4.20E-06	0.2	2.10E-05	0.003
Manganese	4.24E-01	0.65	0.685	4.2	70	4.2	2.70E-03	0.005	5.39E-01	74.10
Methylene chloride	1.73E-03	0.65	0.685	4.2	70	4.2	1.10E-05	0.06	1.83E-04	0.03
Tetrachloroethene	7.90E-04	0.65	0.685	4.2	70	4.2	5.02E-06	0.01	5.02E-04	0.07
1,1,1-Trichloroethane	8.80E-04	0.65	0.685	4.2	70	4.2	5.60E-06	0.09	6.22E-05	0.01
Trichloroethene	1.26E-02	0.65	0.685	4.2	70	4.2	8.01E-05	0.006	1.34E-02	1.83
Vinyl chloride	1.52E-02	0.65	0.685	4.2	70	4.2	9.67E-05	NA		
								Total	**0.73**	

Estimated Cancer Risk Associated with Groundwater Ingestion for a RME Hypothetical Future Offsite Worker

Chemical	Cw (mg/L)	IR (L/d)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	LADD (mg/kg-d)	SF (mg/kg-d)-1	Cancer Risk (u)	Percentage (u)
Arsenic	9.02E-03	1	0.69	25	70	70	3.15E-05	1.5	4.73E-05	18.06
Benzene	3.56E-03	1	0.69	25	70	70	1.24E-05	0.029	3.61E-07	0.14
Chloroform	1.36E-03	1	0.69	25	70	70	4.75E-06	0.0061	2.90E-08	0.01
1,4-Dichlorobenzene	1.06E-03	1	0.69	25	70	70	3.70E-06	0.024	8.89E-08	0.03
1,2-Dichloroethane	4.60E-04	1	0.69	25	70	70	1.61E-06	0.091	1.46E-07	0.06
1,1-Dichloroethene	2.82E-03	1	0.69	25	70	70	9.86E-06	0.6	5.91E-06	2.26
Methylene chloride	2.27E-03	1	0.69	25	70	70	7.93E-06	0.0075	5.95E-08	0.02
Tetrachloroethene	9.40E-04	1	0.69	25	70	70	3.29E-06	0.052	1.71E-07	0.07
Trichloroethene	1.50E-02	1	0.69	25	70	70	5.24E-05	0.011	5.77E-07	0.22
Vinyl chloride	3.12E-02	1	0.69	25	70	70	1.09E-04	1.9	2.07E-04	79.13
								Total	**2.62E-04**	

Estimated Cancer Risk Associated with Groundwater Ingestion for an Average Hypothetical Future Offsite Worker

Chemical	Cw (mg/L)	IR (L/d)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	LADD (mg/kg-d)	SF (mg/kg-d)-1	Cancer Risk (u)	Percentage (u)
Arsenic	7.73E-03	0.65	0.685	4.2	70	70	2.95E-06	1.5	4.43E-06	27.46
Benzene	1.04E-03	0.65	0.685	4.2	70	70	3.97E-07	0.029	1.15E-08	0.07
Chloroform	9.90E-04	0.65	0.685	4.2	70	70	3.78E-07	0.0061	2.30E-09	0.01
1,4-Dichlorobenzene	8.00E-04	0.65	0.685	4.2	70	70	3.05E-07	0.024	7.33E-09	0.05
1,2-Dichloroethane	3.90E-04	0.65	0.685	4.2	70	70	1.49E-07	0.091	1.35E-08	0.08
1,1-Dichloroethene	2.45E-03	0.65	0.685	4.2	70	70	9.35E-07	0.6	5.61E-07	3.48
Methylene chloride	1.73E-03	0.65	0.685	4.2	70	70	6.60E-07	0.0075	4.95E-09	0.03
Tetrachloroethene	7.90E-04	0.65	0.685	4.2	70	70	3.01E-07	0.052	1.57E-08	0.10
Trichloroethene	1.26E-02	0.65	0.685	4.2	70	70	4.81E-06	0.011	5.29E-08	0.33
Vinyl chloride	1.52E-02	0.65	0.685	4.2	70	70	5.80E-06	1.9	1.10E-05	68.39
								Total	**1.61E-05**	

APPENDIX E

PROBABILISTIC ASSESSMENT

Variable Type						
Name	Arsenic	Vinyl chloride	Total	Body	Water	Exposure
Description	Risk	Risk	Risk	Weight (kg)	Consumption (L/d)	Duration (yrs)
Cell	F79	F91	F94	G30	G31	G33
Minimum =	5.84E-09	5.48E-10	6.83E-09	44.03133	5.65E-02	1.07E-02
Maximum =	1.61E-04	5.57E-03	5.64E-03	106.9845	2.099601	29.99676
Mean =	8.17E-06	4.40E-05	5.21E-05	70.96748	0.7362598	7.605209
Std Deviation =	1.21E-05	2.42E-04	2.45E-04	13.56883	0.4126834	8.126957
Variance =	1.46E-10	5.85E-08	6.01E-08	184.1132	0.1703076	66.04743
Skewness =	3.71365	10.88547	10.84759	0.5098163	0.9556738	1.361402
Kurtosis =	25.60597	159.6749	159.1809	2.746547	4.002302	3.950731
Errors Calculated =	0	0	0	0	0	0
Mode =	4.04E-06	1.39E-04	1.41E-04	64.49111	0.5162089	0.7603227
5% Perc =	3.48E-07	2.02E-08	5.06E-07	52.29869	0.1998366	0.9967395
10% Perc =	5.53E-07	4.02E-08	8.34E-07	54.94976	0.2737974	1.00999
15% Perc =	7.57E-07	7.17E-08	1.18E-06	57.5977	0.3305235	1.01333
20% Perc =	9.71E-07	1.13E-07	1.56E-06	59.18203	0.3871565	1.016659
25% Perc =	1.21E-06	1.73E-07	2.04E-06	60.7662	0.4438341	1.019996
30% Perc =	1.49E-06	2.55E-07	2.55E-06	62.35517	0.4873261	1.573913
35% Perc =	1.81E-06	3.66E-07	3.20E-06	63.93675	0.5306973	2.129903
40% Perc =	2.20E-06	5.46E-07	4.10E-06	65.5285	0.5741885	2.687942
45% Perc =	2.72E-06	7.60E-07	5.27E-06	67.10999	0.6175126	3.243546
50% Perc =	3.44E-06	1.08E-06	6.67E-06	68.69744	0.66097	3.799362
55% Perc =	4.27E-06	1.51E-06	8.54E-06	70.94012	0.7186725	5.237109
60% Perc =	5.54E-06	2.11E-06	1.07E-05	73.18129	0.7763907	6.679086
65% Perc =	6.87E-06	2.99E-06	1.35E-05	75.42008	0.8343203	8.117139
70% Perc =	8.42E-06	4.36E-06	1.70E-05	77.66408	0.8920282	9.556803
75% Perc =	1.04E-05	6.74E-06	2.18E-05	79.90672	0.9498407	10.99931
80% Perc =	1.32E-05	1.14E-05	2.80E-05	82.15582	1.047955	13.66296
85% Perc =	1.62E-05	1.93E-05	3.85E-05	84.39707	1.146445	16.33293
90% Perc =	2.11E-05	3.95E-05	6.12E-05	90.6952	1.244642	18.99906
95% Perc =	3.02E-05	1.33E-04	1.46E-04	96.99828	1.492186	28.97494

Estimated Hazard Index Associated with Groundwater Ingestion for a RME Hypothetical Future Offsite Worker

Chemical	Cs (mg/L)	IR (L/d)	EF (u)	ED (yrs)	BW (kg)	AT (yrs)	ADD (mg/kg-d)	RfD (mg/kg-d)	HQ (u)	Percentage (u)
Arsenic	9.02E-03	1	0.69	25	70	25	8.83E-05	0.0003	2.94E-01	20.28
Benzene	3.56E-03	1	0.69	25	70	25	3.48E-05	NA		
Chlorobenzene	2.24E-03	1	0.69	25	70	25	2.19E-05	0.02	1.10E-03	0.08
Chloroform	1.36E-03	1	0.69	25	70	25	1.33E-05	0.01	1.33E-03	0.09
1,2-Dichlorobenzene	3.76E-03	1	0.69	25	70	25	3.68E-05	0.09	4.09E-04	0.03
1,4-Dichlorobenzene	1.06E-03	1	0.69	25	70	25	1.04E-05	0.23	4.51E-05	0.003
1,1-Dichloroethane	2.27E-03	1	0.69	25	70	25	2.22E-05	0.1	2.22E-04	0.02
1,2-Dichloroethane	4.60E-04	1	0.69	25	70	25	4.50E-06	NA		
1,1-Dichloroethene	2.82E-03	1	0.69	25	70	25	2.76E-05	0.009	3.07E-03	0.21
1,2-Dichloroethene (cis)	1.69E-02	1	0.69	25	70	25	1.65E-04	0.01	1.65E-02	1.14
1,2-Dichloroethene (trans)	6.30E-04	1	0.69	25	70	25	6.17E-06	0.02	3.08E-04	0.02
Freon 11	6.70E-04	1	0.69	25	70	25	6.56E-06	0.3	2.19E-05	0.002
Freon 12	8.00E-04	1	0.69	25	70	25	7.83E-06	0.2	3.91E-05	0.003
Manganese	5.66E-01	1	0.69	25	70	25	5.54E-03	0.005	1.11E+00	76.35
Methylene chloride	2.27E-03	1	0.69	25	70	25	2.22E-05	0.06	3.70E-04	0.03
Tetrachloroethene	9.40E-04	1	0.69	25	70	25	9.20E-06	0.01	9.20E-04	0.06
1,1,1-Trichloroethane	1.04E-03	1	0.69	25	70	25	1.02E-05	0.09	1.13E-04	0.01
Trichloroethene	1.50E-02	1	0.69	25	70	25	1.47E-04	0.006	2.45E-02	1.69
Vinyl chloride	3.12E-02	1	0.69	25	70	25	3.05E-04	NA		
								Total	**1.45**	

Detail Statistics

Variable Type						
Name	Arsenic	Vinyl chloride	Total	Body	Water	Exposure
Description	Risk	Risk	Risk	Weight (kg)	Consumption (L/d)	Duration (yrs)
Cell	F79	F91	F94	G30	G31	G33
Minimum =	3.14E-09	1.19E-09	5.66E-09	44.01759	5.65E-02	1.20E-02
Maximum =	1.13E-04	8.28E-03	8.38E-03	106.9881	2.099589	29.99692
Mean =	8.16E-06	4.72E-05	5.54E-05	70.96746	0.7362552	7.605277
Std Deviation =	1.18E-05	2.97E-04	3.01E-04	13.56904	0.4126657	8.126974
Variance =	1.39E-10	8.83E-08	9.03E-08	184.1189	0.170293	66.04771
Skewness =	2.897543	13.90733	13.87819	0.509796	0.9554618	1.361369
Kurtosis =	14.26665	264.514	263.9855	2.746622	4.001552	3.950612
Errors Calculated =	0	0	0	0	0	0
Mode =	2.83E-06	2.07E-04	2.09E-04	61.33448	0.5161991	0.7616413
5% Perc =	3.60E-07	2.05E-08	5.10E-07	52.28555	0.1996499	0.9991615
10% Perc =	5.75E-07	3.89E-08	8.34E-07	54.94429	0.2737577	1.009996
15% Perc =	7.60E-07	6.80E-08	1.14E-06	57.59411	0.3306493	1.013327
20% Perc =	9.48E-07	1.06E-07	1.52E-06	59.18429	0.3872821	1.016655
25% Perc =	1.17E-06	1.58E-07	1.95E-06	60.76655	0.443898	1.019997
30% Perc =	1.45E-06	2.38E-07	2.50E-06	62.35349	0.4873382	1.575496
35% Perc =	1.80E-06	3.62E-07	3.19E-06	63.94027	0.5307866	2.130343
40% Perc =	2.21E-06	5.33E-07	4.02E-06	65.52324	0.574095	2.687205
45% Perc =	2.76E-06	7.73E-07	5.12E-06	67.11214	0.6174406	3.241853
50% Perc =	3.45E-06	1.10E-06	6.50E-06	68.69878	0.6608395	3.799496
55% Perc =	4.31E-06	1.51E-06	8.56E-06	70.93893	0.7186103	5.234635
60% Perc =	5.24E-06	2.09E-06	1.06E-05	73.18224	0.776472	6.676726
65% Perc =	6.43E-06	3.07E-06	1.31E-05	75.42527	0.8343148	8.119433
70% Perc =	8.13E-06	4.72E-06	1.68E-05	77.66422	0.8919953	9.558237
75% Perc =	1.00E-05	7.31E-06	2.15E-05	79.90917	0.949909	10.99557
80% Perc =	1.26E-05	1.17E-05	2.85E-05	82.15171	1.04828	13.66043
85% Perc =	1.64E-05	1.97E-05	4.06E-05	84.39143	1.146466	16.32914
90% Perc =	2.17E-05	3.78E-05	6.09E-05	90.6855	1.24486	18.99936
95% Perc =	3.31E-05	1.29E-04	1.44E-04	96.98125	1.492189	28.97065

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Edward Z. Fox, Director

RPU95-605 E-5161

September 1, 1995

Mr. Donald P. Hanson, R.G.
Harding Lawson Associates
2800 North 44th Street, Suite 500
Phoenix, Arizona 85008

Re: Draft Risk Assessment for the Estes Landfill

Dear Don:

Enclosed for your review and comment is the draft human health risk assessment for the Estes Landfill prepared by the Arizona Department of Health Services.

If you have any questions regarding this matter please feel to contact me at 207-4575.

Sincerely,

Ed Pond
Project Manager
Remedial Projects Section

Enclosure

3033 North Central Avenue, Phoenix, Arizona 85012, (602)207-2300

Draft Human Health Risk Assessment
Estes Landfill
Phoenix, Arizona

Prepared By

ARIZONA DEPARTMENT OF HEALTH SERVICES
Epidemiology and Disease Control
Office of Environmental Health

Prepared For

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

under the
Water Quality Assurance Revolving Fund

August, 1995

TABLE OF CONTENTS

1.0 INTRODUCTION 1
- 1.1 Authority 1
- 1.2 Overview 1
- 1.3 Goals and Objectives 1
- 1.4 Site Background 1

2.0 CHEMICALS OF CONCERN 3
- 2.1 Sources of Contamination 3
- 2.2 Data Collection and Evaluation 4
- 2.3 Selection Criteria 6
- 2.4 Data Quality 20

3.0 EXPOSURE ASSESSMENT 22
- 3.1 Exposure Setting Characterization 22
- 3.2 Exposed Populations 24
- 3.3 Exposure Pathway Identification 24
  - 3.3.1 Source and Receiving Media 25
  - 3.3.2 Fate in Release Media 25
  - 3.3.3 Exposure Points and Routes 25
  - 3.3.4 Summary of Current Exposure Points. 27
- 3.4 Quantification of Exposures 29
  - 3.4.1 Groundwater Exposure Estimation Methods 29
  - 3.4.2 Fugitive Dust Exposure Estimation Methods 33
- 3.5 Uncertainties in the Exposure Assessment 36
  - 3.5.1 Exposure Pathways 36
  - 3.5.2 Modeling 36
  - 3.5.3 Exposure Parameters 36
- 3.6 Exposure Assessment Summary 36

4.0 TOXICITY ASSESSMENT 37
- 4.1 Dose-Response Variable for Non-Carcinogenic Effects 37
- 4.2 Dose-Response Variable for Carcinogenic Effects 41
- 4.3 Toxicity Summaries for Inorganic and Organic Chemicals of Concern 44
- 4.4 Uncertainties Regarding the Reference Dose (RfD) 106

5.0 RISK CHARACTERIZATION 109
5.1 Risk Estimation Methods 109
5.1.1 Calculation of Carcinogenic Risk 109
5.1.2 Noncarcinogenic Effects 109
5.1.3 Health Risks for Multiple Substances 110
5.2 Risk Analysis Under Current Conditions 110
5.2.1 Downgradient Public/Private Domestic Use Wells 111
5.2.2 Bradley Production Well 111
5.2.3 Soil Gas Emissions 111
5.2.4 Fugitive Dust Emissions 112
5.2.5 Southbank Lake 112
5.3 Risk Analysis - *Potential Future Exposure* 112
5.3.1 Site-Related Potential Risk as Measured in the Monitor Wells 113
5.3.2 Total Potential Risk in Monitor Wells 117
5.4 Uncertainties in the Risk Characterization 121
5.5 Summary 121
5.6 Conclusions 123

EXECUTIVE SUMMARY

The goal of this risk assessment is to provide risk information necessary to assist decision-making within the risk management process. The objectives of this risk assessment are to provide an evaluation of health risks and the threat to public health that may result from exposure to contaminants present in various media in the area of the Estes Landfill.

This risk assessment evaluates exposure to contaminants from soil gas, fugitive dust, surface water, water in downgradient private wells, and exposures from use of the Bradley Landfill production well. In addition, hypothetical potential future exposure to water in the monitor wells is evaluated.

No private domestic or public wells close enough to have been impacted by the Estes/Bradley Landfills have been identified. Therefore, no current risk is known to exist from exposure to contaminants in groundwater through registered private domestic or public wells downgradient of the landfill area. If unregistered private domestic wells exist in the area of contaminated groundwater, then some risk may be presented by contaminants from the landfill. However, given the nature of land uses downgradient of the landfill, such an occurrence is considered unlikely.

The Bradley production well is located on the Bradley Landfill property, just south of the Estes/ Bradley property boundary. The well is used to fill a dust control vehicle with water. This risk analysis has determined that use of this well water for dust control currently would not be expected to pose an unacceptable health risk to workers.

The reasonable maximum occupational ELCR estimate from inhalation of soil gas escaping from the Estes Landfill within the acceptable range of risk established by the USEPA. The central tendency exposure ELCR would present a negligible health risk. Both exposure scenarios indicated that non-cancer health effects would not be expected to occur as a result of inhalation of vapors escaping from the Estes Landfill as it currently exists.

The estimated ELCR resulting from inhalation of fugitive dust from the landfill in an occupational exposure scenario would present a negligible cancer risk. Occupational inhalation of fugitive dust from the site would not be expected to result in acute adverse health effects.

The health effects from incidental exposure to TCE at the Southbank Lake is expected to be negligible due to the low concentration of TCE in the water. All detections of TCE in the lake are at levels lower than the USEPA MCL for TCE. Additional analytical water quality and exposure data from the lake would be required in order to quantitatively characterize risk at Southbank Lake.

In addition to health risks from currently complete exposure routes, *potential* health risks were evaluated for occupational ingestion of groundwater underneath and downgradient of the Estes Landfill. These risk estimates are made in order to provide additional information for decision making within the risk management process, and because there are no institutional controls preventing the installation of wells within the plume area. Groundwater data from the monitor and piezometric wells in the investigation were used to measure hypothetical potential future health risk. *All of the monitor and piezometric wells are locked and are not used as drinking water.*

Total potential ELCR for the entire groundwater data set (using all qualified analytical results from all water samples) ranged from 3E-4 (three-in-ten-thousand) for 4.2 years of occupational exposure to 2E-3 (two-in-one-thousand) for 25 years of occupational exposure. Both of these risk estimates are in excess of the acceptable range of risk of 1E-4 (one-in-ten-thousand) to 1E-6 (one-in-one-million) established by the USEPA. The majority of total potential future carcinogenic risk is presented by vinyl chloride.

This risk assessment supports the following conclusions:

No current risk is known to exist from exposure to contaminants in groundwater through registered private domestic wells within the portion of the aquifer contaminated by the Estes/Bradley Landfills.

Use of the Bradley Landfill production well for dust control purposes currently presents a negligible health risk.

Emissions of organic compounds present in the soil gas at the Estes Landfill currently presents a negligible health risk.

Emissions of fugitive dust that may result from wind erosion of surface soil from the Estes Landfill presents a negligible health risk.

If unregistered private domestic wells exist in the area of contaminated groundwater, then some risk may be presented by contaminants from the landfill. However, given the nature of land uses downgradient of the landfill, such an occurrence is considered unlikely.

While no public or semi-public wells present in the area are impacted by groundwater contamination from the landfill, groundwater quality in the monitor wells in and downgradient of the landfill has been degraded. Vinyl chloride is present in many of the monitor wells at concentrations that would be of public health concern if the water were used for drinking. In the absence of effective risk management actions, it is possible that migration of the contaminants to the southwest and west of the landfills could impact domestic use and production wells in the future. Such an impact would have the potential to adversely affect public health.

1.0 INTRODUCTION

The purpose of this risk assessment is to evaluate potential exposure and risk from contaminants present in various media in and adjacent to the Estes Landfill.

1.1 Authority

Pursuant to Arizona Revised Statutes §§ 49-282, this risk assessment is prepared in accordance with the requirements of Contract Number 2217-000000-3-3-AB-2001 for the Arizona Department of Environmental Quality (ADEQ). This document was prepared using guidelines prescribed by the U.S. Environmental Protection Agency (USEPA) Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual: Part A[1] and RAGS Human Health Supplement.[2]

1.2 Overview

Water quality analyses have indicated that there is groundwater contamination underneath and downgradient of the Estes Landfill, located in southeast Phoenix, Arizona. The nature and location of the contaminants indicate that the landfill is one source of the contamination.[3]

The Bradley Landfill is located adjacent to the Estes Landfill to the south. This risk assessment addresses groundwater contamination underneath and downgradient of the two landfills without respect to source. Risk analyses from exposure to fugitive dust and soil gas are specific to the Estes Landfill.

1.3 Goals and Objectives

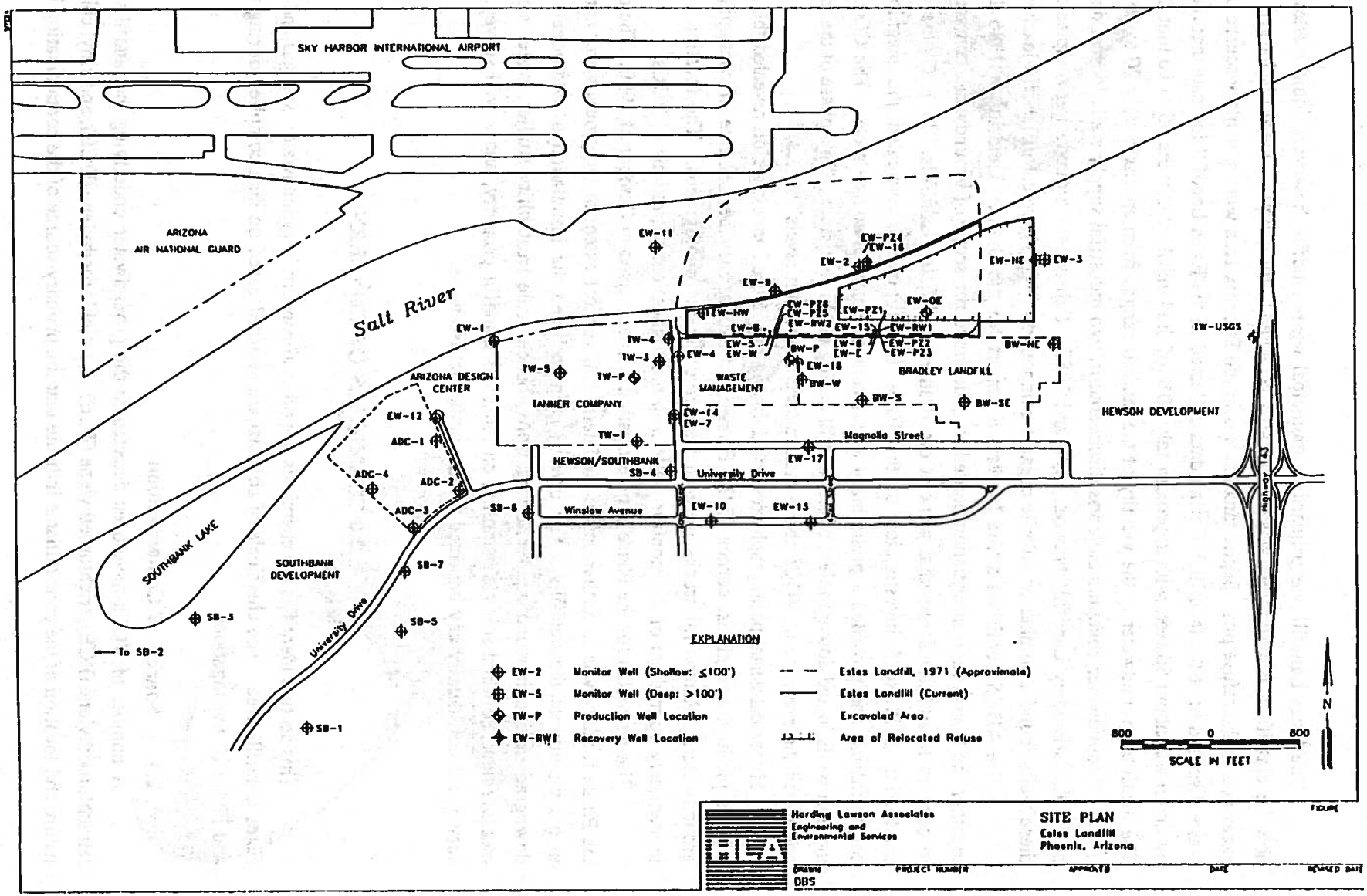
The goal of this risk assessment is to provide risk information necessary to assist decision-making within the risk management process. The objectives of this risk assessment are to provide an evaluation of health risks and the threat to public health that may result from exposure to contaminants present in various media in the vicinity of the Estes Landfill.

1.4 Site Background

The Estes Landfill is a former landfill that occupies about 40 acres south of Sky Harbor International Airport in Phoenix, Arizona. The Estes Landfill is bounded on the west by 40th Street, on the north by the Salt River, on the south by the Waste Management Regional Waste Transfer Station and the Bradley Landfill, and on the east by vacant land.[4] Figure 1.1 displays a map of the area.

The Estes Landfill was operated by a commercial refuse collection and disposal company from the early 1950s through 1972. The landfill was permanently closed as a commercial disposal site in 1972. The City of Phoenix (COP) purchased the landfill in the early 1980s in order to re-channel the Salt River to prevent future flooding of Sky Harbor Airport. The Bradley Landfill, located directly south and adjacent to the Estes Landfill, began commercial operations in the early 1970s. The Bradley landfill is still in operation.

Figure 1.1 - Detailed Map of Estes Landfill Area



The Estes Landfill was primarily a municipal waste landfill, however, liquid wastes that would now be classified as hazardous waste were also accepted. Bulk liquids were discharged into ponds excavated in the refuse pits. Septic tank haulers in the Phoenix area were a primary source of the liquid waste disposed of at the landfill.[3] Coring data collected in the Estes Landfill indicate that the maximum pit depth was about 50 feet, with approximately 40% of the landfill within the 35 to 50 foot depth range. The depth to groundwater in the vicinity of the landfill ranges from approximately 20 to 80 feet.[3]

Groundwater contamination was discovered in two industrial supply wells located downgradient of the Estes/Bradley Landfills between 1980 and 1982. Subsequent groundwater samples collected in these wells found a number of volatile organic compounds (VOCs) typical of landfill leachate.

The ADHS published a Site Inspection Report for the Bradley Landfill in 1986 that brought together the background information needed to understand the scope of groundwater contamination and to coordinate additional remedial work at the Bradley and Estes Landfills. In 1987, the COP began conducting a Phase I investigation of the Estes Landfill which evaluated the magnitude of the contamination and provided a preliminary assessment of potential source areas. The COP installed 6 monitor wells in and downgradient of the landfill during the investigation. This phase of the investigation confirmed the presence of VOCs above maximum contaminant levels (MCLs).

Historical aerial photographs reviewed during the Phase I investigation revealed the presence of a large pit in the southeast corner of the Estes Landfill that may be a source of contaminants in the groundwater.[4] Ramps for trucks were also observed in the photographs. The location of the pit is immediately upgradient of the monitor wells with the highest concentrations of VOCs.

The workplan for the Phase II investigation was approved in October of 1990. The objective of the Phase II study was to further define the lateral and vertical extent of the groundwater contamination in the vicinity of the landfills. The investigation included the installation of additional on-site and downgradient monitor and aquifer testing wells, bench scale treatability studies, water sampling and measurement, soil and soil gas sampling on the Estes Landfill property, and a well survey. The well survey did not identify any impacted private domestic use wells.

2.0 CHEMICALS OF CONCERN

This section identifies the chemicals of potential concern in groundwater, soil gas and soil for the Estes Landfill area. The chemicals of concern are selected based on data compiled during the Phase I and Phase II investigations.

2.1 Sources of Contamination

A number of VOCs have been detected in the groundwater underlying the landfills, including tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1 dichloroethylene (DCE), and vinyl chloride. The nature and location of the contaminants indicate that the primary source of the contamination is the Estes

and/or Bradley Landfills.[3] This risk assessment does not attempt to determine the source of the groundwater contamination.

2.2 Data Collection and Evaluation

Groundwater

Groundwater samples were obtained from monitor and piezometric wells on the landfill properties, and at downgradient locations south and west of the landfills. In addition, data are available for 2 upgradient monitor wells. This risk assessment uses data from groundwater samples collected between 1988 and early 1995.

Groundwater data from 1988 include sample analyses from 6 monitor wells (BW-N, BW-S, EW-E, EW-N, EW-W and EW-NW) and the former Tanner production well (TW-P). In 1989, data became available for 8 additional monitor wells (BW-SE, EW1 through EW-6, and EW-OE) and the Bradley production well (BW-P). Data from 1988 and 1989 include analyses for VOCs using EPA methods 601/602 and 624, SVOCs using EPA method 625, and organochlorine pesticides and polychlorinated bi-phenyls (PCBs) using EPA method 608. In addition, analyses were available for inorganics, including metals. Groundwater samples collected prior to September, 1990 were analyzed by Ennseco Laboratories. Samples collected after September, 1990 were analyzed by Vista Laboratories.

During November of 1990, 4 additional monitor wells (TW-1 through TW-4) were installed on the Tanner property. These wells were sampled quarterly beginning in December 1990. Installation of a pilot testing/recovery well (EW-RW1) and 8 additional monitor wells (EW-7 through EW-14) was completed in February, 1991. These wells were sampled quarterly beginning in March, 1991.

Additional monitor and piezometric wells were constructed and sampled after March, 1991. As of June, 1995 data were available for a total of 49 monitor, piezometric, recovery, or industrial production wells.

Groundwater data were provided to the ADHS by Harding Lawson Associates in electronic format and were imported into an ADHS software program. Mean and 95% upper confidence limit (UCL) of concentrations of organic and inorganic constituents were calculated using ADHS software. Calculations were made using the reported concentration or one-half of the limit of detection for each compound (< or N), in accordance with EPA guidance.[1] Analytes that were detected in the method blank of a particular sample were not included in the data set for that sample. The following formula was used to calculate the 95% UCL:

$$UCL = \text{mean} + t_{(n-1)} * (\sigma/\sqrt{n})$$

where:

mean	=	average concentration
$t_{(n-1)}$	=	student's t test statistic with n-1 degrees of freedom
n	=	number of samples in data set
σ	=	standard deviation of data set

Surface Water

Two surface water samples were collected from Southbank Lake, which is located just east of Interstate 10 and the Salt River by Harding Lawson Associates on June 6, 1989. The samples were analyzed for VOCs using EPA method 601. TCE was detected in the 2 samples at concentrations of 1.8 μg/L and 2.3 μg/L. No other VOCs were detected during the 1989 sampling.

One sample from Southbank Lake was collected by Kenneth D. Smith and Associates on January 14, 1994 and analyzed for VOCs using EPA method 601. TCE was detected at a concentration of 1.7 μg/L. No other VOCs were detected during the 1994 sampling.

Soil

Analytical results from the Phase II surface soil investigation[7] were used to evaluate the potential health risks from exposure to fugitive dust from surface soil at the landfill. The Phase II surface soil investigation consisted of 11 composite surface soil samples analyzed for 15 metals using a variety of EPA test methods, and for organochlorine pesticides and PCBs using EPA Test Method 8080. In addition, 11 discrete surface soil samples were analyzed for VOCs using EPA Test Method 8010/8020, and for SVOCs using EPA method 8270. Sample locations were determined using a systematic methodology developed by Harding Lawson Associates.[7] Soil sample results and a map indicating the sample locations are displayed in Appendix Table D.

Discrete soil sample results for VOCs and SVOCs were all reported to be less than method detection limits, except for bis(2-ethylhexyl)phthalate, which was reported at 0.27 mg/kg in one sample. Arsenic, barium, cadmium, copper, manganese, nickel, and lead were detected in 100% of composite samples. A few pesticides including DDD, DDE, DDT were also detected in surface soil.

Data were converted into electronic format by ADHS staff, and calculations were made using commercially available software. The mean and 95% UCL of organic constituents were calculated using the reported concentration of the constituent or one-half of the limit of detection for each compound.

Soil Gas

Analytical results from the Phase II soil gas investigation conducted August 8-14, 1994 by Harding Lawson Associates and the Tracer Research Corporation were used to estimate health risk presented by exposure to vapors escaping from the landfill.[6] The Phase II soil gas survey consisted of 46 soil gas samples analyzed for 21 organic constituents using the Modified EPA Test Method 8021. Sample locations were predominantly in the east portion of the Estes Landfill. Soil gas sample results and a map indicating the sample locations are displayed in Appendix Table E.

The most frequently detected analytes were TCE, PCE, trichloroethane (TCA), vinyl chloride, benzene, toluene, ethylbenzene, xylenes, and methane. The mean and 95% UCL of each constituent were calculated across all sample locations. Calculations were made using the reported concentration of the constituent or one-half of the limit of detection for each compound.[1] Data were converted into electronic format by ADHS staff, and calculations were made using commercially available software.

2.3 Selection Criteria

Groundwater

Constituents were removed as chemicals of concern for a well if there were no positive detections in the data set; or the highest detected value was less than the USEPA Maximum Contaminant Level (MCL) or the June, 1995 Arizona Health Based Guidance Level (HBGL) and the chemical is not recognized by the USEPA on-line Integrated Risk Information System (IRIS)[8] as a possible (C), probable (B1,B2), or known human (A) carcinogen. Chemicals of concern were selected independently for each well.

An analysis conducted by Harding Lawson Associates has determined that arsenic concentrations in the other monitor wells are at regional background concentrations. In accordance with EPA risk assessment guidance[1], background risk from naturally occurring arsenic has been evaluated separately from site-related risk. Arsenic has been selected as a site-related chemical of concern in 12 wells. Site-related and total potential risk, including potential background risk from arsenic, are presented separately in Chapter 5. Calculated background risk from arsenic is presented separately for each monitor well in Appendix Table B.

Tables 2.1 and 2.2 display the inorganic and organic chemicals detected in groundwater underneath and downgradient of the landfills. Tables 2.3 and 2.4 display the chemicals for which analyses were conducted, the frequency of detection, and the mean and 95% UCL concentrations. Tables 2.5 and 2.6 list the inorganic and organic constituents that were eliminated from the risk assessment based upon the criteria described above. A total of 35 constituents were retained as chemicals of concern in groundwater (Tables 2.7 and 2.8).

Surface Water

Since TCE was the only VOC detected in surface water (at Southbank Lake), TCE is considered the only chemical of concern in surface water. No data for inorganic constituents in the lake are available.

Soil

Discrete soil sample results for VOCs and SVOCs were all reported to be less than method detection limits, except for bis(2-ethylhexyl)phthalate, which was reported at 0.27 mg/kg in one sample.[7] Arsenic, barium, cadmium, copper, manganese, nickel, and lead were detected in 100% of composite samples. A few pesticides including DDD, DDE, DDT were also detected in composite surface soil samples. All metals and pesticides with positive detections during the surface soil investigation were selected as chemicals of concern in surface soil, even though many of these compounds are likely present at background concentrations. VOCs and SVOCs, with the exception of bis(2-ethylhexyl)phthalate, have been eliminated as chemicals of concern in surface soil.

Appendix Table D displays the 95% UCL of metal and pesticide concentrations found in surface soil at the Estes Landfill.

Soil Gas

All VOCs detected in the Phase II soil gas investigation conducted by Tracer Research[6] are included as COCs. Appendix Table E displays the COCs in soil gas.

Table 2.1 - Inorganic chemicals detected in groundwater samples, Estes Landfill Risk Assessment

Chemical Name	CASRN	Detects	Det %
I N O R G A N I C			
1. Ammonia (NH3)	7664-41-7	192/362	53.0%
2. Antimony (Sb)	7440-36-0	3/361	0.8%
3. Arsenic, inorganic (As)	7440-38-2	284/361	78.7%
4. Barium (Ba)	7440-39-3	188/347	54.2%
5. Beryllium (Be)	7440-41-7	4/361	1.1%
6. Boron and borates only (B)	7440-42-8	330/337	97.9%
7. Cadmium (Cd)	7440-43-9	18/361	5.0%
8. Calcium (Ca)	7440-70-2	365/365	100.0%
9. Chloride (Cl) -		365/365	100.0%
10. Chromium(III)	16065-83-1	22/361	6.1%
11. Copper (Cu)	7440-50-8	23/361	6.4%
12. Cyanide (Cn)	57-12-5	5/183	2.7%
13. Fluoride (F)	7782-41-4	277/343	80.8%
14. Iron (Fe)	7439-89-6	179/347	51.6%
15. Lead and compounds (inorganic) (Pb)	7439-92-1	82/361	22.7%
16. Magnesium (Mg)	7439-95-4	354/365	97.0%
17. Manganese (Mn)	7439-96-5	280/369	75.9%
18. Mercury (inorganic) (Hg)	7439-97-6	2/361	0.6%
19. Nickel, soluble salts (Ni)	7440-02-0	39/361	10.8%
20. Nitrate/Nitrite (total)		82/113	72.6%
21. Nitrite	14797-65-0	8/158	5.1%
22. Potassium (K)	7440-09-7	326/365	89.3%
23. Selenium and compounds (Se)	7782-49-2	1/361	0.3%
24. Sodium (Na)	7440-23-5	365/365	100.0%
25. Sulfate (SO4)	14808-79-8	352/365	96.4%
26. Total Dissolved Solids (TDS)		365/365	100.0%
27. Zinc and compounds (Zn)	7440-66-6	321/361	88.9%

Table 2.2 - Organic chemicals detected in groundwater samples, Estes Landfill Risk Assessment

	Chemical Name	CASRN	Detects	Det %
O R G A N I C				
1.	Benzene (BNZ)	71-43-2	51/518	9.8%
2.	Bromodichloromethane (THM) (BDCM)	75-27-4	25/516	4.8%
3.	Bromomethane (BMM)	74-83-9	1/516	0.2%
4.	Carbon tetrachloride (CCL4)	56-23-5	4/518	0.8%
5.	Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	351/904	38.8%
6.	Chloroethane (CE)	75-00-3	26/516	5.0%
7.	Chloroform (THM) (CLFM)	67-66-3	135/519	26.0%
8.	Chloromethane (CM)	74-87-3	13/517	2.5%
9.	Dibromochloromethane (THM) (DBCM)	124-48-1	3/517	0.6%
10.	1,2-Dichlorobenzene (DCB2)	95-50-1	366/846	43.3%
11.	1,3-Dichlorobenzene (DCB3)	541-73-1	35/846	4.1%
12.	1,4-Dichlorobenzene (DCB4)	106-46-7	148/846	17.5%
13.	Dichlorodifluoromethane (DCDFM)	75-71-8	49/432	11.3%
14.	1,1-Dichloroethane (DCA)	75-34-3	208/517	40.2%
15.	1,2-Dichloroethane (DCA2)	107-06-2	28/519	5.4%
16.	1,1-Dichloroethylene (DCE)	75-35-4	178/519	34.3%
17.	1,2-Dichloroethylene (TOTAL)		59/ 86	68.6%
18.	cis-1,2-Dichloroethylene	156-59-2	305/432	70.6%
19.	trans-1,2-Dichloroethylene	156-60-5	116/432	26.9%
20.	Dichloromethane (DCM)	75-09-2	31/517	6.0%
21.	1,2-Dichloropropane (DCP2)	78-87-5	2/503	0.4%
22.	cis-1,3-Dichloropropene (cDCP3)	10061-01-5	1/517	0.2%
23.	Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	5/ 14	35.7%
24.	Ethylbenzene (ETB)	100-41-4	28/517	5.4%
25.	Parachlorophenyl methyl sulfide	123-09-1	4/ 23	17.4%
26.	Phenol	108-95-2	4/ 14	28.6%
27.	1,1,2,2-Tetrachloroethane (TET)	79-34-5	3/517	0.6%
28.	Tetrachloroethylene (PCE)	127-18-4	123/519	23.7%
29.	Toluene (TOL)	108-88-3	53/517	10.3%
30.	1,1,1-Trichloroethane (TCA)	71-55-6	100/517	19.3%
31.	Trichloroethylene (TCE)	79-01-6	275/519	53.0%
32.	Trichlorofluoromethane (TCFM)	75-69-4	83/432	19.2%
33.	Trichlorotrifluoroethane (F113)	76-13-1	114/502	22.7%
34.	Vinyl chloride (VC)	75-01-4	268/519	51.6%
35.	Xylenes (total) (XYL)	1330-20-7	36/433	8.3%

Table 2.3 - Inorganic chemical summary for all groundwater samples,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	1.3	1.5	2.4	0.03	15	192/362	53.0%	√	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.022	0.024	0.02	0.005	0.05	3/361	0.8%	√	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.015	0.017	0.017	0.005	0.14	284/361	78.7%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.24	0.28	0.38	0.013	2.8	188/347	54.2%	√	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L	0.0024	0.0026	0.0016	0.003	0.003	4/361	1.1%	√	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.39	0.41	0.18	0.08	1.1	330/337	97.9%	√	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.0026	0.0028	0.0023	0.0006	0.035	18/361	5.0%	√	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	51	53	19	4	130	365/365	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	160	170	39	44	340	365/365	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.0084	0.01	0.016	0.01	0.12	22/361	6.1%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.024	0.051	0.27	0.01	5.1	23/361	6.4%	√	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L	0.0054	0.0058	0.0029	0.01	0.04	5/183	2.7%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.46	0.52	0.52	0.2	3.2	277/343	80.8%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.65	0.83	1.7	0.022	15.6	179/347	51.6%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0044	0.0052	0.0077	0.002	0.11	82/361	22.7%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	23	24	9.6	0.6	69	354/365	97.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	1.2	1.4	1.5	0.005	8.6	280/369	75.9%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L	0.00011	0.00012	0.00012	0.0002	0.0021	2/361	0.6%	√	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.024	0.027	0.032	0.02	0.48	39/361	10.8%	√	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	1.8	2.3	2.5	0.05	12	82/113	72.6%	√	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L	0.015	0.017	0.014	0.01	0.09	8/158	5.1%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	7.1	7.7	6.2	1.5	59	326/365	89.3%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L	0.004	0.0046	0.0052	0.006	0.006	1/361	0.3%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/361	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	160	170	37	68	270	365/365	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	62	64	23	5.4	150	352/365	96.4%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/361	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	670	690	170	218	1620	365/365	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.11	0.15	0.3	0.01	4.6	321/361	88.9%	√	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A" or "B2".

94ADHS35
Draft 8/95

Table 2.4 - Organic chemical summary for all groundwater samples,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
ORGANIC													
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 14	0.0%	--	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 14	0.0%	--	D	4E+02	
3. Acetone	67-64-1	µg/L						0/114	0.0%	--	D	7E+02	
4. Aldrin	309-00-2	µg/L						0/ 8	0.0%	--	B2	2E-03	
5. Anthracene (PAH)	120-12-7	µg/L						0/ 14	0.0%	--	D	2E+03	
6. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 14	0.0%	--	B2	3E-02	2E-01
7. Benzene (BNZ)	71-43-2	µg/L	2.3	3.4	13	0.5	93	51/518	9.8%	✓	A	1E+00	5E+00
8. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 14	0.0%	--	B2	5E-03	2E-01
9. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 14	0.0%	--	B2	3E-02	2E-01
10. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 14	0.0%	--	D		
11. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 14	0.0%	--	B2	3E-02	2E-01
12. Benzoic acid	65-85-0	µg/L						0/ 14	0.0%	--	D	3E+04	
13. Benzyl alcohol	100-51-6	µg/L						0/ 14	0.0%	--	ND	2E+03	
14. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 14	0.0%	--	D		
15. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 14	0.0%	--	B2	3E-02	
16. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 14	0.0%	--	ND	5E-01	
17. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	1.1	1.6	5.3	0.21	10	25/516	4.8%	✓	B2	6E-01	1E+02
18. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 14	0.0%	--	D		
19. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/516	0.0%	--	B2	4E+00	1E+02
20. Bromomethane (BMM)	74-83-9	µg/L	2.1	2.7	7.4	2.5	2.5	1/516	0.2%	--	D	1E+01	
21. Butyl benzyl phthalate	85-68-7	µg/L						0/ 14	0.0%	--	C	1E+02	1E+02
22. Carbon disulfide	75-15-0	µg/L						0/ 14	0.0%	--	D	7E+02	
23. Carbon tetrachloride (CCL4)	56-23-5	µg/L	1.1	1.6	5.3	0.5	9.1	4/518	0.8%	✓	B2	3E-01	5E+00
24. Chlordane	57-74-9	µg/L						0/ 8	0.0%	--	B2	3E-02	2E+00
25. p-Chloroaniline	106-47-8	µg/L						0/ 14	0.0%	--	NA	3E+01	
26. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	10	12	33	0.2	290	351/904	38.8%	✓	D	1E+02	1E+02
27. Chloroethane (CE)	75-00-3	µg/L	2.2	2.8	7.4	0.2	9	26/516	5.0%	--	ND		
28. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/444	0.0%	--	ND		
29. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.4	1.9	5.4	0.2	22	135/519	26.0%	✓	B2	6E+00	1E+02
30. Chloromethane (CM)	74-87-3	µg/L	2.1	2.7	7.4	0.24	7.7	13/517	2.5%	✓	C	3E+00	
31. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 14	0.0%	--	ND		
32. beta-Chloronaphthalene	91-58-7	µg/L						0/ 14	0.0%	--	NA	6E+02	
33. 2-Chlorophenol	95-57-8	µg/L						0/ 14	0.0%	--	D	4E+01	
34. Chrysene (PAH)	218-01-9	µg/L						0/ 14	0.0%	--	B2	3E+00	2E-01
35. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 8	0.0%	--	B2	2E-01	
36. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 8	0.0%	--	B2	1E-01	
37. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 8	0.0%	--	B2	1E-01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A" or "B2".

94ADHS35
Draft 8/95

Table 2.4 - Organic chemical summary for all groundwater samples,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
O R G A N I C													
38. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 14	0.0%	--	B2	3E-03	2E-01
39. Dibenzofuran	132-64-9	µg/L						0/ 14	0.0%	--	D		
40. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L	1.3	1.9	6.6	0.26	0.34	3/517	0.6%	--	C	4E-01	1E+02
41. Dibutyl phthalate	84-74-2	µg/L						0/ 14	0.0%	--	D	7E+02	
42. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	30	40	140	0.6	2500	366/846	43.3%	✓	D	6E+02	6E+02
43. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	6.7	12	85	0.8	1900	35/846	4.1%	✓	D	6E+02	
44. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	7.5	13	87	0.8	1900	148/846	17.5%	✓	C	2E+00	8E+01
45. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 14	0.0%	--	B2	8E-02	
46. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	1.7	2.5	8.19999999	0.22	83	49/432	11.3%	--	D	1E+03	
47. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.9	2.4	5.5	0.2	17	208/517	40.2%	--	C	7E+01	
48. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	1.2	1.6	5.3	0.2	6.4	28/519	5.4%	✓	B2	4E-01	5E+00
49. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	2.1	2.6	5.6	0.2	18	178/519	34.3%	✓	C	6E-02	7E+00
50. 1,2-Dichloroethylene (TOTAL)		µg/L	27	41	66	0.6	509.999999	59/ 86	68.6%	✓	D	7E+01	
51. cis-1,2-Dichloroethylene	156-59-2	µg/L	200	290	940	0.2	12000	305/432	70.6%	✓	D	7E+01	7E+01
52. trans-1,2-Dichloroethylene	156-60-5	µg/L	3	4	10	0.21	100	116/432	26.9%	--	D	1E+02	1E+02
53. Dichloromethane (DCM)	75-09-2	µg/L	8.1	12	48	2.2	150	31/517	6.0%	✓	B2	5E+00	5E+00
54. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 14	0.0%	--	D	2E+01	
55. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L	1	1.5	5.3	0.3	0.4	2/503	0.4%	✓	B2	5E-01	5E+00
56. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L	1.5	2.1	6.7	0.5	0.5	1/517	0.2%	✓	B2		
57. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/517	0.0%	--	B2		
58. Dieldrin	60-57-1	µg/L						0/ 8	0.0%	--	B2	2E-03	
59. Diethyl phthalate	84-66-2	µg/L						0/ 14	0.0%	--	D	6E+03	5E+03
60. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L	19	31	21	22	87	5/ 14	35.7%	✓	B2	3E+00	4E+00
61. Dimethyl phthalate	131-11-3	µg/L						0/ 14	0.0%	--	D	7E+04	
62. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 14	0.0%	--	NA	1E+02	
63. 2,4-dinitrophenol	51-28-5	µg/L						0/ 14	0.0%	--	ND	1E+01	
64. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 14	0.0%	--	B2	5E-02	
65. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 14	0.0%	--	ND	7E+00	
66. Dioctylphthalate	117-84-0	µg/L						0/ 14	0.0%	--	ND	1E+02	
67. Endosulfan i	959-98-8	µg/L						0/ 8	0.0%	--	D	4E-01	
68. Endosulfan ii	33213-65-9	µg/L						0/ 8	0.0%	--	ND		
69. Endosulfan sulfate	1031-07-8	µg/L						0/ 8	0.0%	--	ND		
70. Endrin	72-20-8	µg/L						0/ 8	0.0%	--	D	2E+00	2E+00
71. Ethylbenzene (ETB)	100-41-4	µg/L	4.3	6.6	26	1.1	330	28/517	5.4%	--	D	7E+02	7E+02
72. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 72	0.0%	--	B2	4E-04	5E-02
73. Fluoranthene (PAH)	206-44-0	µg/L						0/ 14	0.0%	--	D	3E+02	
74. Fluorene (PAH)	86-73-7	µg/L						0/ 14	0.0%	--	D	3E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A" or "B2".

94ADHS35
Draft 8/95

Table 2.4 - Organic chemical summary for all groundwater samples,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
O R G A N I C												
75. Heptachlor	76-44-8	µg/L						0/ 8	0.0% --	B2	8E-03	4E-01
76. Heptachlor epoxide	1024-57-3	µg/L						0/ 8	0.0% --	B2	4E-03	2E-01
77. Hexachlorobenzene	118-74-1	µg/L						0/ 14	0.0% --	B2	2E-02	1E+00
78. Hexachlorobutadiene	87-68-3	µg/L						0/ 14	0.0% --	C	5E-01	
79. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L						0/ 8	0.0% --	B2	6E-03	
80. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L						0/ 8	0.0% --	C	2E-02	
81. Delta-hexachlorocyclohexane	319-86-8	µg/L						0/ 8	0.0% --	D		
82. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 14	0.0% --	D	5E+01	5E+01
83. Hexachloroethane	67-72-1	µg/L						0/ 14	0.0% --	C	3E+00	
84. 2-Hexanone	591-78-6	µg/L						0/ 14	0.0% --	NA		
85. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 14	0.0% --	B2	3E-02	2E-01
86. Isophorone	78-59-1	µg/L						0/ 14	0.0% --	C	4E+01	
87. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L						0/ 8	0.0% --	C	3E-02	2E-01
88. Methoxychlor	72-43-5	µg/L						0/ 8	0.0% --	D	4E+01	4E+01
89. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 14	0.0% --	D	4E+03	
90. Methyl isobutyl ketone	108-10-1	µg/L						0/ 14	0.0% --	NA	6E+02	
91. 2-methylnaphthalene	91-57-6	µg/L						0/ 14	0.0% --	ND		
92. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 14	0.0% --	C	4E+01	
93. 4-methylphenol	106-44-5	µg/L						0/ 14	0.0% --	C	4E+01	
94. Naphthalene (PAH)	91-20-3	µg/L						0/ 14	0.0% --	D	3E+02	
95. 2-Nitroaniline	88-74-4	µg/L						0/ 14	0.0% --	NA	4E-01	
96. m-Nitroaniline	99-09-2	µg/L						0/ 14	0.0% --	ND		
97. Nitrobenzene	98-95-3	µg/L						0/ 14	0.0% --	D	4E+00	
98. p-Nitrophenol	100-02-7	µg/L						0/ 14	0.0% --	NA		
99. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 14	0.0% --	ND		
100. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 14	0.0% --	B2	5E-03	
101. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 14	0.0% --	B2	7E+00	
102. Parachlorophenyl methyl sulfide	123-09-1	mg/L	0.23	0.55	0.74	0.07	3.62	4/ 23	17.4% --	D		
103. Pentachlorophenol	87-86-5	µg/L						0/ 14	0.0% --	B2	3E-01	1E+00
104. Phenanthrene (PAH)	85-01-8	µg/L						0/ 14	0.0% --	D		
105. Phenol	108-95-2	µg/L	19	30	20	37	74	4/ 14	28.6% --	D	4E+03	
106. Polychlorinated biphenyls (PCBs)	1336-36-3	µg/L						0/ 40	0.0% --	B2	5E-03	5E-01
107. Polychlorinated biphenyl - ar	12674-11-2	µg/L						0/ 8	0.0% --	ND	5E-01	
108. Pyrene (PAH)	129-00-0	µg/L						0/ 14	0.0% --	D	2E+02	
109. Styrene	100-42-5	µg/L						0/ 14	0.0% --	C	1E+02	1E+02
110. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L	1.1	1.5	5.3	0.59	4.4	3/517	0.6% ✓	C	2E-01	
111. Tetrachloroethylene (PCE)	127-18-4	µg/L	1.3	1.7	5.3	0.2	6.7	123/519	23.7% ✓	B2	7E-01	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A" or "B2".

94ADHS35
Draft 8/95

Table 2.4 - Organic chemical summary for all groundwater samples,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
O R G A N I C													
112. Toluene (TOL)	108-88-3	µg/L	2	3.1	12	0.51	28	53/517	10.3%	--	D	1E+03	1E+03
113. Toxaphene	8001-35-2	µg/L						0/ 8	0.0%	--	B2	3E-02	3E+00
114. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 14	0.0%	--	D	7E+01	9E+00
115. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.4	1.9	5.7	0.2	50	100/517	19.3%	--	D	6E+02	2E+02
116. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/517	0.0%	--	C	6E-01	5E+00
117. Trichloroethylene (TCE)	79-01-6	µg/L	7.8	9.1	15	0.23	120	275/519	53.0%	√	B2	3E+00	5E+00
118. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	2.2	2.9	8.4	0.2	29	83/432	19.2%	--	D	2E+03	
119. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 14	0.0%	--	D	7E+02	
120. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 14	0.0%	--	B2	3E+00	
121. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	3.3	4.8	16	0.2	14	114/502	22.7%	--	D	2E+05	
122. Vinyl acetate	108-05-4	µg/L						0/ 14	0.0%	--	NA	7E+03	
123. Vinyl chloride (VC)	75-01-4	µg/L	220	290	840	0.2	10000	268/519	51.6%	√	A	2E-02	2E+00
124. Xylenes (total) (XYL)	1330-20-7	µg/L	6.8	12	53	0.7	1000	36/433	8.3%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A" or "B2".

94ADHS35
Draft 8/95

Table 2.5 - Inorganic chemicals eliminated as COCs in groundwater, Estes Landfill Risk Assessment

Chemical Name	CASRN	Detects	Det %
I N O R G A N I C			
1. Calcium (Ca)	7440-70-2	365/365	100.0%
2. Chloride (Cl)-		365/365	100.0%
3. Chromium(III)	16065-83-1	22/361	6.1%
4. Cyanide (Cn)	57-12-5	5/183	2.7%
5. Fluoride (F)	7782-41-4	277/343	80.8%
6. Iron (Fe)	7439-89-6	179/347	51.6%
7. Magnesium (Mg)	7439-95-4	354/365	97.0%
8. Nitrite	14797-65-0	8/158	5.1%
9. Potassium (K)	7440-09-7	326/365	89.3%
10. Selenium and compounds (Se)	7782-49-2	1/361	0.3%
11. Silver (Ag)	7440-22-4	0/361	0.0%
12. Sodium (Na)	7440-23-5	365/365	100.0%
13. Sulfate (SO4)	14808-79-8	352/365	96.4%
14. Thallium (Tl)	7440-28-0	0/361	0.0%
15. Total Dissolved Solids (TDS)		365/365	100.0%

Table 2.6 - Organic chemicals eliminated as COCs in groundwater, Estes Landfill Risk Assessment

Chemical Name	CASRN	Detects	Det %
O R G A N I C			
1. Acenaphthene (PAH)	83-32-9	0/ 14	0.0%
2. Acenaphthylene (PAH)	208-96-8	0/ 14	0.0%
3. Acetone	67-64-1	0/114	0.0%
4. Aldrin	309-00-2	0/ 8	0.0%
5. Anthracene (PAH)	120-12-7	0/ 14	0.0%
6. Benz[a]anthracene (PAH)	56-55-3	0/ 14	0.0%
7. Benzo[a]pyrene (PAH)	50-32-8	0/ 14	0.0%
8. Benzo[b]fluoranthene (PAH)	205-99-2	0/ 14	0.0%
9. Benzo[g,h,i]perylene (PAH)	191-24-2	0/ 14	0.0%
10. Benzo[k]fluoranthene (PAH)	207-08-9	0/ 14	0.0%
11. Benzoic acid	65-85-0	0/ 14	0.0%
12. Benzyl alcohol	100-51-6	0/ 14	0.0%
13. Bis(2-chloroethoxy)methane	111-91-1	0/ 14	0.0%
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	0/ 14	0.0%
15. Bis(2-chloroisopropyl) ether	39638-32-9	0/ 14	0.0%
16. p-Bromodiphenyl ether	101-55-3	0/ 14	0.0%
17. Bromoform (THM) (BRFM)	75-25-2	0/516	0.0%
18. Bromomethane (BMM)	74-83-9	1/516	0.2%
19. Butyl benzyl phthalate	85-68-7	0/ 14	0.0%
20. Carbon disulfide	75-15-0	0/ 14	0.0%
21. Chlordane	57-74-9	0/ 8	0.0%
22. p-Chloroaniline	106-47-8	0/ 14	0.0%
23. Chloroethane (CE)	75-00-3	26/516	5.0%
24. 2-Chloroethylvinyl ether (CEVE)	110-75-8	0/444	0.0%
25. 4-Chloro-3-methylphenol	59-50-7	0/ 14	0.0%
26. beta-Chloronaphthalene	91-58-7	0/ 14	0.0%
27. 2-Chlorophenol	95-57-8	0/ 14	0.0%
28. Chrysene (PAH)	218-01-9	0/ 14	0.0%
29. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	0/ 8	0.0%
30. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	0/ 8	0.0%
31. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	0/ 8	0.0%
32. Dibenz[a,h]anthracene (PAH)	53-70-3	0/ 14	0.0%
33. Dibenzofuran	132-64-9	0/ 14	0.0%
34. Dibromochloromethane (THM) (DBCM)	124-48-1	3/517	0.6%
35. Dibutyl phthalate	84-74-2	0/ 14	0.0%
36. 3,3'-dichlorobenzidine	91-94-1	0/ 14	0.0%
37. Dichlorodifluoromethane (DCDFM)	75-71-8	49/432	11.3%
38. 1,1-Dichloroethane (DCA)	75-34-3	208/517	40.2%
39. trans-1,2-Dichloroethylene	156-60-5	116/432	26.9%
40. 2,4-Dichlorophenol	120-83-2	0/ 14	0.0%
41. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	0/517	0.0%
42. Dieldrin	60-57-1	0/ 8	0.0%
43. Diethyl phthalate	84-66-2	0/ 14	0.0%
44. Dimethyl phthalate	131-11-3	0/ 14	0.0%
45. 2,4-Dimethylphenol	105-67-9	0/ 14	0.0%
46. 2,4-dinitrophenol	51-28-5	0/ 14	0.0%
47. 2,4-dinitrotoluene	121-14-2	0/ 14	0.0%
48. 2,6-dinitrotoluene	606-20-2	0/ 14	0.0%
49. Dioctylphthalate	117-84-0	0/ 14	0.0%
50. Endosulfan i	959-98-8	0/ 8	0.0%
51. Endosulfan ii	33213-65-9	0/ 8	0.0%
52. Endosulfan sulfate	1031-07-8	0/ 8	0.0%
53. Endrin	72-20-8	0/ 8	0.0%
54. Ethylbenzene (ETB)	100-41-4	28/517	5.4%
55. Ethylene dibromide (EDB)	106-93-4	0/ 72	0.0%
56. Fluoranthene (PAH)	206-44-0	0/ 14	0.0%
57. Fluorene (PAH)	86-73-7	0/ 14	0.0%
58. Heptachlor	76-44-8	0/ 8	0.0%
59. Heptachlor epoxide	1024-57-3	0/ 8	0.0%

Table 2.6 - Organic chemicals eliminated as COCs in groundwater, Estes Landfill Risk Assessment

	Chemical Name	CASRN	Detects	Det %
O R G A N I C				
60.	Hexachlorobenzene	118-74-1	0/ 14	0.0%
61.	Hexachlorobutadiene	87-68-3	0/ 14	0.0%
62.	alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	0/ 8	0.0%
63.	beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	0/ 8	0.0%
64.	Delta-hexachlorocyclohexane	319-86-8	0/ 8	0.0%
65.	Hexachlorocyclopentadiene (HCCPD)	77-47-4	0/ 14	0.0%
66.	Hexachloroethane	67-72-1	0/ 14	0.0%
67.	2-Hexanone	591-78-6	0/ 14	0.0%
68.	Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	0/ 14	0.0%
69.	Isophorone	78-59-1	0/ 14	0.0%
70.	Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	0/ 8	0.0%
71.	Methoxychlor	72-43-5	0/ 8	0.0%
72.	Methyl Ethyl Ketone (MEK)	78-93-3	0/ 14	0.0%
73.	Methyl isobutyl ketone	108-10-1	0/ 14	0.0%
74.	2-methylnaphthalene	91-57-6	0/ 14	0.0%
75.	2-Methylphenol (o-Cresol)	95-48-7	0/ 14	0.0%
76.	4-methylphenol	106-44-5	0/ 14	0.0%
77.	Naphthalene (PAH)	91-20-3	0/ 14	0.0%
78.	2-Nitroaniline	88-74-4	0/ 14	0.0%
79.	m-Nitroaniline	99-09-2	0/ 14	0.0%
80.	Nitrobenzene	98-95-3	0/ 14	0.0%
81.	p-Nitrophenol	100-02-7	0/ 14	0.0%
82.	2-NITROPHENOL (UG/L)	88-75-5	0/ 14	0.0%
83.	n-Nitroso-di-n-propylamine	621-64-7	0/ 14	0.0%
84.	n-Nitroso-diphenylamine	86-30-6	0/ 14	0.0%
85.	Parachlorophenyl methyl sulfide	123-09-1	4/ 23	17.4%
86.	Pentachlorophenol	87-86-5	0/ 14	0.0%
87.	Phenanthrene (PAH)	85-01-8	0/ 14	0.0%
88.	Phenol	108-95-2	4/ 14	28.6%
89.	Polychlorinated biphenyls (PCBs)	1336-36-3	0/ 40	0.0%
90.	Polychlorinated biphenyl - ar	12674-11-2	0/ 8	0.0%
91.	Pyrene (PAH)	129-00-0	0/ 14	0.0%
92.	Styrene	100-42-5	0/ 14	0.0%
93.	Toluene (TOL)	108-88-3	53/517	10.3%
94.	Toxaphene	8001-35-2	0/ 8	0.0%
95.	1,2,4-Trichlorobenzene	120-82-1	0/ 14	0.0%
96.	1,1,1-Trichloroethane (TCA)	71-55-6	100/517	19.3%
97.	1,1,2-Trichloroethane (TCA2)	79-00-5	0/517	0.0%
98.	Trichlorofluoromethane (TCFM)	75-69-4	83/432	19.2%
99.	2,4,5-Trichlorophenol	95-95-4	0/ 14	0.0%
100.	2,4,6-Trichlorophenol	88-06-2	0/ 14	0.0%
101.	Trichlorotrifluoroethane (F113)	76-13-1	114/502	22.7%
102.	Vinyl acetate	108-05-4	0/ 14	0.0%
103.	Xylenes (total) (XYL)	1330-20-7	36/433	8.3%

Table 2.7 - Inorganic chemicals of concern in groundwater,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	1.3	1.5	2.4	0.03	15	192/362	53.0% ✓	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.022	0.024	0.02	0.005	0.05	3/361	0.8% ✓	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.015	0.017	0.017	0.005	0.14	284/361	78.7% ✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.24	0.28	0.38	0.013	2.8	188/347	54.2% ✓	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L	0.0024	0.0026	0.0016	0.003	0.003	4/361	1.1% ✓	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.39	0.41	0.18	0.08	1.1	330/337	97.9% ✓	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.0026	0.0028	0.0023	0.0006	0.035	18/361	5.0% ✓	B1	4E-03	5E-03
8. Copper (Cu)	7440-50-8	mg/L	0.024	0.051	0.27	0.01	5.1	23/361	6.4% ✓	D	3E-01	
9. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0044	0.0052	0.0077	0.002	0.11	82/361	22.7% ✓	B2	5E-03	
10. Manganese (Mn)	7439-96-5	mg/L	1.2	1.4	1.5	0.005	8.6	280/369	75.9% ✓	D	4E-02	
11. Mercury (inorganic) (Hg)	7439-97-6	mg/L	0.00011	0.00012	0.00012	0.0002	0.0021	2/361	0.6% ✓	D	2E-03	2E-03
12. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.024	0.027	0.032	0.02	0.48	39/361	10.8% ✓	D	1E-01	1E-01
13. Nitrate/Nitrite (total)		mg/L	1.8	2.3	2.5	0.05	12	82/113	72.6% ✓	D	1E+01	1E+01
14. Zinc and compounds (Zn)	7440-66-6	mg/L	0.11	0.15	0.3	0.01	4.6	321/361	88.9% ✓	D	2E+00	

Table 2.8 - Organic chemicals of concern in groundwater,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
O R G A N I C													
1. Benzene (BNZ)	71-43-2	µg/L	2.3	3.4	13	0.5	93	51/518	9.8%	✓	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	1.1	1.6	5.3	0.21	10	25/516	4.8%	✓	B2	6E-01	1E+02
3. Carbon tetrachloride (CCL4)	56-23-5	µg/L	1.1	1.6	5.3	0.5	9.1	4/518	0.8%	✓	B2	3E-01	5E+00
4. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	10	12	33	0.2	290	351/904	38.8%	✓	D	1E+02	1E+02
5. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.4	1.9	5.4	0.2	22	135/519	26.0%	✓	B2	6E+00	1E+02
6. Chloromethane (CM)	74-87-3	µg/L	2.1	2.7	7.4	0.24	7.7	13/517	2.5%	✓	C	3E+00	
7. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	30	40	140	0.6	2500	366/846	43.3%	✓	D	6E+02	6E+02
8. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	6.7	12	85	0.8	1900	35/846	4.1%	✓	D	6E+02	
9. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	7.5	13	87	0.8	1900	148/846	17.5%	✓	C	2E+00	8E+01
10. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	1.2	1.6	5.3	0.2	6.4	28/519	5.4%	✓	B2	4E-01	5E+00
11. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	2.1	2.6	5.6	0.2	18	178/519	34.3%	✓	C	6E-02	7E+00
12. 1,2-Dichloroethylene (TOTAL)		µg/L	27	41	66	0.6	509.999999	59/ 86	68.6%	✓	D	7E+01	
13. cis-1,2-Dichloroethylene	156-59-2	µg/L	200	290	940	0.2	12000	305/432	70.6%	✓	D	7E+01	7E+01
14. Dichloromethane (DCM)	75-09-2	µg/L	8.1	12	48	2.2	150	31/517	6.0%	✓	B2	5E+00	5E+00
15. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L	1	1.5	5.3	0.3	0.4	2/503	0.4%	✓	B2	5E-01	5E+00
16. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L	1.5	2.1	6.7	0.5	0.5	1/517	0.2%	✓	B2		
17. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L	19	31	21	22	87	5/ 14	35.7%	✓	B2	3E+00	4E+00
18. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L	1.1	1.5	5.3	0.59	4.4	3/517	0.6%	✓	C	2E-01	
19. Tetrachloroethylene (PCE)	127-18-4	µg/L	1.3	1.7	5.3	0.2	6.7	123/519	23.7%	✓	B2	7E-01	5E+00
20. Trichloroethylene (TCE)	79-01-6	µg/L	7.8	9.1	15	0.23	120	275/519	53.0%	✓	B2	3E+00	5E+00
21. Vinyl chloride (VC)	75-01-4	µg/L	220	290	840	0.2	10000	268/519	51.6%	✓	A	2E-02	2E+00

2.4 Data Quality

Groundwater

Groundwater data include analyses for VOCs using EPA methods 601/602 and 624, SVOCs using EPA method 625, and organochlorine pesticides and polychlorinated bi-phenyls (PCBs) using EPA method 608. EPA method 625 was used to analyze samples for base/neutrals, acids and pesticides. EPA series 600 methods are used under regulatory programs under the Clean Water Act to determine chemicals present in municipal and industrial wastewater.

Quality Assurance/Quality Control QA/QC measures taken to ensure data quality are detailed in Appendix B of the Draft Phase II Report.[4] QA/QC measures included trip blanks, field blanks, field duplicates, laboratory spikes, and laboratory duplicates. The QA/QC procedures appear to be sufficient to insure that qualified groundwater data are of adequate quality for inclusion in the risk assessment.

Groundwater data used in the risk assessment have been validated using data qualifiers for data usability. Qualifiers were included in the groundwater data provided by Harding Lawson Associates. The following qualifier codes were used to qualify data:

Data included in the risk assessment

U = Analyte not detected above reported sample quantitation limit. Associated numerical value is the SQL.

J = Analyte positively identified, reported concentration is approximate.

B = Compound detected in associated blank at >10x blank concentration for common VOCs and >5x blank concentration for other VOCs.

D = Compound analyzed at greater dilution than the rest of the run.

Data eliminated from the risk assessment

NJ = Analyte tentatively identified, reported concentration is approximate.

UJ = Analyte not detected above reported quantitation limit, but limit is approximate, and may not represent the actual quantitation needed to measure the analyte.

R = Sample results are rejected due to serious deficiencies in QC.

UB = Compound detected in associated blank at <10x blank concentration for common VOCs and <5x blank concentrations for other VOCs.

N = Analysis indicates presence of an analyte for which presumptive evidence indicates tentative identification.

Surface Water

Two samples from the Southbank Lake were collected by Harding Lawson Associates on June 6, 1989 and analyzed for VOCs by Enseco, Inc. of West Sacramento, California, using EPA method 601.

One lake sample was collected by Kenneth D. Smith and Associates on January 14, 1994, and analyzed for VOCs by APPL, Inc. of Fresno, California using EPA method 601.

The QA/QC procedures for the 1989 samples are unknown. The 1994 sample was accompanied by a method blank and spike analysis. While the available data from the lake are limited, it is assumed to be of adequate quality for use in the risk assessment.

Soil Gas

The Phase II soil gas survey consisted of 46 soil gas samples analyzed for 21 organic constituents using the Modified EPA Test Method 8021. QA/QC measures taken to ensure data quality are detailed in the Remedial Data Acquisition document prepared by Harding Lawson Associates.[6] QA/QC measures included analytical method blanks (5% of samples), continuing calibration checks (20%), 1 field system blank per day, reagent blanks (1 per set of working standards), and replicate samples (10% of all samples). The measures taken appear to be sufficient to insure that the soil gas data is of adequate quality for inclusion in the risk assessment.

Soil

The Phase II surface soil investigation consisted of 11 composite surface soil samples analyzed for 15 metals using a variety of EPA test methods, and for organochlorine pesticides and PCBs using EPA Test Method 8080. In addition, 11 discrete surface soil samples were analyzed for VOCs using EPA Test Method 8010/8020, and for SVOCs using EPA method 8270.

QA/QC measures taken to ensure data quality are detailed in the Surface Soil Sampling document prepared by Harding Lawson Associates[7] QA/QC procedures included the collection and "blind" laboratory analysis of a field duplicate, spike samples, and reagent blanks.[7] The procedures appear to be sufficient to insure that the surface soil data is of adequate quality for inclusion in the risk assessment.

3.0 EXPOSURE ASSESSMENT

This exposure assessment focuses on current and potential future human exposure to chemicals in groundwater, surface water, fugitive dust and soil gases at the site. An exposure pathway is considered complete when a chemical of concern comes into contact with a person. An exposure assessment requires an estimate of exposure concentrations and an estimate of intake for each pathway.

The four steps comprising an exposure assessment are: 1) identification of the exposure setting; 2) description of the exposed population and exposure pathways; 3) estimation of exposure concentrations of chemicals; and 4) calculation of intake doses for each pathway. The discussion is divided into the following five sections:

* **3.1 Exposure Setting Characterization**
* **3.2 Exposed Populations**
* **3.3 Exposure Pathway Identification**
* **3.4 Quantification of Exposures**
* **3.5 Uncertainties in the Exposure Assessment**
* **3.6 Exposure Assessment Summary**

3.1 Exposure Setting Characterization

This section describes the physical setting of the site, including location, meteorology, geology, soils, surface and groundwater flow and current land use.

Location

The Estes Landfill is bounded on the west by 40th Street, on the north by the Salt River, on the south by the Waste Management Regional Waste Transfer Station and the Bradley Landfill, and on the east by vacant land.[4] Figure 1.1 displays a map of the area.

Meteorology

The Estes Landfill is located in the Salt River Valley within the Sonoran Desert Climate Region. The area is characterized by hot summers and mild winters. Average maximum daily temperatures range from a high of 105° F in July, to a low of 65° F in December. Precipitation averages approximately 7 inches annually; with most rainfall occurring during the summer (July through September), and the winter (December through March). Average annual pan evaporation is approximately 106 inches, allowing little rainfall infiltration below the root zone.

Wind velocities are recorded at Phoenix Sky Harbor Airport. Climatic data indicate wind velocities of 0 - 3 mph, 4 - 6 mph, 7 - 10 mph, and greater than 10 mph occur 13%, 43%, 31%, and 8% of the time, respectively. Winds are calm an average of 5% of the time. The mean wind speed in Phoenix is approximately 6.2 miles/hour (2.8 meters/second).

Geology

The Estes Landfill is located on the south side of the Salt River in an area where limited historical geologic information exists. The area is on the border of the east and west Salt River Valleys due to thinning of the basin fill and nearby exposures of crystalline bedrock at the Camels Head Formation.[4] Core samples indicate the presence of a reddish and moderately gray brown, moderately to well sorted, moderately bedded, fine grained sandstone dipping at approximately 40 to 50 degrees. A test hole 2,000 feet north of the landfill indicated the presence of Tertiary sedimentary deposits beginning at 158 feet below ground surface, and extending for several hundred feet.

Soils

The surface soils in the vicinity of the landfill consists of recent channel and flood plain deposits of sands, gravels, cobbles and boulders to a depth of 50-60 feet below ground surface. Beneath this layer, is a 30-40 foot thick sequence of unconsolidated to semiconsolidated gravel and cobbles supported in a clayey silt matrix.

Hydrology

Known groundwater usage downgradient of the landfills is currently limited to the Bradley production well. The depth to groundwater in the vicinity of the landfill ranges from approximately 20 to 80 feet.[3] The majority of the groundwater recharge near the landfill occurs through the bottom of the Salt River during periods of runoff and when releases from upstream dams cause flow in the river.[4]

During static conditions, groundwater flow direction appears to be generally west along the axes of the Estes and Bradley Landfills, slightly northwest south of the landfills, and slightly southwest north of the landfills.[4] Historical water level information indicates that during periods when the Salt River is flowing, groundwater flow shifts from west to southwest.[4]

Surface water

Surface water flow in the vicinity of the landfill is dominated by ephemeral water in the Salt River. The Salt River flows only in response to major precipitation events or releases from upstream dams.[3] From 1965 through 1986 flow was recorded in the Salt River 8.8% of the time.[3] However, when the river does flow, the effects can be significant. Direct washout of wastes occurred during a flood in 1980, when floodwaters eroded a channel through the northeast corner of the Estes landfill. In 1982, the COP and State of Arizona completed a channelization project along this reach of the river in order to prevent future flooding problems at Sky Harbor Airport and the Estes Landfill.

Southbank Lake is an old gravel pit that was excavated to below the water table. The rim of the lake is approximately 30 feet below the level ground surface. The lake is located about 1/2 mile west-southwest of the Estes Landfill and is approximately 700 feet wide and 2,000 feet in length. The lake is of unknown depth, but is at least 20 feet deep in some sections.

Southbank Lake is downgradient of the Estes Landfill and is fed by shallow groundwater from the alluvium of the Salt River channel. While low levels of TCE have been detected in Southbank Lake, the Estes Landfill has not been identified as the source of TCE in the lake. Bromar Arizona owns the

lake and intends to allow fishing in the lake with a catch and release policy. Under the plan, no fish would be allowed to be removed from the site. The lake is fenced with a six-foot chain link fence and is well marked with "no trespassing" signs. Currently, no fishing occurs at the lake.[15]

3.2 Exposed Populations

The populations potentially exposed to contaminants in the study area include:

Current Exposure:

- Exposure to contaminants in water from the Bradley Landfill production well.
- Individuals working at the Bradley Landfill may be exposed to VOCs as a result of inhalation of vapors from soil gas and fugitive dust from the Estes Landfill.
- Individuals using the Southbank Lake for recreational purposes may be exposed to low levels of contaminants in the lake.
- Well surveys of the area indicate that no registered private or public domestic use wells are in the known area of groundwater contamination downgradient of the landfills.[6]

Potential Future Exposure:

- While no known current exposure route exists to the contaminated groundwater underneath and downgradient of the landfill other than the Bradley well, there are no institutional controls preventing the installation of wells within the plume area. Therefore, a ***potential*** for future exposure to contaminated groundwater exists. Historical data from monitor and piezometric wells underneath and downgradient of the landfills will be used to evaluate this potential exposure pathway. However, implementation of effective risk management procedures would make future exposure to the contaminants in groundwater unlikely.

3.3 Exposure Pathway Identification

A potentially complete human exposure pathway describes the route a chemical may take from the source to a receptor. A complete exposure pathway includes the following components:

1) A source and mechanism of release to the environment,
2) A medium for the transport of the released chemical to the environment.
3) A point of potential human contact with the contaminated medium (exposure point).
4) An exposure route at the exposure point, (ingestion, inhalation, dermal contact).

Exposure pathways were identified based on a review of data from the Phase II investigations, communications with employees of the ADEQ, the COP, Harding Lawson Associates, and from a site visit to the landfill.

3.3.1 Source and Receiving Media

Groundwater upgradient (east) of the Estes Landfill has no detectable concentrations of VOCs, little to no detectable levels of metals, and low concentrations of other inorganics.[4] The Estes Landfill is a confirmed source of groundwater contamination downgradient (west) of the landfill, however, additional sources of groundwater contamination may exist to the south and southeast of the landfill.[4] Since the origin of the contamination is not known with certainty, this risk assessment evaluates available groundwater data and estimates risk without regard to the source of the contamination.

Solid waste and soil likely served as the receiving media for liquid wastes containing VOCs disposed of at the landfill. The inorganic chemicals of concern detected in the groundwater may occur naturally, and comparisons to background levels are necessary in order to determine whether these constituents are present as a result of release to the environment.

3.3.2 Fate in Release Media

The organic contaminants found in groundwater downgradient of the landfill include those chemicals listed in Table 2.2. VOCs detected in the greatest concentrations are: PCE, TCE, chlorobenzene, dichlorobenzenes, 1,2 dichloroethene (1,2 DCE), and vinyl chloride.

In a methanogenic or anaerobic environment, such as a landfill, VOCs present in the groundwater undergo reductive dehalogenation.[9] Under these conditions, PCE is transformed into TCE, DCEs, and vinyl chloride. Likewise, TCE is transformed into DCE and vinyl chloride. Since PCE and TCE are common industrial solvents that may have been disposed of in the landfill, it is possible that DCE and vinyl chloride in groundwater may be breakdown products of PCE and TCE.

An analysis of the transport of organics in the alluvial aquifer are beyond the scope of this risk assessment, however, hydrologic analyses of the area are available in various Harding Lawson Associates reports.

3.3.3 Exposure Points and Routes

Potentially complete exposure routes include exposure to contaminated water, soil gas (via inhalation), and soil. Each complete exposure route is discussed in more detail in this section.

Groundwater

A survey of registered wells within a 36 square mile (6 mi. x 6 mi.) area around the landfill was conducted by Harding Lawson Associates.[6] The closest wells registered for domestic use are registered to R.F. Kingston and G. Sorensen. The Kingston well is located southwest of 40th Street and Van Buren Street, approximately 1.5 miles north-northwest of the landfill. The Sorensen well is located between 32nd and 40th Streets and between Broadway Road and Southern Avenue, approximately 2 miles south-southwest of the Estes Landfill. Neither of these wells are considered by hydrologists at Harding Lawson

Associates to be close enough to have been impacted by the Estes/Bradley Landfills.[6] However, no data were available for these wells at the time this risk assessment was prepared.

The Bradley production well is the only well that is used in the area known to be impacted. Water from this is currently being used for dust control at the Bradley Landfill. Data from the Bradley well will be evaluated to estimate health risk presented by use of water from this well.

Table 3.1 provides information about the Bradley well. Table 3.2 provides information about the 2 closest registered domestic use wells.

Table 3.1- Dust Control Well at the Bradley Landfill

Owner	Location	Reg. Number	Well Depth (ft)		Hydrology	
			Cased	Total	Water Level (ft)	Yield (gpm)
Bradley Investments	Bradley Landfill	55-800536	300	N/A	100	35

Table 3.2- Closest Domestic Use Wells to the Estes Landfill

Owner	Location	Reg. Number	Cased Depth	Well Depth	Water Level (ft)	Yield (gpm)
R.F. Kingston	1.5 miles north-northwest of Estes Landfill	55-639522	80	60	40	26
G. Sorensen	2 miles south-southwest of Estes Landfill	55-639512	0	300	63	Unknown

Air Exposure

Potential exposure to landfill gases may be possible as a result of inhalation of VOC vapors escaping from the landfill. Data from the Phase II soil gas investigation will be used to estimate soil gas exposure.[6]

Soil Exposure

Potential exposure to fugitive dust from the landfill may be possible as a result of inhalation of respirable soil particles from wind erosion of soil. Ingestion of soil from the landfill is considered an incomplete exposure route since the site is fenced and access to the site is prevented. Data from the 1994 Surface Soil Investigation will be used to estimate fugitive dust exposure.[7]

3.3.4 Summary of Current Exposure Points.

Current exposure pathways evaluated, and those selected for quantified risk analysis are summarized in Table 3.3.

Table 3.3 – Current exposure pathway summary

Potential Exposed Population	Exposure Point	Exposure Route	Path Evaluated	Path Selected	Exposure Type	Rationale
Water	**Current Land Use**					
Occupational	Groundwater from the Bradley production well	Ingestion Inhalation Dermal	Yes Yes Yes	No Yes No	*Potential*	Well used for dust control, no ingestion
Residential	Groundwater in downgradient public or private wells	Ingestion Inhalation Dermal	Yes Yes Yes	No No No	*None*	Closest downgradient public/private wells not affected by landfills
Recreational	Surface water in Southbank Lake	Ingestion Inhalation Dermal	Yes Yes Yes	Yes Yes Yes	*Potential*	Recreational exposure possible
Soil Gas						
Occupational	Inhalation of vapors on site	Inhalation	Yes	Yes	*Potential*	Potential for human exposure
Soil						
Occupational	Inhalation of fugitive dust from landfill	Ingestion Inhalation Dermal	Yes Yes Yes	No Yes No	*Potential*	No direct access to site, wind erosion of surface soil possible

3.4 Quantification of Exposures

In order to quantify exposures, estimates were made of exposure concentrations and doses. Exposures to groundwater, fugitive dust, and soil gases will be quantitatively evaluated. Exposure to surface water will be qualitatively evaluated. In addition, hypothetical *potential future* exposure to water in the monitor wells will be quantitatively evaluated. Exposure pathways for these groups are summarized in Table 3.3.

3.4.1 Groundwater Exposure Estimation Methods

Exposure concentrations are estimated levels of chemicals that are, or potentially could be, contacted at an exposure point. Chemical intake or dose is expressed as mass per unit body weight and time (mg/kg-day) and is referred to as the chronic daily intake (CDI).

Exposure to Water in the Bradley Production Well

Assumptions used to estimate exposure from the Bradley well were developed by ADHS staff following a visit to the well site. Some assumptions incorporate standard default USEPA exposure assumptions.

Emissions of VOCs from the Bradley production well during dust control activities were estimated using Equations 1 and 2 as described below. The mean and 95% UCL were used as estimates of the concentration of each contaminant in water from the well. Samples without detections of a chemical of concern were quantified by using 1/2 of the method detection limit as the contaminant concentration.[1] The following "Box Model" provides an estimate of the concentration of each VOC in outside air:

$$OAC_i = E_i/[(W)(H)(U)] \qquad (1)$$

where:

OAC_i = Outdoor air concentration of component i (mg/m^3)
E_i = Emission rate for component i (mg/sec)
W = Square root of the area of the landfill (m)
H = Height of box (m)
U = Average wind velocity for the Phoenix area (m/sec)

and where:

$$E_i = (C_i)(R) \qquad (2)$$

E_i = Emission rate for component i (mg/sec)
C_i = Concentration of component i in well water (mg/L)
R = Rate of application of water for dust control (L/sec)

The emission rate for each VOC was inserted into the "Box Model" to determine a mean and upper-bound estimate of the concentration of each VOC in outside air within the "box" following

application of all water from the 20,000 liter capacity dust control vehicle. A 10 acre portion of the Bradley Landfill (12,300 m^2) was assumed to be the area of emission.

Wind velocity was assumed to be 2.8 m/sec, a value considered to be typical for the Phoenix area by the National Weather Service. The height of the box was assumed to be 10 meters. The application rate for water from the truck was assumed to be 11 liters/second (1 truckload of water per half hour). VOCs are assumed to immediately volatilize from the applied water. The driver of the truck is assumed to be exposed to vapors from the water every working day for 4.2 years for central tendency exposure, and for 25 years for reasonable maximum exposure.

The modeled values for the outside air concentration of the COCs were applied to the exposure scenario described in Section 3.4.2. OAC values are displayed in Appendix Table F.

Soil Gas Exposure

In landfills that generate gas as a result of the decomposition of organic matter, the upward movement of landfill gas controls the movement of VOCs that may be in soil gas. The EPA Superfund Exposure Assessment Manual (SEAM)[10] provides an equation developed by Thibodeaux that estimates the vapor releases from landfills that generate gases. The equation takes into consideration the fact that gas migration inside a landfill accelerates the movement of gases such that soil gas diffusion becomes insignificant. The equation developed by Thiobodeaux is as follows:

$$E_i = (C_i)(V_y)(A)$$

where:

E_i = emission rate of component i (mg/sec)
C_i = concentration of compound i in the soil gas (mg/m^3)
V_y = mean landfill gas velocity (1.6E-5 m/sec)
A = area of emission (m^2)

Soil gas emissions were calculated using this equation and the soil gas results obtained at the Estes Landfill. The mean and 95% UCL concentration of each chemical was used as an estimate of the concentration in soil gas. Samples without detections of a chemical of concern were quantified by using 1/2 of the method detection limit as the contaminant concentration in accordance with EPA guidance.[1] The area of the landfill (1.6E+5 m^2) was used as the area of emission. V_y is the default landfill gas velocity as described in SEAM.[10]

The emission rate for each VOC was inserted into the following "Box Model" to determine a mean and upper-bound estimate of the concentration of each VOC in outside air above the landfill. The "Box Model" provides the concentration in outside air as described below:

Estimate of Outdoor Air Concentration (OAC) of component i:

$$OAC_i = E_i/[(W)(H)(U)]$$

where:

OAC_i	=	Outdoor air concentration of component i (mg/m^3)
E_i	=	Emission rate for component i (mg/sec)
W	=	Square root of the area of the landfill (400 m)
H	=	Height of box (10 m)
U	=	Average wind velocity (2.8 m/sec)

Wind velocity was estimated at 2.8 m/sec, a value considered to be typical for the Phoenix area by the National Weather Service. The area of the landfill (1.6E+5 m^2) was used as the area of emission. The height of the box was assumed to be 10 meters. The modeled values for the outside air concentration were applied to the exposure scenario described in the following section. OAC values are displayed in Appendix Table E.

Soil Gas Exposure

CDIs for workers were calculated using standard assumptions in an occupational exposure scenario. This scenario should be considered to be an intentional overestimate, since the landfill is closed, and there is no exposure directly downwind of the landfill. The equation and assumptions are shown in Table 3.4. The USEPA recommended upper bound for inhalation rates vary from 15 to 20 m^3/day.[2] The more conservative, 20 m^3/day was used for the scenario in this assessment. An exposure duration of 4.2 years was assumed for central tendency exposure.[15] An exposure duration of 25 years was assumed for RME exposure.[2]

Table 3.4 - Calculation of inhalation intakes under an occupational exposure scenario.

CHRONIC DAILY INTAKE: $CDI = \frac{(OAC)(IR)(EF)(ED)}{(BW)(AT)}$

Where:

OAC = Chemical Concentration in Air (mg/m^3)
IR = Inhalation Rate (m^3/workday)
EF = Exposure Frequency (workdays/year)
ED = Exposure Duration (years)
BW = Body Weight (kilograms)
AT = Averaging Time (days)

Variable Values:

	Central Tendency	RME
OAC:	mean (mg/m^3)	95% UCL (mg/m^3)
IR:	20 (m^3/day)	20 (m^3/day)
EF:	250 (days/year)	250 (days/year)
ED:	4.2 (years)	25 (years)
BW:	70 (kg)	70 (kg)
AT: (carcinogenic effects)	70 (years) x 365 (days/year)	70 (years) x 365 (days/year)
AT: (non-carc. effects)	4.2 (years) x 365 (days/year)	25 (years) x 365 (days/year)

The modeling worksheet for calculating soil gas exposure is displayed in Appendix Table E. The worksheet includes calculated values for OACs concentrations and CDIs.

3.4.2 Fugitive Dust Exposure Estimation Methods

Estimates of exposure concentrations and pathway specific intake doses were made to quantify exposures. Conservative assumptions are made about present and future activities that may occur at the site. Exposures are estimated to derive the potential hazard and risk that humans may face as a result of exposure to fugitive dust downwind of the site.

The intake equations for inhalation of fugitive dust are summarized in Table 3.5. Variable values incorporate standard assumptions adopted by the EPA for exposure assessments. The particulate emission factor (PEF) estimates the concentration of respirable particulates in the air, and is used to quantify inhalation exposure. The PEF was taken from EPA Human Health Evaluation Manual[11]. The parameters used to calculate the PEF are conservative estimates, and likely result in an overestimate of particle concentration and exposure.

Table 3.5 Formula Used to Calculate CDI From Inhalation of Fugitive Dust

$$CDI = \frac{(CS)(PEF)(IR)(EF)(ED)}{(BW)(AT)}$$

Where:

CDI	=	Chronic Daily Intake (mg/kg-day)
CS	=	Chemical Concentration in Soil (mg/kg)
PEF	=	Particulate Emission Factor (kg/m^3)
IR	=	Inhalation Rate (m^3/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged-days)

Variable Values:

	Central Tendency	RME
CS:	mean (mg/kg)	95% UCL (mg/kg)
PEF:	5.26E-8 (kg/m^3)	5.26E-8 (kg/m^3)
IR:	20 (m^3/day)	20 (m^3/day)
EF:	250 (days/year)	250 (days/year)
ED:	4.2 (years)	25 (years)
BW:	70 (kg)	70 (kg)
AT: (carcinogenic effects)	70 (years) x 365 (days/year)	70 (years) x 365 (days/year)
AT: (non-carc. effects)	4.2 (years) x 365 (days/year)	25 (years) x 365 (days/year)

Potential Future Exposure to Contaminated Water Downgradient of the Landfills

Variable values used to estimate potential future exposure incorporate standard assumptions adopted by the USEPA for occupational exposure. Occupational exposure is assumed downgradient of the landfill since land uses are industrial/commercial, and are reasonably expected to remain so in the foreseeable future.

The CDI values using the formula in Table 3.6 are calculated using the contaminant concentrations displayed in Appendix Table A. The CDIs are displayed in Appendix Table B.

Table 3.6 - Groundwater Ingestion Intake Formula.

Chronic Daily Intake: $\frac{(CW)(IR)(EF)(ED)}{(BW)(AT)}$

Where:

CW = Chemical Concentration in Water (mg/l)
IR = Workday Drinking Water Ingestion Rate (l/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (days)

Potential Exposures- Monitor Well Data

Variable Values:		**Central Tendency**	**RME**
CW:	(mg/l)	Mean	95% UCL
IR:	(l/day)	1	1
EF:	(days/year)	250	250
ED:	(years)	4.2	25
BW:	(kg)	70	70

AT: For carcinogenic effects = 70 years x 365 days/year
For noncarcinogenic effects = ED x 365 days/year

3.5 Uncertainties in the Exposure Assessment

Uncertainties enter into the calculations at all levels, for all populations, and land uses.

3.5.1 Exposure Pathways

Exposures calculated from groundwater monitoring data at the monitor wells are ***potential*** exposures which ***may never be complete***. The exposures quantified represent conservative estimates of human exposure.

3.5.2 Modeling

The major modeling efforts in this assessment are related to the releases of VOCs to the atmosphere from the landfill. The assumptions used are designed to produce conservative estimates of risk. The model used has been approved for this use by the USEPA. It should be recognized that when a model is used the uncertainty of the estimated quantities is greater than if an accurate measurement were taken.

3.5.3 Exposure Parameters

All exposure parameters were chosen to produce conservative estimates of total risk from exposures to contaminants. Exposure concentrations used in the calculation of intakes were mean concentrations for average exposures and 95% upper bounds of the sampling means for reasonable maximum exposures (RME).

3.6 Exposure Assessment Summary

Exposure doses (CDI) used in the calculation of carcinogenic risks and noncarcinogenic hazard quotients are also included in the risk calculation worksheets in Appendix Tables E and F. These doses are based on the assumptions and calculations shown in previous sections. They may be considered upper-bound estimates. The estimated doses are used in conjunction with slope factors (carcinogenic risk calculations) and reference doses (noncarcinogenic calculations) to produce probability estimates of carcinogenic risk and hazard quotients for noncarcinogenic adverse health effects.

4.0 TOXICITY ASSESSMENT

Toxicological information on the chemicals of concern for this study is summarized in this chapter. Emphasis is placed upon the non-carcinogenic and carcinogenic effects with discussions on the dose-response variables (reference dose, slope factor) utilized in the risk assessment analysis. Each chemical is summarized with regard to use, interactions with other chemicals, exposure routes, toxicokinetics, toxic (health) effects, and carcinogenicity.

4.1 Dose-Response Variable for Non-Carcinogenic Effects

The reference dose (RfD) is used as a dose-response variable for assessing the non-carcinogenic effects of exposure to chemicals. The chronic RfD is utilized in calculating the risk of long-term exposure to specific chemicals. USEPA defines the chronic reference dose as "an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound".[1]

The USEPA derives the RfDs from animal and, when available, human studies by taking the highest dose at which no adverse effect is seen (NOAEL or no-observed-adverse-effect level) and dividing it by the product of the uncertainty factor (UF) and modifying factor (MF) as shown in the formula below (1). The UF is usually 10 or factors of 10 and estimates the uncertainty in the data from which the NOAEL is derived, especially if it is obtained from animal studies. The MF usually ranges from 0 to 10 and indicates further uncertainty as judged by the professional.

$$RfD = NOAEL/UF \times MF \qquad (1)$$

The RfD is measured in mg/kg-day and assumes a threshold or level of exposure at which no adverse health effect will be seen. Although the subchronic RfD is available for short-term exposures, the chronic RfD is utilized in this study to measure the long-term, non-carcinogenic effect from exposure to the chemicals of concern.

The noncarcinogenic hazard quotient (HQ) is computed by dividing the exposure level for the chemical of concern by the specific RfD for that chemical. The noncarcinogenic hazard index (HI) is computed by summing the HQ for individual chemicals for an exposure pathway and represents an estimate of the total hazard for that pathway. Adverse health effects may occur when the HQ or HI exceeds one. Table 4-1 displays RfDs for chemicals of potential concern.

Table 4.1: Reference Dose (RfD) for Ingestion and Inhalation for Chemicals of Concern

Chemical	Inhalation RfD[1] (mg/m³)	Ingestion RfD[1] (mg/kg-d)	Confidence In Data[2] (Oral)	Sensitive Organs and Systems Affected[3]	RfD(inh)/RfD[4] Source	UF/MF[4]
ORGANIC CHEMICALS						
Benzene	———	—	———	Blood; CNS; GI, Immune, Reproductive Systems; Skin	———	———
Bromodichloromethane	———	2E-2	Medium	Adrenal, Blood, Brain, CNS, Developmental & Genotoxicity, Immune System, Kidney, Liver, Lungs[3]	——— /IRIS	1,000/1
Carbon Tetrachloride	———	7E-4	Medium	CNS, Kidney, Liver	——— /IRIS	1,000/1
Chlorobenzene	———	2E-2	Medium	CNS, Kidney, Liver	——— /IRIS	1,000/1
Chloroform	———	1E-2	Medium	CNS, Kidney, Liver	——— /IRIS	1,000/1
Chloromethane	———	———	———	CNS, Kidney, Liver	———	———
1,2 Dichlorobenzene	———	9E-2	Low	Blood, Kidney, Liver, Lung, Skin	——— /IRIS	1,000/1
1,2 Dichloroethane	———	———	———	CNS, GI, and Respiratory Systems, Kidney, Liver	———	———
1,1-Dichloroethylene	———	9E-3	Medium	Developmental, GI and Respiratory Systems, Liver[3], and CNS (humans)	——— /IRIS	1,000/1
1,2-Dichloroethylene (Total)	———	9E-3	———	CNS[5]	HEAST[4]/———	1,000/-
Cis-1,2-Dichloroethylene	———	1E-2	———	Blood, CNS, Kidney[3]	HEAST[4]/———	3,000/-
Trans-1,2-Dichloroethylene	———	2E-2	Low	Heart, Liver, Lung[3]	——— /IRIS	1,000/1
Dichloromethane	———	6E-2	Medium	CNS, Kidney, Liver	——— /IRIS	100/1
1,2-Dichloropropane	4E-3	———	Medium	CNS, Kidney, Liver[3]	IRIS/———	300/1 Inh.
Di(2-Ethylhexyl)Phthalate	———	2E-2	Medium	Developmental, Kidney, Reproductive System[3]	——— /IRIS	1,000/1

Table 4.1: Reference Dose (RfD) for Ingestion and Inhalation for Chemicals of Concern (Continued)

Chemical	Inhalation RfD[1] (mg/mg³)	Ingestion RfD[1] (mg/kg-d)	Confidence In Data[2] (Oral)	Sensitive Organs and Systems Affected[3]	RfD(inh)/RfD[4] Source	UF/MF[4]
ORGANIC CHEMICALS						
1,1,2,2-Tetrachloroethane	———	3.0E-2	———	Blood, CNS, GI and Respiratory Systems, Liver	———/HEAST[7]	———/———
Tetrachloroethylene	———	1E-2	Medium	Reproductive and Respiratory Systems, CNS, Eye, Kidney, Liver	———/IRIS	1,000/1
Trichloroethylene	———	———	———	CNS, GI and Respiratory Systems, Heart, Kidney, Liver	———/———	———/———
Vinyl Chloride	———	———	———	CNS, Heart-Circulation, Liver, Lung, Reproductive System, Skin	———/———	———/———
INORGANIC CHEMICALS						
Antimony	———	4E-4	Low	GI System, Heart, Lung,Skin	——— /IRIS	1000/1
Arsenic (Inorganic)	———	3E-4	Medium	Blood, CNS, Developmental, Genotoxicity, GI and Respiratory Systems, Heart, Kidney, Liver, Skin	——— /IRIS	3/1
Barium	———	7E-2	Medium	Cardiovascular, GI and Respiratory Systems	——— /IRIS	3/1
Beryllium	———	5E-3	Low	———	——— /IRIS	100/1
Boron	———	9E-2	Medium	Brain, CNS, GI and Respiratory Systems, Kidney, Liver	——— /IRIS	100/1
Cadmium	———	5E-4	High	GI and Respiratory Systems, Kidney, Liver	——— /IRIS	10/1
Chromium (III)	———	1E+0	Low	Kidney, Liver, Respiratory System, Skin	——— /IRIS	100/10
Chromium (VI)	———	5E-3	Low	Kidney, Liver, Respiratory System, Skin	——— /IRIS	500/1
Copper	———	3.7E-2	———	Blood, GI System, Kidney, Liver	———/HEAST[6]	———

Table 4.1: Reference Dose (RfD) for Ingestion and Inhalation for Chemicals of Concern (Continued)

Chemical	Inhalation RfD[1] (mg/mg³)	Ingestion RfD[1] (mg/kg-d)	Confidence In Data[2] (Oral)	Sensitive Organs and Systems Affected[3]	RfD (inh)/RfD[4] Source	UF/MF[1]
INORGANIC CHEMICALS						
Lead (Inorganic)	———	———	———	Blood; CNS; Developmental; GI,Immune, and Reproductive Systems; Heart; Kidneys	———/———	———/———
Manganese	5E-5	5E-3	Varied	CNS	IRIS/IRIS	1000/1-Inh. 1/1-Ing.
Mercury (Inorganic)	3E-4	3E-4	———	Brain, CNS, Developmental, Kidney, Lung, Respiratory System, Skin	HEAST/HEAST[6]	30/———Inh. 1000/———Ing.
Nickel (Soluble Salts)	———	2E-2	Medium	Blood, GI and Immune Systems, Liver, Lung, Kidney[5]	———/IRIS	300/1
Nitrate	———	1.6+0	High	Blood	———/IRIS	1/1
Nitrite	———	1E-1	High	Blood	———/IRIS	1/10
Zinc	———	3E-1	Medium	GI System	———/IRIS	3/1

[1] RfD, UF, and MF: See text for definition.
Inhalation RfD refers to the airborne concentration levels of a substance which results in intakes equal to the ingestion RfD.

[2] Confidence in Data: Adequacy of the ingestion data from which RfD is derived.

[3] Information on Sensitive Organs and Systems derived from the ATSDR Toxicological Profile for the specific substance and Handbook of Toxic and Hazardous Chemicals and Carcinogens (1990) for 1,2-Dichlorobenzene and Nitrates (Nitrites).

[4] When no data were found in IRIS, information was obtained from HEAST. All blanks indicate no information was available in IRIS or HEAST.

[5] Information derived from animal studies.

[6] EPA Health Effects Assessment Tables (HEAST), FY-1994 Annual.

[7] EPA HEAST,FY-1990 Annual.

4.2 Dose-Response Variable for Carcinogenic Effects

The slope factor (SF) is utilized as the dose-response variable for assessing the carcinogenic effects of exposure to chemicals. USEPA defines the slope factor as "a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used to estimate an upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen".[1] The SF is an estimate of the quantitative relationship between dose and carcinogenic response.

The SF is measured in units of $(mg/kg\text{-}day)^{-1}$ and is usually determined using the upper 95 percent confidence limit of the slope of the linearized multi-stage model. The model assumes that there is no threshold for the initiation of cancer (i.e. any exposure poses a risk of cancer). Since data on carcinogenicity is often derived from high-dose experiments on animals, extrapolations are made from these high doses to lower doses. When available, human data are utilized to determine the slope factor. Excess cancer risk is expressed as a function of exposure and is calculated by multiplying an estimated ose of a chemical by the slope factor (SF). The application of the nonthreshold assumption and the utilization of the upper 95 percent confidence limit for estimating the slope factor provides a conservative estimate of potential carcinogenic risk.

From human and animal experimental data, the USEPA's Carcinogen Advisory Group has grouped chemicals by weight-of-evidence (WoE) into classes from A to E which designate their potential as a cancer-causing agent. The WoE represents the carcinogenicity evidence from human and animal studies and indicates the strength of the data. An A classification signifies that the chemical is a proven human carcinogen. Probable human carcinogens are designated either B1, showing that studies in humans are strongly suggestive but not conclusive, or B2 if the chemical has been found to be conclusively carcinogenic in repeated animal studies but not conclusive in human studies. A chemical may be classified C, a possible human carcinogen, if a single high-quality animal study or several low-quality animal studies indicate carcinogenicity. If there is insufficient human and animal evidence to determine the carcinogenicity of the chemical, it is classified as D. A chemical conclusively demonstrated to be non-carcinogenic to humans is in group E. This designation is rare due to the difficulty in producing the necessary negative data.

RfDs for non-carcinogenic toxicity and slope factors for carcinogenic toxicity were obtained from the USEPA on-line Integrated Risk Information System (IRIS)[8] database, and the USEPA Health Effects Assessment Summary Tables (HEAST), FY-1994[12], unless otherwise stated in Tables 4.1 and 4.2. Slope factors and weight of evidence ratings for carcinogens are listed in Table 4-2.

Table 4.2: Slope Factor (SF) for Organic Carcinogenic Chemicals of Concern

Chemical	WoE[1]	Slope Factor[2]		Type of Cancer[3]	Study Source of SF	Reference for SF
		Inhalation $(ug/m^3)^{-1}$ $[(mg/kg\text{-}day)^{-1}]$	Ingestion $(ug/L)^{-1}$ $[(mg/kg\text{-}day)^{-1}]$	Inhalation/Ingestion		
ORGANIC CHEMICALS						
Benzene	A	8.3E-6	8.3E-7 [2.9E-2][5]	Leukemia/Lymphomas[4]	Human/Human	IRIS
Bromodichloromethane	B2	———	1.8E-6 [6.2E-2]	———/Tumors of Large Intestines, Kidney, Liver[4]	———/Mouse	IRIS
Carbon Tetrachloride	B2	1.5E-5	3.7E-6 [1.3E-1]	———/Liver Cancer[4]	Mouse, Rat, Hamster/ Mouse,Rat,Hamster	IRIS
Chloroform	B2	2.3E-5	1.7E.7 [6.1E-3]	———/Kidney and Liver Cancers[4]	Mouse/Rat	IRIS
Chloromethane	C	[6.3E-3]	[1.3E-2]	Kidney Cancer[4]/———	Mouse/———	HEAST[6]
1,2-Dichloroethane	B2	2.6E-5	2.6E-6 [9.1E-2]	———/Multiple Tumor Types (Hemangiosarcomas, Liver Cancer)[4]	Rat/Rat	IRIS
1,1-Dichloroethylene	C	5.0E-5	1.7E-5 [6.0E-1]	Kidney and Mammary Cancers, Leukemia, Lung Tumor[4]/Liver Tumor[4]	Mouse/Rat	IRIS
Dichloromethane	B2	4.7E-7	2.1E-7 [7.5E-3]	Liver and Lung Cancer/Liver Cancer[4]	Mouse/Mouse	IRIS
Di(2-Ethylhexyl)Phthalate	B2	———	4.0E-7 [1.4E-2]	———/Liver Tumor[4]	———/Mouse	IRIS
1,1,2,2,-Tetrachloroethane	C	5.8E-5	5.8E-6 [2.0E-1]	———/Liver Cancer[4]	Mouse/Mouse	IRIS
Tetrachloroethylene	B2	5.2E-7	1.5E-6 [5.1E-2]	Kidney Tumor, Leukemia[4]/Liver Cancer[4]	Rat,Mouse/ Mouse	HEAST[6]
Trichloroethylene	B2	1.7E-6 [1.7E-2]	3.2E-7 [1.1E-2]	Testicular Tumor, Lymphomas, Liver and Lung Cancers[4]/Liver Cancer[4]	Mouse/Mouse	HEAST[6]
Vinyl Chloride	A	8.4E-5 [3.0E-1]	5.4E-5 [1.9E+0]	Liver Cancer/Liver Cancer,Lung Tumor[4]	Rat/Rat	HEAST[7]

Table 4.2 SlopeFactor (SF) for Inorganic Chemicals of Concern

Chemical	WoE[1]	Slope Factor[2]		Type of Cancer[3]	Study Source of SF	Reference for SF
		Inhalation $(ug/m^3)^{-1}$ $[(mg/kg\text{-}day)^{-1}]$	Ingestion $(ug/L)^{-1}$ $[(mg/kg\text{-}day)^{-1}]$	Inhalation/Ingestion		
INORGANIC CHEMICALS						
Arsenic	A	4.3E-3	[1.5]	Lung Cancer/Skin Cancer	Human/——	IRIS
Beryllium	B2	2.4E-3	[4.3E+0]	Lung Cancer/——	Human/Rat	IRIS
Cadmium	B1	1.8E-3	——	Lung Cancer/——	Human/——	IRIS
Chromium(VI)	A-(lab.)	1.2E-2	——	Respiratory Cancer/Lung and Stomach Cancer	Human/——	IRIS
Lead	B2	——	——	Total Malignant Neoplasms, Digestive and Respiratory Tumors[4](Health Effects Based on Blood Lead Levels)	——	——
Nickel(Refinery Dust)	A	[8.4E-1]	——	Respiratory Cancer/——	Human/——	HEAST[5]

1. SF and Weight of Evidence(WoE): See text for definition.

2. Type of Cancer: Information derived from the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for specific chemicals. Unless otherwise stated, Type of Cancer refers to human cancers.

3. Oral Slope Factor was based upon human inhalation exposure data for benzene.
Inhalation unit risk derived from oral data for carbon tetrachloride, chloroform, 1,2-dichloroethane, and 1,1,2,2-tetrachloroethane.

4. Refers to animal cancers.

5. EPA Health Effects Assessment Summary Tables (HEAST), FY-1994 Annual.

6. EPA HEAST,FY-1991 Annual. Slope factors for tetrachloroethylene and trichloroethylene have been withdrawn from IRIS for review.

7. EPA HEAST, FY-1994, Supplement 1.

4.3 Toxicity Summaries for Inorganic and Organic Chemicals of Concern

The chemicals of concern are discussed with regard to use, chemical interactions, exposure routes, toxicokinetics, toxic (health) effects, and carcinogenicity. These summaries do not represent a comprehensive discussion of these substances, but offer highlights about their toxicity. Reference sources, from which this information was obtained, include the most recent ***Toxicological Profiles*** from the Agency for Toxic Substances and Disease Registry[13] for specific chemicals, ***IRIS***[6], and ***Handbook of Toxic and Hazardous Chemicals and Carcinogens***[14].

Inorganic Chemicals of Concern

Antimony (Sb)

Antimony (CAS No. 7440-36-0) is an element occurring in the natural environment in the earth's crust and from human industrial activities. Synonyms include antimony black, stibium, and antimony regulus. It is used commonly as a fire retardant and mixed with other metals to increase hardness. Antimony can be found naturally in windblown dust, volcanic eruption, sea spray, and forest fires. Manufacturing, processing, and antimony-using facilities are man-made sources of emission. Persons living or working close to smelters, coal-fired power plants, and refuse incinerators have a potential for high levels of exposure.

No information was found which dealt with interaction of antimony with other substances.

Routes of exposure include ingestion, inhalation, and to a lesser degree, dermal contact. Ingestion and inhalation exposures are believed to result in absorption of antimony as evidenced by the elevated levels of antimony in urine and blood in exposed workers. The death of rabbits receiving dermal application of antimony indicated that antimony was absorbed. Following inhalation exposure of animals, antimony had been found deposited in the respiratory tract, liver, thyroid, skeleton, and fur. With ingestion exposure, antimony accumulated in the gastrointestinal tract, liver, kidney, bone, lung, spleen, and thyroid of animals. Since it is an element, antimony is not catabolized; it can, however, interact with sulfhydryl groups and phosphate but the toxicological significance of this is unknown. Ingestion, inhalation, and dermal (parenteral) exposure results in elimination of antimony through the urine and feces.

Following ingestion exposure, cardiovascular and other effects were reported in animals with fewer effects documented in humans. Cardiovascular reflexes regulating arterial blood pressure were influenced by pre and postnatal exposure or only postnatal exposure of rats to 0.0748 mg/kg/day of antimony trichloride.

The gastrointestinal effect of vomiting was reported in workers drinking an average of 10 ounces of lemonade contaminated with 0.53 mg/kg of potassium antimony tartrate.

In animals, mild hematological changes (e.g. reduction in red blood cell count) were documented at 418 mg/kg/day or greater exposure levels of antimony. A rise in red blood cell count was seen in rats receiving an ingestion exposure of 894 mg/kg/day of antimony trioxide. Ingestion exposure of 500-1000

mg/kg/day for 12-24 weeks have produced a reduction in hematocrit and hemoglobin levels and plasma protein levels.

The hepatic effects of swelling of the hepatic cord has been reported in rats exposed to 418 mg/kg/day ingestion of antimony trioxide or 500 mg/kg/day of metallic antimony by ingestion.

Neurological effects (muscle weakness and difficulty moving limbs) were seen in dogs exposed to 6,644 mg/kg/day of antimony trioxide for 32 days.

Developmental effects (differences in the number of newborn pups per litter) were demonstrated in rat offspring receiving ingestion exposure during gestation to 0.748 mg/kg/day of antimony trichloride.

Death was reported in rats following a single exposure to 188-16,714 mg/kg/day or lower of inorganic antimony or to a 7,000 mg/kg dose of metallic antimony.

No effect on cancer incidence was seen in rats given 0.262 of 0.33 mg/kg/day of potassium antimony tartrate for a lifetime. The study was limited since the exposure level was less than the maximum tolerated doses.

Inhalation exposures have also resulted in health effects. Respiratory effects (antimony pneumoconiosis or inflammation of the lungs) have been observed in workers exposed to antimony trioxide and/or pentoxide dust at a concentration of 8.87 mg/m^3 or greater.

Cardiovascular effects (rise in blood pressure) were documented in workers exposed to 2.15 mg/m^3 of antimony trisulfide for 8 months to 2 years.

Gastrointestinal disorders (abdominal pain, diarrhea, vomiting) have been found in factory workers with repeated exposures to airborne antimony trichloride, antimony trisulfide, or antimony oxide.

Hematological changes have also been observed with inhalation exposure. Long-term exposure to aerosols of antimony trioxide at 4 to 20 mg/m^3 resulted in small changes in hemoglobin concentration in the erythrocytes and erythrocyte volume in rats.

Hepatic effects (parenchymatous and fatty degeneration) were reported in rabbits exposed to 19.94 mg/m^3 of antimony trisulfide for 5 days and in guinea pigs exposed to 37.9 mg/m^3 of antimony trioxide for 30 weeks. No effects were seen in rats exposed for one year to antimony trioxide or antimony trisulfide at concentrations of 36 mg/m^3 or lower.

The renal effect of tubular dilatation was reported in rats and guinea pigs with exposure to stibine gas at 799 mg/m^3 for 30 minutes. No effects to the kidney were noted at 19.6 mg/m^3 of antimony trioxide for 13 weeks or 17.5 mg/m^3 of antimony trisulfide or up to 36 mg/m^3 of antimony trioxide for one year.

Dermal effects (ocular conjunctivitis and dermatosis) have resulted from contact to the eyes and/or skin with airborne antimony.

The developmental effects of reduction in the number of offspring in a liter was seen with exposure of rats to 209 mg/m^3 of antimony trioxide before conception and during gestation.

The reproductive effect of menstrual cycle disturbance was documented in women workers in a metallurgical plant with exposures to airborne metallic antimony, antimony pentasulfide, and antimony trioxide.

Deaths in guinea pigs have been reported with exposure of 37.9 mg/m^3 of antimony trioxide for 52-125 days or 1,395 mg/m^3 of stibine gas for 30 minutes in guinea pigs and rats.

Inhalation exposure of 8.87 mg/m^3 of antimony oxide did not influence the cancer incidence for workers employed for 9-31 years. Antimony has been carcinogenic in animals as evidenced by the development of lung tumors in rats exposed to 4.2 or 36 mg/m^3 of antimony trioxide or 17.48 mg/m^3 of antimony trisulfide for one year.

Dermal application of antimony compounds to the skin of animals have resulted in respiratory (lung) and gastrointestinal (stomach hemorrhage) effects in animals. The ocular effect of eye irritation was observed in rabbits receiving an eye instillation of 79-100 mg of antimony oxide and antimony thioantimonate. Ocular conjunctivitis eye irritation and dermatosis have been documented in humans and animals receiving airborne exposure to antimony.

The neurological effect of an abnormal gait was reported in rabbits receiving a dermal application of 6,685 mg/kg/day of antimony trioxide.

No USEPA WoE classification has been established for antimony.

Arsenic (As)

Arsenic (CAS No. 7440-38-2) is an element which occurs naturally in the environment and from emissions arising from human activity (e.g. metal smelting). Synonyms for arsenic include gray arsenic, arsenic black, and colloidal arsenic. Arsenic is found throughout the environment in soil, air, food, and water and is a component of arsenical pesticides and emissions from metal smelters, chemical production, and coal combustion. High arsenic exposure concentrations are found in certain industries (smelters), chemical waste sites, areas where arsenical pesticides have been used, and geographic areas with natural arsenic deposits contaminating groundwater.

Arsenic has been found to interact with a number of other substances. The mechanism is unknown; however, when arsenic and selenium are administered together, each chemical tends to diminish the effect caused by the other. For example, selenium has been observed to reduce the teratogenic effect of arsenic. An interaction has been observed between cigarette smoking, inhalation of arsenic, and the risk of lung cancer. Cigarette smoking raised the lung cancer risk synergistically in a study of smelter workers. In animals, a positive interaction has occurred between arsenic and benzo(a)pyrene (a component of cigarette smoke) in the induction of lung adenocarcinomas. Arsenic is detoxified in the methylation process. Studies support the assumption that chemicals which interfere with methylation could increase the toxicity of arsenic. Animal studies support this assumption. Reagents that restrain methylation enzymes caused a rise in tissue levels of inorganic arsenic.

The routes of exposure include inhalation, ingestion, or dermal contact. Human studies indicate that considerable absorption of arsenates and arsenites occurs with oral and inhalation exposure. Although distribution data are generally limited, arsenic has been seen distributed in tissues throughout the body with ingestion exposure. Metabolism of inorganic arsenic consist of reduction/oxidation reactions with As(+5) and As(+3), and methylation of As(+3) to produce monomethyl arsonic acid (MMA) and dimethyl arsinic acid (DMA). As(+3), the trivalent form or inorganic arsenite, is considered more toxic than As(+5), the pentavalent form or inorganic arsenate. Methylation is considered a detoxification process. Excretion of arsenic occurs through the urine in the form of organic arsenics, MMA, and DMA.

Health effects from arsenic may be produced by inorganic or organic forms of arsenic. The inorganic forms consists of arsenates (AS+5), arsenite (AS+3), or a combination of the two. Organic arsenics are generally considered less toxic than the inorganic arsenics. Some methyl and phenyl derivatives of arsenic, which are commonly used in agriculture, may be of potential health concern. These include monomethyl arsonic acid (MMA) and its salts, dimethyl arsinic acid (DMA) and its sodium salt, and roxarsone (3-nitro-4-hydroxyphenylarsonic acid). A number of organic arsenicals (arsenobetaine and arsenocholine) may aggregate in fish and shellfish. However, research had indicated that these substances are basically nontoxic.

Pulmonary edema and hemorrhagic bronchitis have been observed in moderate to severe cases of human ingestion exposure. Generally, however, inorganic arsenic does not produce serious damage to the respiratory system.

Serious cardiovascular effects have been seen with acute and long-term ingestion exposures to inorganic arsenic. Changes in myocardial depolarization (QT and ST changes) and cardiac arrhythmia have been observed. In addition, long-term exposures have been associated with vascular changes manifested by loss of circulation in the hands and feet progressing to necrosis and gangrene at doses of 0.014 to 0.065 mg/kg/day.

Gastrointestinal system effects have also been reported with inorganic arsenic exposures. Nausea, vomiting, diarrhea, and abdominal pain have been documented in acute high-dose exposures. At exposure concentrations below 0.0l mg/kg/day of arsenic, no detectable effects have been seen. In one study, repeated intake of MMA, an organic arsenic, resulted in irritation and weakening of the intestinal wall in rabbits.

Hematological effects have been reported with exposures to both inorganic and organic arsenic. Acute, intermediate, and chronic oral exposures in humans with inorganic arsenics have resulted in anemia and leukopenia. These may be caused by a cytotoxic or hemolytic effect on the blood cells and a suppression of erythropoiesis. At concentrations of 0.07 mg/kg/day or less of inorganic arsenic, no hematological effects are usually seen. In one study, however, an exposure of 0.05 mg/kg for an intermediate duration produced mild anemia. With organic arsenics, rodent studies have show that repeated exposures to MMA, dimethyl arsinic acid (DMA), or roxarsone at does of 1.1 - 55 mg/kg/day have not resulted in any significant hematological effects in rodents.

Hepatic effects have been seen with inorganic and organic arsenic exposures by ingestion. Chronic human exposure doses of 0.019 - 0.1 mg/kg/day of inorganic arsenic in humans have often resulted in swollen and tender liver and an elevated level of liver enzymes. Histological examination of the chronically exposed, who have received similar doses, have shown portal tract fibrosis. In rodents, slight fluctuations in liver weights have been demonstrated with oral doses of the organic arsenic, roxarsone.

Some renal effects have been demonstrated with inorganic and organic arsenic. However, human and animal studies indicate that the kidney is not a major target organ. Acute and chronic toxicity studies in humans with inorganic arsenic have not generally resulted in significant renal injury. In some instances, however, elevated serum creatinine or bilirubin and mild proteinuria have been seen. With organic arsenics, tubular degeneration and necrosis have been observed in rats administered repeated

doses of roxarsone, and interstitial nephritis and tubular nephrosis in rabbits with repeated oral exposures of MMA.

Dermal and ocular effects have been observed with inorganic arsenic exposure by ingestion. Common characteristic effects are skin changes of hyperkeratosis and hyperkeratotic warts or corns on the palms and soles with hyperpigmentation and hypopigmentation on the face, neck, and back. In the majority of human studies, intermediate or chronic oral exposures have resulted in these findings. Chronic dose levels of 0.01 - 0.1 mg/kg/day have produced dermal effects. At average chronic doses of 0.0004 - 0.01 mg/kg/day, no dermal or other effects were observed in several epidemiological studies of populations of from 20 to 200 people exposed to inorganic arsenic in drinking water. In addition, an average total daily intake of 0.0008 mg/kg/day resulted in no effects to 17,000 persons in another study.

Immunological effects were not observed in mice exposed at levels up to 20 mg/kg/day of inorganic arsenate.

Neurological effects have been seen with oral exposures to inorganic and organic arsenic. Epidemiological studies and case reports have shown that acute, high dose exposures of 1 mg/kg/day or above of inorganic arsenic produce encephalopathy with signs and symptoms of headache, lethargy, mental confusion, hallucination, seizures, and coma. Intermediate and chronic exposures of 0.019 - 0.5 mg/kg/day produce peripheral neuropathy. Histological examination of nerves of affected persons have revealed an axonopathy with demyelination. No effects were seen at chronic doses of 0.01 mg/kg/day or less of inorganic arsenic. Repeated oral doses of the organic arsenic, roxarsone, at 0.87 - 5.8 mg/kg/day for one month, in pigs resulted in neurotoxicity of muscle tremors, partial paralysis, and seizures. Histological examination of the spinal cord demonstrated a time-dependent degeneration of myelin and axons.

Developmental effects have also been seen with oral exposures to inorganic and organic arsenics. In a case control study, an association was observed between drinking H_20 with inorganic arsenic and the congenital heart defect of coarctation of the aorta. The small number of cases left questions as to the importance of the finding. In another case control study, a marginal association was detected between inorganic arsenic in drinking H_20 and spontaneous abortion. Due to multiple contaminants in water, the finding was questionable. In an animal study, a low rate of skeletal defects was seen in fetuses of female mice exposed during pregnancy to 23-68 mg/kg/day of sodium arsenite. A rise in the rate of fetal mortality and maternal toxicity resulted from exposure of female hamsters to 14 mg/kg/day of sodium arsenite. Fetal effects of malformed palate, reduced fetal weight, delayed ossification, and rise in fetal mortality have also been observed in rodents repeatedly exposed to high doses of up to 217 mg/kg/day of organic arsenics.

One study of mice examined the reproductive effect on mice of administering sodium arsenite in drinking water at an average dose of 1 mg/kg/day. A trend was observed toward a reduced number of pups per litter and changes in the male and female sex ratio. With organic arsenic (MMA) exposure, fewer litters than normal were observed from male and female mice dosed at 55 mg/kg/day before mating and during pregnancy.

Genotoxic effects have also been observed with ingestion exposure. In humans given potassium arsenite at about 0.3 mg/kg/day, a rise in sister chromatid exchange was seen while chromosomal

aberrations were observed in another human study. DNA strand breaks were seen in the lung and other tissue of mice administered oral doses of DMA, an organic arsenic.

Case reports have shown that high doses of inorganic arsenic result in vomiting, diarrhea, gastrointestinal hemorrhage, and death. Although definitive data were unavailable, the lethal dose for inorganic arsenic was estimated at 2 mg/kg/day. With organic arsenic (MMA & DMA, and roxarsone), the acute lethal values were from 15 to 70 mg/kg in animals. However, intermediate exposures to roxarsone resulted in death for pigs at 5.8-20 mg/kg/day.

Epidemiological studies and case reports have established persuasive evidence that prolonged oral exposure to inorganic arsenic increases the risk of skin cancer. The most common skin cancers are squamous cell carcinomas which seem to develop from hyperkeratotic warts or corns. Basal cell carcinomas also develop. One reliable study examining 40,000 persons in Taiwan demonstrated an increased skin cancer risk with a lifetime exposure to a drinking water concentration of 1 ug/L inorganic arsenic. Skin cancers have been reported at oral doses of 0.009 mg/kg/day for a continuous period of 14 to 23 years to 0.04 mg/kg/day for an average occupational exposure duration of 16 years. In addition, evidence from case studies is increasing regarding the development of internal cancers from ingestion exposures. Case studies have shown the development of tumors of the liver and other tissues in patients with arsenic-induced skin cancer. Epidemiological studies in Taiwan have substantiated this and shown tumors of the bladder, kidney, liver, and lung associated with (and/or showing dose - response trends with) the ingestion of inorganic arsenic. A slight increase in pancreatic tumors have been observed in male rats who received oral lifetime doses of 1.4 mg/kg/day of the organic arsenic, roxarsone.

Inhalation exposure studies have generally been done in the occupational setting. Problems (such as absence of early exposure data, occurrence of other exposure routes besides inhalation, and simultaneous exposure to multiple chemicals) result in difficulties with findings from occupational settings.

Respiratory effects (laryngitis, bronchitis, or rhinitis and even nasal septum perforation at high doses) have been observed in workers exposed by inhalation to inorganic arsenic dust. These respiratory effects are usually not found at exposure levels of about 0.1 - 1 mg/m^3. DMA exposure for a short period at a high concentrations of 2,170 mg/m^3 caused respiratory distress in rodents.

A number of epidemiological studies have shown that smelter workers with chronic inhalation exposure to inorganic arsenic (arsenic trioxide) have a higher risk of dying from cardiovascular disease. In addition, these workers may have a higher rate of vascular problems (Raynaud's disease) at inhalation exposure levels above 0.05 - 0.5 mg/^{3}.

Gastrointestinal effects (nausea, vomiting, and diarrhea) have also been observed in workers exposed to high concentrations of inorganic arsenic dust. Nausea and anorexia were observed in one worker exposed to arsenic trioxide at a concentration of 0.11 mg/m^3. Workers of a chemical plant exposed to low levels of an organic arsenic (arsanilic acid) at an average of 0.13 mg/m^3 were not found to have a higher than average rate of complaints for gastrointestinal conditions.

Hematological effects have not been seen in workers exposed by inhalation to inorganic or to organic arsenics (arsanilic acid dusts).

Hepatic effects have not been observed in several workers exposed to inorganic arsenic dust.

Urinalysis of workers exposed to inorganic dust did not reveal evidence of renal damage with inorganic arsenics.

Hyperpigmentation of the skin was observed in 16 out of 40 workers and hyperkeratotic warts in 2 out of 40 workers chronically exposed by inhalation to inorganic arsenic at 0.078 mg/m^3. Dermal or ocular effects were not seen in workers exposed to organic arsenic (arsanilic acid) at an average concentration of 0.13 mg/m^3.

Immunological effects were not seen in workers exposed to inorganic arsenic at a coal-burning power plant, but arsenic levels were not taken. In mice, a single dose of arsenic trioxide of 0.94 mg/m^3 resulted in increased susceptibility to respiratory bacterial pathogens.

Case reports and epidemiological studies demonstrate that inhalation of inorganic arsenic may result in neurological effects (numbness, loss of reflexes, muscle weakness, and encephalopathy).

Developmental effects (congenital malfunctions) have been observed in babies born to women exposed during pregnancy to inorganic arsenic dust in a copper smelter plant. Women living near the smelter also tended to have higher rates of spontaneous abortion. As distance from the smelter increased, the rate of abortions decreased.

Genotoxic effects (chromosomal aberrations) have been observed in the peripheral lymphocytes of smelter workers with inhalation exposure to arsenic trioxide.

Human studies have not shown lethal effects from human inhalation exposure to inorganic arsenic. However, an inhalation dose of 2,100 mg/m^3 was fatal to 50% of the female rats exposed by inhalation to the organic arsenic of DMA.

Substantial evidence from epidemiological studies have demonstrated that inhalation of inorganic arsenic raises the risk of lung cancer. Exposure levels of 0.01 mg/m^3 for an occupational exposure of 1 to 30 years to 0.3 mg/m^3 for an occupational exposure of 13 to 22 years have resulted in higher than expected deaths from lung cancer. The increased risk of lung cancer is particularly notable in chemical plants, especially copper smelters, where exposure is mainly to arsenic trioxide dust. Residents living near smelters may also have an elevated risk for lung cancer.

Health effects have been observed with dermal/ocular exposures. Humans exposed dermally, particularly to arsenic trioxide dusts, have developed contact dermatitis. The dermal concentration at which this occurs has not been quantified in humans. However, at an exposure level of 2.5 mg/kg of sodium arsenite, mice have been seen to develop irritation of the skin. In addition, application of MMA to rabbits' skin caused mild dermal irritation.

Immunological effects have also been observed with inorganic arsenic exposure (arsenic trioxide dust) by dermal contact. Dermal patch tests were positive in 80% of workers receiving dermal exposure to arsenic trioxide dust as compared to 30% of the controls.

Arsenic (arsenic acid) did not act as a carcinogenic promoter when applied to the skin of mice pretreated with dimethylbenzanthracene. Arsenic has an USEPA WoE classification of A (human carcinogen).

Barium (Ba)

Barium (CAS No. 7440-39-3) is an element which is generated by the reduction of barium oxide. Its main sources are from barite ($BaSO_4$) and witherite ($BaCO_3$). Metallic barium is utilized to withdraw residual gas from vacuum tubes and in alloys with nickel, lead, calcium, and other substances. Barium compounds have a multitude of uses, including the production of substances such as chlorine and sodium hydroxide, in x-ray diagnostic work, glassmaking, and other processes.

Metallic barium and its alloys are incompatible with water. The metallic barium is also incompatible with halogens and acids.

The routes of exposure for barium include ingestion, inhalation, and dermal contact. Local irritation to the eyes, nose, throat, and skin have been observed with alkaline barium compounds (hydroxide and carbonate). With ingestion exposure, the soluble barium compounds cause increased muscle contraction, especially of the smooth muscles. The effect may include a slowing of the heart rate (even stopping in systole), rise in the intestinal peristalsis, vascular constriction, bladder contraction, and a rise in voluntary muscle tension.

In one retrospective epidemiology study, age-adjusted mortality rates for cardiovascular disease were compared in community groups receiving high barium doses in water (2-10 mg/L) and those receiving a minimal amount of barium ($\leq$0.2 mg/L) in drinking water. Significantly higher mortality rates from all cardiovascular diseases were observed in persons from communities with the elevated barium, especially in the 65 years and older age group. However, adjustment was not made for confounders, which included population mobility, use of water softeners, or medications, limiting the study's findings. For morbidity, no significant differences were seen in mean systolic and diastolic pressures or in prevalence rates for hypertension, stroke, and heart and kidney disease.

In another ingestion study, 11 healthy male volunteer subjects were studied. The age range of the study participants was from 27 to 61 years with none having a history of diabetes, hypertension, or cardiovascular disease. The volunteers were administered 1.5 L/day of distilled and charcoal-filtered water with 0 mg/L barium for weeks 0 to 2; 5 mg/L for weeks 3 to 6; and 10 mg/L for weeks 7 to 10, in addition to receiving a strict diet. The subjects' status (blood pressure, urine and blood, and electrocardiogram) was monitored. The study's outcome revealed no changes in the systolic or diastolic blood pressures, serum chemistry, or cardiac cycle as reflected in the electrocardiogram. Deposition in the lungs of inhaled barium sulfate dust in high concentrations may produce a benign pneumoconiosis known as baritosis. Although symptoms or physical signs may not be present, x-ray will reveal nodular opacities of the lungs. In an occupational inhalation study, workers, who had received barium dust exposure and had developed baritosis, were examined. They were found to have no symptoms, physical signs, loss of vital capacity, or interference with pulmonary function. However, they were found to have a significantly higher incidence of high blood pressure.

No USEPA WoE classification has been established for barium.

Beryllium (Be)

Beryllium (CAS No. 7440-41-7) is an element found naturally in certain types of rocks. Synonyms include beryllium-9, glucinium, and beryllium metallic. The majority of the mined beryllium ore is utilized to manufacture metal alloys which are used in the electronic industry and for structural

operations. Burning of coal contaminated with beryllium and wastewater effluents from industry are the primary sources of beryllium emissions into the environment. Occupational groups which have the highest exposure to beryllium are involved in the mining, processing and conversion of beryllium to metal, alloys, and chemicals. Individuals living in areas of high emission concentrations from industry also receive exposure to beryllium. Since beryllium is a natural component of tobacco, smokers have been observed to receive high levels of exposure to beryllium with inhalation.

The examination of acute beryllium toxicity has provided information on beryllium's ability to interact with other substances. Aurintricarboxylic acid with salicylates and ferritin have been used to bind beryllium to inhibit toxic effects. Beryllium oxide has been observed to enhance the carcinogenic effect of 20-methylcholanthrene to a greater degree than carbon black.

The routes of exposure for beryllium include inhalation, ingestion, or dermal contact. No human studies were found documenting absorption of beryllium by inhalation and ingestion. It is uncertain whether absorption occurs following dermal contact. In animals, beryllium is absorbed through the lungs when inhaled but poorly absorbed with ingestion and dermal contact. In the tissues of workers exposed by inhalation, the concentration of beryllium distributed in the body was highest in the bones and lungs with lower concentrations in the kidney and liver. Following ingestion exposure, animals were sacrificed and found to have beryllium distributed in the large and small intestines, kidneys, liver, lungs, spleen, and stomach. Although beryllium and its compounds are not metabolized, the soluble salts are converted to an insoluble form. Human data was unavailable for excretion of beryllium following inhalation, ingestion, and dermal exposures. In animals, beryllium was excreted in the urine following inhalation and in the urine and feces following ingestion. No data was available for excretion following dermal exposure.

Toxic effects, especially to the lungs, have been observed with human inhalation exposure to beryllium. Chronic respiratory diseases in the form of acute pneumonitis and granuloma (tumor-like inflammatory mass) have been documented with occupational exposure to beryllium. Dermal exposures to beryllium have produced dermatitis and other skin problems in humans.

A number of epidemiologic studies have shown a possible association between inhalation exposure to beryllium and lung cancer in humans. Since certain factors such as adjustment for smoking and actual exposure to beryllium were not examined, the evidence has been considered inadequate. One study did show a statistically significant association between beryllium exposure by inhalation and lung cancer. When the data was adjusted for smoking, however, the association was no longer significant. No studies were found dealing with the association between ingestion and dermal exposures and cancer. In addition, genotoxic effects (i.e. chromosome aberrations, sister chromatid exchange) have been seen in vitro with mammalian cells. Beryllium has an EPA Weight-of-Evidence Classification of B2 (probable human carcinogen).

Boron (B)

Boron (CAS No. 7440-42-8) is an element found naturally in sediment and sedimentary rock. The environmental discharge of boron occurs mainly from the natural weathering process. In addition, air, water, or soil may be contaminated with boron following discharge from coal-burning plants, copper

smelters, and pesticides. Typical boron compounds are boric acid, borax, borate, and boron oxide. Boron's main use is in the manufacture of glass with other applications in fire retardant and in leather tanning and finishing industries. High exposure levels are found with workers employed in industries utilizing boron-containing products, with persons residing near waste sites or areas with natural boron deposits, and with consumers utilizing cosmetics, medicines, or pesticides containing boron.

No studies were found on the interaction of boron with other substances.

The routes of exposure for boron include inhalation, ingestion, or dermal contact. No human or animal studies were found which dealt with absorption, distribution, metabolism, or excretion of boron by the three routes of exposure.

Toxic effects following inhalation of boron include irritation to the upper respiratory tract (cough; dry mouth, nose, throat; sore throat) and chronic eye irritation in occupational groups exposed to boron oxide and boric acid dust. No human studies were found for other systems of the body. With ingestion, a variety of toxic effects have been documented for infants who have received an accidental ingestion dose of boron. Infant deaths have been observed due to respiratory failure. Prior to death, manifestations of lethargy, vomiting, and diarrhea have been observed. Degenerative changes have been observed in the brain, kidney, and liver. Respiratory (congestion and hemorrhage of the lungs), gastrointestinal (nausea and vomiting, diarrhea, colic, abdominal pain), hepatic (jaundice, fatty changes in the liver), renal (degenerative changes in the cells), dermal (dermatitis), and neurological (headache, tremor, convulsion, coma) effects have also been observed in infants. In two adults, symptoms of vomiting occurred following ingestion of boric acid-containing fungicide and insecticide. No human studies were available which dealt with the effect of dermal exposure. In rabbits, conjunctivitis and dermatitis were seen with dermal and ocular exposures. No studies were found dealing with the development of cancer in animals or humans following boron exposure by inhalation, ingestion, or dermal contact. Boron has an USEPA WoE classification of D (not classifiable as to human carcinogenicity).

Cadmium (Cd)

Cadmium (CAS No. 7440-43-9) is a naturally occurring element found in the earth in concentrations of about 1-2 ppm. Cadmium is primarily used in the production of nickel-cadmium batteries and for metal plating. It may be present in the air as a suspended solid, as a solid in soil, or may be dissolved in water if it is present as a chloride or sulfate.

The routes of exposure to cadmium include inhalation, ingestion and to limited extent dermal contact. Breathing air containing small cadmium particles may result in deposition of cadmium particles in the lung. Smoking cigarettes may also expose the public to cadmium. Exposure may also result from ingestion of food or water containing cadmium. Very little is absorbed through the skin unless the skin is scraped or cut.

Cadmium is readily absorbed by the lung. Up to 50% of inhaled cadmium particles less than 0.1 micron in size will be deposited in the lungs. Between 50% and 100% of the cadmium will ultimately be absorbed into the body. Cadmium inhaled through cigarette smoking is very efficient at being deposited into the lung and absorbed into the blood. Most ingested cadmium passes through the gastrointestinal track without being absorbed. Most cadmium that is inhaled or ingested is eventually

excreted in the feces. Most of this excreted material represents cadmium that was not absorbed by the gastrointestinal tract. Cadmium that is absorbed is excreted very slowly, with excretion in the urine and feces being nearly equal.

Health effects from short term inhalation of large quantities of cadmium include irritation of the nose and throat, chest pain, headache, chills, muscle aches, nausea, vomiting and diarrhea. Inhalation of 5 mg/m^3 for 8 hours may result in death. Longer term inhalation may result in irreversible lung injury, open sores in the nose, and loss of sense of smell. Both inhalation and ingestion of cadmium over a long period of time may result in liver and kidney damage.

There is some evidence that cadmium is a carcinogen in humans when inhaled; however, only one study has shown an increase in lung cancer associated with cumulative exposure. Inhalation of cadmium may result in prostate cancer. There is no evidence that cadmium is carcinogenic when ingested. Cadmium has a USEPA WoE classification for inhalation exposure of B1 (probable human carcinogen).

Chromium III, VI, Total (CrIII, CrVI, Tot)

Chromium is a naturally occurring element found in rocks, soil, animals and plants and is found in different forms or ionic states. Chromium (0) (CAS# 7440-47-3) is a steel gray solid used in making steel and other alloys and does not occur naturally. Chromium (III) and chromium (VI) (CAS Nos.16065-83-1 and 18540-29-9 respectively) are ions used for chrome plating and in the manufacture of dyes and pigments.

Chromium (III) may be oxidized to chromium (VI) in the presence of oxidizable organic substances, oxygen, manganese dioxide and moisture. Under anaerobic conditions, chromium (VI) is reduced to chromium (III) in the presence of S^{-2} and Fe^{+2}.

The routes of exposure to chromium include inhalation, ingestion and dermal contact. Breathing air containing chromium can result in deposition of chromium in the lungs or ingestion of the chromium as the body removes it from the lungs. Exposure to chromium may also result from incidental ingestion of dirt containing chromium or from eating foods or drinking water containing chromium. Exposure may also occur as a result of dermal contact with chromium, although little will be absorbed into the body unless the skin is scraped or cut.

Chromium (VI) is more readily absorbed by the body than chromium (III). Studies indicate that between 53% and 85% of inhaled chromium (VI) is absorbed by the lungs into the bloodstream or cleared by the pharynx and ingested. The remainder or the chromate remains in the lungs. Approximately 0.5% to 2% of ingested chromium is absorbed by the gastrointestinal tract. When ingested, chromium (VI) compounds are converted to chromium (III) in the stomach. Both chromium (III) and (VI) can penetrate the skin to some extent if the chromium is in an acidic solution or if applied as a salve. Chromium compounds may also penetrate the skin if the skin is scraped or cut.

In general, chromium (VI) compounds are more toxic than chromium (III) compounds. Health effects due to inhalation are the most significant of the exposure routes. Noncancer health effects from inhalation include nasal septum damage, irritating respiratory effects, liver and kidney effects and

increased risk of death from noncancer respiratory effects. Dermal exposure to chromium compounds may result in allergic dermatitis and formation of skin ulcers known as chrome holes.

Human epidemiological studies clearly indicate increased risk of lung cancer in chromate (chromium VI) production workers and in some pigment and chrome plating workers. Based upon epidemiological evidence, chromium (VI) is considered carcinogenic in humans when inhaled. Chromium (VI) has a USEPA WoE classification of A for inhalation exposure (human carcinogen).

Copper (Cu)

Copper (CAS No. 7440-50-8) is a reddish metal which is a natural component of rock, soil, water, sediment, and air. It occurs in the elemental state and as a compound. Copper is an essential element for all living organisms including humans. The Recommended Daily Allowance of copper is between 2-3 mg per day. Most people eat or drink about 1 mg of copper every day. The major sources of release, primarily into soil, are from mining operations, agriculture, solid waste, and sludge from public treatment plants. The waste from these sources is generally in a mineral form and is unlikely to harm biota (plant and animal life). Also, transport and transformation of copper is unlikely. Copper in water occurs from weathering of soil and discharges from industries and sewage treatment plants. Air emissions of copper result from wind-blown dust, volcanoes, and human sources, such as copper smelters and ore processing facilities.

High exposure levels may occur in the general population from drinking water which contains copper settling out of the distribution system. However, copper may be tasted in drinking water at a level which is not toxic to the human body. Running tap water may lower the concentration of copper in drinking water. Job-related exposures may occur in mining, agriculture, and water treatment occupations.

Human exposure may occur by inhalation, ingestion, or dermal contact with soil, water, or other copper containing substances. The majority of the copper compounds found in the environment are in a fixed state (adhering to dust, dirt, or mineral particles) and are unlikely to affect human health. Copper detected at hazardous waste sites are usually found in this form. Soluble copper compounds are the form most likely to impact on human health. However, if dissolved in water bodies such as lakes or rivers, soluble copper compounds adhere to solid particles, diminishing their ability to cause adverse health effects. Copper is also a component of food, and a mineral needed by the human body.

Gastrointestinal (vomiting, diarrhea, nausea, abdominal pain, and metallic taste in mouth), hematological (acute hemolytic anemia), hepatic (cirrhosis, necrosis of liver), and renal (necrosis of tubular cells) effects have been observed with ingestion of large quantities in humans. Copper has a USEPA WoE classification of D (not classifiable).

Lead (Pb)

Lead (CAS No. 7439-92-1) is an element found throughout the environment in the earth's crust and from processes initiated by man. Synonyms include lead metal, plumbum, and pigment metal. Lead is found in air, food, water, and dust. Its primary use is in the production of storage batteries with additional applications which include the manufacture of paint, gasoline additives, metal products (sheet lead, solder), and ammunition. The highest airborne concentrations of lead have been from vehicle

emissions during the period when gasoline with lead additive was widely used. Other airborne sources include industrial emissions (smelting operations and the production of lead batteries), natural emissions (active volcano), and cigarette smoking. The primary source of lead in water is from plumbing and solder and lead-containing dust, soil, and wastewater. Food and beverages may also contain lead if crops or the food operations are contaminated with lead-filled dust. Workers are mainly exposed through inhalation in jobs involving smelting, production of steel and batteries, gasoline stations, and auto repair.

Lead interacts with a number of substances as demonstrated in human and animal studies. For example, absorption of lead in the body was lower in subjects given oral calcium and phosphorus supplements. An inverse relationship was also seen between dietary iron, vitamin D, and zinc and lead. With high lead levels in the body, the concentrations of these three substances were low. In fact, iron deficiency resulted in a two to threefold greater absorption rate of lead in study subjects when compared to those individuals who were not deficient. In animals, similar conditions were observed. For example, the administration of iron orally or by injection seemed to lessen the effect of lead on body enzyme activity in one animal study. When lead was administered to rats, mercury deposition increased in the rat kidneys. Animal studies have shown that the combined activity of cadmium and lead manifested itself in rats with weight loss and an increase in the weight of body organs (brain, liver, and adrenal glands). Rats exposed to lead and ethanol demonstrated a greater inclination toward the neurological and hepatic effects of lead. Phenylhydrazine and lead combined intensified the effect on the different phases of anemia in a rat experiment.

The routes of exposure for lead include inhalation, ingestion, or dermal contact. If deposition of lead particles occurs in the lower respiratory tract, the particle absorption is almost total. Fifty percent of the lead which is ingested by children is absorbed by the body with an 8% and 15% rate of absorption in two separate studies examining ingestion exposure in adults. Fasting has been shown to enhance ingestion absorption to 45% in adults. In animals, the absorption of alkyl lead (tetraethyl lead) occurred more rapidly by dermal application in rabbits than by ingestion. Since man's dermal absorption rate is lower, absorption in humans by dermal contact is less than by inhalation or ingestion. Inorganic lead is not metabolized or biotransformed; however, metabolism does occur in the liver with organic (alkyl) lead. Regardless of the route of absorption, lead is distributed in the blood, soft tissue, and bone with the majority of the total body burden in the bone. For the lead which is not absorbed, excretion in humans occurs through the urine and feces. Transplacental transfer has also been observed in humans.

The health effects data on lead contain a great deal of human information on dose response, mainly derived from occupationally-exposed groups and the general public. Most dose-response studies examine health effects in terms of the external exposure levels which are measured in milligrams of the substance per kilogram of body weight per day of exposure (mg/kg/day). With lead, however, the external measurements (mg/kg/day) are frequently unavailable. In most instances, data on the ***absorbed dose***, representing the amount of lead in the blood in micrograms per deciliter of blood (ug/dL), are available. For this reason, the ***absorbed dose*** is used with lead to express the concentration at which a particular response or health effect is seen.

In addition, occupational exposures generally involve inhalation as the main route of exposure with ingestion secondarily. With the general population, exposure, particularly with children, is by the

oral route and secondarily by inhalation. Whatever the route of exposure, the health effects are the same and are associated with the ***absorbed dose*** to demonstrate a dose response effect. For these reasons, the information in this section represents multiple routes of exposure, which have not been separated out, with the exposure concentration level shown as the ***absorbed dose***. Health effects by specific routes of exposure (ingestion, inhalation, and dermal) are not discussed in this summary.

Respiratory effects were documented in a case report of a 41 year old male exposed to lead for six years while taking lead-based paint off of a bridge. Initial examination revealed a blood lead level of 87 ug/dL with the patient's complaint of mild dyspnea for two to three years. Clinical examination showed no effects to respiratory function making it difficult to correlate symptoms to lead exposure.

An uncertainty exists as to whether lead exposure results in the cardiovascular effect of hypertension. The question has arisen as to the influence of race (African Americans more sensitive) as a factor in the development of hypertension with lead exposure. Occupational and general population studies have not been conclusive in establishing a causal relationship between lead exposure and the development of hypertension.

Occupational studies have had relatively small samples and have frequently not adjusted for confounding factors such as smoking and alcohol consumption. In a study of 89 policemen (race not stated), a rise in the systolic blood pressure of 1.5-11 mmHg could be predicted from high blood lead levels of 30 ug/dL or greater. This finding, in policemen with normal blood pressure was significant after adjustment for previous blood pressure, body mass index, age, and cigarette smoking status. Another occupational study involved construction workers using oxyacetylene torches to cut a bridge painted with lead-based paint. The peak body lead levels were found to be from 48 to 120 ug/dL with airborne lead in the personal breathing zone measuring 600 to 4,000 ug/m^3. Following four weeks of exposure, the workers had developed an increase both in heart rate and blood pressure. In another occupational study with a larger sample size, a significant association was not found between blood lead levels and systolic and diastolic blood pressure. Randomly-selected white battery plant workers (n=270) were examined and compared to 158 nonexposed workers. In the exposed workers, the mean blood lead level was 40 ug/dL with a 7 ug/dL level for the nonexposed. After adjusting statistically for confounders (age, education, income, cigarette and alcohol use, and exercise), only a small and nonsignificant association was found between exposure and blood pressure when the two groups were compared. In yet another study, electrocardiogram changes were observed in 95 lead smelter workers with a mean blood lead level of 51 ug/dL. The workers were compared to matched unexposed controls, who had a mean blood lead level of 11 ug/dL. A significantly higher rate of ischemic electrocardiogram changes were observed in the exposed (20%) when compared to the nonexposed workers (6%). Additionally, a small but significant rise in diastolic blood pressure was seen in the lead workers when compared to the nonexposed workers. In a larger-scale study (British Regional Heart Study), a clinical survey of 7,735 males (ages 40 to 49 years from 24 British towns) investigated the association between blood lead levels and blood pressure. A small but statistically significant association was seen between systolic blood pressure and blood lead level. Seventy-four men were found to have blood lead levels higher than 37 ug/dL, and these men had a higher proportion with systolic or diastolic hypertension than the other men combined. When these data were reanalyzed and adjusted subsequently, the association was determined

to be weak and not conclusive. In another large scale study, National Health and Nutrition Examination Survey (NHANES II), a statistically significant association was detected between blood lead levels and blood pressure for men after adjusting for confounders (age, race, and body mass index). At blood lead levels of 14 and 30 ug/dL, an increase in blood pressure of 7 mmHg was estimated. Reanalysis of the data focusing upon white males, ages 40 to 59 years, supported the relationship with no threshold below which blood lead was not significantly associated with systolic and diastolic blood pressure over the range of 7-38 ug/dL. Subsequent reanalysis of the NHANES II data using stepwise regression, however, showed a weak association between blood lead level and blood pressure. In addition, the NHANES II blood pressure data also came under question. Correction for blood pressure revealed that the significance and magnitude of the blood lead-blood pressure association were less than initially reported. Another large study examined 963 men and 1,019 women from Belgium. Step wise multiple regression adjusted for confounders (age, body mass index, pulse rate, γ-glutamyltranspeptidase, smoking habits, and contraceptive use). A statistically significant negative association was detected between blood lead and systolic blood pressure in men, which resulted in the investigators concluding no association between blood lead levels and blood pressure in this population. These and some other studies (not reported here) fail to give decisive evidence that lead exposure is associated with hypertension.

Gastrointestinal effects in the form of colic (abdominal pain, constipation, cramps, nausea, vomiting, anorexia, and weight loss) have been documented in workers whose blood lead levels were as low as 40-60 ug/dL, but are usually seen at levels of 100-200 ug/dL. Colic is also seen in lead poisoning of children. The lowest blood lead level, in which signs of acute leading poisoning (constipation, anorexia, and vomiting) occurs in children, is 60 ug/dL or greater.

The hematological effects of lead exposure have been well known for a lengthy period. Lead suppresses certain enzymes (e.g. δ-aminolevulinic acid dehydratase acid or ALAD) which carry out the heme biosynthesis. The heme biosynthesis subsequently declines and the δ-aminolevulinic acid synthetase (ALAS) rises. This results in a rise in urinary porphyrins, coproporphyrin, and δ-aminolevulinic acid (ALA); rise in blood and plasma ALA; a rise in erythrocyte protoporphyrin (EP), free erythrocyte protoporphyrin (FEP); and erythrocyte zinc protoporphyrin (ZPP). An increase in the ALAS activity has been shown in lead workers at a blood lead level of 87 ug/dL. Erythrocyte and hepatic ALAD activities have also been associated inversely with blood lead levels in the range of 12-56 ug/dL. In a case report, an elevated urinary ALA was documented for a man, with a blood lead level of 55 ug/dL, who had an 11 year exposure to lead in his job of removing lead-based paint from a bridge. A threshold has been observed for FEP elevation in male lead workers at 25-35 ug/dL and for EP elevation at 30-40 ug/dL. A rise in urinary coproporphyrins has been utilized as an indicator for excess lead exposure in workers and children. The lowest level, at which an adverse effect was observed for elevated coproporphyrin, was at a blood lead level of 40 ug/dL for adults and 35 ug/dL for children. For occupationally exposed adults, the threshold level for lead, at which hemoglobin level declines, is estimated at 50 ug/dL. This estimate is reflected in an examination of smelter workers for blood lead levels and anemia. Anemia was diagnosed in five percent of the workers with blood lead levels of 40-59 ug/dL, 14% with levels of 60-79 ug/dL, and 36% with levels greater than 80 ug/dL. The threshold in children is approximately 40 ug/dL. Blood lead levels and hematocrit were examined in 579 children, ages 1 to 5 years, who lived near a lead

smelter. A hematocrit of less than 35% was the definition of anemia. At lead levels below 20 ug/dL, no anemia was seen. At blood lead levels between 20 ug/dL and 100 ug/dL, the decline in the hematocrit was proportionally greater than the rise in blood lead levels, representing a strong nonlinear dose-response relationship. The study demonstrated a strong association between elevated blood level and the probability of anemia.

Hepatic effects have also been observed. Lead has been shown to suppress the formation of heme-containing protein cytochrome P-450 in children, as manifested in the decline of hepatic mixed-function oxygenase. In addition, abnormal liver function tests (e.g. alkaline phosphatase) and mild hepatitis were seen on autopsy in a 52 year old male with occupational exposure to lead from the use of oxyacetylene for cutting lead-painted ironwork. The man's blood lead level was 203 ug/dL on hospital admission. Since no documentation was available on the man's medical history or drinking habits, the cause of the hepatotoxicity was uncertain.

Renal tubular carcinomas developed in 81% of the treated rats (13 out of 16 rats) with no renal tumors developing in ten control rats. Additionally, a rise in the incidence of renal tumors (adenomas and carcinomas) was reported in male mice receiving a dietary dose of 0.1% basic lead acetate for two years. Control animals did not develop renal tumors.

Renal effects have also been reported with lead exposures. Early or acute lead-induced nephropathy in humans is characterized by nuclear inclusion bodies, mitochondrial changes, and cytomegaly of the proximal tubular epithelial cells; dysfunction of the proximal tubules (Fanconi's syndrome) appearing as aminoaciduria, glucosuria, and phosphaturia with hypophosphatemia; and a rise in sodium and a decline in uric acid excretion. The acute effects seem to be reversible and are generally seen in lead intoxicated children. Chronic lead nephropathy is characterized by progressive interstitial fibrosis; dilation of tubules and atrophy or hyperplasia of the tubular epithelial cells; few or no inclusion bodies; decline in glomerular filtration rate; and azotemia. The chronic effects are not reversible and are generally seen in occupational lead exposure.

In one Japanese study of 158 male and 51 female lead workers, 30 professional and laboratory staff with no history of renal disease or lead exposure acted as controls. The average length of exposure was 10.8 years. The blood lead level ranged from 3-80 ug/dL with only five workers exceeding the blood lead level of 60 ug/dL. A statistically significant positive association was detected between 1) blood lead and blood urea nitrogen and 2) blood lead and serum creatinine. In addition, creatinine clearance detected a rise in blood lead level. These associations were also detected with urinary lead level. Levels of N-acetyl-B-D-glucosaminidase (NAG) were significantly greater in the lead exposed when compared to controls and significantly greater with rising blood and urinary levels, NAG is a lysosomal enzyme which is found in the renal tubule cells and which act as an early indicator of subclinical renal disease. These findings would suggest that relatively low levels of blood lead are capable of influencing renal function. In contrast, no significant differences were detected between 25 male lead smelter workers and 88 male control workers with regard to renal function and signs of clinical renal impairment. The two groups were evaluated in terms of age, smoking status, socioeconomic status, and length of employment. Blood lead levels, urinary lead levels, FEP, and a variety of enzymes and proteins were examined. The duration for lead exposure ranged from 3.1-29.8 years. The blood lead

level in the exposed was 33.8-61.3 ug/dL and 5.5-34.2 ug/dL in controls. On mortality study of lead-exposed workers die, however, demonstrate a statistically significant rise in deaths from "other hypertensive disease" and "chronic nephritis" when the mortality of these workers were compared to national figures. The study had some limitations, however, including multiple chemical exposures. In a separate study, 17 cases of chronic nephropathy were clinically confirmed out of 102 cases of occupational lead exposure. The mean blood lead level for the entire group was 80 ug/dL. Nephropathy was more frequent in workers exposed to lead for more than 10 years when compared to workers with less than 10 years of exposure. Another study demonstrated histopathological evidence of renal damage in five men, who were exposed to lead in the occupational setting. Blood lead levels in this group ranged from 71 to 138 ug/dL. Two of the men, who had lead exposures of six weeks and eight months, had blood lead levels of 89-129 ug/dL and were found to have intranuclear inclusions in the proximal tubules. The blood lead levels for workers with 4-20 years of lead exposure were 71-138 ug/dL. These workers were found to have diffuse interstitial or peritubular fibrosis. Regardless of the dose, no pathology was observed in the glomeruli, and the renal function tests were normal. One worker did, however, have a decline in glomerular filtration rate. In yet another study, renal function was evaluated in 155 male lead workers and 126 male control workers. The exposed and nonexposed were matched for age, smoking habits, socioeconomic status, and duration of employment. Blood lead levels, ZPP, NAG, and other parameters were examined. The blood lead level was 33.8-63.2 ug/dL in the exposed and 5.6-12 ug/dL in controls. The only significant finding was a rise in the NAG in the lead-exposed as compared to the controls, and these levels were significantly greater with increasing blood lead level and ZPP. These and other studies together offer confirmation for the association of chronic nephropathy with lead blood levels ranging from 40 to greater than 100 ug/dL.

In addition, other disease conditions have been observed simultaneously with renal effects in lead exposure cases. In one study, 44 gout patients were selected, who had like characteristics of age, duration of gout, hypertension, lead exposure history, serum uric acid concentration, blood lead concentration, and ZPP. The patients received a three-day EDTA (edentate disodium calcium) lead mobilization test to examine the urinary output of lead. EDTA acts as a chelating agent, removing lead from the extracellular space. The gout patients, with renal impairment had an urinary output of 806 $\pm$ 90 ug lead. Those with gout but without renal impairment had an output of 470 $\pm$ 52 ug/lead. Controls with renal disease but no gout excreted 424 $\pm$ 72 ug/lead within the three-day test. A direct association was observed between the severity of the renal impairment and the amount of mobilizable lead measured in the EDTA test. Blood lead levels in all groups did not differ. These results indicate that excessive lead absorption may be related to renal impairment with some types of gout. Excessive lead exposure has also been involved in kidney disease associated with essential hypertension.

Children are especially sensitive to the toxic effect of lead. Research has demonstrated adverse health effects in children at blood lead levels as low as 10 ug/dL. The National Academy of Science has reported full Fanconi syndrome in children with lead encephalopathy. One out of three children with encephalopathy and with blood lead levels of approximately 150 ug/dL are estimated to have Fanconi syndrome. At blood lead levels of greater than 80 ug/dL, aminoaciduria is present in acute symptomatic lead poisoning. The acute lead poisoning symptoms cease following treatment. In a study of 43 children,

aminoaciduria was detected in four of the children. The average blood lead level in these children was 35 ug/dL with a high of 68 ug/dL. It is assumed that the children with aminoaciduria had high blood lead levels. In another study, 55 adolescents were examined. These individuals had received treatment for lead intoxication in early childhood. Their blood lead levels during the acute stage of lead intoxication was between 100 to 650 ug/dL. All the individuals received chelation therapy. The blood lead level for the adolescents in the more recent study declined to less than 40 ug/dL. Tests for creatinine clearance, blood urea nitrogen, serum uric acid, and routine urinalysis demonstrated no signs of chronic nephropathy. These studies suggest that nephropathy develops in children at blood lead levels above 80 ug/dL and generally above 120 ug/dL.

Lead exposure has also been involved in other systemic health effects. A study of 172 black males from Kenya examined the effect of occupational lead exposure on thyroid function. The mean blood lead level was 56 ug/dL with a mean duration of exposure of 7.6 years. A weak but statistically significant negative association was observed between duration of exposure and the levels of thyroid hormone (free thyroxin and total thyroxin). The association was more evident when workers with blood lead levels of 56 ug/dL or greater were examined. Limitations of the study included confounding factors (e.g. exposure to other chemicals) and variations in the worker's lead exposure. In contrast, no effects to the thyroid have been reported in children with lead exposure.

Lead also appears to influence the conversion of Vitamin D to its hormonal form of 1,25-dihydroxyvitamin D. Serum levels of 1,25-dihydroxyvitamin D declined in lead-exposed children with blood lead levels of 33-120 ug/dL. In contrast, another study showed that low to moderate lead exposure (lifetime average 4.9-23.6 ug/dL) in children with adequate nutrition resulted in no effect on vitamin D metabolism.

Some studies have shown a possible effect on childhood growth from lead exposure. The NHANES II study examined 2,695 children who were seven years or younger. Regression analysis demonstrated that blood lead levels of 4-35 ug/dL significantly predicted children's height, weight, and chest circumference (after adjusting for age, race, sex, and nutritional status). For example, the mean blood lead level (for children at the average age of five) appeared to be associated with a 1.5% decline in height (when using a blood lead level of zero as a reference). Adjustment was not made in the analysis for parental smoking, and this omission prevented causal inferences ... childhood blood lead levels and other growth factors. In a retrospective study of 54 children, the youngsters with high blood lead levels (30 ug/dL) were followed from birth to four years of age. The two groups were like in gender and skin color. A significant decline in growth (height and weight) was observed for the period from birth to three years in the high-lead exposed children when compared to the low-lead exposed group. In contrast, a study of 104 lead intoxicated between blood lead and growth or the genetic predisposition for eventual adult height. The lead intoxicated subjects had blood lead levels which ranged from 10 to 47 ug/dL, and the nonexposed sibling controls had blood lead levels of from 1 to 4 ug/dL.

In addition, the Cleveland Prospective Study examined a cohort of 359 mother-infant pairs to determine the association between blood lead levels and size. Statistical analyses showed no significant association between blood lead levels and growth for the period from birth to almost five years of age.

In other studies, occupational investigations have demonstrated that lead may influence the cellular aspect of the immune system but not the humoral. More colds and influenza infections per year were seen in lead workers with blood lead levels of 21-90 ug/dL. In contrast, immune function in lead workers, with blood lead levels ranging from 25 to 53 ug/dL for an exposure period of from 4 to 30 years, did not differ from controls with blood lead levels ranging from 8 to 17 ug/dL. No differences were observed in serum concentrations of IgG, IgA, or IgM. In addition, 12 preschool children with blood lead levels of 40 ug/dL or greater and 7 preschool children with blood lead levels of 14-30 ug/dL were compared and found to have no differences with regard to immunoglobulin and complement levels or antitoxoid titers following booster shots of tetanus toxoid.

Lead has also generated neurological effects in those who were exposed. For example, three groups of 20 workers each, employed in an electric storage battery plant, were evaluated for lead exposure. One group consisted of unexposed workers (mean blood lead of 20.4 ug/dL), the second exposed to low-lead levels (mean blood lead of 31.7 ug/dL), and the third consisting of workers exposed to high lead levels (mean blood lead of 52.5 ug/dL).

Significant dose-response trends were seen in symptoms, including appetite loss, paresthesia in lower limbs, weakness of upper limbs, and dropping of objects. The high-lead exposed workers manifested significant deficits in the performance of neurobehavioral tests, particularly on cognitive and visual-motor coordination tasks and verbal reasoning. In another occupational study, 288 lead exposed workers from a battery plant (with current or past blood lead level of greater than 35 ug/dL) and 181 unexposed workers from a truck plant (with current blood lead level of 35 ug/dL or less) were evaluated. The mean current blood lead levels for exposed workers was 40 ug/dL. Regression analyses revealed a significant dose-response association between current or cumulative blood lead levels and levels-of-conflict measure (interpersonal relationships). In addition, exposed workers had a rise in work-related accidents, poorly executed motor/manual dexterity test and higher levels of conflict. In others studies, subjective symptoms of neurotoxicity (malaise, forgetfulness, irritability, lethargy, headache, fatigue, impotence, decreased libido, dizziness, weakness and paresthesia) have also been reported at blood lead levels ranging from 40 to 120 ug/dL. One of the most serious neurological effects of lead exposure in adults is lead encephalopathy. The term represents different diseases that influence the brain's function. Symptoms, which may manifest with weeks of the initial exposure, include dullness, irritability, poor attention span, headache, muscular tremor, loss of memory, and hallucinations. If the condition deteriorates, delirium, convulsions, paralysis, coma, and death may occur. Severe lead encephalopathy usually develops at very high blood lead levels (460 ug/dL).

Neurological effects in the form of behavioral function in adults have also been documented. Workers with a time-weighted average blood lead levels ranging from 27-52 ug/dL manifested deficits in memory and learning ability. In contrast, no neurobehavioral effects were observed in an occupationally exposed group of 288 randomly selected males who were compared to 181 demographically similar controls. The exposed workers had a mean blood lead level of 40.1 ug/dL, while the controls had a mean blood lead of 7.2 ug/dL. In a separate study, neurobehavioral tests examining information processing) were administered to 59 lead workers and 59 controls matched for age, type of job, time on the job, education level, smoking history and alcohol consumption. The lead-

exposed workers had mean blood lead levels of 50 ug/dL. The study outcome revealed a statistically significant reduction in reaction times, tracking speeds hand steadiness, and sensory store memory in the lead exposed workers. In another study, impairment in hand-eye coordination and reaction time was documented in 190 lead exposed workers, who had a mean blood lead level of 60.5 ug/dL. The period of exposure for these workers was from 5 to 20 years. In a like study, no differences were documented in workers with a mean blood lead level of 61 ug/dL (with a mean exposure period of 12 years) and controls with a mean blood lead of 28 ug/dL for behavioral functions of arousal reaction time, or grip strength. ?Neuroperphological testing was also administered to workers, who were grouped by their blood lead level: 1) less than 20 ug/dL, 2) 21-40 ug/dL, and 3) 41-80 ug/dL. Deficits in serial reaction time and category search were found in workers with high blood lead concentrations, and the extent of the deficit was correlated with the blood lead level.

Other neurological effects concerning peripheral nerve function in adults have been observed. At blood lead levels of 30-48 ug/dL a reduction was seen in the nerve conduction velocities (NCV) of workers. However, in another study, no significant differences were seen in the NCVs for workers having blood lead levels of 60-80 ug/dL when compared to controls. Other neurological areas affected by blood lead levels include neurological signs and symptoms in children, behavioral function in children, electrophysiological evidence of neurotoxicity in children, and peripheral nerve function in children.

Developmental effects have also been observed in low level lead exposures. Prenatal exposures were evaluated by analyses of the maternal and/or cord blood lead levels. At low levels of lead exposure, no major congenital anomalies wee seen in one study. However, a significant association was reported between cord blood lead levels and minor anomalies in over 4,000 Boston infants. The majority of the anomalies included hemangiomas, lymphangiomas, minor skin anomalies (tags), and undescended testicles. Mothers and infants were studied in a prospective study in Cleveland, Ohio in which blood lead levels were obtained at the time of delivery. Analysis of the blood lead level revealed a mean of 6.5 ug/dL range (2.7-11.8 ug/dL) for 185 maternal samples and 5.8 ug/dL range (2.6-14.7 ug/dL) for 162 cord samples. The infants were examined for anomalies and neurobehavioral effects. Regression analysis was done and determined no association between blood lead levels and morphological anomalies. When the complete data set of mother and infants was examined a significant association was observed between abnormal reflexes and neurological soft-signs, and cord blood levels. In addition, a significant relationship was also reported between the muscle tonicity scale and maternal blood lead level. Associations have also been reported between lead exposure and the heme metabolism. A study of 500 mothers at delivery showed a negative correlation between blood lead levels and ALAD activity in mothers and infants. In the mothers, the mean blood lead level was 10.2 ug/dL (range 3.1-31 ug/dL). In the infants, the mean was 8.4 ug/dL (range 2.7-27.3 ug/dL). In the Port Pirie study (lead smelter town), low-level exposures to lead have been reported to impede mental development of children. Neurobehavioral and blood lead testings were carried out on 592 children. The lead testing showed a rise in the geometric mean blood levels from approximately 14 ug/dL at 6 months to approximately 21 ug/dL at 15 and 24 months. Around 20% of the children had blood lead levels >30 ug/dL at 24 months. Regression analyses showed a significant relationship between a decline in the Bayley Mental

Development Index (MDI) done at 24 months with higher integrated postnatal blood lead levels and with 6 month blood lead levels.

Reproductive effects have also been documented with high levels of lead exposure. Miscarriages and stillbirths have been reported in women receiving lead exposure during pregnancy. The underlying mechanism for this is not known. In the Port Pirie study, 645 pregnant women who lived in the center of Port Pirie with high environmental lead levels (mean maternal mid-pregnancy blood lead of 10.6 ug/dL) were compared to 185 women residing in surrounding areas with low environmental lead levels (mean maternal mid-pregnancy blood level of 7.6 ug/dL). No association was detected between blood lead levels and spontaneous abortions; however, the Port Pirie residents had 22 of 23 miscarriages and 10 of 11 stillbirths while residents outside Port Pirie had one miscarriage and one stillbirth. Two groups of women were examined in a prospective study of females residing close to a lead smelter and those residing 25 miles away. The 304 women living close to the lead smelter had a mean blood lead concentration of 15.9 ug/dL. The 335 females living 25 miles away had a mid-pregnancy mean blood lead concentration of 5.2 ug/dL. No differences in spontaneous abortion were found between the two groups of women. Ten men received occupational lead exposures which produced a reduction in sperm count and motility, and a rise in the percentage of abnormal spermatozoa. The lead-exposed workers had a mean blood lead level of 42.5 ug/dL while the controls had blood lead levels of 14.8 ug/dL.

Evidence is suggestive that occupational exposure results in genotoxic (chromosomal) effects. In occupationally exposed adults, no rise in sister chromatid exchange was reported in exposed adults with blood lead levels of 48.7 ug/dL or in environmentally exposed children with blood lead levels of 30-63 ug/dL. In another study, chromosomal aberrations were documented with rising blood lead levels, especially at the 50 ug/dL level, in 21 battery factory workers. A significant rise in sister chromatid exchanges was also documented in these workers when blood lead levels reached 80 ug/dL.

A statistically significant rise in deaths due to cerebrovascular disease has been reported in mortality studies of lead exposure. In one investigation, a cohort of 1,261 white male newspaper typesetters were found to have an elevated risk of death from cerebrovascular disease. No data were available for personal or environmental lead monitoring. From prior studies, it was assumed that the workers had a lead exposure below 50 ug/m^3, the Occupational Safety and Health Administration's Permissible Exposure Limit. No significant rise in malignant or nonmalignant causes of death was reported. However, a significantly elevated standardized mortality ratio for cerebrovascular disease was documented in workers employed for more than 30 years.

Human cancer studies of lead exposure have limitations because the lead compound, route of exposure, and environmental lead concentrations have not been reported. In one study of six lead production plants and 10 battery plants, the incidence of total malignant neoplasms was significantly higher in lead production workers. In another study, the standardized mortality ratio for renal cancers in lead smelter workers was 204%. Although these findings were not statistically significant, animal studies have supported the association between lead exposure and the development of kidney cancers. In yet another study, a significant association was observed between exposure to tetraethyl lead and rectal cancer. Lead has a USEPA WoE classification of B2 (probable human carcinogen).

Manganese (Mn)

Manganese (CAS No. 7439-96-5) is a naturally occurring substance found in various types of rock, and is a trace nutrient in food. In the environment, manganese is combined with oxygen, sulfur or chlorine to form a variety of compounds. Rocks containing manganese are mined for use in the production of steel. Manganese is also used in the production of batteries, pesticides, and fertilizers.

Human exposure occurs through inhalation of fumes or dust (usually in an industrial setting) and by ingestion. Very little manganese is absorbed through the skin. Low concentrations of Mn containing compounds are often present in water. The average concentration of Mn in water is about 0.004 mg/l (milligrams of manganese per liter). The average human intake is about 10 mg/day. About 3 to 5% of ingested manganese is absorbed by the body. When blood levels of iron are low, a greater percentage of the manganese is absorbed. The manganese that is not absorbed by the gastrointestinal tract is eliminated in the feces. When it is inhaled as a fume or dust, much of the Mn is transported to the gastrointestinal tract and ingested. Excess Mn in the blood is removed in the liver and excreted in bile.

While manganese may be beneficial in low doses, exposure in high doses has been shown to cause adverse health effects. Inhalation of large quantities of manganese dust or fumes causes serious and disabling neurological effects. The symptoms of this disease, called manganism, are speech disturbances, mask-like facial appearance, tremors and psychosis.

While inhalation of manganese clearly causes neurological disturbances, there is little evidence that ingestion of food or water containing manganese causes these problems. A study conducted in an area with high concentrations of manganese in water (14 mg/l) found some limited evidence that neurological effects may result from oral exposure to manganese. The similarity in symptoms between ingestion and inhalation suggests that excess oral exposure may lead to neurological injury.

There is no evidence to suggest that manganese causes cancer in humans or laboratory animals. Manganese has a USEPA WoE classification of D (not classifiable as to human carcinogenicity).

Mercury (Hg)

Mercury (CAS No.7439-97-6) is an element found naturally in the environment, usually as a sulfide compound, and as a result of human activities. Mercury has been used in thermometers, barometers, pressure-sensing devices, batteries, electric or mercury lamps, and as a catalyst in the chlorine and caustic soda industry. Man-made releases to the environment are from mining and smelting of mercury ores, industrial processes utilizing mercury, and combustion of fossil fuels. The elderly and the young are considered susceptible to the effects of mercury exposure, with ingestion exposure to contaminated foods being the major source of exposure. High exposures have been seen in persons working in occupations in which mercury is used and in individuals who consume much fish.

Mercury interacts with a number of substances which enhance its toxicity. Potassium dichromate has been shown to increase the toxicity of inorganic mercury in renal slices as determined by renal transport of organic ions. Atrazine, a herbicide, has been shown to promote the toxicity of methylmercury as shown by the deposition of mercury in the liver and the manifestation of neurotoxicity. In addition, dissolved mercury vapor remains in the plasma longer as metallic mercury in the presence of alcohol which prevents its conversion into mercuric ion. Vitamin D, vitamin E, thiol compounds,

selenium, and copper all act as antagonists to the toxic effects of mercury. Pretreatment of rats with zinc has a protective effect from the nephrotoxic effects of inorganic mercury.

Routes of exposure for mercury include ingestion, inhalation, and dermal contact. A high degree of absorption exists with inhalation of metallic mercury vapors, low with ingestion exposure to metallic mercury, and an absorption from 2% to 38% for ingestion exposure to inorganic mercury. Absorption of organic mercury is almost 100% with ingestion, but little is known about absorption following inhalation. Once absorbed, the kidney becomes the organ where metallic, inorganic, and organic mercury are distributed and deposited. Also, metallic mercury is lipophilic which allows it to pass easily through the placenta and the blood-brain barrier. The oxidation of metallic mercury to an inorganic divalent cation in the brain can cause its longer retention there. Inorganic mercury compounds may be distributed to most organs but not to the brain and the fetus due to its low lipophilicity. Organic mercury may also bioaccumulate in the brain and fetus due to its high lipophilicity and due to its conversion to the inorganic divalent cation in the brain and fetus. Metabolism occurs in most tissues with the hydrogen peroxidase-catalase process which permits the oxidation of metallic mercury to the inorganic divalent mercury. This form can also be reduced to metallic mercury. Organic mercury may also be transformed into inorganic divalent mercury. Metallic mercury may be eliminated through the urine, feces, and expired air and inorganic mercury through the urine and feces only. Organic mercury which has not been metabolized may be eliminated through the feces in humans. In animals, elimination of methylmercury is in the feces and phenylmercury is in the feces and the urine. Organic mercury is transformed into the inorganic form and them eliminated.

Adverse health effects from mercury ingestion exposure have generally been examined in animals with some effects observed in humans. Cardiovascular effects have been studied in rats exposed to inorganic mercury (mercuric chloride) at 7 mg/kg/day. Following chronic ingestion exposure in drinking water, the rats were found to have a rise in blood pressure and cardiac contractility. A rise in blood pressure was also documented in male rats administered organic mercury (methylmercuric chloride) by gavage at a dose of 0.4 mg /kg/day over a 3-4 week period.

Gastrointestinal effects (forestomach hyperplasia) were reported in male rats exposed by gavage to inorganic mercury (mercuric chloride) at 1.9 or 3.7 mg/kg/day in a two year study. In addition, case studies of humans exposed by ingestion to organic mercury (alkyl) compounds showed that diarrhea, tenesmus (ineffectual and painful straining in stool or urination), irritation, and blisters in the upper gastrointestinal tract occurred in the exposed.

Ingestion of mercuric salts have resulted in adverse effects to the kidney, the critical organ of toxicity. Acute oral exposure to inorganic mercury salts have resulted in the development of the nephrotic syndrome (i.e. albuminuria, hypoalbuminemia) following therapy with inorganic mercury salts. In a case study, the urinary protein secretion rose in a patient who ingested inorganic mercury (mercuric chloride) in a single dose of 15.8 mg/kg. It was thought that this was due to mercury-induced tubular and glomerular pathology. Chronic ingestion by two women of a mercurous chloride-containing laxative was associated with renal failure. Individuals exposed to organic mercury in the form of an ethylmercury fungicide manifested urinary problems of polyuria, polydypsia, and albuminuria.

Immunological effects (suppression of the lymphoproliferative response to T-cell mitogens, concanavalin A, and phytohemagglutinin) were reported in male mice receiving 2.9 or 14.3 mg/kg/day of inorganic mercury (mercuric chloride) in drinking water for seven weeks. Thymus weight and cell number were reduced in mice with exposure to organic mercury (methylmercury) at 0.5 mg/kg /day for 12 weeks when compared to controls.

Neurological effects have been documented in humans following ingestion exposure to mercury. Dementia and irritability developed in two women who ingested inorganic mercury laxative containing 120 mg of mercurous chloride (0.72 mg/kg/day), one for 25 years and the other for 6 years. Both patients died. Neurological disorders were also documented following ingestion exposure to organic mercury (methyl mercury) from contaminated fish found in the Minamata region of Japan. Neurological symptoms consisted of prickling, tingling sensation in the extremities; impaired peripheral vision, hearing, taste, and smell; slurred speech; unsteadiness of gait and limbs; muscle weakness; irritability; memory loss; depression; and sleep difficulties. High levels of methylmercury were reported in the hair and brains of the affected. A similar epidemic of neurologic disorders also occurred in Iraq. Over 500 persons died and 6,000 required hospitalization from central nervous system failure after bread made from wheat and other cereals contaminated with a methylmercury fungicide were ingested.

Reproductive effects have also been reported with ingestion of mercury. A 31-year old women attempted to end her pregnancy by ingesting inorganic mercury (mercuric chloride) at 26 mg/kg in week 10 of her pregnancy. Thirteen days later, she had a spontaneous abortion. The cause of the abortion was not known with certainty. Abortions and a reduction in the mean litter size were two dominant outcomes noted with oral exposure to organic mercury in animals. Mating occurred between male rats and unexposed female rats following 5-7 days of oral gavage doses of 1, 2.5, or 5 mg/kg/day of organic mercury (methylmercuric chloride). A dose-related decline in mean litter size was seen after the treatment of the parent male rat.

Developmental effects have additionally been seen with exposure to inorganic and organic mercury. Single oral gavage doses of 2.5 - 63.0 mg/kg of inorganic mercury (mercuric acetate) was administered to pregnant hamsters. At 5 mg/kg, a reduction in crown-rump length was seen while the incidence of resorption rose at 22 mg/kg. At higher doses, retarded or edematous embryos were reported. Organic mercury (alkylmercury compound) was utilized as an antifungal agent for grain, which was subsequently ingested. As a result, pregnant Swedish women in 1952 experienced intrauterine toxic effects. At birth, one infant had brain damage manifested by mental retardation, incoordination, and inability to move. In 1955, 22 infants, whose mothers had eaten fish contaminated with methylmercury during pregnancy, were found to have brain damage in an outbreak in Minamata, Japan. In Iraq (1956 and 1960), ingestion of wheat flour, originating from seeds treated with ethylmercury p-toluene sulfonanilide, proved fatal to 14 out of 31 women who ingested the wheat flour. Infants had severe brain damage at birth. In another methylmercury outbreak in Iraq (1971-1972), follow-up studies revealed more moderate effects of delayed development, subtle neurologic abnormalities, and psychomotor retardation at lower levels of exposure. Continued investigation of the 1971 Iraqi exposure showed that the frequency of neurological symptoms in children rose with a rise in the maternal exposure level. Paresthesia was the symptom most frequently reported in mothers. The hair levels of mercury in the

mothers of 5 of 14 Iraqi children with severe psychomotor retardation were between 165 and 320 ug/g. The hair levels of mercury, in mothers of 3 of 14 children with moderate psychomotor retardation, ranged between 18.0 - 67.6 ug/g. Children with the most severe disorders received exposure to methylmercury through the maternal pathway in the second trimester of pregnancy.

Genotoxic effects have also been observed with ingestion exposures. A positive association was detected between mercury levels and structural and numerical chromosome aberrations in the lymphocytes of 23 persons, who had ingested mercury-contaminated fish. A rise in the incidence of sister chromatid exchange was also seen in persons who consumed mercury-contaminated seal meat. Due to methodological problems, a definitive statement could not be made regarding the outcome of these studies.

Inorganic and organic mercury ingestion has also caused human deaths. Nine of eighteen persons, who attempted suicide ingesting mercuric chloride, died. The fatal doses were between 29 to >50 mg/kg of mercuric chloride. Gastrointestinal lesions (e.g. mild gastritis to necrotizing ulceration of the mucosa) and renal involvement (e.g. albuminuria, anuria, and uremia) were frequent findings in these cases. In addition, death has generally been due to shock, cardiovascular collapse, acute renal failure, and severe gastrointestinal damage. The dose of mercury chloride, which is lethal, is judged to be between 10 - 42 mg/kg for a 70 kg adult. Deaths were also reported following ingestion of acute lethal doses of organic mercury compounds (e.g. ingestion of methylmercury-contaminated fish in Minamata, Japan, and grains contaminated with methyl- and ethylmercury in Iraq).

Cancer in the form of leukemia has been reported in farmers who used inorganic mercury as fungicides as measured by mercury levels in hair. The study, however, had its limitation due to methodological problems. No tumors or precancerous lesions were seen in rats receiving organic mercury (phenylmercuric acetate) in their diet for 2 years. The animals received 0.04-66.0 mg/kg/day of phenylmercuric acetate. As with the human study, this animal study had its limitations.

Inhalation exposures have also resulted in adverse health effects. Metallic mercury vapors were accidentally inhaled by workers at an estimated concentration of 1.1 - 44.0 mg/m^3 for 4-8 hours. The workers manifested chest pains and respiratory effects which included dyspnea, cough, hemoptysis, impaired pulmonary function, diffuse pulmonary infiltrates, and evidence of interstitial pneumonitis. No respiratory effects were seen in four men who inhaled organic mercury (methylmercury) for several months. The study did have its limitations which prevented any definitive conclusions.

Cardiovascular effects have also been seen with inhalation exposure. A rise in blood pressure has been noted following acute inhalation exposure to metallic mercury vapors. Chronic exposure to mercury vapors in chlorine-alkali workers was followed by a significant rise in heart palpitations. It was believed that mercury created a temporary disturbance in the baroreflex pathway which controls blood pressure and heart rate. Cardiovascular effects were not detected in four men exposed to organic mercury dust (methylmercury) for several months.

Gastrointestinal effects have additionally been observed with inhalation exposure. Anorexia, intermittent abdominal cramps, mild diarrhea, painful mouth, and bleeding gingiva were reported in teenage girls two weeks following an acute inhalation exposure to metallic mercury vapors. The dose was not specified. Following an acute inhalation exposure to organic mercury (ethylphenyl mercury),

a male patient manifested a swollen mouth, reddened and tender gums, decayed teeth, thin blue line at the gums, and an infected and swollen throat. Following chronic inhalation of organic mercury (methylmercury), four men exhibited no gastrointestinal effects. The dose of mercury was not specified.

Hematological effects have been documented following acute and chronic exposure to metallic mercury. Moderate to high leukocytosis with neutrophilia has been detected following acute inhalation exposure to metallic mercury vapor. A significant reduction in hemoglobin and hematocrit and a rise in mean corpuscular hemoglobin concentration were demonstrated in study volunteers with dental amalgam when compared to controls without dental amalgam. At inhalation exposures of 0.106 - 0.783 mg/m³ of mercury vapors, a significantly high rise in α_2 macroglobulin and ceruloplasmin (α-globulin protein involved in storage and transport of copper) was observed in workers as compared to unexposed workers.

Musculoskeletal effects have also been detected with inhalation exposure. Two workers chronically exposed to high unspecified concentrations of inorganic mercury (mercury oxide) for 60-80 hours a week manifested debilitating muscular pains of the lower back and extremities, severe burning sensation of the feet and lower legs, muscle cramp, and muscle fasciculation. The symptoms abated within three months following termination of exposure. Organic mercury inhalation exposure (alkyl mercury) has produced muscle fasciculation and absence of deep reflexes in arms.

Hepatic effects have also been seen with inhalation exposure. Acute poisoning of a child followed exposure to metallic mercury vapors. Biochemical change (e.g. rise in serum glutamic-pyruvic transaminase, ornithine carbamyl transferase, and serum bilirubin levels), and a reduction in the synthesis of hepatic coagulation factors were seen.

Renal effects have been documented with inhalation exposure to metallic mercury. The kidney has been the target organ for this exposure route. Acute inhalation exposure has produced a rise in creatinine elimination, proteinuria, hematuria, and degeneration of the convoluted tubules of the kidney. Chronic inhalation exposure to metallic mercury vapors generally occurs in the occupational setting, particularly in chlorine-alkali factories. Effects from chronic exposure to metallic mercury include glomerular dysfunction, acute nephrotic syndrome (e.g. proteinuria and casts in urine), and edema. Low-level chronic inhalation exposure to estimated air concentrations of 0.05 - 0.5 mg/m³ of metallic mercury vapor have produced symptoms of mild proteinuria and enzymuria in exposed workers. An autopsy of a male exposed to acute high levels of organic mercury (alkyl mercury) demonstrated necrosis of tubule epithelium, swollen granular protoplasm, and nonstainable nuclei in the kidney.

Dermal effects (i.e. skin rash) have been seen with inhalation exposure to metallic mercury vapor up to 1.0 mg/m³ for two weeks and intermediate exposure to an unspecified concentration for two months. Ocular effects of conjunctivitis, double vision, and haze on the surface of the lenses have also been reported.

The workers with average blood and urinary levels of 14 ug/L and 73.2 ug/L, respectively, following a 20-year exposure, manifested significantly lower immunoglobulin levels when compared to unexposed controls. The plant mercury levels were between 0 to 6.6 mg/m³.

The most critical target organ for inhalation exposure to metallic mercury vapor is the central nervous system. Following acute inhalation of mercury vapor, symptoms of tremors, irritability (with insomnia and emotional instability), decline in motor function and muscle reflexes, headaches, and

abnormal electroencephalograms were seen. Workers with less than an eight hour exposure to a mercury level of 44 mg/m³ demonstrated long-term feelings of irritability, and lack of sexual desire. A syndrome similar to amyotrophic lateral sclerosis has been observed following an acute two day inhalation exposure to high levels of mercury. The condition reversed itself following termination of exposure. Chronic exposures to low levels of metallic mercury in the occupational setting have produced tremors, irritability, poor concentration, short-term memory deficits, performance decline in psychomotor skills, and a reduction in nerve conduction. Most studies have demonstrated that motor system disturbances reversed itself after exposure stopped. However, cognitive impairments, particularly memory deficits, may not be reversible. Chlorine-alkali workers with low air level exposures to inorganic mercury for at least five years were found to have a rise in subjective measure of memory disturbances and sleep disorders when compared to controls. In thermometer plant workers with breathing zone air concentrations of mercury vapors ranging from 0.026 - 0.27 mg/m³, the incidences of static tremor and difficulty with heel-to-toe gait were higher in workers when compared to controls. In contrast, no significant differences in tremors were detected in chlorine-alkali workers exposed to 0.075 mg/m³ of mercury when contrasted to unexposed workers. Chlorine-alkali plant workers with a mean exposure of 15.6 years to metallic mercury vapors had evidence of slower electroencephalogram studies. In addition, investigations of dentists with chronic low level exposures to mercury vapor showed a high prevalence of polyneuropathies (i.e. reduced motor and sensory nerve conduction velocities). Twenty-eight subjects exposed to 20 - 96 mg/m³ of mercury vapors were also observed to have a decline in sensory nerve conduction. Four men, with acute inhalation exposure to dust containing organic mercury (methylmercury), manifested symptoms of numbness and tingling of limbs, unsteadiness in gait, performance difficulties for fine movements, irritability, and constricted visual fields. After a two-year cessation of the occupational exposure, full recovery from symptoms had not occurred.

A number of human studies showed no reproductive effects with regard to fertility following intermediate or chronic exposure to metallic mercury. In one study, the mercury concentrations of urine (before pregnancy) were examined in fathers, who were employed in chlorine-alkali plants and had been exposed to metallic mercury. A positive correlation was found in the mercury concentrations of urine and the rate of spontaneous abortion.

In a Department of Energy retrospective cohort study, no association was found between the inhalation exposure of the father to metallic mercury and the rates of major fetal malformations or serious childhood illnesses (reproductive effects). In one case study, a woman experienced a spontaneous abortion in her first pregnancy and the death of her newborn in the second pregnancy while chronically exposed to mercury vapors. She delivered a normal child after recovering from the mercury poisoning.

Studies of genotoxic effects from metallic mercury and from organic and inorganic mercury exposures have been inconclusive. Chromosome breaks were detected in four workers exposed to high concentrations of metallic mercury and in 18 workers exposed to a mixture of mercuric chloride. Concentrations of mercury at the work area were between 0.15 to 0.44 mg/m³. Methodological problems prevented a conclusive statement about the outcome. No rise in the frequency of structural aberrations were seen in 22 workers who received exposure to mercury vapors. The average length of exposure was four years.

Deaths have been reported with exposure to metallic mercury vapor due to severe pulmonary tissue damage that compromised respiratory function. In addition, organic mercury vapor exposures may also be followed by death. Two months after he had cleaned up a spill of seed dressing liquid containing organic mercury (alkyl mercury), a 41 year old male died. Autopsy showed pronounced gastrointestinal disorders.

There is no evidence linking the inhalation of metallic mercury and the development of cancer. Excess deaths from lung cancer were, however, observed in Swedish chlorine-alkali workers 10 years following long-term, high-level exposure to metallic mercury. The conclusions of the study were not definitive since the workers had simultaneous exposure to asbestos and the smoking status of the group had not been quantified.

Some effects have also been reported with dermal exposure. Gastrointestinal effects in the form of necrosis, swelling, and ulceration of the intestinal mucosa; vomiting; and diarrhea were reported in a female who placed a mercury perchloride tablet in her vagina. Hypersensitivity to mercury has also occurred in patients with stomatitis forming at the sites of contact with amalgam fillings. The stomatitis receded with the removal of the amalgam fillings. Renal effects have also been seen with dermal exposure. A woman who received inorganic mercury in the form of mercuric chloride (93 mg/kg) in the vagina, developed pathology of the kidney (i.e. congested medulla; pale and swollen cortex; and extensive necrosis, degeneration, and calcification of tubular epithelium). Tests which included electron microscopic studies were done on eight kidney patients with nephrotic syndrome. The patients had applied skin-lightening creams with an unspecified form of mercury. The nephrotoxicity that resulted was believed to be due to an immunological component.

Dermal effects have also been seen with inorganic and organic mercury exposures dermally. Contact dermatitis has been reported in a number of case reports involving acute or occupational exposure to inorganic mercury. In addition, children who had repeated dermal exposures to mercury-containing products developed a papular rash, bright red finger tips, and sheets of peeling skin. Rashes and blisters to the skin have also been reported with organic mercury (methylmercury or phenylmercury) exposure.

Neurological symptoms (i.e. tremors of the face or extremities, sudden jerky movements, lack of muscle tone, impaired reflexes, seizures, light sensitivity, deafness, insomnia, and irritability have been associated with dermal exposure to inorganic mercury. This complex neurological syndrome is know as a acrodynia. A four month old child developed acrodynia with coma, paralysis of one side of body, generalized muscle stiffness, and muscular tremors 12 days after the application of yellow mercuric oxide ointment for eczema.

No animal or human studies were found with regard to dermal exposure and the development of cancer.

Elemental mercury has a USEPA WoE classification of D (not classifiable as to human carcinogenicity). Mercuric chloride has a USEPA WoE classification of C (possible human carcinogen).

Nickel (Ni)

Nickel (CAS# 7440-02-0) is a hard metal found in a number of ores, often combined with sulfur, antimony and arsenic and is often used in metal alloys such as stainless steel. Nickel is also used in a number of industrial processes like electroplating, anodizing and casting.

Humans are exposed to nickel by inhaling nickel dust or fumes (usually in an occupational setting), by ingesting nickel in food and water, and from skin contact. For most people, ingestion of food containing nickel is the main source of exposure. The average person takes in .3 mg of nickel per day from food. Typical drinking water contains about .005 mg/l nickel. About 10% of the nickel ingested is absorbed by the intestinal tract. When nickel fumes or dust are inhaled, a larger percentage of the nickel is absorbed. The percentage absorbed depends upon the size and type of particle inhaled. When nickel comes into contact with the skin, it may or may not be absorbed, depending upon what chemicals are combined with the nickel.

The primary health effect from ingestion of excess nickel is gastrointestinal distress including diarrhea, vomiting, abdominal cramps and nausea. When skin contact with nickel is made, a skin allergy often develops resulting in itching, redness and a rash. The most serious effects from exposure to nickel result from inhalation of nickel fumes or dust. Inhalation of nickel in the short run can result in cough, shortness of breath, and fluid in the lungs. Inhalation of nickel is known to cause damage to a developing fetus and can result in cancer.

Nickel is known to be a human carcinogen when inhaled, however, there is no evidence that it causes cancer as a result of ingestion or dermal contact. Nickel has a USEPA WoE classification for inhalation of A (human carcinogen).

Nitrate (NO_3)

Nitrate (CAS No. 14797-55-8) and ammonia are forms of nitrogen which are commonly found in the environment. Ammonia is a component of human and animal waste and penetrates the soil from improperly functioning septic systems, animal feedlots, or manure which has been applied as fertilizer or placed in storage. Microorganisms then transform the ammonia to nitrate. Nitrogen, a component of fertilizer, is also transformed into nitrate. As the nitrate level in the soil exceeds what is needed by plants, water from rainfall or irrigation transports the nitrate (leaching) through the soil into groundwater (which may be used for drinking). This problem is more likely to occur in the rural water supplies.

When ingested, nitrate may be converted by the bacteria in the stomach to nitrite. Because of the low acidity level in the stomachs of infants, bacterial growth is encouraged which enhances the conversion of nitrate to nitrite. The nitrite then reacts with the hemoglobin in blood to form methemoglobin which is unable to carry oxygen. This results in oxygen starvation with death from suffocation in extreme cases. This condition is most often seen in infants. Other nitrogen compounds in the body may react with nitrites to form substances known as N-nitrosamines which have been determined to be carcinogenic in animals. Although inconclusive, epidemiologic studies have shown a possible association between high level exposures to nitrate and nitrites and the development of stomach and esophageal cancer. Nitrate is presently being assessed by USEPA for human carcinogenic potential.

Zinc (Zn)

Zinc (CAS No. 7740-66-6) and compounds containing zinc are found naturally in the air, water, soil and foods. Zinc has many industrial uses and is a component in several metal alloys including brass. Zinc is also an important food element needed by the body in low doses, but can be harmful if too much is taken in. The average daily intake of zinc is between 7 and 16 mg per day. The Recommended Daily Allowance of zinc is 15 mg per day for men and 12 mg per day for women.

The primary exposure routes for zinc are ingestion and inhalation. About 20-30% of ingested zinc is absorbed by the body when ingested. Most zinc is unabsorbed and passes in the feces. The greater the quantity of zinc present in the blood and tissues, the less it will be absorbed. There is some evidence to indicate that high calcium intake may also decrease the amount of zinc absorbed by the body. Zinc may also be absorbed through inhalation of zinc containing fumes, usually in an industrial setting. Very little zinc is absorbed through the skin.

Zinc toxicity from excessive ingestion is unusual, but gastrointestinal distress has been reported following large oral exposure to zinc. The major health effects of drinking water with too much zinc are digestive problems. These problems include intestinal cramps and diarrhea. Higher doses of zinc that may occur from taking too many dietary supplements may result in more acute symptoms including nausea, vomiting, and intestinal bleeding.

There is no evidence that zinc causes cancer or birth defects in humans. Zinc has a USEPA WoE classification of D (not classifiable as to human carcinogenicity).

Organic Chemicals of Concern

Benzene (BNZ)

Benzene (CAS No. 71-43-2, C_6H_6) is an aromatic hydrocarbon which occurs naturally in the environment and in the man-made form. Synonyms include benzol, coal naphtha, phenyl hydride, and pyrobenzol. Benzene is utilized mainly in the manufacture of ethylbenzene (intermediate in synthesis of styrene for plastics), cumene (for the manufacture of phenol and acetone), and cyclohexane (for nylon resins). Environmental emissions of benzene, which are mainly airborne, arise from gasoline vapors, auto exhaust, and industrial production and applications. Benzene is discharged into water and soil from industry, landfills, and underground storage tank leaks. Emissions from motor vehicles, tobacco smoke, hazardous waste sites, industry, and consumer use of products such as paints and adhesives are the main sources for human exposure. The highest exposure concentrations of benzene are found in industries utilizing benzene and benzene-containing products.

A number of substances are known to interact with benzene and, therefore, influence its metabolic activity and toxicity. Ethanol has been shown to intensify the metabolism of benzene and the toxic effects of anemia, lymphocytopenia, and atypical cell morphology in animals. In addition, when animals have

been pretreated with phenobarbital, benzene hydroxylation has also been shown to be activated. In contrast, toluene inhibits the breakdown of benzene to phenol, one of benzene's toxic metabolites. In-vitro experiments of mouse liver microsomes have demonstrated that carbon monoxide, aniline, aminopyrine, cytochrome C, and metyrapone have also been shown to inhibit benzene metabolism.

Routes of exposure include inhalation, ingestion, or dermal contact with human absorption of benzene occurring by these three routes. Less benzene is absorbed by dermal contact than with inhalation and ingestion exposures. Benzene has been determined to be distributed in the bile, blood, brain, fat (abdominal), kidney, liver, stomach, and urine of humans following inhalation exposure and in the adipose tissue, blood, bone marrow, kidney, liver, and mammary gland of animals with ingestion. In addition, dermal exposure studies in animals have demonstrated distribution in the kidney, liver, and skin. No evidence was found to indicate that the route of exposure influences benzene metabolism. In humans and animals, benzene is metabolized mainly by the liver's cytochrome P-450 system with toxicity believed due to benzene metabolites (e.g. hydroquinone, phenol, and muconic dialdehyde). Following inhalation in humans, benzene may be excreted unchanged by exhalation or through urinary output of conjugated derivatives (sulfates and glucuronides). Human dermal exposures have also resulted in urinary excretion of benzene. With ingestion exposures in animals, exhalation and urinary excretion have also been reported.

Documented research and reports on health effects from ingestion exposure are sparse compared to the documentation on inhalation exposure. Effects have been reported in humans, often without exposure concentration levels attributed to the specific health effect. For example, gastrointestinal effects, in the form of gastritis and later pyloric stenosis, have been reported in an individual who swallowed an unspecified amount of benzene. In another case, an accidental poisoning by ingestion resulted in an odd skin condition in the patient in which swelling and edema of the skin was observed. Symptoms of central nervous system toxicity (giddiness, vertigo, muscular incoordination, and unconsciousness) have been documented after a single ingestion dose of benzene at 125 mg/kg. Before 1913, leukemia was treated with oral benzene in gelatin capsules. The dosage began at 43 mg/kg/day and rose to 71 mg/kg/day for unspecified durations. These patients manifested a decrease in white blood cell counts and multiple hemorrhages resulting in anemia. It was not clear if the benzene treatment caused the effects or if they were due to the leukemic condition. In addition, fatal oral doses of benzene have been estimated to be 125 mg/kg for a 70-kg weight person. Death has been caused by respiratory arrests, central nervous system depression, or collapse of the heart. Accidental ingestion or attempted suicide have resulted in manifestations of staggering gait, vomiting, shallow and rapid pulse, somnolence, and loss of consciousness with delirium, pneumonitis, collapse, central nervous system depression, coma, and death. Visual disturbances and/or feelings of excitement or euphoria which may suddenly reverse to weariness, fatigue, sleepiness, convulsion, coma, and death have also been observed with lethal doses. No other effects have been documented for humans following ingestion exposure.

The hematological system is a major site of benzene toxicity from inhalation exposure. Exposure to benzene for a duration of several months to several years may result in a progressive sequence of diseases of greater severity, dependent upon concentration of exposure. Exposure to benzene for several months to several years may produce abnormal numbers of circulating blood cells and pancytopenia

(decrease in red and white blood cells and platelets due to pathology in the red bone marrow). Aplastic anemia is a more serious effect observed when the bone marrow ceases to function. With further progression, preleukemia (myeloblastic dysplasia) or acute leukemia may occur. Aplastic anemia is often a precursor of the more serious condition of acute myelogenous leukemia.

Health effects have been studied in a number of studies of workers with inhalation exposure to benzene for intermediate and chronic periods. Occupational studies may lack controls and adequate exposure data and may have multiple chemicals present, but they have helped to demonstrate the gross effect of dose in the development of anomalies.

In one investigation of refinery workers, no adverse health effects to the blood were observed at low levels of exposure to benzene (0.5 ppm) for a duration of from 1-21 years. Ten workers of a chemical factory, however, who were exposed over a duration of less than 10 years to benzene levels of 25 ppm or greater, were found to have a rise in the mean corpuscular volume at the termination of the high exposure period. At 75 ppm, a significant reduction in the red and white cell counts and hemoglobin was reported in workers of the rubber industry after an exposure period of 10 years. These changes disappeared when the exposure concentrations subsequently fell to 15-20 ppm in later years.

With a rise in the concentration levels or duration of exposure, more severe effects have been reported in a study of Turkish shoe manufacturing workers exposed to a maximum of 210 ppm of benzene between 4 months and 17 years. Hematological abnormalities were seen in 51 out of the 217 Turkish male workers and included loss of leukocytes, leukopenia, thrombocytopenia, pancytopenia, and eosinophilia. In another shoe industry cohort with exposure concentrations of 210-640 ppm for 4 months to 15 years, thirty-two workers, demonstrated pancytopenia with abnormal bone marrow function. In one other investigation, intensive studies of the blood were done on 102 out of 332 workers exposed to 11-1,060 ppm of benzene for 6 months to 5 years in a study of printing industry workers. Of the 102, 22 were found to have pancytopenia or other clinical manifestations. A positive correlation has also been reported between the prevalence of adverse health effect and concentration of exposure to benzene in shoe factory workers in a Chinese study. Four out of 211 workers, who were exposed to a mean concentration of 324 ppm for 8 months, developed aplastic anemia. In addition, preleukemia or acute leukemia was reported in 26 out of 28,500 workers exposed to benzene at 210-650 ppm for a period of from 1 to 15 years. Further indications of a dose-response effect were observed in a follow-up study done in 44 pancytopenic patients who received benzene exposure (150-650 ppm) from adhesives for a period of from 4 months to 15 years. Of the 44, 23 experienced complete remission, 14 died of complications from the pancytopenia, 1 died of myeloid metaplasia, and 6 developed leukemia. With the reduction in concentrations of benzene, less serious effects were noted.

Benzene exposure by inhalation has also been shown to influence acquired immunity, both humoral and cellular. The alteration of the antibody levels in the blood (humoral immunity) and the modification of circulating leukocytes (cellular immunity) are examples of the effects to the immunological system from benzene exposure. A study of benzene exposure at 3-7 ppm in painters, who had simultaneous exposures to toluene and xylene for 1-21 years, resulted in findings of a rise in serum immunoglobulin levels for IgM and a reduction for the IgG and IgA levels (humoral immunity). Due to multiple chemical exposures received by the painters, the changes could not be attributed to benzene

alone. Reports of reduced circulating leukocytes (cellular immunity) have been documented in a number of benzene exposure studies which were previously described in the hematological effects section. In addition, the leukocyte alkaline phosphatase activity rose in workers with chronic benzene exposure at around 31 ppm.

Acute inhalation exposure to benzene has been shown to produce neurological effects (drowsiness, dizziness, headache, vertigo, tremor, delirium, and loss of consciousness) at levels from 300 to 3,000 ppm. At a higher concentration (approximately 20,000 ppm), an acute exposure of 5-10 minutes can produce death. In nonlethal cases, individuals have manifested headaches, nausea, staggering gait, paralysis, convulsions, and unconsciousness at levels of 700-3,000 ppm. Chronic benzene exposures have also been associated with neurological deficits. Eight patients (six with aplastic anemia and two with preleukemia) with prior work-related exposure to adhesives and solutions containing 9-88% benzene were evaluated. Four of the six with aplastic anemia were found to have neurological abnormalities (global atrophy of the lower extremities and distal neuropathy of the upper extremities). The concentration of benzene in air at this site was 210 ppm or higher. Effects of chronic benzene and toluene exposure were also investigated in 121 workers. The exposure duration to benzene was 2-9 years with four of these years at concentrations of from 6-15.6 ppm (20-50 mg/m^3). Toluene concentrations at this time did not exceed 5-mg/m^3. Seventy-four of the workers had complaints of frequent headaches (generally at the completion of a work day), tiring easily, sleep problems, and memory loss.

Developmental effects from inhalation exposure to benzene have been inconclusive due to study limitations (e.g. multiple chemical exposure, insufficient exposure data). One study reported higher occurrences of chromatid and isochromatid breaks and sister chromatid exchange in lymphocytes for the children of mothers, who had received inhalation exposure to benzene and other organic solvents during pregnancy.

Reproductive effects have been noted with inhalation exposure to benzene. Thirty women, with symptoms of toxic effects from benzene exposure, were studied. Twelve of the women were found to have menstrual disorders. Of the 12, 10 were married with two of these women having experienced spontaneous abortions. Benzene concentrations in air were presumed to be greater than 1 ppm. Menstrual cycle abnormalities have also been shown in other studies. These studies were limited due to the presence of other chemicals besides benzene and lack of exposure data.

In addition, genotoxic effects have been reported with benzene inhalation exposure, especially at levels causing abnormalities to the blood. Fifty-two workers were exposed to benzene concentrations less than 10 ppm for 1 month to 26 years. A significant rise in the frequency of chromosomal abnormalities were found in peripheral lymphocytes of workers when compared to 44 controls. Other factors such as radiation or chemicals may have facilitated the development of the chromosomal deviations. In addition, the study lacked a baseline blood workup in the workers. In one case study, a worker was reported exposed for 18 months to benzene at levels of 200-1640 mg/m^3 (62.6-513.4 ppm). The individual developed severe anemia, neutropenia, and thrombocytopenia and subsequently was diagnosed as having leukemia. Bone marrow specimens showed an excess number of D-group chromosomes. In another example, metaphase chromosome spreads were examined in 48 out of 66 benzene-exposed persons and

29 out of 33 controls. The incidence of metaphase chromosome spreads was found to be slightly higher in the workers exposed to benzene at levels of 10-100 ppm as compared to a group of controls.

Studies of the association between exposure from benzene and the development of neoplastic disease have had deficiencies in the study methodology (e.g. inappropriate sampling techniques) and with the inadequate exposure data. However, a cause-effect relationship has been established between benzene and the development of acute myeloid leukemia (AML), as evidenced by the consistently higher incidence of AML in workers with excess benzene exposure. With AML, a decline is seen in the production of normal erythrocytes, granulocytes, and platelets which subsequently causes death by anemia, infection, or hemorrhage. Other leukemias and lymphomas have been associated with benzene exposure, but only the association between excess benzene exposure and AML has been consistently observed. Research was done on 3,536 male chemical workers with cumulative benzene exposures of less than 180 ppm (1,809 workers), 180-719 (1,047 workers) or equal to or greater than 720 ppm (680 workers). The 680 workers in the highest category of exposure were four times more likely to develop leukemia or other lymphopoietic cancers. None of the leukemias were of the myelogenous type. The research demonstrates the dose-response effect of benzene exposure. In another study, mortality was examined in 594 white males with occupational exposure to benzene in a chemical manufacturing facility with varying employment periods between 1940 to 1970. The time-weighted average exposure to benzene was 0.1 to 35 ppm. Three cases of myelogenous leukemia (as compared to an expected of 0.8 cases) developed, with one of these cases having an exposure level to benzene of less than 2 ppm. This study demonstrated that a risk of leukemia is present even at a low exposure concentration. In a retrospective study of 26,319 benzene factory workers in China, thirty cases of leukemia (23 of them AML) were discovered. Workers with leukemia had mean benzene exposure levels between 3 to 313 ppm, with most workers exposed at levels between 16 to 157 ppm. And, finally, in another epidemiologic study, no leukemia deaths were observed at benzene exposure concentrations of less than 1 ppm. The study cohort included 454 workers of a Texas refinery, employed in the period between 1952 and 1978. The refinery workers had a median benzene exposure of 0.14 ppm while employees of benzene-related units had 0.53 ppm levels of exposure. The relative risk for all cancers within this group was not significantly different from non-exposed comparison groups. Other epidemiologic studies for inhalation exposure, which have not been discussed, have supported the causal association between benzene exposure and the development of neoplastic disease, particularly AML. Benzene is one of the few substances in which human evidence is sufficient to categorize it as a human carcinogen. Benzene has an USEPA WoE classification of A (human carcinogen).

Human studies of human health effects from dermal exposure to benzene are even rarer than for ingestion exposure. Benzene is a skin irritant for humans, causing erythema, vesiculation, and dry and scaly dermatitis due to the defatting of the keratin layer. In addition, genotoxic effects have been observed with inhalation exposures which may have had a simultaneous dermal exposure.

Bromodichloromethane (BDCM)

Bromodichloromethane (CAS No. 75-27-4, $CHBrCl_2$) is a volatile halogenated hydrocarbon (trihalomethane) which is formed as a by-product from chlorination of water. Synonyms include

dichlorobromomethane, monobromodichloromethane, and methane, bromodichloro-. BDCM is generally used as an intermediate in the synthesis of other chemicals and as a laboratory reagent. Domestic water supplies contaminated with organic material require added chlorination resulting in elevated levels of BDCM and other trihalomethanes. Higher concentrations of exposure to BDCM are seen in individuals consuming or exposed dermally to this water. Even under normal conditions, individuals with health problems who consume a large quantity of water (diabetics) or who are exposed by inhalation and dermal contact in swimming pools will have potentially higher exposures to BDCM than others.

A study of rats demonstrated BDCM's interaction with acetone. The toxic effects on liver and kidneys were enhanced when rats were given oral BDCM following the ingestion of acetone.

The routes of exposure for BDCM include inhalation, ingestion, or dermal contact. No studies were available which dealt with human absorption, distribution, and excretion of BDCM following inhalation, ingestion, or dermal contact. With ingestion exposure, examination of female monkeys demonstrated almost complete gastrointestinal absorption. In rodents, BDCM was administered by gavage and remained in the stomach for a period of time before being distributed to the fat, liver, muscle, and other tissues. The metabolic pathways for BDCM in humans have not been established. However, animal studies have shown that carbon dioxide is the major end product in mice. In rats, mice, and monkeys, excretion was by exhalation following ingestion and, to a lesser degree, through the urinary and fecal routes. In rats, 42% of BDCM was expired unchanged with 14% expired as carbon dioxide.

Only animal studies were available for examining the consequences to health from ingestion exposure to BDCM. A number of body systems have been shown to be affected by oral exposure dependent upon the concentration of exposure.

In one study, rats who received 130 mg/kg/day of BDCM in their diet for two years had no hematological changes when compared to control animals. Similarly, a dose of 213 mg/kg/day of BDCM in drinking water for a period of 90 days produced no adverse effect to lymphocyte levels in male or female rats. Hematological effects have been observed at relatively high levels of oral exposure. After a single dose of BDCM at 390 mg/kg, hemoglobin and hematocrit levels decreased significantly in male rats.

The liver has been shown to be sensitive to the harmful effects of BDCM at various concentrations. In one rare finding, a low dose of 7 mg/kg/day resulted in significant effects to the liver. In subchronic rodent studies of 10 to 14 days, slight effects (mild increases in weight and minimal microscopic changes in the liver) have been seen at 37 mg/kg/day and 50 mg/kg/day. These effects become more noticeable at doses of 125 to 300 mg/kg/day. Liver damage in rodents have also been observed at doses ranging from 50 to 200 mg/kg/day for long-term studies. At acute, single doses around 1,250 mg/kg or higher, characteristic signs (increased liver weight, pale discoloration of the liver, rise in levels of hepatic tissue enzymes in serum, reduction in secreted hepatic proteins in blood, and focal inflammation or degeneration of the liver) have been observed. At this concentration level, death has resulted within two weeks.

The kidney is also an organ sensitive to BDCM oral exposure. In long-term studies, focal necrosis of the proximal tubular epithelium was observed in male mice exposed for 13 weeks to doses of 100 mg/kg/day with cytomegaly following chronic exposure of 25 mg/kg/day. Cytomegaly and

nephrosis were reported in rats chronically exposed at 50 to 100 mg/kg/day. Doses of from 74 to 148 mg/kg/day resulted in a reduction in the uptake of p-aminohippurate into kidney slices from mice, indicating a decrease in the kidney excretory flow. A dose of 200 mg/kg/day for 10 days resulted in a rise in the renal weight of rats. In subchronic studies (14-day), a rise in the blood urea nitrogen has been noted in mice receiving 250 mg/kg/day of BDCM.

Immunological effects have not been examined in detail, but effects have been reported with oral exposure. In one study, mice received BDCM for 14 days. Females were found to have a reduction in the number of antibody-forming cells in the spleen and in the hemagglutination titer at doses of 125 to 250 mg/kg/day.

Neurological outcomes have also been observed. One study explored the long-term effects on behavior from BDCM ingestion exposure. Mice were examined two days after the final doses of BDCM. No effect was observed on tests of coordination, strength, endurance, or exploratory activity at doses of 1.2 to 11.6 mg/kg/day for 14 to 90 days. Passive-avoidance learning was not influenced by a 90 day exposure to BDCM at 100 mg/kg/day. Acute effect on operant behavior (decreased pressing of a lever that delivers food) was seen at 100 or 400 mg/kg/day for 90 days, but these effects were not lasting. Oral doses for rodents of 150 to 600 mg/kg frequently result in signs of acute central nervous system (CNS) depression (lethargy, labored breathing, sedation, and flaccid muscle tone) with reverse of these signs after several hours.

Developmental effects (sternebral anomalies) were observed in fetuses of female mice exposed orally to 50 to 200 mg/kg/day on days 6 to 15 of gestation (when organogenesis occurs). Maternal toxicity (40% reduction in body weight gain) was also observed.

Genotoxic effects of a rise in occurrence of sister chromatid exchange (SCE) in mice have been detected. A significant rise in SCE s have been demonstrated in animals receiving doses of 50 or 100 mg/kg/day for four days of BDCM. Doses of 200 mg/kg/day for four days resulted in death.

The acute dose, which is lethal to 50% of the exposed rodents, ranges between 400 and 1000 mg/kg. Pathological changes detected in acutely poisoned animals included fatty infiltration of liver and hemorrhagic lesion in the kidney, adrenals, lung, and brain. In a two week, repeated-dose study, a dose of 150 mg/kg/day was lethal to all the animals in the study. Male rodents appeared more sensitive to the lethal effects of BDCM.

No human studies were available which documented the effect of BDCM exposure and the development of cancer with ingestion exposure. However, epidemiologic studies have been done on the frequency of cancer with ingestion of chlorinated water. Because other trihalomethanes are present in chlorinated water, difficulties arise in determining the specific effect of BDCM on the development of cancer. Chronic oral studies of animals have, however, given persuasive evidence that BDCM is carcinogenic. Tumors of the large intestine were reported in male rats exposed to 50 and 100 mg/kg/day and in females at 100 mg/kg/day. Male and female rats exposed to 100 mg/kg/day had a rise in the frequency of liver tumors. Female rats exposed orally to 150 mg/kg/day of BDCM had a rise in the frequency of liver tumors. In mice, renal tumors were detected with oral exposure at 50 mg/kg/day, and hepatic tumors were reported in females exposed at 75 or 150 mg/kg/day. BDCM has an USEPA WoE classification of B2 (probable human carcinogen).

No studies were available in animals or humans for inhalation or dermal exposures.

Carbon Tetrachloride (CCL_4)

Carbon tetrachloride (CAS No. 56-23-5, CCl_4) is a man made chemical which is used primarily in the production of chlorofluorocarbons. In the past, carbon tetrachloride was widely used in industry, medicine and in the home. Synonyms of carbon tetrachloride include tetrachloroethane and perchloromethane. Carbon tetrachloride is very stable once released into the environment and is relatively non reactive.

The routes of exposure to carbon tetrachloride include inhalation of vapor, oral ingestion, and dermal and ocular contact. Most overexposures result from use of carbon tetrachloride as a cleaning fluid.

Carbon tetrachloride is well absorbed by both inhalation and ingestion, with about 60% of the dose absorbed when inhaled and 80% absorbed when ingested. It is also absorbed through the skin, through less readily than from the lung. Once absorbed, it is rapidly distributed by the blood where it concentrates in fat and organs. Carbon tetrachloride is metabolized in the liver by the P-450 cytochrome system. Between 40% and 70% is excreted unchanged in expired air. The remainder is excreted in the urine and feces or is metabolized and excreted as CO_2 or other metabolites.

The primary non carcinogenic health effects from exposure to carbon tetrachloride are central nervous system depression and liver and kidney damage. Evidence of liver damage includes jaundice, swollen liver, and biochemical alterations of the blood. Damage to the kidney and liver is often delayed after exposure. Ingestion or inhalation of carbon tetrachloride may result in death as a result of liver or kidney damage. Fatal doses are in the range of 40-320 mg/kg. If death can be averted, liver and kidney function usually recover within 1 to 2 weeks, and recovery generally appears to be complete.

There is some evidence that indicates carbon tetrachloride as a carcinogen in humans, however, the evidence is not conclusive. Animal studies indicate that it causes liver cancer in laboratory animals. Carbon tetrachloride has a USEPA WoE classification of B2 (probable human carcinogen).

Chlorobenzene (MCB)

Chlorobenzene (CAS No. 108-90-7, C_6H_5Cl) is a chlorinated benzene. Synonyms include monochlorobenzene, benzene chloride, phenylchloride, and chlorobenzol. MCB is used as a solvent, chemical intermediate, and degreaser. Chlorobenzene concentrations are high in certain occupational groups and in industrial areas with improper control of emissions.

The interactive effect of cyclohexane oxide and BDCM has been documented with reports of a reduction in the metabolism of chlorobenzene and thus, its liver toxicity.

Routes of exposure include inhalation, ingestion, or dermal contact With inhalation exposure, two workers were found to have absorbed 38% and 45% of the chlorobenzene dose which was administered. With ingestion, 31% of an oral dose was absorbed from the gastrointestinal (GI) tract in a single human subject while 18% of the ingested dose was absorbed in an animal study. No research was found on absorption with dermal exposure. No human or animal studies were found dealing with the distribution of chlorobenzene following ingestion and dermal contact. Although human studies were

unavailable, animal studies demonstrated that adipose tissue was the most likely site for distribution of chlorobenzene with inhalation exposure. By oral or inhalation exposure, chlorobenzene was metabolized into 4-chlorocatechol and p-chlorophenymercapturic acid and excreted in the urine in three human subjects. Animal studies have also revealed excretion through the kidneys.

Human and animal inhalation studies have shown toxic effects to the CNS, liver, and kidneys. No human studies were found examining the development of cancer with exposure to chlorobenzene. Although an increased incidence of neoplastic nodules of the liver with ingestion exposure was seen in animals, no clear evidence exists presently to show that MCB causes cancer. Chlorobenzene has an USEPA WoE classification of D (not classifiable as to human carcinogenicity).

Chloroform (CLFM)

Chloroform (CAS No. 67-66-3, $CHCl_3$) is a halogenated hydrocarbon (trihalomethane) which occurs naturally in the environment and is also man-made. Synonyms include trichloromethane, methenyl chloride, methane trichloride, methyl trichloride, and formyl trichloride. Chloroform is used mainly for the manufacture of fluoropolymers and as a coolant in air conditioners. In the past, chloroform was also used as an anesthetic. Environmental discharge of chloroform arises primarily from its manufacture and use, and from chlorination of wastewater and drinking water. The greatest release occurs to the air and secondarily to the groundwater. Occupational exposures take place in industries which manufacture or utilize chloroform. Exposure to the public occurs from consumption of contaminated food and water, inhaling contaminated air, and dermal contact with water which contains chloroform (e.g. shower) with high exposures for persons residing in areas with background levels of chloroform (e.g. proximity to water treatment plants).

Chemical interactions have been observed between chloroform and a number of other substances. When the drug, morphine, was utilized as a premedication with chloroform as an anesthetic, severe respiratory depression was observed. Animal studies have also demonstrated interaction of chloroform with other substances. When chloroform was administered together with dicophane (DDT), phenobarbital, ketonic solvents and chemicals, carbon tetrachloride, or ethanol, the hepatotoxicity of chloroform was enhanced. In experiments with rat hepatocytes, cadmium and chloroform have been observed to act synergistically to increase the cytotoxicity of each. When disulfiram, diethyldithiocarbamate, or carbon disulfide was given simultaneous with chloroform, the hepatotoxicity of chloroform was diminished.

The routes of exposure for chloroform include inhalation, ingestion, or dermal contact. Of the inhaled dose of chloroform, the amount of absorption by the body is related to factors such as concentration of chloroform in inhaled air. With oral exposure in humans, 100% of the chloroform was shown to be absorbed from the gastrointestinal tract. Following death from chloroform anesthesia, the organs of seven patients were examined for concentrations of chloroform. Highest levels were distributed in the brain, followed by the lungs and liver. In one human study, half of an oral dose of chloroform was shown to be metabolized into CO_2. In another study, around 38% of the chloroform received orally was metabolized in the liver with approximately 17% exhaled unchanged. Chloroform was excreted by

exhalation following inhalation exposure and mainly by exhalation and secondarily by urinary excretion following ingestion exposure in humans.

Health effects from ingestion exposure of chloroform are frequently limited to case studies of humans. Animal data are presented in the absence of human studies. Data on respiratory effects from ingestion of chloroform are limited. In a case report of an accidental ingestion of chloroform, the patient was shown to have a respiratory tract obstruction due to muscular relaxation. The oral dose for this patient was estimated at 2,500 mg/kg of chloroform. In another case, a patient committed suicide by ingesting 3,755 mg/kg of chloroform. On autopsy, the lungs were found to be congested with scattered patches of pneumonic consolidation.

Data on cardiovascular effects after ingestion exposure are also limited. A patient who accidentally ingested 2,500 mg/kg of chloroform was found to have some electrocardiogram changes (occasional extrasystoles and a slight S-T segment depression). The patient's blood pressure was 140/90 with a pulse of 70 beats per minute.

Gastrointestinal effects have also been observed in case studies of accidental or intentional ingestion of chloroform. Retrosternal soreness, pain on swallowing, and gastric distress with vomiting have been documented. Congestion with patchy necrosis of the mucosa have been found in the stomach and duodenum of a of a male who ingested approximately 3,755 mg/kg of chloroform and subsequently died. These findings were noted on autopsy.

Hematological effects were documented from a case study of one subject who took approximately 21 mg/kg/day of chloroform in cough medicine. The intake of this medicine for ten years was associated with a reduction in the erythrocyte count and in the hemoglobin level.

Musculoskeletal effects were also seen in an individual case study of a man who accidentally took 2,500 mg/kg of chloroform. The ingestion was associated with a relaxation of the jaw which resulted in the development of upper respiratory obstruction.

Hepatic effects have been observed with ingestion exposure to chloroform. The liver has been shown to be the target organ in chloroform toxicity. Injury to the liver has been observed in patients within 1-3 days of ingestion exposure. Jaundice, liver enlargement and tenderness manifested in all the patients who were observed. Blood tests revealed a rise in liver enzymes (SGOT, SGPT, LDH) and bilirubin levels. In a single fatal case, fatty degeneration and extensive centrilobular necrosis were detected on autopsy. Impaired liver function was seen in a person who took cough medicine containing 21 mg/kg/day of chloroform for 10 years. These changes reversed when the cough medicine was stopped. In another example, liver function was not altered in humans using mouthwash with a chloroform concentration of 2.46 mg/kg/day of chloroform for a period of five years or less.

Renal effects have also been observed with ingestion exposure to chloroform. The kidney has also been shown to be a target organ in chloroform toxicity. Following chloroform ingestion (2,500 mg/kg or approximately 3,755 mg/kg), oliguria was reported the day following the oral intake. Renal injury was also manifested by a rise in blood urea nitrogen and creatinine levels. Albumin and casts were also found in urine. In one fatal case, histopathological tests showed epithelial swelling and hyaline and fatty degeneration in the convoluted tubules of the kidney. Albumin and casts were also detected in the

urine of a subject who took cough medicine for 10 years which had a concentration of 21 mg/kg/day of chloroform.

Dermal/ocular affects have been observed in animals with ingestion exposure. Mice developed rough coats at exposure levels of 100 mg/kg/day of chloroform in oil for 14 days. Alopecia was reported in pregnant rats exposed to 126 mg/kg/day of chloroform in oil.

Immunological effects have been reported in animals following ingestion exposures. Depression of the humoral immunity (antibody-forming cells) was observed in mice receiving 50 mg/kg/day of chloroform for 14 days. Cell-mediated immunity (delayed type hypersensitivity) was influenced by a high dose of 250 mg/kg/day of chloroform administered to female mice for a 14 day period and a 90 day period. Reduced lymphocyte counts were seen in female rats receiving a single gavage dose of 1,071 mg/kg, but no health effects were detected in the group receiving 765 mg/kg.

Neurological effects have additionally been reported in case reports of humans following oral exposure. Levels of 2,500 or 3,755 mg/kg produced deep coma immediately following intentional or accidental ingestion. Reflexes were absent and the size of the pupil changed. With the exception of one individual, all patients lived. One person died several days later of extensive liver necrosis. Another patient was reported to have mild cerebellar damage (unstable gait and intentional tremor) which later reversed itself.

Developmental effects have also been documented in animals. No effects were reported in rats from oral exposures of 50 mg/kg/day. A rise in the rate of resorptions was seen in rabbits exposed to 100 mg/kg/day during gestation. Reduced birth weight was detected in offspring of mothers receiving 126 mg/kg/day of chloroform exposure. Decreased fetal weight was not seen in offspring of mothers receiving 200 mg/kg/day but was observed in offspring of mothers who were treated by gavage with 400 mg/kg/day of chloroform.

Reproductive effects were seen in some studies but not in others. Rabbits exposed to 63 mg/kg/day of chloroform during gestation experienced abortions. Intermediate duration of exposure to 160 mg/kg//day of chloroform in drinking water resulted in no histopathology in rabbits. A rise in the rate of resorptions was detected in rats exposed to 316 mg/kg/day of chloroform by ingestion. Gonadal atrophy was reported in male and female rats treated by gavage with 410 mg/kg/day of chloroform in toothpaste. Chronic exposures at concentrations of 200 and 477 mg/kg/day of chloroform by gavage did not result in histopathological changes in the reproductive organs of male and female rats.

Additionally, genotoxic effects of increased sister chromatid exchange in bone marrow cells of mice were observed with ingestion exposure of 200 mg/kg/day of chloroform in oil by gavage for four days.

Death has been observed in accidental or intentional ingestion of chloroform. A dose of 212 mg/kg may be fatal to humans. An ingested dose of 3,755 mg/kg of chloroform proved fatal to a man whose death was due to severe hepatic injury. Human studies indicate an association between ingestion of chlorinated drinking water and bladder and colon cancers. These studies had limitations due to the presence of other chemicals in the drinking water besides chloroform. Chloroform has been shown to be carcinogenic in animals with ingestion exposure. A rise in the incidence of hepatomas was seen in mice exposed by gavage to 595 mg/kg/day of chloroform for 30 days but not at a dose of 297

mg/kg/day. Renal tumors (tubular cell adenoma and carcinoma) were reported in male rats receiving a gavage dose of 90 mg/kg/day of chloroform for 78 weeks. Chloroform has an EPA WoE classification of B2 (probable human carcinogen).

Health effects have been observed with inhalation exposure to chloroform. Respiratory effects (change in respiration) have been reported in patients receiving anesthesia of chloroform at 10,000 - 22,500 ppm.

Cardiovascular effects have also been observed in inhalation exposure. In the same studies as above, 27% of the patients with exposures at 10,000 - 22,500 ppm manifested hypotension. Fifty percent of those receiving 8,000 - 10,000 ppm of chloroform as an anesthesia manifested arrhythmia and 12% demonstrated hypotension.

Gastrointestinal effects were also seen in anesthetic doses (8,000 - 22,500 ppm), including nausea and vomiting. Workers exposed to 14 - 400 ppm of chloroform for 1 - 6 months also were reported to have symptoms of nausea and vomiting.

Hematological effects were not generally observed with inhalation chloroform exposure. However, a rise in prothrombin time has been reported in humans after an anesthetic exposure at 8,000 ppm.

Hepatic effects have also been observed with inhalation chloroform exposure. Impaired liver function was reported at anesthetic exposures of 8,000 - 10,000 ppm. Workers with exposures of 14 - 400 ppm for 1 - 6 months were found to have toxic hepatitis and other health effects such as jaundice.

Renal effects were observed in one woman who died at childbirth and who had received chloroform anesthesia. An autopsy showed fatty degeneration of the kidneys which suggested chloroform-induced damage. Centrilobular necrosis of the liver was also observed.

Neurological effects have been observed in humans and animals following inhalation exposure. Chloroform concentrations of 8,000 - 30,000 ppm were administered to produce anesthesia. Concentrations < 1,500 ppm did not produce anesthesia. At concentrations around 40,000 ppm, death may occur. An intermediate-duration occupational exposure of 10 women at ≥22 ppm of chloroform resulted in complaints of exhaustion from the women. Chronic exposure at concentrations ≥77 ppm resulted in exhaustion, lack of concentration, depression, or irritability in 9 out of 10 occupationally exposed women. Psychotic episodes were also documented in a woman who was addicted to chloroform inhalation for 12 years.

Developmental effects were seen in animals with inhalation exposures. At 30 ppm, offspring of rats exposed during gestation demonstrated delayed ossification, imperforate anus and missing ribs at 100 ppm, and a rise in fetal resorptions at 300 ppm.

Reproductive effects were also observed in animals with inhalation exposures. At 100 ppm, mice were reported to have difficulty in maintaining pregnancy. At 300 ppm, rats administered chloroform during gestation has a reduction in conception rates.

Genotoxic effects were also seen in animals. At 400 ppm for five days, mice demonstrated a rise in the percent of abnormal sperm.

No human or animal studies regarding cancer were available for inhalation exposures. Toxicological end points for cancer (mouse liver tumor) are the same for oral and inhalation exposures. For this reason, the inhalation slope factor is derived from the oral data.

The information on health effects from dermal exposure is minimal. No hepatic effects or deaths were observed in rabbits administered a dermal application of chloroform at 3,980 mg/kg for 24 hours. Renal effects (tubular degeneration) were reported in the kidneys of rabbits exposed dermally to 1,000 mg/kg of chloroform for 24 hours. Destruction of the skin (stratum corneum) was reported in two human volunteers receiving dermal exposures of chloroform for 15 minutes on six consecutive days. Other effects included the loss in weight of rabbits receiving a dermal exposure of 1,000 mg/kg of chloroform for 24 hours. No cancer studies were found for dermal exposures.

Chloromethane (CM)

Chloromethane (CAS No.74-87-3, CH_3Cl) is a colorless gas which is produced in large amounts in the ocean and during microbial decomposition of plants and wood. It is also produced industrially and has been used as a refrigerant. When present in water, chloromethane evaporates rapidly. Chloromethane may also be referred to as methyl chloride.

The routes of exposure to chloromethane include inhalation and ingestion. Breathing air containing chloromethane is the most common exposure route. Ingesting chloromethane is possible if it is present in drinking water.

Chloromethane is rapidly and efficiently absorbed following inhalation or ingestion. Following absorption, chloromethane is distributed rapidly by the blood and deposited in various tissues. Chloromethane is then metabolized and excreted primarily as metabolites. Very little unmetabolized chloromethane is excreted in the urine or feces.

The central nervous system is the major site of toxicity from exposure to chloromethane. Typical CNS depression symptoms such as dizziness, blurred vision, muscle incoordination and coma result from high exposures. The liver and kidneys may be damaged following exposure. Death has resulted from overexposure, however, concentrations necessary to cause death would usually occur only in industrial settings with little ventilation.

The evidence that chloromethane is a carcinogen is limited to one animal study in which only one sex of one species developed a statistically significant increase in tumors. There is no evidence to suggest that chloromethane is a carcinogen in humans. Chloromethane has a USEPA WoE classification of C (possible human carcinogen).

1,2,-Dichlorobenzene (DCB2)

1,2-Dichlorobenzene (Cas No. 95-50-1) is an organic chemical utilized as a solvent in the production of toluene diisocyanate and as an intermediate in the manufacture of dyestuff, herbicides, and degreasers. It is a major by-product in the production of monochlorobenzene. Its synonyms include 1,2-Dichloro-o DCB, 1,2-DCB, ODB, and ODCB. The dichlorobenzenes consists of three isomers: 1) 1,2-dichlorobenzene, 2) 1,3-dichlorobenzene, and 3) 1,4-dichlorobenzene.

Strong oxidizers, hot aluminum, or aluminum alloys are incompatible with 1,2-dichlorobenzene. Routes of exposure include ingestion, inhalation, and dermal contact. Mammals, including humans, metabolize the dichlorobenzenes into dichlorophenols which may be as toxic as the dichlorobenzenes.

Animal studies have demonstrated health effects primarily to the liver with ingestion and inhalation exposures to 1,2-dichlorobenzene. Rodents were given gavage doses of 0, 30, 60, 125, 250, or 500 mg/kg/day, 5 days/week for 13 days. Animals receiving 25 mg/kg/day developed liver necrosis. At the higher dose of 500 mg/kg/day, animals developed a slight reduction in hemoglobin, hematocrit, and red blood counts, renal tubular degeneration; drop in lymphocyte in the spleen and thymus; degeneration and necrosis in the liver, and death. On another study, liver necrosis was reported in rodents receiving 125 mg/kg/day. Other effects included a rise in: 1) serum cholesterol at all doses but 60 mg/kg/day in male rats and at 125 to 500 mg/kg/day for female rats, 2) the liver weight/body weight ratios for male and female rats at 125 to 500 mg/kg/day and 3) serum protein at all doses in female rats and at 250 to 500 mg/kg/day in male rats. These changes represented exposure-related effects to the liver at doses >125mg/kg/day. No liver pathology was documented for rodents receiving 60 to 120 mg/kg/day, 5 days/week for 2 years and no rise in serum enzymes (e.g. alkaline phosphatase for rodents in a 13 week study. Rats received gavage administered doses of 18.8, 188, or 37 mg/kg/day, of 1,2-dichlorobenzene, 5 days/week for 192 days. The liver and kidney weights rose at 188 mg/kg/day. In addition, liver pathology and a rise in spleen weight were reported at 376 mg/kg/day, no adverse effects were documented at 18.8 mg/kg/day.

Rats, mice, guinea pigs, rabbits and monkeys received inhalation doses of 1,2-dichlorobenzene at 49 or 93 ppm, 7 hours/day, 5 days/week for 6 to 7 months. At a dose of 93 ppm, rats showed a rise in body weight while guinea pigs manifested a decline in the weight of the spleen. A dose of 49 ppm exposure represents 19.3 mg/kg for rats and 14.4 mg/kg for guinea pigs. On another inhalation study, pregnant rats and rabbits were exposed to 1,2-dichlorobenzene at 0, 100, 200, or 400 ppm for 6 hours daily on days 6 through 15 (rats) and 6 through 18 (rabbits) of gestation. Body weight gain was reduced in rats at all doses and in rabbits at 400 ppm for the first three days of exposure. Finer weight rose in rats at 400 ppm for the first three days of exposure. No developmental effects were observed at any dose.

The dichlorobenzenes may cause hemolytic anemia and liver necrosis in humans. Irritation to the skin and eyes and damage to the liver, kidneys, and lungs are other health effects. In addition, headache; dizziness, swelling of the eyes, hands, and feet; and nausea, may occur with exposures. At higher concentrations, severe liver damage and death may result.

No EPA WoE classification has been established for 1,2-dichlorobenzene.

1,2-Dichloroethane (DCA2)

1,2-Dichloroethane (CAS No. 107-06-2, $C_2H_4Cl_2$) is a halogenated hydrocarbon which is man made and an intermediate chemical utilized in the manufacture of vinyl chloride, 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene. It is also used as an additive for leaded gasoline. Synonyms include 1,2-dichloroethane; 1,2-ethylene dichloride; alpha, beta-dichloroethane; dichloro-1,2-ethane;

dichloroethylene; ethane 1,2-dichloride; and ethylene chloride. Environmental emissions occur primarily into the atmosphere from industry. 1,2-Dichloroethane evaporates rapidly from surface water and spills to soil surfaces. Dependent on the organic content of the soil, 1,2-dichloroethane may be transported into the groundwater. Human exposure occurs in certain occupations and from residing in industrial areas or close to chemical waste sites with high emissions of 1,2-dichloroethane.

A number of interactions between 1,2-dichloroethane and other chemicals have been documented in animal studies. Administration of phenobarbital, 3-methylcholanthrene, and/or ethanol (low concentrations) resulted in increased liver enzymatic action (cytochrome P-450) which hastened the formation of toxic metabolites of 1,2-dichloroethane. Toxicity to the liver was enhanced when 1,2-dichloroethane was given by inhalation with oral sulfiram. Other studies have demonstrated that the administration of glutathione, precursors of glutathione, or amino acids reduced the toxic effects and mortality from oral exposure to 1,2-dichloroethane. Disulfiram by ingestion and 1,2-dichloroethane administered by inhalation enhanced liver toxicity beyond the level of exposure with 1,2-dichloroethane alone. High concentrations of ethanol reduced toxicity of 1,2-dichloroethane.

Although exposure may result from ingestion of contaminated food and water or by dermal contact, the most common mode of exposure is the inhalation of contaminated air. Animal studies have demonstrated that absorption occurs following inhalation, ingestion, or dermal exposure. No human studies involving metabolism of 1,2-dichloroethane were found; however, animal studies indicate that 1,2-dichloroethane is easily metabolized producing urinary metabolites resulting from inhalation and ingestion exposure. With inhalation exposure, 1,2-dichloroethane has been distributed in human breath and breast milk while ingestion exposure has resulted in the distribution of 1,2-dichloroethane in the blood, liver, and lungs. In addition, 1,2-dichloroethane has been detected in human breast milk with dermal exposure. Animal studies have reported removal of 1,2-dichloroethane from the body through exhalation and by urinary output following inhalation or oral exposure. In women who had inhaled 1,2-dichloroethane in the workplace, the substance was exhaled in the unchanged form. A number of toxic effects has been observed in humans with inhalation and ingestion exposures to 1,2-dichloroethane. With acute inhalation and ingestion exposures, CNS (depression), GI (nausea, vomiting), hepatic (necrosis), renal (necrosis), and respiratory tract (pulmonary edema) effects have been observed with deaths attributed to cardiac arrest and arrhythmia (irregular heart rate). Following death in animals and humans, pathological changes on autopsy have been observed in the brain, heart, kidneys, liver, and lungs. Ocular effects have been seen in humans with inhalation exposures, and a decrease in blood clotting was observed with ingestion exposure.

Specific epidemiologic studies of exposure to 1,2-dichloroethane and incidence of cancer have not been carried out. Human studies have shown an increased rate of cancers with inhalation and ingestion exposures, but the presence of multiple chemicals has prevented isolation of a single causative agent as 1,2-dichloroethane. In animal studies, 1,2-dichloroethane has been reported to be carcinogenic with oral exposure but not with inhalation and dermal exposures; however, nonmalignant tumors were seen in animals with dermal exposures. A statistically significant rise in multiple tumor types was seen with exposure by ingestion. The tumor types included circulatory system, endometrial, liver, mammary

and stomach cancers; fibromas of the subcutaneous tissue; and lung adenomas in rodents. 1,2-Dichloroethane has an EPA Weight-of-Evidence Classification of B2 (probable human carcinogen).

1,1-Dichloroethylene (DCE)

1,1-Dichloroethylene (CAS No. 75-35-4, $C_2H_2Cl_2$) is a halogenated hydrocarbon made by man. Synonyms include 1,1-dichloroethene; 1,1-DCE; and vinylidene chloride. DCE is used to manufacture packing wrap (Saran™) and flame-retardant fabrics. DCE is released primarily into air and water from industrial emissions, hazardous waste sites, and accidental spills. The highest potential exposure levels are seen in occupations utilizing DCE and in populations residing near hazardous waste sites.

Toxic intermediates from the metabolism of DCE are responsible for its adverse health effects. A number of substances act to increase or decrease the development of these intermediates. SKF-525-A, disulfiram, and other dithiocarbamates (thiram, diethyldithiocarbamate) are thought to inhibit the enzymes responsible for the formation of the DCE toxic intermediates. Administration of amino acids (cysteine, methionine) also has a protective effect against DCE toxicity. On the contrary, substances such as 1,1,1-trichloropropane and other inhibitors of epoxide hydrolase enhance DCE toxicity as does phenobarbital with high levels of DCE by inhalation. In addition, replacement therapy of thyroxine following removal of the thyroid in rats intensifies the liver damage from subsequent DCE exposure. In addition, diethyl maleate also increases liver damage by depleting glutathione (reducing agent in the body).

The routes of exposure for DCE include inhalation, ingestion, or dermal contact. No human studies were available for the absorption, distribution, metabolism, and excretion of DCE. In animal studies, DCE was readily absorbed following inhalation and ingestion exposures and was distributed to the kidneys, liver, and lungs on inhalation and to the kidneys and liver on ingestion. The metabolic pathway of DCE in rats has been extensively studied with formation in the initial stages of an epoxide intermediate. With inhalation exposure, the majority of the DCE metabolites was excreted in the urine with very little eliminated unchanged in the expired air. In an ingestion study of rats, the greatest portion of the DCE was excreted in the urine (44-80%) and recovered as CO_2 (5-14%) with 1% unchanged in expired air and a small amount in the feces.

Upper airway irritation, a high incidence of liver toxicity in workers of a DCE polymerization plant, and CNS depression (convulsions, spasms, unconsciousness) have been demonstrated in humans with inhaled DCE. In addition, animal research has demonstrated that DCE is a weak teratogen and also causes reproductive effects and DNA damage with inhalation. Toxic effects in humans were not available for ingestion exposure. However, oral animal studies produced adverse outcomes to the gastrointestinal (forestomach edema) and respiratory (pulmonary edema) systems, to the liver (necrosis, hemorrhage), and to fetal development (increase in mean fetal crown-rump length in pups). With human dermal exposure, local irritant effects were observed.

Three human studies investigated the association of inhalation exposure to DCE and the development of cancer. No association was discovered, but the studies had real limitations such as small sample sizes. Animal studies have reported an increase in kidney and mammary cancers and lung tumors with inhalation exposures. Liver cancer was seen in oral animal studies. Dermal application of DCE

in mice demonstrated its tumor initiator effect. DCE has an EPA WoE classification of C (possible human carcinogen).

1,2-Dichloroethylene (DCE2)

1,2-Dichloroethylene (CAS No. 540-59-0, $C_2H_2Cl_2$) is a halogenated hydrocarbon which is an intermediate chemical in the manufacture of chlorinated solvents and compounds. Synonyms include 1,2-dichloroethene, acetylene dichloride, and sym-1,2-dichloroethylene. The total 1,2-dichloroethylene consists of the two isomers: trans-1,2-dichloroethylene and cis-1,2-dichloroethylene. High levels of exposure occur in certain occupations and from residing near chemical waste sites with emissions of 1,2-dichloroethylene. Environmental exposure occurs as a result of industrial emissions from the production and use of 1,2-dichloroethylene; wastewater, landfill, and solvent vaporization; breakdown of polyvinyl chloride and vinyl copolymers; and leaching from chemical landfills.
No studies were found which dealt with the interaction of 1,2-dichoroethylene with other chemicals.

Since 1,2-dichloroethylene is found in air, soil, and water, exposure occurs through inhalation, ingestion, and dermal contact The most likely form of exposure is by inhalation. Absorption of both isomers occurs through the lungs following inhalation exposure. Rat studies have demonstrated gastrointestinal absorption after oral administration. No research was available on dermal absorption, or on the distribution of 1,2-dichloroethylene. Metabolism of 1,2-dichloroethylene commences with the liver's cytochrome P-450 system, but little work has been done in the metabolic process outside of the liver. No studies were found dealing with the excretion following inhalation, ingestion, or dermal exposure.

Human toxicity data were also sparse. Some information was available on acute exposures, but the effects were not well documented. One man died following inhalation exposure but the conditions producing this effect were not reported. High oral doses of the two isomers have produced death in rats and mice. In humans, inhalation of trans-1,2-dichloroethylene can cause neurological effects (nausea, lethargy, fatigue) and burning of the eyes. In animals, respiratory (pulmonary edema), cardiovascular (swelling of myocardium), hematological (decrease in circulating RBC and WBC), hepatic (degeneration), and suggestive immunological effects have been reported with trans-1,2-dichloroethylene exposure by inhalation. Exposure to the two isomers have resulted in neurological effects (behavioral changes) by inhalation in rodents. No human ingestion studies were available. In animal studies, GI (hyperemia of stomach and small intestines), hepatic (fatty degeneration), immune (suppression of humoral immune system), and respiratory (pulmonary capillary hyperemia) effects were observed with ingestion exposure with trans-1,2-dichloroethylene; hematological (decrease RBC and hematocrit) and renal (increase in kidney weight with decrease in blood urea nitrogen) effects with cis-1,2-dichloroethylene; and CNS depression with exposure to the two isomers. The long-term effects, including cancer, have not been documented. No epidemiologic studies dealing with 1,2-dichloroethylene were found. 1,2-dichloroethylene has an EPA WoE classification of D (not classifiable as to human carcinogenicity).

Dichloromethane (DCM)

Dichloromethane (CAS No. 75-09-2, CH_2Cl_2) is a man made chemical that is widely used in industry as a paint stripper, as a propellant in aerosol sprays, and in the photographic and electronics industry. Dichloromethane is commonly referred to as methylene chloride.

The routes of exposure to dichloromethane include inhalation, ingestion and dermal contact. Since dichloromethane evaporates readily, the most important exposure route is by inhalation of vapors. The highest human exposures to dichloromethane usually occur in the industrial workplace.

Since dichloromethane is usually present as a vapor, the primary route of exposure is by inhalation. Approximately 70% - 75% of inhaled and ingested dichloromethane is absorbed. After absorption it is rapidly distributed by the blood to adipose tissue and body organs. Dichloromethane is then metabolized along two pathways which produce either CO or CO_2, with CO being the major product. The CO produced during metabolism then forms carboxyhemoglobin to produce symptoms of carbon monoxide poisoning.

The primary non-cancer health effects involve the central nervous system, but also involve the kidney and liver following long term exposure. Acute CNS effects include loss of muscle control, stupor, dizziness, chest pain, unconsciousness and death. Acute symptoms occur following inhalation exposure of 300 - 700 ppm for 3 to 5 hours.

Human epidemiological studies have not shown a causal relationship between occupational exposure to dichloromethane and cancer. Animal studies have demonstrated that it is carcinogenic in laboratory animals. Dichloromethane has a USEPA WoE classification of B2 (probable human carcinogen).

1,2-Dichloropropane (DCP2)

1,2-Dichloropropane(CAS No. 78-87-5) is an organic chemical which is present in the environment due to human activities. Synonyms include propylene dichloride; propylene chloride; 2,3-dichloropropane; and 1,2-D. It's main uses are as a chemical intermediate in the production of tetrachloroethylene and other chlorinated products and as an industrial solvent. Environmental emissions occur as a result of its production and uses as described above and, and its evaporation from wastewater streams. No specific groups have been reported to have greater susceptibility to the health effects of 1,2-dichloropropane than others.

When 1,2-dichloropropane has been mixed with other substances, chemical interactions have been observed. When administered orally or by inhalation with 1,1,2-trichloroethane and when administered with both ethylene dichloride and tetrachloethylene, a toxic effect which was additive was observed for the dose lethal to 50% of the animals. An additive health effect to the lung, liver, and nervous system was seen when 1,2-dichloropropane was administered to rodents in combination with 1,2,3-trichloproprane and tetrachlorethylene.

Routes of exposure include ingestion, inhalation, and dermal contact. Following animal ingestion and inhalation exposure, absorption is considered to occur as evidenced by the presence of 1,2-dichloropropane in urine and expired radioactive carbon-labelled CO_2 in air, 1,2,-dichloropropane was also found in excreta. Following application to the skin of rabbits, absorption was assumed to occur due

to the death of the exposed animals. The liver, kidney, lung, and blood were the areas of distribution for 1,2-dichloropropane following inhalation exposure. The brain and cerebellar tissue, adipose tissue, and liver had the highest concentration following ingestion exposure. When radioactive carbon-labelled 1,2-dichloropropane was metabolized by rats following ingestion exposure, over 40% of the dose was measured in expired air. Rats exposed by gavage or inhalation to 1,2-dichloropropane were reported to have three major metabolites in their urine: 1) N-acetyl-S-(2-hydroxypropyl)-L-cysteine, 2) N-acetyl-S-(2-oxopropyl)-L-cysteine, and 3) N-acetyl-S-(1-carboxyethyl)-L-cysteine. These metabolites formed after oxidation of 1,2-dichloroproprane and also before or after conjugation with gluathione. It may also conjugate with lactate, producing CO_2 and Acetyl Co-A, which may eventually breakdown into CO_2 or used in other biosynthetic pathways. With radioactive-labelled 1,2-dichloropropane, it was found that the urine and expired air were major excretory routes for ingestion and inhalation exposures and also the feces for ingestion exposure.

Health effects have been documented in some studies of humans and animals following ingestion exposure. No respiratory effect (histopathological lesions to the lungs, bronchi, and trachea) were reported in rats receiving gavage exposures of up to 1,000 mg/kg/day of 1,2-dichloropropane for 13 weeks, mice receiving up to 500 mg/kg/day for 13 weeks, or rats and mice receiving up to 250 mg/kg/day for 103 weeks.

Cardiovascular effects have, however, been documented with ingestion exposure to 1,2-dichloropropane. A single ingestion dose of unknown quantity resulted in the death by cardiac failure of two individuals 30 to 36 hours following exposure.

Gastrointestinal effects have also been noted with ingestion exposure. A case report documented an overexposure by ingestion concerning a 59 year old man. He suffered a burning feeling in the oropharynx, esophagus, and stomach with vomiting for an extended duration. In another case of unknown dosage, a man drank 1,2-dichloropropane in a suicide attempt and developed esophagitis and esophageal varices which eventually reversed itself.

Hematological effects have also been observed with ingestion exposure. Anemia, leukopenia, and disseminated intravascular coagulation was observed following accidental ingestion of an unknown dose of 1,2-dichloropropane. One of the patients recuperated while two died, one from septic shock and the other from cardiac arrest.

Hepatic effects have been documented with ingestion exposure. Liver damage in the form of hepatic necrosis and histological changes have been reported in persons who intentionally ingested 1,2-dichloropropane.

Renal failure has also been documented in three humans following ingestion of 1,2-dichloropropane. Two of the persons died but death was not attributed to renal failure.

Neurological effects (dizziness, headache, disorientation, and coma) have been documented in patients who received lethal exposures to 1,2-dichloropropane. The concentration of the single doses were unknown.

The developmental effects of delayed ossification of the skull bones was seen in the fetuses of female rats receiving 125 mg/kg/day of 1,2-dichloropropane by gavage during gestation days 6-21.

Reproductive effects were reported in female and male rodents receiving gavage doses of 1,2-dichloropropane. Female mice administered doses of 125 and 250 mg/kg/day for 103 weeks had a rise in the incidence of infections to the ovary, uterus, or the other organs. With male rats, testicular degeneration was observed at gavage doses of 500 mg/kg/day for 1,5, or 10 consecutive days of for 13 weeks (5 days/week).

When the occurrence of cancer was examined, a marginal but statistically significant rise in the incidence of adenocarcinomas of the mammary gland was reported for female rats who received 250 mg/kg/day of 1,2-dichloropropane for 103 weeks. In addition, a dose-related rise in liver adenoma was reported in male and female mice receiving gavage doses of 125 or 250 mg/kg/day of 1,2-dichloropropane.

Inhalation exposure to 1,2-dichloropropane has been found to produce respiratory effects to humans. An accidental spill of 2,000 gallons produced chest discomfort, dyspnea, and cough in some exposed individuals indicating respiratory irritation. No measurements of air concentrations were made. No adverse cardiovascular effects were seen on histological examination of the heart and aorta of rodents receiving exposures $\leq$ 150 ppm and rabbits exposed to $\leq$ 1000 ppm, 6 hours/day, 5 days/week for 13 weeks. However, fatty degeneration of the heart was observed in dogs receiving exposures of 1,000 ppm for 7 hours/day, 5 days/week for 27-128 exposures.

Gastrointestinal effects (vomiting, abdominal pain) were documented in a young female who sniffed stain remover composed mainly of 98% 1,2-dichloropropane. Inhalation exposure to 1,2-dichloropropane in two individuals resulted in hematological effects (epistaxis, hemolytic anemia, and disseminated intravascular coagulation.

Musculoskeletal effects were not observed in rodents exposed to $\leq$ 150 ppm and rabbits exposed to $\leq$ 1000 ppm, 6 hours/day, 5 days/week for 13 weeks. Hepatic effects have been observed in humans following inhalation exposure. Severe hepatic failure, as evidenced by the presence of liver enzymes, was documented in the case of a woman who inhaled cleaning solution containing 60% 1,2-dichloropropane. In another case a female inhaled trielina which was 98% 1,2-dichloropropane. Subsequent tests demonstrated liver damage. Severe renal failure was also observed in this woman. The concentrations of 1,2-dichloropropane were not documented in the two cases.

Ocular hemorrhages were also observed in a patient who had inhaled vapors of 1,2-dichloropropane. No information of the concentration was reported.

No immune system effects were documented in rodents and rabbits exposed to 150 ppm and 1,000 ppm respectively for an exposure lasting 13 weeks, 6 hours/day, 5 days/week. This was also true for an exposure at 1,000 ppm , 6 hours a day, 4-5 days/week for 2 weeks. In contrast, mice exposed to 300 ppm of 1,2-dichloropropane for 2 weeks, 6 hours/day, 4-5 days/week, manifested a reduction in the absolute and relative thymus weight and a decrease in cortical lymphoid cells.

Fatigue, which was possibly a neurological effect due to central nervous system depression, occurred following exposure to a leak of 2,000 gallons of 1,2-dichloropropane from a tank truck. The concentration of the leaked chemical was not known.

The reproductive effect of uterine bleeding between menstrual periods occurred in a woman following an acute inhalation exposure to 1,2-dichloropropane. The lethal concentration for 50% of the

exposed mice was 480 ppm for a single 10 hour exposure and up to 3,029 ppm for a single 8 hour exposure in rats.

The hepatocarcinogenic effect of 1,2-dichloropropane inhalation has also been examined. Hepatomas were reported in 3 out of 80 mice exposed 37 time to 400 ppm for 4-7 hours. High mortality was also reported. Dermatitis was the main health effect from dermal exposure to 1,2-dichloropropane. For animals, 8.75 ml/kg was the dermal dose calculated as being fatal to 50% of the exposed rabbits.

No EPA WoE classification has been established for 1,2-dichloropropane.

Di(2-Ethylhexyl) Phthalate (DEHP)

Di(2-ethylhexyl)phthalate (CAS No. 117-81-7) is one of a group of phthalate esters, known as dioctyl phthalates. Synonyms include DEHP, octylphthalate, BEHP, and bis(2-ethylhexyl)phthalate. DEHP is used mainly as a plasticizer in the manufacture of polyvinyl chloride (PVC) and vinyl chloride resins. Environmental releases are principally from industrial disposal and from municipal landfills. As it volatilizes slowly into air, vapors from water and soil are not significant contributors to atmospheric pollution. Its adsorption characteristic results in its adherence to solid particles, when released to soil or water. Though relatively insoluble, the presence of other organic solvents (such as alcohols and ketones) may enhance its solubility, facilitating the leaching from waste site into subsoil and groundwater. Bioaccumulation occurs in aquatic organisms. Under aerobic conditions, biodegradation of DEHP occurs in soil, but is not significant due to its soil adsorption ability. Microbial systems biodegrade DEHP in water. In air, DEHP reacts with hydroxyl radicals. Highest exposure to DEHP occurs from medical procedures, such as blood transfusions or hemodialysis, during which the substance seeps from the plastic tubing into the body fluids. Occupational exposure may take place in the manufacture and processing of DEHP.

Interaction between DEHP and other chemicals have been reported. In humans, DEHP replaced propyl-2,3-dihydroalprenol from low affinity sites on the mononuclear leukocytes. An increase in the effect of DEHP on the liver's peroxisomal system was noted in rats consuming a choline deficient diet. A rise in the number of dead and resorbed fetuses and malformed survivors was observed in pregnant rats, administered caffeine by injection with a single dose of DEHP. Animals pretreated with DEHP had a reduction in the toxic effects of 2,3,7,8-tetrachlorodibenzo-b-dioxin. Oral DEHP acted as a tumor promotor when administered to animals with carcinogens (dimethylnitrosamine and N-ethyl-N-hydroxyethylnitrosamine). When combined with the carcinogen N-nitrosodimethylamine, a reduction in tumor incidence seemed to occur. Timing and dose may account for theses differences.

Absorption of DEHP into the body, following inhalation, may take place as evidenced by DEHP derivatives in the blood of infants who received exposure during respiratory therapy. Absorption is also apparent following oral exposure by the presence of DEHP metabolites in human urine. In addition, animal studies have demonstrated absorption following dermal exposure. Autopsy findings reveal distribution of DEHP in the adipose tissue of human cadavers. Exposure for these cases most likely occurred through the oral route. Distribution sites included the liver, kidney, muscles, and fat in animals following dermal exposure. DEHP metabolism includes a number of complex reactions resulting in 30 metabolites. Around 65% of the DEHP metabolites are eliminated as glucuronide conjugates in human

urine. Oral exposures have resulted in the excretion of DEHP metabolites through urine in humans. Ingestion and dermal studies on animals have shown excretion of DEHP and its metabolites in both the urine and feces.

The main route of exposure to humans is by the ingestion of foods, such as seafood or fatty foods, which have been contaminated with DEHP. Other routes of exposure include inhalation and dermal contact. Examination of human and animal ingestion data has shown that acute mortality following high dose exposure in humans is unlikely. One oral dose of 10 grams of DEHP was reported to cause only gastrointestinal distress (abdominal pain and diarrhea), in one study subject who received this high dose. Ingestion exposure to animals has been associated with pathology in the liver. These include: 1) hyperplasia (abnormal increase in normal cells) and hypertrophy (enlarged organ) of the liver; 2) morphological changes (fat deposits in the periportal area, decline in centrilobular glycogen deposits, and structural changes in the bile ducts); 3) rise in cellular peroxisomes, indicating hepatic toxicity; 4) reduction in the circulating cholesterol and triglyceride levels; 5) increase in the mixed-function oxidase (hepatic enzyme system) with DEHP exposure; 6) decline in the carbohydrate metabolism (reduction in glycogen deposits), and 7) cell membrane changes. Renal (increase kidney weight, focal cystic changes, and lipofuscin deposits), general systemic (decrease in body weight in rodents, alteration in thyroid structure and activity, and pancreatic changes), developmental (dose-response rise in dead and resorbed fetuses and a number of malformations in survivors, such as hydronephrosis, and cardiovascular and tail malformations), reproductive (testicular changes, female fertility), and genotoxic (alterations in DNA) effects have also been observed in animal ingestion studies. The proximate substance from DEHP metabolism, which acts as a teratogen, is 2-ethylhexanoic acid. Mono(2-ethylhexyl)phthalate (MEHP) is a DEHP metabolite, which may be the toxic factor in the pathology of the testes. Inhalation and dermal exposure studies for DEHP were sparse. DEHP mist administered to rats over a 2 to 4 hour period proved fatal, but the study failed to examine the concentration of DEHP in the mist. When rabbits received a single, high-dose dermal exposure of DEHP, 2 of 6 rabbits in the maximum dose group died.

Deaths from pancreatic cancer and uremia were significantly higher in DEHP production workers when compared to the general population of the same age. The significant rise was reported in workers exposed for a period greater than 15 years. A short follow up and exposure, which was not quantified, were limitations of this study. An animal ingestion study demonstrated a statistically significant rise in the incidence of hepatocellular carcinoma and combined incidence of carcinomas and adenomas with exposure to DEHP. Chromosomal aberration and morphological transformations were induced in cultured fetal Syrian hamster cells with exposure in utero to DEHP and MEHP (IRIS, 1993). DEHP has a USEPA WoE classification of B2 (probable human carcinogen).

1,1,2,2-Tetrachloroethane

1,1,2,2-Tetrachloroethane (CAS No. 79-34-5, $C_2H_2Cl_4$) is a chlorinated hydrocarbon, which is not a natural component of the environment. Synonyms include acetylene tetrachloride; sym-tetrachloroethane; s-tetrachloroethane; TCE tetrachloroethane; and 1,1-dichloro-2,2-dichloroethane. Due to its proprietary status, information on its uses is limited. Its one major use is in the production of

trichloroethylene, tetrachloroethylene, and 1,2-dichloroethylene. Other uses may be as a solvent, cleaner and degreaser, paint remover, varnish and lacquer, extractant for oils and fats, and for photographic film.

Because of its moderate vapor pressure and low adsorptivity to soil, it is assumed that a release on soil or into a lagoon would result in volatilization with part of the substance leaching into the subsurface and groundwater. In groundwater, under anaerobic conditions, degradation occurs by biodegradation and chemical hydrolysis. Biodegradation takes place by dehydrodehalogenation with the formation of 1,1,2-trichloroethane, trichloroethylene, dichloroethylene, and vinyl chloride. With chemical hydrolysis, trichloroethylene is the main end product. No potentially high exposure groups have been identified. People residing near waste disposal sites may have high exposure levels.

The usual route of exposure may be by inhalation of ambient air, ingestion of contaminated drinking water, or dermal contact with contaminated soil. In one human study, 97% of a single breath of 1,1,2,2-tetrachloroethane was reported to be absorbed by volunteers. Absorption has also been observed in animals following oral and dermal exposures. An animal ingestion study demonstrated distribution of the substance to the liver, as manifested by the high level of hepatic protein binding. Approximately 80% of the ingested substance has been reported to be metabolized by animals. Glyoxylic acid and oxalic acid have been observed as metabolic products. Nonenzymatic degradation of 1,1,2,2-tetrachloroethane has resulted in the formation of trichloroethylene and tetrachloroethylene. Further degradation of these products results in the formation of vinyl chloride. In-vitro studies have demonstrated conversion of 1,1,2,2-tetrachloroethane to dichloroacetic acid, catalyzed by the liver's cytochrome P-450 system. Human volunteers were reported to excrete the inhaled substance in the breathe and to a lesser degree in the urine. Following ingestion exposure, animal studies have shown excretion in the breathe, and in the urine and feces. Body retention of the substance has also been seen. Excretion following dermal exposure has been reported in animals.

The interaction between 1,1,2,2-tetrachloroethane and other chemicals has been studied in animals. Survival time was prolonged in animals when 1,1,2,2-tetrachloroethane was dispensed with carbon or castor oil, and reduced when given with milk, mineral oil, or paraffin. Alcohol was seen to enhance the effects of 1,1,2,2-tetrachloroethane by increasing the levels of acid phosphatase.

Health effects have been observed with inhalation exposures to humans. Four workers became comatose and died when they inhaled 1,1,2,2-tetrachloroethane contained in varnish used to cover airplane wings. Autopsies disclosed extreme destruction and degeneration of the liver. Respiratory failure and unconsciousness were reported in two workers exposed by both inhalation and dermal contact with spilled airplane varnish. Both subsequently recovered consciousness. Gastric distress has also been observed following inhalation exposure to 1,1,2,2-tetrachloroethane in workers of the airplane wing varnish industry, and in individuals employed in factories producing artificial pearls, penicillin, and jewelry. Exposure to 1,1,2,2-tetrachloroethane vapors has also caused a rise in the number of white blood cells in workers of an artificial silk factory. In addition, 1,1,2,2-tetrachloroethane produces one of the most significant systemic effects in the liver. Jaundice and an enlarged liver have been seen in workers exposed to its vapors. The neurological effect of dizziness has been demonstrated following inhalation of the substance by human volunteers. Ocular and immunological effects have been reported in animals with inhalation exposure.

Health effects have also been documented with ingestion exposure. Deaths were observed in human suicide cases when 1,1,2,2-tetrachloroethane was consumed orally. Autopsies of these cases revealed congestion of the lungs, which did not appear to be the cause of death. In addition, loss of consciousness was reported in an accidental oral administration of 1,1,2,2-tetrachloroethane given to African men and women being treated for parasites. A rise in liver enzymes, chronic inflammation of the kidneys, and histopathological changes in the testes were noted with ingestion exposure in animals.

Dermal exposure has resulted in a single human death. A male worker, who had cleaned up a spill of 1,1,2,2-tetrachloroethane with his bare hands, subsequently died. In the bangle industry of India, neurological symptoms of tremors, headache, dizziness, and gastric disturbance were reported in workers inhaling and immersing their hands in 1,1,2,2-tetrachloroethane.

When compared to individuals not working in the plant, army clothing plant workers, who inhaled the fumes of 1,1,2,2-tetrachloroethane, were found to have a slight increase in the incidence of death due to genital cancers, or to leukemia and other lymphomas. Since other factors were present, the slight increase in cancer incidence may not have been due alone to 1,1,2,2-tetrachloroethane exposure. Following ingestion exposure to 1,1,2,2-tetrachloroethane in mice, a significant increase was observed in the incidence of hepatocellular carcinoma. The substance also proved mutagenic for Salmonella typhimurium mutants (TA1530 and TA1535) (IRIS, 1993). 1,1,2,2-Tetrachloroethane has a USEPA WoE classification of C (possible carcinogen).

Tetrachloroethylene (PCE)

Tetrachloroethylene (CAS No. 127-18-4, C_2Cl_4) is a halogenated hydrocarbon which is man made. Synonyms include carbon bichloride; carbon dichloride; ethylene tetrachloride; perchloroethylene; tetrachloroethene; and 1,1,2,2-tetrachloroethylene. PCE is commonly used as an industrial solvent and degreaser, as an intermediate for manufacturing other chemicals, and is used extensively in the dry cleaning and textile industries. Although PCE is liquid at room temperature, it tends to evaporate into the atmosphere which accounts for most of its environmental emissions, especially from the industrial and dry-cleaning operations. Exposure to PCE results from employment in certain industries (e.g. dry cleaning), residence near emission sites, and ingestion of contaminated food and water.

The interactive effect of certain chemicals in the presence of PCE has resulted in conflicting outcomes. An epoxide intermediate is produced from PCE metabolism and is believed to be the toxic agent in the development of adverse health effects such as liver tumors in rodents. Any substance (e.g. ethanol, phenobarbital, polychlorinated biphenyls) which stimulates PCE metabolism would be expected to increase PCE's toxicity. Animal experiments have demonstrated that pretreatment with PCBs did stimulate metabolism as evidenced by the increase in hepatotoxicity and the presence of urinary metabolites for PCE. However, ethanol and phenobarbital failed to increase PCE toxicity. Urinary metabolites were reduced when Chinese dry cleaning workers were exposed to both PCE and TCE and not TCE alone.

The routes of exposure for PCE include inhalation, ingestion, or dermal contact. Absorption following inhalation or ingestion is extensive but poor with dermal exposure. Following absorption, much of the inhaled and ingested PCE is deposited in the fatty tissue. PCE was reported to be distributed

in the liver, kidney, brain, and lung of a dry cleaner who received a fatal inhalation exposure to PCE. The metabolism of PCE in the human body has been established by the detection of known metabolites (trichloroacetic and trichloroethanol) in the urine and blood of humans. In humans, PCE is excreted primarily through exhalation with urinary excretion playing only a secondary role in inhalation and ingestion exposures. With dermal exposure, excretion occurs by exhalation. With inhalation and ingestion exposure in humans, metabolites of PCE have been identified in urine and blood.

Data on human health effects from ingestion exposure to PCE are limited. Research on the health effects to animals are more commonly found. Hematological effects, including the relative reduction of bone marrow erythropoiesis, have been observed in mice receiving PCE in drinking water at a concentration of 0.1 mg/kg/day for seven weeks. At a concentration of 0.05 mg/kg/day, slight or no hematological effects were observed. A recovery period of two months resulted in the disappearance of all hematological effects.

Cardiovascular outcomes were reported in the Woburn Massachusetts study, in which health outcomes (particularly childhood leukemia) associated with contaminated drinking water were investigated. One of the solvents contaminating the drinking water was PCE. Family members (14/25 - 14 persons out of 25) of leukemia cases manifested cardiac symptoms of tachycardia at rest, palpitations, or near syncope at 21 ppb of PCE. Detailed testing was done on 11 of the individuals with some findings of serious ventricular dysfunctions and premature ventricular beats diagnosed in a number of those tested.

Hepatic effects to humans from ingestion exposure to PCE have been rare. In one case study, an infant developed obstructive jaundice and hepatomegaly following exposure to PCE from the mother's breast milk. In rodents, PCE delivered by gavage at 1,000 mg/kg/day for 10 days produced evidence of peroxisomal proliferation. Gavage doses of PCE at 0, 20, 100, 200, 500, 1,000, 1,500, or 2,000 mg/kg/day for six weeks, produced a rise in relative liver weight and triglycerides starting at 100 mg/kg/day; reduction in glucose-6-phosphate and rise in alanine aminotransferase at 500 mg/kg; and hepatocellular lesions, including centrilobular hepatocellular hypertrophy and centrilobular necrosis. These changes were observed histologically at 200 and 1,000 mg/kg/day. In another study, the liver weights rose, relative to body weight in rats receiving concentrations of PCE at doses of 1,400 mg/kg/day in drinking water for 13 weeks. Gross examination of the animals during autopsy did not show any abnormalities in the liver or other selected body organs. Most biochemical parameters examined did not indicate hepatotoxicity.

Renal effects (nephropathy) and increased mortality were reported at all dose levels in rats and mice administered PCE in corn oil by gavage for 78 weeks, followed by a period of observation. Time-weighted-average (TWA) dose of 536 and 1,072 mg/kg/day for male mice, 386 and 772 mg/kg/day for female mice, 471 and 941 mg/kg/day for male rats, and 474 and 949 mg/kg/day for female rats were included in the study which compared exposed to controls. Degenerative changes in the kidney tubules with swelling, fatty degeneration, and necrosis of the tubular epithelium and hyaline intraluminal casts were detected. Following a gavage administered dose of 1,000 mg/kg of PCE to male rats for 10 days, compound-induced renal damage (i.e. rise in protein droplet accumulation and cell proliferation in a specific segment of the kidney) was shown. Renal pathology involving the α-2μ-globulin was observed in male rats exposed to concentrations of 1,500 mg/kg of PCE by gavage for 42 days. Dermal

effects have also been detected in a study of humans with multiple chemical exposures. The population of Woburn, Massachusetts, was examined to determine health outcomes (particularly childhood leukemia) from ingestion of drinking water contaminated with solvents. Two of the solvents, trichloroethylene and PCE, were detected at higher concentrations than other substances. Family members (13/25) of leukemia cases, with lengthy exposure history to the contaminated water, were found to have skin rashes occurring twice a year for 2-4 weeks. The skin problems disappeared within 1-2 years after termination of exposure to the contaminated water.

Furthermore, immunological effects were observed in the Woburn study. Twenty-three adults, family members of children with leukemia, who were exposed to contaminated water, were found to have persistent lymphocytosis, rise in the number of T lymphocytes, and depressed helper:suppressor T cell ratio. Subsequent testing 18 months later demonstrated a decrease in lymphocytic counts and numbers of suppressor T cells, and a rise in the helper:suppressor ratio. Auto-antibodies were found in 48% of the adults tested (11/23).

Neurological effects, similar to those observed in inhalation exposure, have been reported in humans with oral exposures. PCE was used orally at one time for the treatment of worms. Doses ranging from 2.8 to 4 ml (around 4.2-6 g) produced narcotic effects, inebriation, perceptual distortion, exhilaration, but not death. A case study of a 6-year-old child who received a 12-16 g dose of PCE, resulted in the development of somnolence and coma. In addition, drowsiness, vertigo, agitation, and hallucinations were also manifested in the child.

Developmental effects have been reported in the Woburn study. An association was reported between eye/ear anomalies and central nervous system/chromosomal/oral cleft anomalies and ingestion of contaminated water. In addition to other solvents in the water, PCE was detected at 21 ppb. Scientists have disputed the biological relevance of the groupings of these anomalies.

A death following a 3 ml oral dose of PCE for treatment of hookworm was reported in a severely undernourished individual. The cause of death was unknown due to the pre-existent state of chronic malnutrition and septic cholecystitis.

The Woburn study also demonstrated a potential association between ingestion of contaminated water and a rise in the risk of childhood cancer (leukemia). Because of the presence of multiple chemicals in the drinking water, it was not possible to attribute the development of childhood leukemia to any specific substance.

Inhalation exposure to PCE has also affected a number of body systems. Respiratory irritation was documented in volunteers exposed to a concentration of 216 ppm for 45 minutes to 2 hours workers and in workers exposed to PCE at inhalation levels of 232-385 ppm. Human volunteers exposed to concentrations as high as 1,060 ppm could only endure an exposure period of one to two minutes before leaving the study chamber.

Cardiovascular effects (cardiac arrhythmia) were detected in a worker employed for seven months in a dry cleaning facility where his job required the use of PCE for cleaning clothes. The worker was without symptoms a month after finding new employment.

Hematological effects have also been observed with inhalation exposure. Polycythemia vera (disorder of bone marrow) was diagnosed in a male with a history of 22 years of exposure, including

transient exposure concentrations above 300 ppm for five minutes out of any three hours. Because genetic and other environmental factors may increase the chances of developing the disease, PCE could not be singly associated with this disease outcome.

The liver has been a target organ in PCE exposure. Hepatocellular damage was diagnosed in a woman worker inhaling PCE fumes. In addition, a dry cleaner, who was exposed to PCE fumes, was found to have diffuse fatty liver and died shortly after the exposure. This condition may have existed prior to employment. No effect to the liver (as measured by the presence of liver enzymes - alanine aminotransferase) was observed in 22 dry cleaning workers who received a TWA exposure to PCE of 21 ppm.

Renal effects have additionally been observed based upon the inhalation dose. An examination of the workers with an estimated TWA of 10 ppm of PCE for 14 years demonstrated a rise in urinary levels of lysozyme and ß-glucuronidase indicating mild tubular damage of the kidney. Serum creatinine and urinary albumin, ß-μ-globulin and retinol-binding protein levels were found to be within normal limits in dry cleaning workers exposed to a TWA of 21 ppm of PCE for six years.

In addition, dermal/ocular effects (mild ocular irritation) were documented in four subjects at an exposure levels of 106 ppm or 216 ppm. Burning and stinging of the eyes was noted with exposures of 280 ppm or 600 ppm. An acute exposure of greater than 1,000 ppm resulted in intense eye irritation in humans.

Data to evaluate immunological effects from inhalation exposure are not firm. However, in one study. mice were found to be more sensitive to pulmonary bacterial infection following a three hour inhalation exposure to PCE at 50 ppm.

Neurological effects have additionally been observed in humans. The brain is the target organ for exposure by inhalation. Impaired perceptual and intellectual function and attention were detected in dry cleaning workers exposed to a TWA of 12 ppm (for 141 days) or 54 ppm (for 127 days) of PCE when compared to controls. In a separate study of dry cleaning workers, no significant changes in neurological symptoms or psychomotor performance were seen in the workers who received a TWA exposure to PCE of 21 ppm over an average of six years. However, in 17 of 22 subjects, neurologic symptoms (memory loss and difficulty sleeping) were more widespread in the exposed compared to the control group. In one study, headache, dizziness, difficulty speaking, and sleepiness occurred after inhalation exposure to 100 ppm of PCE for seven hours. After a one hour exposure to 106 ppm, volunteers of one exposure study manifested no symptoms of neurological impairment. At 216 ppm for an exposure period of 45 minutes to 2 hours, symptoms of dizziness and drowsiness developed. In a separate study, motor coordination was lost at an inhalation exposure concentration of 280 ppm for two hours or 600 ppm for 10 minutes. Additionally, mood change, slight ataxia, faintness, and dizziness were observed in four volunteer subjects receiving inhalation exposure to PCE at concentrations of 1,000-1,300 ppm for less than two hours. The subjects had the sense of impending collapse at exposure to 2,000 ppm for 5-7 minutes.

Reproductive effects have also been seen with occupational inhalation exposure to PCE in the dry cleaning business. Menstrual disorders and spontaneous abortions have been observed in female dry cleaning workers.

Genotoxic effects have not been consistent from inhalation exposure to PCE. Inhalation exposure concentrations of from 10-220 ppm for three months to 18 years did not result in genotoxic effects (sister chromatid exchanges and chromosome aberrations) to 10 workers with occupational exposure to PCE. In a separate study, sister chromatid exchange was significantly higher in exposed workers who smoked when compared to a group of controls who were non-smokers. The workers received a TWA of 10 ppm for eight hours. Epidemiologic research has shown a potential association between chronic PCE exposure and an increased cancer risk. The findings are limited due to the simultaneous exposure to a number of chemicals. In one investigation, a subcohort (consisting of 615 dry cleaning workers employed in shops where PCE was the main solvent) was examined. The workers had no history of exposure to petroleum solvents. Excess cancer risk was not observed in this subcohort. However, the main cohort, consisting of 1,690 workers with a number having petroleum solvent exposure, had a significant increase in mortality from kidney, bladder, and cervical cancer. In two other epidemiological studies of laundry and dry cleaning workers, an increased risk of bladder cancer was not observed in workers who were compared with controls. Additional studies of dry cleaning and laundry workers have demonstrated significant increases in mortality from lung, cervical, esophageal, renal, dermal, lymphatic/hematopoietic system, and/or colon cancers. In one study, an increased risk of primary liver cancer was found in male workers with classifications of craftsman or operators of laundry or dry cleaning operations. Additionally, a retrospective cohort study of 14,457 aircraft maintenance workers examined mortality in relation to occupational exposure to over 20 solvents which included PCE. Female workers who were exposed to PCE for at least one year were found to have elevated death rates due to multiple myeloma or on-Hodgkin's lymphoma. In contrast, a cohort of white male chemical workers, having multiple chemical exposures which included PCE, was examined and found not to have an increased risk for total mortality or cancer.

Very little information is available for health effects from dermal exposures. Chemical burns (redness, blistering, sloughing of skin) have been observed with extended exposure (greater than five hours) in dry cleaning operations. Intense ocular irritation have been documented in humans following acute exposure to PCE vapors at concentrations greater than 1000 ppm.

EPA is presently reviewing PCE's WoE classification and slope factor. Pending EPA's final report, this study utilizes the existing information (EPA Health Effects Assessment document, 1991)[4] on classification and slope factor. This document gives an EPA WoE classification of B2 (probable human carcinogen) for PCE.

Trichloroethylene (TCE)

Trichloroethylene (CAS No. 79-01-6, C_2HCl_3) is a halogenated hydrocarbon. Synonyms include 1-chloro-2,2-dichloroethylene; 1,1-dichloro-2-chloroethylene; ethylene trichloride; and 1,1,2 trichloroethylene. TCE is used as an industrial solvent and degreaser, an intermediate for manufacturing other chemicals, and is commonly used in the automotive, metal, and textile industries. In the past, it has also been used as a general and obstetrical anesthetic, surgical disinfectant, and extractant of caffeine for decaffeinated coffee. Although TCE is liquid at a room temperature, evaporation does occur in industrial processes resulting in exposure by inhalation for workers and the general public residing in areas of

industry and waste disposal sites. The degreasing operation in industry is the primary cause of TCE emissions into the environment with releases also occurring from other industries and disposal of waste. Due to the ease with which it travels through soil, groundwater contamination with TCE is common. Since vaporization does not occur in subsurface areas, TCE's persistence in groundwater is evidenced by its detection in a large number of monitoring studies. Exposure may also result from contact or ingestion of food and water contaminated with TCE.

TCE interacts with a number of substances which either increase or inhibit its effect. At low concentrations of ingested alcohol, inhaled TCE metabolism is enhanced while high does of alcohol restrict the metabolism. TCE causes the heart to be more susceptible to epinephrine-induced cardiac arrhythmia in animals. Phenobarbital and 3-methylcholanthrene promoted the injury to the liver caused by TCE metabolites. The liver toxicity of carbon tetrachloride in rats is also known to be enhanced by TCE. In addition, a TCE metabolite enhances the anti-clotting effect of warfarin.

Routes of exposure for TCE include inhalation, ingestion, or dermal contact. Human absorption following inhalation or ingestion is extensive, but poor with dermal exposure. Studies on the distribution of TCE have been done on humans but primarily in animals and have demonstrated deposition in the blood and fat. TCE has been found in the blood of babies at birth following TCE anesthesia in the mother. With oral exposure, TCE has been observed in fatty tissue in animals while dermal exposure resulted in the detection of TCE in the blood of humans. In animals and humans, TCE metabolism occurs primarily in the liver following inhalation exposure. In addition to the liver, metabolism of TCE following inhalation also appears to occur in the kidneys and lungs of animals. Major metabolites are common to animals and humans. In humans, excretion of TCE occurs in the urine and by exhalation through the lungs following inhalation exposure. The same excretory pathway is also found in animals following ingestion exposure. With dermal exposure, excretion of TCE was by exhalation in subjects whose hand was submerged in a solution of TCE.

Neurological effects have been observed in animal ingestion studies with TCE. Ataxia, lethargy, convulsions, and hind limb paralysis were observed in rats administered gavage doses of 500 or 1,000 mg/kg for five days a week up to 103-104 weeks. In a separate study, mice were observed to experience a period of excitation with a subsequent subanesthetic state following exposure to TCE by gavage at doses of 1,800 mg/kg (females) or 2,400 mg/kg (males) for a period of five days a week for 35 weeks.

Hepatic lesions were not detected in persons accidentally ingesting TCE. However, rapid death following ingestion of TCE may have prevented the development of these lesions. Animal studies, however, have shown hepatic changes, including increase in the weight of the liver, at gavage doses of 240 mg/kg or greater for periods of two weeks or more. Yet, another study of rats demonstrated no non-neoplastic effects to the liver at gavage doses of 500 or 1,000 mg/kg for a period of five days a week for 103 to 104 weeks.

Renal effects have also been noted in animals with ingestion exposure. Kidney effects, which included a rise in ketone and protein levels in urine, have been documented in rodents receiving TCE in drinking water at a dose of 393 mg/kg/day or greater for a period of six months. This condition may suggest renal dysfunction. Treatment-related nephropathy has also been detected at gavage doses of 500 mg/kg or greater for a five day a week period of 103 weeks or more of exposure. In contrast, a separate

study revealed that kidney weights and histology were not out of the ordinary for mice with gavage doses of 250, 500, 1,200, or 2,400 mg/kg of TCE for an exposure period of five days a week for three weeks.

Data on the immunotoxic effects in humans were unavailable and inconclusive in animals. Effects to the hematological system have also been observed in animals. A 5% lower hematocrit was reported at a gavage exposure level of 240 mg/kg/day for 14 days in male mice. In addition, a reduction in erythrocyte count was seen in male mice at 660.2 mg/kg/day of TCE administered in drinking water after four and six months.

Case reports of humans indicate that TCE can produce cardiac arrhythmias at an ingestion dose of 350 to 500 ml.

Additionally, intestinal lesions have been seen in gavage-treated mice at doses of 216.7 or 660.2 mg/kg/day for six months.

Developmental effects, which included perinatal deaths and congenital anomalies, have been observed in humans with exposure to well water contaminated with a number of chlorinated hydrocarbons, including TCE. TCE was detected at 267 ppb while other substances were detected at much lower levels (e.g. tetrachloroethylene at 21 ppb). Due to the study's limitations which included multiple chemical exposures, the association between TCE and disease outcome could not be established.

Reproductive effects of impaired copulatory behavior were observed in male rats after a week of TCE exposure by gavage at 1,000 mg/kg for five days a week for a period of six weeks.

Human death has been documented following an accidental ingestion of TCE (dose unknown) with cause of death documented as hepatorenal failure.

Potential carcinogenic effects from ingestion exposure to TCE have also been observed. An elevated rate of childhood leukemia was observed in a study conducted in Woburn, Massachusetts. In a follow-up investigation of the same community, the leukemia cases were found to be significantly associated with access to wells with drinking water contaminated with TCE and other chlorinated organic compounds. Due to the limitations of the study (e.g. multiple chemicals in the drinking water), the cause of the leukemia was not established. Significant increases have also been observed in the incidence of hepatocellular carcinoma in mice treated by gavage with TCE at 1,000 mg/kg for a period of five days a week for 103 weeks. In addition, a dose-related increase has been seen in the incidence of leukemia in male rats receiving 50 or 250 mg/kg of TCE for a period of four to five days a week for one year.

Inhalation exposure has also resulted in health effects. Neurological outcomes have been observed in humans following exposure by inhalation. Concentrations of 0, 27, 81, or 201 ppm of TCE were administered to groups of three human subjects for four hours. Irritation of the eyes and throat and drowsiness were observed at 27 ppm or greater, headache at 81 ppm or greater, and dizziness and anorexia at 201 ppm. In another study, subjects were found to have a significant reduction in performance on a perception test, the Wechsler Memory Scale, a complex reaction time test, and manual dexterity tests with inhalation exposure of 110 ppm of TCE for two four hour exposures with an interval of 1.5 hours. In contrast, no significant treatment-related effects on behavioral task performance were reported in subjects receiving 95 ppm or 150 ppm or 300 ppm of exposure to TCE for 2.5 hours. Subjects were tested for reaction time, hand steadiness, hand tapping, and pursuit tracking. In a separate study, however. eight male human volunteers were found to have a compromise in visual-motor skills.

Subjects were exposed to 0, 100, 300, or 1,000 ppm of TCE for two hour periods with an interval of three days between exposure sessions. A significant reduction in visual-motor performance was seen at an exposure of 1,000 ppm. Subjective symptom, neurological, and psychiatric evaluations have been done in yet another study. Workers who had been employed an average of 3.75 years in industrial operations utilizing TCE as a solvent were found to have a greater likelihood of complaints which included vertigo, fatigue, and headaches with test results showing short-term memory loss, fewer word associations, and increase misunderstanding at higher mean concentrations of TCE (85 ppm). The high-dose workers were compared to those exposed to lower mean concentrations of TCE (14 or 34 ppm).

Severe liver damage in the form of necrosis has been observed in acute occupational inhalation exposure to lethal concentrations of TCE.

Kidney dysfunction and failure have also been seen with inhalation exposures in acute occupational and intentional exposure.

Immune system effects as manifested by the change in weight of the thymus gland have been observed in rats receiving continuous exposure at 800 ppm of TCE.

Hematological effects in the form of depression of delta-aminolevulinate dehydratase activity was reported in rats with continuous inhalation exposure for 10 days. The reduced activity was detected in liver and bone marrow cells at 50 ppm or greater and in erythrocytes at 398 ppm or greater.

Male mice experienced a reduction in the weight of the spleen with continuous exposure to TCE at 150 ppm for 120 days. The toxicological significance of this weight reduction is unknown.

The respiratory system has also been affected as manifested by a rise in the rate of respiration and a reduced alveolar ventilatory amplitude when TCE was administered in anesthetic concentrations to humans.

When used as an anesthetic in humans, an association has been observed between TCE and the development of cardiac arrhythmia (i.e. bradycardia, atrial and ventricular premature contractions, and ventricular extrasystole).

Chronic gastrointestinal system effects (anorexia, nausea, vomiting, and intolerance to fatty foods) have been detected in occupational inhalation exposure to TCE. In addition, a large percentage of workers with primary pneumatosis cystoides intestinalis (PCI) had a history of occupational exposure to TCE. PCI manifests as thin-walled, gas-containing cysts in the intestinal wall.

Developmental toxicity studies have shown that no malformed babies were born to mothers from a cohort of 2,117 Finnish workers, who were exposed to TCE between 1963 and 1976. In an animal study, however, litter resorption, reduced fetal body weight, and skeletal ossification anomalies were observed in the fetuses of rats, who were exposed by distillation to TCE. The exposure concentration was 100 ppm for four hours a day on days 8 to 21 of gestation.

Reproductive toxicity has also been observed with inhalation exposure. A significant rise in sperm morphology abnormalities was seen in mice, exposed to 2,000 ppm of TCE for a period of four hours a day for five days.

Potential genotoxic effects have been observed with TCE inhalation exposure of workers. Workers exposed to TCE up to 75 ppm for 1 to 21 years were observed to have a rise in hypoploid cells. In yet another study, six workers who were exposed to TCE were reported to have an increase in sister

chromatid exchanges. Since multiple chemical exposures were involved, these studies were not conclusive in associating genotoxic effects to TCE.

TCE exposure has proven fatal in a number of industrial operations. Four men died suddenly after being exposed to TCE by inhalation in degreasing operations. The cause of death was believed to be ventricular fibrillation. The TCE exposure concentrations were 200 to 8,000 ppm at the working area of one of the workers who died. In another case, a man died approximately 17 hours after cleaning a vat containing TCE at an electroplating shop. A post-mortem examination revealed fatty degeneration of the liver and old and new lung hemorrhages. Air samples obtained after the death of a male dry cleaning operator revealed TCE breathing zone concentrations of 2,900 ppm.

A number of epidemiologic studies have been done examining the effect on workers from inhalation exposure to TCE. A significant increase in bladder cancer and lymphomas was detected in a cohort of 1,424 men with unspecified exposure to TCE. In another study, a significant rise was also discovered in the incidence of lung/bronchus/trachea, cervix, and skin cancers in over 330 deceased cleaning and/or laundry workers. Exposures were mainly to tetrachloroethylene. The TCE exposure was not well documented. In contrast, fewer deaths from non-respiratory cancer were found in white males from a group of 2,646 employees of a manufacturing plant that used TCE. The workers were employed for three months or longer during 1957 to 1983. However, an association was observed between cancer of the naso- and oropharynx and exposure to TCE and cutting oil. The researchers believed that the cutting oil was more likely than TCE to be involved in the cancer formation.

Studies of the health effects from dermal exposure are sparse. In one study, dermal application of TCE made on the skin of rabbits resulted in the death of 50% of the animals at a concentration of 29 g/kg. Purified TCE (1 mg in acetone) was spread on the shaved skin of female mice. A significant rise in the incidence of tumor formation was not observed in this study.

EPA is presently reviewing TCE's WoE classification and slope factor. Pending EPA's final report, this study utilizes the existing information (EPA Health Effects Assessment document, 1991)[4] on classification and slope factor. This document gives an EPA WoE classification of B2 (probable human carcinogen) for TCE.

Vinyl Chloride (VC)

Vinyl chloride (CAS No. 75-01-4, C_2H_3Cl) is a halogenated hydrocarbon which occurs in the gaseous state. Synonyms include chloroethene, chloroethylene, ethylene monochloride, and monochloroethylene. Vinyl chloride is commonly used in the manufacture of polyvinyl chloride (PVC), a component of plastic and vinyl products. Vinyl chloride is produced from the anaerobic degradation of trichloroethylene and is found in the air and in wastewater discharges from the plastics industries. The highest potential exposure levels are seen in workers employed in the production of vinyl chloride and in populations residing near these industrial facilities or near landfills and waste disposal sites.

Vinyl chloride interacts with other substances to produce acute toxic effects to the liver as demonstrated by animal studies. Phenobarbital, Arochlor 1254 (a polychlorinated biphenyl), and trichloropropene oxide have been shown to promote the liver toxicity in animals from vinyl chloride

exposure. Ingested ethanol given simultaneously with inhaled vinyl chloride has also been observed to influence the adverse fetal and maternal effects from vinyl chloride exposure. Contrary to these other substances, cysteine reduced the liver toxicity in animals from vinyl chloride exposure.

The routes of exposure for vinyl chloride include inhalation and ingestion and less likely by dermal exposure. Human inhalation data have demonstrated that 42% of an inhaled dose of vinyl chloride is absorbed. No human studies were available examining absorption following oral and dermal exposure to vinyl chloride. However, a number of rat studies have shown complete absorption of vinyl chloride from the gastrointestinal tract following ingestion exposure. Absorption was estimated to be 0.03% or less in monkeys exposed for approximately two hours dermally. No human data were available on the distribution of vinyl chloride following inhalation, ingestion, or dermal contact. Following inhalation, animal studies have demonstrated distribution of vinyl chloride to the bile duct, blood, digestive tract, fat, kidney, liver, lung, muscle, salivary and lacrimal glands, skin, spleen, thymus, and urinary tract with highest levels of vinyl chloride metabolites found in the kidney and liver. With oral exposure, vinyl chloride was distributed to the fat, liver, lung, muscle, plasma, and skin with highest levels in the liver. The metabolic pathway has been documented for animals with inhalation and ingestion exposures. One of the pathways results in the formation of a highly reactive epoxide known as 2-chloroethylene oxide. Human data indicate that vinyl chloride metabolites are excreted in the urine and much less by exhalation following an inhalation exposure. Excretion data were unavailable for oral and dermal exposures in humans. With animals, oral exposure to vinyl chloride has resulted in excretion by exhalation and in the urine and feces.

Toxicity from vinyl chloride exposure has been primarily observed with inhalation exposure. Cases of death from narcosis have been documented in the occupational setting. Hepatic (liver damage), neurological (dizziness, ataxia, headache, narcosis, peripheral neuropathy), and reproductive (ovarian dysfunction, uterine growth) effects have also been noted with inhalation exposures. A systemic effect known as vinyl chloride disease has been seen with occupational inhalation exposure to vinyl chloride. The clinical condition is manifested by dissolution of the distal phalanges (fingers), circulatory disturbance, Raynaud's syndrome, scleroderma and effects to the blood, liver, and lung. This condition is also seen in animals with ingestion exposures.

A number of epidemiologic studies have demonstrated an association between inhalation exposure to vinyl chloride and the development of angiosarcoma, a rare liver cancer. This finding was substantiated in animal studies. More recent studies have also shown an association between inhalation exposure to vinyl chloride and the development of brain cancer. In animal studies, liver angiosarcoma and lung tumors were reported with inhalation and ingestion exposures, and brain tumors with inhalation exposure. Genotoxicity (chromosomal aberrations in lymphocytes of exposed workers) has also been reported. Children appear to be a sensitive subpopulation. Vinyl chloride has an USEPA WoE classification of A (human carcinogen).

4.4 Uncertainties Regarding the Reference Dose (RfD)

The oral reference dose (RfD) is the approximate daily exposure level for the human population (including those who are especially sensitive) which is without perceptible risk for adverse health effects. It is a value obtained by dividing the exposure level at which no adverse health effect is observed (NOAEL) by the uncertainty factor (UF) and modifying factor (MF). If a satisfactory NOAEL is unavailable, the lowest exposure level at which an adverse effect is observed (LOAEL) is utilized.

The equation for the RFD is as follows:

$$RFD = NOAEL \text{ or } LOAEL/(UF_1 \times UF_2 \ldots \times MF)$$

The uncertainty factor is a numeric value expressed in multiples of 10. Each value of 10 (e.g. 10 x 10 x 10....) stands for an area of uncertainty in the extrapolation from available data. A UF of 10 has been established for the following conditions and considers:

1) differences in the general population in order to insure the safety of the sensitive subpopulation (i.e. children and elderly)

2) extrapolation from animals to humans in order to compensate for interspecies variability between animals and humans.

3) a NOAEL obtained from a subchronic study when the risk assessment addresses a chronic exposure.

4) a LOAEL which is utilized rather than a NOAEL in order to compensate for extrapolating from a LOAEL.

The MF is a numeric value between <0-10 representing a qualitative professional assessment of further uncertainties which have not been accounted for with the uncertainty factors.

Also, the methodology of the animal studies from which the RfD is derived may not be that exacting. For this reason, EPA has established ratings (high, medium, or low) which reflect EPA's overall confidence in the specific RfD. These are shown in Table 4.1.

When human data are unavailable, animal studies are utilized to establish a RfD. EPA selects animal studies which have models that are biologically close to humans to determine the NOAEL. The objective of the computations to obtain the RfD is to guarantee an exposure level at which an adverse health effect will be unlikely. By dividing the NOAEL by the UF and MF, a 10, 100, or 1,000 fold or greater reduction in the original NOAEL is obtained. Because of this, the uncertainty of the RfD may be an order of magnitude or more and should not be seen as an exact boundary between a toxic and a nontoxic level of exposure. In fact, the RfD could very possibly be much higher without a resultant risk to health.

This procedure, therefore, overestimates the potential for a human health effect by lowering, even more, the chemical concentration level at which no health effect may be expected to develop (RfD). The hazard quotient for which the RfD acts as a denominator will very likely exceed unity in instances where the RfD is small. This acts as a positive safeguard to protect public health but may not be realistic.

4.5 Uncertainties Regarding the Slope Factor (SF)

The slope factor (SF) represents the upper bound estimate of the probability for a given response with each unit of a chemical taken in over a lifetime. The SF equation is as follows:

SF=risk per mg/kg-day

The precision of the SF has come under question due to the assumptions utilized in the formulation of the slope factor. These are listed below:

1) **Extrapolating Animal Data To Humans:** Due to ethical considerations, it would be impossible to intentionally expose humans to chemicals in order to determine the resultant adverse health effects. Occupational groups have, therefore, been investigated to examine the health effects to humans from long-term exposure to chemicals (e.g. benzene and leukemia). The number of occupational studies, however, have been limited requiring use of animal studies. When possible, data for the slope factor have been derived from human studies. If human studies are unavailable, EPA utilizes data from studies with animals which have similar responses to humans. If no single animal study is shown to be applicable, than several animal studies are utilized to compute a slope factor. EPA assumes that an animal carcinogen is carcinogenic to humans. This helps to insure that a substance with a potential for causing cancer in humans will be identified. Critics, however, question the validity of utilizing animal data. Some of the issues are discussed below.

Animal Carcinogen Assumed to Be Human Carcinogen: EPA assumes that any animal carcinogen is also a human carcinogen. This assumption is made even without research into human effects for the particular substance.

Anatomic and Physiologic Differences: Because of limited human data, EPA generally obtains information for slope factors from animal studies. Since animals (rodents) differ somewhat anatomically (e.g. no sweat glands in rats) and physiologically (e.g. less efficient DNA repair in rats) from humans, the mechanism of cancer induction may differ markedly between animals and humans.

Surface Area and Absorption: Another issue is whether the animal concentration of a chemical per unit of body weight (mg/m^2 or mg/kg) will result in the same level of toxicity for a human measured in like units. This assumes that absorption of a chemical (toxicokinetics) as seen in

animals will be similar in humans and, therefore, similar health effect will result. In reality, this may not be the case.

Sensitive Strain: The inbred strains of rats and mice used in animal studies make them highly susceptible to developing specific types of cancer. For example, the frequently used $B6C3F_1$ mouse strain is very susceptible to liver cancers (sensitive strain). Up to 40% of this strain will develop liver cancer spontaneously. Humans have a much lower rate of liver cancer (5 cases per 10,000 population). Since the same proclivity of liver cancer is not seen in humans, a likelihood exists for an overestimation of liver carcinogenicity in humans.

2) Low Dose Extrapolation and Other Dose Issues: To minimize the likelihood of cancer developing, USEPA assumes that any concentration of a chemical greater than zero has a probability of producing a carcinogenic response. Because of the body's ability to clear foreign substances, this may or may not be true. The exact concentration for specific chemicals at which the body mechanisms fail and cancer growth occurs is unknown. The conditions, under which low dose extrapolation occurs, are discussed below:

Mathematical Model: In order to determine low dose effects from high dose exposures, the EPA has selected the multistage linear mathematical model. The outcome of this model is considered to be consistent with the process of carcinogenicity (i.e. risk increase as the exposure concentration increases). It is unknown whether a cancer risk actually exists at lower doses. By assuming that no threshold exists, risk is likely overestimated.

95% Confidence Limit - Upper Bound: When an estimate is established with this model, the 95% confidence interval is computed for the estimate and the upper bound limit is utilized as the slope factor. This results in increasing the probability of cancer risk (i.e. overestimation) with every unit increase in the concentration of the chemical of concern. The probability of cancer risk is likely lower than the upper bound estimate.

Concept of Nonthreshold Effects: EPA assumes that any concentration of a chemical greater than zero has a probability of producing a carcinogenic response. Because of the body's ability to clear foreign substances, this may not be true. The exact concentration for specific chemicals at which the body mechanisms fail and cancer growth occurs is unknown. To minimize the likelihood of cancer developing, EPA has taken the position that even a minimal dose results in a quantifiable cancer risk.

A number of assumptions are utilized in computing the SF for individual chemicals. These assumptions are based on the perspective that the maximal effect can be expected in humans following exposure to any chemical. For example, the most sensitive strain of experimental animals is utilized to determine carcinogenicity of a chemical (e.g. liver cancer). The same

sensitivity would not be expected in humans. By examining the most sensitive animals or those most prone to develop cancer, the exposure concentration of a chemical which will result in an acceptable cancer risk is lowered. By utilizing these conditions and animal models, any substance with a potential for causing human cancer will be identified and measures taken to decrease the probability of cancer risk.

5.0 RISK CHARACTERIZATION

Current and potential future risks are evaluated in this chapter utilizing exposure and toxicology information previously discussed. Risk characterization is presented in both quantitative and/or qualitative format. When data are available, quantitative risk characterizations are performed and evaluated. If data are unavailable, possible risks are discussed in a qualitative manner. The risk characterization is reported in the following sections:

* **Section 5.1 - Risk Estimation Methods**
* **Section 5.2 - Current Conditions**
* **Section 5.3 - Future Conditions**
* **Section 5.4 - Uncertainties**
* **Section 5.5 - Summary**
* **Section 5.6 - Conclusions**

5.1 Risk Estimation Methods

Risk estimation methods used in this report were based on USEPA guidelines.[1]

5.1.1 Calculation of Carcinogenic Risk

Carcinogenic risk is calculated as the incremental probability of an individual developing cancer over a lifetime (70 years), due to exposure to a carcinogenic compound. This is also referred to as incremental or excess lifetime cancer risk (ELCR) and represents the increased risk of developing cancer above the background rate, estimated at about 3E-1 (30%).

Estimates of ELCR are based on exposure pathways, exposure concentrations, and toxicological information. Exposure is estimated using assumptions presented in Chapter 3. Chemical specific carcinogenic slope factors (SF), were used to convert estimated CDI, averaged over a lifetime, to ELCR.

The dose-response relationship is considered to be linear under the low dose conditions usually encountered in environmental exposures. Under this assumption, the SF is a constant and risk is directly related to intake. The linear low-dose cancer risk equation is:

$$Risk = CDI \times SF$$

where:

Risk = a unitless probability of an individual developing cancer;

CDI = Chronic daily intake (dose) averaged over 70 years (mg/kg-day);

SF = slope factor, expressed in $(mg/kg\text{-}day)^{-1}$.

The SF usually represents an upper 95th percentile confidence limit of the probability of response, based on experimental animal data. Therefore, the risk estimate will also be an upper-bound estimate and *true risk* is likely to be less than predicted by this model.

5.1.2 Noncarcinogenic Effects

Noncarcinogenic effects include neurotoxic, hepatotoxic, nephrotoxic, teratogenic, reproductive reactions, and any other noncancer related systemic toxic responses. The potential for an individual suffering a noncarcinogenic effect is not expressed as a probability, but as a ratio or quotient. The hazard quotient (HQ) is the ratio of an exposure level over a specified period (CDI) to the chemical specific reference dose (RfD) which is not expected to produce toxic effects over the period of concern. The HQ is calculated as follows:

$$\text{Noncancer Hazard Quotient} = CDI/RfD$$

CDI = Daily intake (dose) in mg/kg-day;

RfD = reference dose in mg/kg-day.

The HQ *is not a probability*. If the HQ exceeds 1 there is concern that the most sensitive members of the exposed population may experience adverse health effects. The higher the HQ, the greater the concern. Effects can be evaluated over three time periods; short term, usually less than 2 weeks (acute), 2 weeks to 7 years (subchronic), and more than 7 years (chronic). In this assessment only chronic exposures were evaluated.

5.1.3 Health Risks for Multiple Substances

Exposures to more than one chemical may occur at a site. Very little data are available on the combined action of chemical mixtures. It is possible that the presence of two or more chemicals may have an antagonistic, synergistic, or additive effect on health. Unless data are available supporting another interpretation, carcinogenic risk, carcinogenic and non-carcinogenic hazard quotients are assumed to be additive.[1] In both cases, values for individual chemical specific ELCR and HQs are summed to obtain an estimate of total ELCR or the systemic hazard index (HI).

5.2 Risk Analysis Under Current Conditions

Data from the Bradley production well was used to estimate human health risk from groundwater under current conditions. Risk estimates were also calculated for exposure to soil gas and fugitive dust from the Estes Landfill. Risk from exposure to water in Southbank Lake is evaluated qualitatively. In addition to current risks, potential future risks from exposure to contaminants found in groundwater underneath and downgradient of the landfills were estimated. The exposure parameters used are described in Chapter 3.

5.2.1 Downgradient Public/Private Domestic Use Wells

There are no municipal or private domestic use wells close enough to have been impacted by groundwater contamination from the landfills according to a private well survey conducted by Harding Lawson Associates.[6]

The closest wells to the Estes Landfill are registered to R.F. Kingston and G. Sorensen. The Kingston well is located southwest of 40th Street and Van Buren Street, approximately 1.5 miles north-northwest of the landfill. The Sorensen well is located between 32nd and 40th Streets and between Broadway Road and Southern Avenue, approximately 2 miles south-southwest of the Estes Landfill. Neither of these wells are considered by hydrologists at Harding Lawson Associates to be close enough to be impacted by the Estes/Bradley Landfills. However, no data were available for these wells at the time this risk assessment was prepared.

Assuming that these 2 wells have not been impacted, no current risk is known to exist from exposure to contaminants in groundwater through registered private domestic wells in the landfill area. If unregistered private domestic wells exist in the area of contaminated groundwater, then some risk may be presented by contaminants from the landfills. However, given the nature of land uses downgradient of the landfills, such an occurrence is unlikely.

5.2.2 Bradley Production Well

The Bradley production well is located on the Bradley Landfill property, just south of the Estes/ Bradley property boundary. The well is used to fill a dust control vehicle with water. The estimated ELCR resulting from inhalation of vapors from dust control use of the water in an occupational exposure scenario ranged from 8E-8 (eight-in-one-hundred-million) for central tendency exposure to 8E-6 (eight-in-one-million) for reasonable maximum exposure (RME). The central tendency estimate is considered a negligible risk, while the RME estimate is within the acceptable range of risk established by the USEPA (1E-4 to 1E-6). The Hazard Indices for both exposure scenarios were substantially less than 1, indicating that the most sensitive members of the workforce would be unlikely to experience acute adverse health effects as a result of inhalation of vapors from water used for dust control at the Bradley Landfill.

5.2.3 Soil Gas Emissions

The estimated ELCR resulting from inhalation of vapors escaping from the Estes Landfill ranged from 5E-7 (five-in-ten-million) for central tendency occupational exposure to 5E-6 (five-in-one-million) for reasonable maximum occupational exposure (RME). The central tendency estimate is considered a

negligible risk, while the RME estimate is within the acceptable range of risk established by the USEPA. The Hazard Indices for both exposure scenarios were substantially less than 1, indicating that the most sensitive members of the workforce would be unlikely to experience acute adverse health effects as a result of inhalation of vapors escaping from the Estes Landfill.

Methane concentrations in soil gas ranged from 500 mg/m^3 to 190,000 mg/m^3. Methane is a simple asphyxiant, but its explosive properties are of more importance to public health. The lower explosive limit for methane in air is 5%. Concentrations of methane in the range found in soil gas at the landfill would not be expected produce asphyxiating or explosive conditions in outdoor air under current conditions.

5.2.4 Fugitive Dust Emissions

The reasonable maximum occupational ELCR from inhalation of fugitive dust eroding from surface soil at the Estes Landfill was estimated to be 7E-11 (seven-in-one-hundred-billion), which is considered an negligible risk. The Hazard Index was substantially less than 1, indicating that the most sensitive members of the workforce would be unlikely to experience acute adverse health effects as a result of inhalation of fugitive dust eroding from the Estes Landfill.

5.2.5 Southbank Lake

Southbank Lake is downgradient of the Estes Landfill and is fed by shallow groundwater from the alluvium of the Salt River channel. While low levels of TCE have been detected in Southbank Lake, the Estes Landfill has not been positively identified as the source of TCE in the lake. Bromar Arizona owns the lake and intends to allow fishing in the lake with a catch and release policy. Under the plan, no fish would be allowed to be removed from the site. The lake is fenced with a six-foot chain link fence and is well marked with "no trespassing" signs. Currently, no fishing occurs at the lake.[16]

Surface water samples collected by Harding Lawson Associates in June, 1989 from Southbank Lake found TCE at concentrations of 2.3 μg/L, and 1.8 μg/L. No other VOCs were detected during the 1989 sampling. One lake sample collected by Kenneth D. Smith and Associates in January, 1994 contained TCE at a concentration of 1.7 μg/L. No other VOCs have been detected in the lake water.

The health effects from incidental exposure to TCE at the lake through inhalation of TCE vapors from the lake would be expected to be negligible due to the low concentration of TCE in the water. In addition, exposure to TCE in fish tissue would be expected to be negligible. All detections of TCE in the lake are at levels lower than the USEPA MCL for TCE of 5 μg/L .

While health risks at Southbank Lake appear negligible, additional analytical water quality and exposure data from the lake would be required in order to quantitatively characterize risk at Southbank Lake.

5.3 Risk Analysis - *Potential Future Exposure*

Data from the monitor wells indicate that groundwater downgradient of the landfills has been contaminated with VOCs. While there is currently only 1 complete exposure route to this contaminated

groundwater (the Bradley well), future exposures may be possible since there are no institutional controls preventing the installation of domestic use production wells within the contaminated area.

5.3.1 Site-Related Potential Risk as Measured in the Monitor Wells

For each of the 48 monitor and piezometer well sites, the potential ELCR for occupational exposure was estimated by summing cancer risks from each chemical found in a specific well.

Potential ELCR estimates were calculated for 48 monitor and piezometric wells downgradient of the landfill, *despite the fact that all of the monitor and piezometric wells are locked and are not used as drinking water*. However, *potential* future exposure to groundwater exists downgradient of the landfill since there are no institutional controls preventing the installation of wells within the plume area. The area downgradient of the landfill is zoned for occupational uses and is in close proximity to Sky Harbor Airport. Any future exposure would be expected to be occupational rather than residential. The risk and hazard estimates represent upper-bounds *theoretical* risk that may result from occupational use of water in the monitor wells.

Arsenic is a natural component of the Arizona environment. To determine potential risk from this naturally occurring component and other chemicals of concern, analyses were conducted that include and exclude arsenic as a chemical of concern. Arsenic has been selected as a site-related chemical of concern in 12 of the monitor/piezometric wells. An analysis conducted by Harding Lawson Associates has determined that arsenic concentrations in the other monitor wells are at background or naturally occurring concentrations.[17] Therefore, in accordance with EPA risk assessment guidance[1], site-related risk estimates from wells containing arsenic at background levels do not include potential risk contributed by arsenic. Total potential risk estimates include risk contributed by arsenic.

Excess Lifetime Cancer Risk Estimates

The highest central tendency (4.2 year occupational exposure) site-related *potential* estimated ELCR was 4E-3 (four-in-one-thousand) in well EWPZ-1. Virtually all of the site-related potential risk in this well is presented by vinyl chloride. EWPZ-1 is a shallow piezometric well located in an area of clustered wells on the Estes/Bradley Landfill border. The highest RME site-related *potential* estimated ELCR was 6E-2 (six-in-one-hundred) in well EWPZ-3. EWPZ-3 is a shallow piezometric well located in an area of clustered wells on the Estes/Bradley Landfill border.

In general, potential ELCR estimates are higher in monitor wells located on the southern edge of the landfill property than in off-site monitor wells. Most of the off-site monitor wells have ELCR estimates within the acceptable range of risk established by the USEPA, while many of the on-site monitor wells have potential ELCR estimates in excess of the acceptable range of risk. *Current real risk from these monitor wells is nonexistent since no currently complete exposure route exists.*

Table 5.1 displays site-related potential ELCR and Hazard Indices for each of the sampled wells.

Table: 5.2: *Total* potential future excess lifetime cancer risk and non-cancer hazard index from potential ingestion of groundwater at each groundwater sampling site, Estes Landfill Study Area

SITE	CURRENT USE	AVERAGE EXPOSURE (MEAN)		REASONABLE MAX EXPOSURE (RME)	
		CARCINOGENIC	NON-CARCINOGENIC	CARCINOGENIC	NON-CARCINOGENIC
		RISK	HAZARD INDEX	RISK	HAZARD INDEX
BW-SD	Monitor	9E-06	<1	8E-05	<1
BW-SES	Monitor	6E-06	1	5E-05	1
BW-WD	Monitor	7E-05	1	7E-04	1
EW-1	Monitor	6E-06	<1	5E-05	<1
EW-2	Monitor	8E-06	2	6E-05	2
EW-3	Monitor	5E-06	<1	4E-05	<1
EW-4	Monitor	6E-05	2	5E-04	3
EW-5	Monitor	1E-04	1	1E-03	1
EW-5TM	Monitor	7E-06	1	4E-05	1
EW-6	Monitor	1E-03	3	1E-02	5
EW-6TM	Monitor	1E-05	5	6E-05	5
EW-7	Monitor	7E-06	<1	5E-05	<1
EW-8	Monitor	1E-05	<1	9E-05	1
EW-9	Monitor	1E-04	8	1E-03	9
EW-10	Monitor	7E-06	<1	6E-05	<1

SITE	CURRENT USE	AVERAGE EXPOSURE (MEAN)		REASONABLE MAX EXPOSURE (RME)	
		CARCINOGENIC	NON-CARCINOGENIC	CARCINOGENIC	NON-CARCINOGENIC
		RISK	HAZARD INDEX	RISK	HAZARD INDEX
EW-11	Monitor	1E-05	3	2E-04	3
EW-12	Monitor	7E-06	<1	6E-05	<1
EW-13	Monitor	6E-06	<1	7E-05	1
EW-14	Monitor	2E-05	1	2E-04	1
EW-15	Monitor	9E-04	1	1E-02	2
EW-16	Monitor	3E-05	9	2E-04	10
EW-17	Monitor	1E-05	2	7E-05	3
EW-18	Monitor	4E-04	7	7E-03	9
EW-E	Monitor	1E-03	7	1E-02	9
EW-ETM	Monitor	7E-05	7	5E-04	7
EW-NE	Monitor	5E-06	<1	4E-05	<1
EW-NW	Monitor	2E-04	6	2E-03	6
EW-OE	Monitor	2E-05	4	2E-04	8
EW-PZ1	Piezometer	4E-03	7	5E-02	15
EW-PZ2	Piezometer	1E-03	3	2E-02	4
EW-PZ3	Piezometer	3E-03	7	6E-02	10
EW-PZ4	Piezometer	1E-05	8	7E-05	9
EW-PZ5	Piezometer	2E-04	5	2E-03	11

SITE	CURRENT USE	CENTRAL TENDENCY EXPOSURE (MEAN)		REASONABLE MAX EXPOSURE (RME)	
		CARCINOGENIC	NON-CARCINOGENIC	CARCINOGENIC	NON-CARCINOGENIC
		RISK	HAZARD INDEX	RISK	HAZARD INDEX
EW-PZ5	Piezometer	2E-04	5	2E-03	11
* EW-PZ6	Piezometer	8E-04	7	6E-03	9
* EW-RW1	Piezometer	2E-03	16	2E-02	28
* EW-RW2	Piezometer	3E-04	7	3E-03	8
* EW-W	Monitor	4E-04	7	4E-03	8
EW-WTM	Monitor	N	6	N	6
SB-3	Monitor	3E-06	<1	2E-05	<1
SB-4	Monitor	2E-06	<1	2E-05	<1
SB-5	Monitor	6E-06	<1	4E-05	<1
SB-6	Monitor	3E-06	<1	3E-05	<1
SB-7	Monitor	6E-06	<1	4E-05	<1
TW-1	Monitor	2E-06	<1	2E-05	<1
TW-2	Monitor	9E-06	<1	5E-05	<1
TW-3	Monitor	6E-06	3	7E-05	4
TW-4	Monitor	5E-06	<1	6E-05	2
TW-4	Monitor	2E-05	3	1E-04	3

N- No site-related carcinogenic chemicals of concern

* -Arsenic included as a site-related chemical of concern

5.3.2 Total Potential Risk in Monitor Wells

Total *potential* ELCR estimates were calculated for 48 monitor or piezometric wells downgradient of the landfill. Total risk estimates include all chemicals of concern regardless of whether or not they are naturally occurring.

All of the monitor and piezometric wells are locked and are not used as drinking water. However, *potential* exposure to groundwater exists in the area downgradient of the landfill since there are no institutional controls preventing the installation of wells within the plume area. Due to proximity to the airport and the fact that the area downgradient of the landfill is zoned for occupational uses, any future exposure would be expected to be occupational rather than residential. The risk and hazard estimates presented in this section represent the theoretical risk that would result from occupational domestic use of groundwater underneath and downgradient of the landfills.

Total potential ELCRs for the entire groundwater data set (using all qualified analytical results from all water samples, including arsenic) ranged from 3E-4 (three-in-ten-thousand) for 4.2 years of occupational exposure to 2E-3 (two-in-one-thousand) for 25 years of occupational exposure. Both of these risk estimates are in excess of the acceptable range of risk of 1E-4 (one-in-ten-thousand) to 1E-6 (one-in-one-million) established by the USEPA. Vinyl chloride represents 92% of the total potential carcinogenic risk. Arsenic accounts for approximately 5% of the risk, with an average scenario contribution of 3E-5 (three-in-one-hundred-thousand) and an RME contribution of 2E-4 (two-in-one-thousand).

The highest central tendency total *potential* estimated ELCR was 4E-3 (four-in-one-thousand) in well EWPZ-1. The highest RME *potential* estimated ELCR was 6E-2 (six-in-one-hundred) in well EWPZ-3. EWPZ-1 and EWPZ-3 are shallow piezometric wells located in an area of clustered wells on the Estes/Bradley Landfill border.

The highest central tendency scenario total *potential* Hazard Index was 16 in well EWRW-1. EWRW-1 is a monitor well located in an area of clustered wells on the Estes/Bradley Landfill border. The highest RME total *potential* Hazard Index was 28 in well EWPZ-3.

In general, potential ELCR and HIs are higher in monitor wells located on the southern edge of the landfill property than in off-site monitor wells. Most of the off-site monitor wells have total ELCR estimates within the acceptable range of risk established by the USEPA, while many of the on-site monitor wells have estimates in excess of the acceptable range of risk. *However, current risks from these monitor wells are nonexistent since no complete exposure routes exist.*

Table 5.2 displays total potential ELCR and Hazard Indices for each of the sampled wells. Appendix Table B provides a breakdown of risk by chemical at each well.

Table: 5.1: *Site-Related* potential future excess lifetime cancer risk and non-cancer hazard index from potential ingestion of groundwater at each groundwater sampling site, Estes Landfill Study Area

SITE	CURRENT USE	CENTRAL TENDENCY EXPOSURE (MEAN)		REASONABLE MAX EXPOSURE (RME)	
		CARCINOGENIC	NON-CARCINOGENIC	CARCINOGENIC	NON-CARCINOGENIC
		RISK	HAZARD INDEX	RISK	HAZARD INDEX
BW-SD	Monitor	3E-06	<1	4E-05	<1
BW-SES	Monitor	4E-07	<1	4E-06	<1
BW-WD	Monitor	6E-05	1	6E-04	1
EW-1	Monitor	2E-06	<1	2E-05	<1
EW-2	Monitor	2E-08	1	2E-07	2
EW-3	Monitor	3E-07	<1	2E-06	<1
EW-4	Monitor	6E-05	2	5E-04	2
EW-5	Monitor	1E-04	<1	1E-03	1
EW-5TM	Monitor	N	<1	N	<1
* EW-6	Monitor	1E-03	3	1E-02	5
EW-6TM	Monitor	N	4	N	<1
EW-7	Monitor	8E-07	<1	1E-05	<1
EW-8	Monitor	8E-07	<1	1E-05	<1
* EW-9	Monitor	1E-04	7	1E-03	9

SITE	CURRENT USE	CENTRAL TENDENCY EXPOSURE (MEAN)		REASONABLE MAX EXPOSURE (RME)	
		CARCINOGENIC	NON-CARCINOGENIC	CARCINOGENIC	NON-CARCINOGENIC
		RISK	HAZARD INDEX	RISK	HAZARD INDEX
EW-10	Monitor	1E-06	<1	1E-05	<1
EW-11	Monitor	9E-06	2	1E-04	3
EW-12	Monitor	1E-07	<1	1E-06	<1
EW-13	Monitor	4E-07	<1	3E-06	<1
EW-14	Monitor	2E-05	<1	2E-04	1
EW-15	Monitor	9E-04	1	1E-02	1
* EW-16	Monitor	3E-05	10	2E-04	10
EW-17	Monitor	1E-07	1	2E-06	3
EW-18	Monitor	4E-04	7	7E-03	8
* EW-E	Monitor	1E-03	7	1E-02	9
EW-ETM	Monitor	N	4	N	4
EW-NE	Monitor	2E-07	<1	1E-06	<1
EW-NW	Monitor	2E-04	6	2E-03	6
* EW-OE	Monitor	2E-05	4	2E-04	8
EW-PZ1	Piezometer	4E-03	7	5E-02	15
* EW-PZ2	Piezometer	1E-03	3	2E-02	4
* EW-PZ3	Piezometer	3E-03	7	6E-02	10
* EW-PZ4	Piezometer	1E-05	8	7E-05	9

SITE	CURRENT USE	AVERAGE EXPOSURE (MEAN)		REASONABLE MAX EXPOSURE (RME)	
		CARCINOGENIC	NON-CARCINOGENIC	CARCINOGENIC	NON-CARCINOGENIC
		RISK	HAZARD INDEX	RISK	HAZARD INDEX
EW-PZ6	Piezometer	8E-04	7	6E-03	9
EW-RW1	Piezometer	2E-03	16	3E-02	28
EW-RW2	Piezometer	3E-04	7	3E-03	8
EW-W	Monitor	4E-04	7	4E-03	8
EW-WTM	Monitor	4E-05	8	2E-04	8
SB-3	Monitor	3E-06	<1	2E-05	<1
SB-4	Monitor	2E-06	<1	2E-05	<1
SB-5	Monitor	6E-06	<1	4E-05	<1
SB-6	Monitor	3E-06	<1	3E-05	<1
SB-7	Monitor	6E-06	<1	4E-05	<1
TW-1	Monitor	9E-06	<1	9E-05	<1
TW-2	Monitor	1E-05	<1	9E-05	<1
TW-3	Monitor	1E-05	3	1E-04	4
TW-4	Monitor	1E-05	<1	1E-04	2
TW-P	Monitor	9E-06	1	8E-05	2

5.4 Uncertainties in the Risk Characterization

All risk estimates are based on a number of assumptions regarding contaminant concentrations, exposures, and toxicity information. Uncertainty is present at all stages in this process. Care is taken at each step to insure that the assumptions made are upper-bound estimates.

The risk estimates that are made for the monitor wells use data acquired from Harding Lawson Associates in electronic format. The data were averaged, and the mean and 95% UCL were assumed to be the contaminant concentration to which people would be exposed for 4.2 and 25 years. VOC concentrations in samples from the monitor wells represent contaminant concentrations at the saturated interval penetrated by the wells. Actual concentrations in different aquifer zones may be higher or lower than the reported values.

Risk and hazard estimates are based on dose-response relationships observed, primarily, in experimental animals. This introduces several sources of uncertainty into the final estimates that are used to characterize risk. There may be differences between animals and humans in metabolic response to a chemical. The test animals may have genetic predispositions that are not considered. High doses are administered to small populations and then low dose response is estimated by extrapolation. Experimental animals have naturally short life spans, whereas humans do not. The toxicity values used were developed singly and responses may differ when complex mixtures are present.

5.5 Summary

The goal of this risk assessment is to provide risk information necessary to assist decision-making within the risk management process. The objectives of this risk assessment are to provide an evaluation of health risks and the threat to public health that may result from exposure to contaminants present in various media in the area of the Estes Landfill.

This risk assessment evaluates exposure to contaminants from soil gas, fugitive dust, surface water, water in downgradient private wells, and exposures from use of the Bradley Landfill production well. In addition, hypothetical potential future exposure to water in the monitor wells is evaluated.

No private domestic or public wells close enough to have been impacted by the Estes/Bradley Landfills have been identified. Therefore, no current risk is known to exist from exposure to contaminants in groundwater through registered private domestic or public wells downgradient of the landfill area. If unregistered private domestic wells exist in the area of contaminated groundwater, then some risk may be presented by contaminants from the landfill. However, given the nature of land uses downgradient of the landfill, such an occurrence is considered unlikely.

The Bradley production well is located on the Bradley Landfill property, just south of the Estes/Bradley property boundary. The well is used to fill a dust control vehicle with water. This risk analysis has determined that use of this well water for dust control currently would not be expected to pose an unacceptable health risk to workers.

The reasonable maximum occupational ELCR estimate from inhalation of soil gas escaping from the Estes Landfill within the acceptable range of risk established by the USEPA. The central tendency exposure ELCR would present a negligible health risk. Both exposure scenarios indicated that non-cancer

health effects would not be expected to occur as a result of inhalation of vapors escaping from the Estes Landfill as it currently exists.

The estimated ELCR resulting from inhalation of fugitive dust from the landfill in an occupational exposure scenario would present a negligible cancer risk. Occupational inhalation of fugitive dust from the site would not be expected to result in acute adverse health effects.

The health effects from incidental exposure to TCE at the Southbank Lake is expected to be negligible due to the low concentration of TCE in the water. All detections of TCE in the lake are at levels lower than the USEPA MCL for TCE. Additional analytical water quality and exposure data from the lake would be required in order to quantitatively characterize risk at Southbank Lake.

In addition to health risks from currently complete exposure routes, *potential* health risks were evaluated for occupational ingestion of groundwater underneath and downgradient of the Estes Landfill. These risk estimates are made in order to provide additional information for decision making within the risk management process, and because there are no institutional controls preventing the installation of wells within the plume area. Groundwater data from the monitor and piezometric wells in the investigation were used to measure hypothetical potential future health risk. *All of the monitor and piezometric wells are locked and are not used as drinking water.*

Total potential ELCR for the entire groundwater data set (using all qualified analytical results from all water samples) ranged from 3E-4 (three-in-ten-thousand) for 4.2 years of occupational exposure to 2E-3 (two-in-one-thousand) for 25 years of occupational exposure. Both of these risk estimates are in excess of the acceptable range of risk of 1E-4 (one-in-ten-thousand) to 1E-6 (one-in-one-million) established by the USEPA. The majority of total potential future carcinogenic risk is presented by vinyl chloride.

5.6 Conclusions

No current risk is known to exist from exposure to contaminants in groundwater through registered private domestic wells within the portion of the aquifer contaminated by the Estes/Bradley Landfills.

Use of the Bradley Landfill production well for dust control purposes currently presents a negligible health risk.

Emissions of organic compounds present in the soil gas at the Estes Landfill currently presents a negligible health risk.

Emissions of fugitive dust that may result from wind erosion of surface soil from the Estes Landfill presents a negligible health risk.

If unregistered private domestic wells exist in the area of contaminated groundwater, then some risk may be presented by contaminants from the landfill. However, given the nature of land uses downgradient of the landfill, such an occurrence is considered unlikely.

While no public or semi-public wells present in the area are impacted by groundwater contamination from the landfill, groundwater quality in the monitor wells in and downgradient of the landfill has been degraded. Vinyl chloride is present in many of the monitor wells at concentrations that would be of public health concern if the water were used for drinking. In the absence of effective risk management actions, it is possible that migration of the contaminants to the southwest and west of the landfills could impact domestic use and production wells in the future. Such an impact would have the potential to adversely affect public health.

References

1. U.S. Environmental Protection Agency. 1989. **Risk Assessment Guidance for Superfund (RAGS).** Volume 1, Human Health Evaluation Manual (Part A), Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89-002.

2. U.S. Environmental Protection Agency. 1991. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Supplemental Guidance, "Standard Default Exposure Factors," Interim Final. Office of Emergency and Remedial Response Toxics Integration Branch. OSWER Directive 9285.6-03.

3. Arizona Department of Health Services. 1986. Fortieth Street (Bradley) Landfill Site Inspection Report, (Includes Information Relevant to the Adjoining Estes Landfill). Office of emergency Response and environmental Analysis. January 17, 1986.

4. Harding Lawson and Associates. 1992. Draft Estes landfill Phase II Groundwater Quality Investigation, Phoenix, Arizona. December 24, 1992.

5. Kenneth D. Schmidt and Associates. 1994. Update on Volatile Halocarbons in Groundwater at the Southbank Project. March 7, 1995.

6. Harding Lawson Associates. 1995. Remedial Data Acquisition, Estes Landfill, Phoenix, Arizona. April 5, 1995.

7. Harding Lawson Associates. 1995. Surface soil Sampling, Estes Landfill, Phoenix, Arizona. March 17, 1995.

8. U.S. Environmental Protection Agency. 1995. Integrated Risk Information System (IRIS) Online. Office of Health and Environment. Cincinnati, OH. June, 1995. Washington, DC. June, 1995.

9. Vogel T., McCarty P. 1985. Biotransformation of Tetrachloroethylene to Trichlorothylene, Dichloroethylene, Vinyl Chloride, and Carbon Dioxide under Methanogenic Conditions. Applied and Environmental Microbiology, May 1985. p. 1080-1083.

10. U.S. Environmental Protection Agency. 1988. Superfund Exposure Assessment Manual. Office of Remedial Response. EPA/540/1-88-001.

11. U.S. Environmental Protection Agency. 1990. Human Health Evaluation Manual Part B. Office of Emergency and Remedial Response. EPA/9285.7-01B.

12. U.S. Environmental Protection Agency. 1994. Health Effects Assessment Summary Tables. Annual FY-1994 Office of Emergency and Remedial Response. Washington, DC. March, 1994.

13. U.S. Department of Health and Human Services. 1989-1995. **Toxicological Profiles.** Agency for Toxic Substances and Disease Registry. Atlanta, Georgia.

14. Sittig, M. 1991. **Handbook of Toxic and Hazardous Chemical and Carcinogens**, 3rd. ed., Noyes Publications: Park Ridge, NJ.

15. U.S. Environmental Protection Agency. 1989. Exposure Factors Handbook. Office of Health and Environmental Assessment. EPA/600/8-89/043.

16. Arizona Department of Environmental Quality. 1995. Estes Landfill Project Summary - June 30, 1995. E-5161.01.11.1

17. Harding Lawson Associates. 1995. Characterization of Background Arsenic Groundwater Concentrations for Use in the Estes Landfill Human Health Risk Assessment. August 2, 1995.

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: BW-NED Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			7.3	7.3	0.00000004	7.3	7.3	1/ 1	100.0%	-- ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 1	0.0%	-- D	7E+00	
2. Calcium (Ca)	7440-70-2	mg/L	40	40		40	40	1/ 1	100.0%	-- ND		
3. Chloride (Cl)-		mg/L	95	95		95	95	1/ 1	100.0%	-- ND		
4. Magnesium (Mg)	7439-95-4	mg/L	18	18		18	18	1/ 1	100.0%	-- ND		
5. Manganese (Mn)	7439-96-5	mg/L	0.032	0.032		0.032	0.032	1/ 1	100.0%	-- D	4E-02	
6. Potassium (K)	7440-09-7	mg/L						0/ 1	0.0%	-- ND		
7. Sodium (Na)	7440-23-5	mg/L	150	150		148	148	1/ 1	100.0%	-- ND		
8. Sulfate (SO4)	14808-79-8	mg/L	23	23		23	23	1/ 1	100.0%	-- D	4E+02	
9. Total Dissolved Solids (TDS)		mg/L	620	620		619	619	1/ 1	100.0%	-- ND		
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0%	-- ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0%	-- D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 1	0.0%	-- D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0%	-- D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0%	-- B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0%	-- A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0%	-- B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0%	-- B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0%	-- D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0%	-- B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0%	-- D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0%	-- ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0%	-- D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0%	-- B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0%	-- ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0%	-- B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0%	-- D		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: BW-NED Usage:											
O R G A N I C											
18. Bromoform (THM) (BRFM)	75-25-2	µg/L					0/ 1	0.0% --	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L					0/ 1	0.0% --	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L					0/ 1	0.0% --	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L					0/ 1	0.0% --	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L					0/ 1	0.0% --	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L					0/ 1	0.0% --	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L					0/ 1	0.0% --	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L					0/ 1	0.0% --	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L					0/ 1	0.0% --	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L					0/ 1	0.0% --	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L					0/ 1	0.0% --	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L					0/ 1	0.0% --	ND		
30. beta-Chloronaphthalene	91-58-7	µg/L					0/ 1	0.0% --	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L					0/ 1	0.0% --	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L					0/ 1	0.0% --	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L					0/ 1	0.0% --	B2	3E-03	2E-01
34. Dibenzofuran	132-64-9	µg/L					0/ 1	0.0% --	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L					0/ 1	0.0% --	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L					0/ 1	0.0% --	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L					0/ 1	0.0% --	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L					0/ 1	0.0% --	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L					0/ 1	0.0% --	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L					0/ 1	0.0% --	B2	8E-02	
41. 1,1-Dichloroethane (DCA)	75-34-3	µg/L					0/ 1	0.0% --	C	7E+01	
42. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L					0/ 1	0.0% --	B2	4E-01	5E+00
43. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L					0/ 1	0.0% --	C	6E-02	7E+00
44. 1,2-Dichloroethylene (TOTAL)		µg/L					0/ 1	0.0% --	D	7E+01	
45. Dichloromethane (DCM)	75-09-2	µg/L					0/ 1	0.0% --	B2	5E+00	5E+00
46. 2,4-Dichlorophenol	120-83-2	µg/L					0/ 1	0.0% --	D	2E+01	
47. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L					0/ 1	0.0% --	B2		
48. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L					0/ 1	0.0% --	B2		
49. Diethyl phthalate	84-66-2	µg/L					0/ 1	0.0% --	D	6E+03	5E+03
50. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L					0/ 1	0.0% --	B2	3E+00	4E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: BW-NED Usage:											
O R G A N I C											
51. Dimethyl phthalate	131-11-3	µg/L					0/ 1	0.0% --	D	7E+04	
52. 2,4-Dimethylphenol	105-67-9	µg/L					0/ 1	0.0% --	NA	1E+02	
53. 2,4-dinitrophenol	51-28-5	µg/L					0/ 1	0.0% --	ND	1E+01	
54. 2,4-dinitrotoluene	121-14-2	µg/L					0/ 1	0.0% --	B2	5E-02	
55. 2,6-dinitrotoluene	606-20-2	µg/L					0/ 1	0.0% --	ND	7E+00	
56. Dioctylphthalate	117-84-0	µg/L					0/ 1	0.0% --	ND	1E+02	
57. Ethylbenzene (ETB)	100-41-4	µg/L					0/ 1	0.0% --	D	7E+02	7E+02
58. Fluoranthene (PAH)	206-44-0	µg/L					0/ 1	0.0% --	D	3E+02	
59. Fluorene (PAH)	86-73-7	µg/L					0/ 1	0.0% --	D	3E+02	
60. Hexachlorobenzene	118-74-1	µg/L					0/ 1	0.0% --	B2	2E-02	1E+00
61. Hexachlorobutadiene	87-68-3	µg/L					0/ 1	0.0% --	C	5E-01	
62. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L					0/ 1	0.0% --	D	5E+01	5E+01
63. Hexachloroethane	67-72-1	µg/L					0/ 1	0.0% --	C	3E+00	
64. 2-Hexanone	591-78-6	µg/L					0/ 1	0.0% --	NA		
65. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L					0/ 1	0.0% --	B2	3E-02	2E-01
66. Isophorone	78-59-1	µg/L					0/ 1	0.0% --	C	4E+01	
67. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L					0/ 1	0.0% --	D	4E+03	
68. Methyl isobutyl ketone	108-10-1	µg/L					0/ 1	0.0% --	NA	6E+02	
69. 2-methylnaphthalene	91-57-6	µg/L					0/ 1	0.0% --	ND		
70. 2-Methylphenol (o-Cresol)	95-48-7	µg/L					0/ 1	0.0% --	C	4E+01	
71. 4-methylphenol	106-44-5	µg/L					0/ 1	0.0% --	C	4E+01	
72. Naphthalene (PAH)	91-20-3	µg/L					0/ 1	0.0% --	D	3E+02	
73. 2-Nitroaniline	88-74-4	µg/L					0/ 1	0.0% --	NA	4E-01	
74. m-Nitroaniline	99-09-2	µg/L					0/ 1	0.0% --	ND		
75. Nitrobenzene	98-95-3	µg/L					0/ 1	0.0% --	D	4E+00	
76. p-Nitrophenol	100-02-7	µg/L					0/ 1	0.0% --	NA		
77. 2-NITROPHENOL (UG/L)	88-75-5	µg/L					0/ 1	0.0% --	ND		
78. n-Nitroso-di-n-propylamine	621-64-7	µg/L					0/ 1	0.0% --	B2	5E-03	
79. n-Nitroso-diphenylamine	86-30-6	µg/L					0/ 1	0.0% --	B2	7E+00	
80. Pentachlorophenol	87-86-5	µg/L					0/ 1	0.0% --	B2	3E-01	1E+00
81. Phenanthrene (PAH)	85-01-8	µg/L					0/ 1	0.0% --	D		
82. Phenol	108-95-2	µg/L					0/ 1	0.0% --	D	4E+03	
83. Pyrene (PAH)	129-00-0	µg/L					0/ 1	0.0% --	D	2E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: BW-NED Usage:											
O R G A N I C											
84. Styrene	100-42-5	µg/L					0/ 1	0.0% --	C	1E+02	1E+02
85. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L					0/ 1	0.0% --	C	2E-01	
86. Tetrachloroethylene (PCE)	127-18-4	µg/L					0/ 1	0.0% --	B2	7E-01	5E+00
87. Toluene (TOL)	108-88-3	µg/L					0/ 1	0.0% --	D	1E+03	1E+03
88. 1,2,4-Trichlorobenzene	120-82-1	µg/L					0/ 1	0.0% --	D	7E+01	9E+00
89. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L					0/ 1	0.0% --	D	6E+02	2E+02
90. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L					0/ 1	0.0% --	C	6E-01	5E+00
91. Trichloroethylene (TCE)	79-01-6	µg/L					0/ 1	0.0% --	B2	3E+00	5E+00
92. 2,4,5-Trichlorophenol	95-95-4	µg/L					0/ 1	0.0% --	D	7E+02	
93. 2,4,6-Trichlorophenol	88-06-2	µg/L					0/ 1	0.0% --	B2	3E+00	
94. Vinyl acetate	108-05-4	µg/L					0/ 1	0.0% --	NA	7E+03	
95. Vinyl chloride (VC)	75-01-4	µg/L					0/ 1	0.0% --	A	2E-02	2E+00
96. Xylenes (total) (XYL)	1330-20-7	µg/L					0/ 1	0.0% --	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-SD Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.5	7.9	0.38	7	8	6/ 6	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 6	0.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 5	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0068	0.0077	0.00075	0.006	0.008	5/ 5	100.0%	/	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.086	0.13	0.025	0.042	0.042	1/ 4	25.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 5	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.29	0.33	0.019	0.26	0.3	3/ 3	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 5	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	37	39	2	33	39	6/ 6	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	160	170	8.19999999	150	170	6/ 6	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 5	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 5	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.53	0.59	0.043	0.5	0.6	4/ 4	100.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 4	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 5	0.0%	--	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	17	17	0.5	16	17	6/ 6	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.019	0.029	0.01	0.02	0.03	4/ 6	66.7%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L	0.0005	0.0015	0.0008	0.0021	0.0021	1/ 5	20.0%	/	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 5	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	3.3	5.1	0.2	3.1	3.5	2/ 2	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	4	5.3	1.3	4	6	4/ 6	66.7%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 5	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 5	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	150	170	13	130	165	6/ 6	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	64	68	4.2	58	69	6/ 6	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 5	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	580	640	58	450	613	6/ 6	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L						0/ 5	0.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: BW-SD Usage:												
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0% --	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0% --	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0% --	D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0% --	D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L	0.57	0.99	0.8	3	3	1/ 17	5.9% ✓	A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0% --	B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0% --	D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0% --	D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0% --	ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0% --	D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0% --	B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0% --	ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 17	0.0% --	B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0% --	D		
18. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 17	0.0% --	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L						0/ 17	0.0% --	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0% --	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 17	0.0% --	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0% --	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.99	1.7	1.8	0.25	7.9	7/ 30	23.3% --	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L	1.2	2.4	2.2	8.1	8.1	1/ 17	5.9% --	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 15	0.0% --	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.42	0.73	0.6	0.29	1.3	3/ 17	17.6% ✓	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L	1.1	1.9	1.5	0.72	4.5	2/ 17	11.8% ✓	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0% --	ND		
30. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0% --	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0% --	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0% --	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0% --	B2	3E-03	2E-01

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-SD Usage:													
O R G A N I C													
34. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0%	--	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 17	0.0%	--	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0%	--	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	1.5	2.3	2.1	1	4.8	7/ 29	24.1%	--	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 29	0.0%	--	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.97	1.6	1.8	1.1	2.3	2/ 29	6.9%	--	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0%	--	B2	8E-02	
41. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.52	0.87	0.61	1.4	2	2/ 14	14.3%	--	D	1E+03	
42. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.85	1.4	1.2	0.39	3.9	5/ 17	29.4%	--	C	7E+01	
43. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 17	0.0%	--	B2	4E-01	5E+00
44. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.53	0.86	0.64	0.42	1.7	4/ 17	23.5%	--	C	6E-02	7E+00
45. 1,2-Dichloroethylene (TOTAL)		µg/L	1.1	3.6	0.99	0.6	0.6	1/ 3	33.3%	--	D	7E+01	
46. cis-1,2-Dichloroethylene	156-59-2	µg/L	20	37	30	0.4	92	9/ 14	64.3%	√	D	7E+01	7E+01
47. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.27	0.4	0.22	0.28	0.74	3/ 14	21.4%	--	D	1E+02	1E+02
48. Dichloromethane (DCM)	75-09-2	µg/L	2	3.3	2.7	2.8	2.8	1/ 17	5.9%	√	B2	5E+00	5E+00
49. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0%	--	D	2E+01	
50. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 16	0.0%	--	B2	5E-01	5E+00
51. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 17	0.0%	--	B2		
52. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 17	0.0%	--	B2		
53. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0%	--	D	6E+03	5E+03
54. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0%	--	B2	3E+00	4E+00
55. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0%	--	D	7E+04	
56. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0%	--	NA	1E+02	
57. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0%	--	ND	1E+01	
58. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0%	--	B2	5E-02	
59. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0%	--	ND	7E+00	
60. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0%	--	ND	1E+02	
61. Ethylbenzene (ETB)	100-41-4	µg/L	0.49	0.8	0.6	1.6	1.6	1/ 17	5.9%	--	D	7E+02	7E+02
62. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 2	0.0%	--	B2	4E-04	5E-02
63. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0%	--	D	3E+02	
64. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0%	--	D	3E+02	
65. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0%	--	B2	2E-02	1E+00
66. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0%	--	C	5E-01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: BW-SD Usage:												
O R G A N I C												
67. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0% --	D	5E+01	5E+01
68. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0% --	C	3E+00	
69. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0% --	NA		
70. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
71. Isophorone	78-59-1	µg/L						0/ 1	0.0% --	C	4E+01	
72. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0% --	D	4E+03	
73. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0% --	NA	6E+02	
74. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0% --	ND		
75. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0% --	C	4E+01	
76. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0% --	C	4E+01	
77. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0% --	D	3E+02	
78. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0% --	NA	4E-01	
79. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0% --	ND		
80. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0% --	D	4E+00	
81. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0% --	NA		
82. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0% --	ND		
83. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
84. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
85. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
86. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
87. Phenol	108-95-2	µg/L						0/ 1	0.0% --	D	4E+03	
88. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
89. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
90. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 17	0.0% --	C	2E-01	
91. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.52	0.91	0.76	0.24	2.6	3/ 17	17.6% √	B2	7E-01	5E+00
92. Toluene (TOL)	108-88-3	µg/L						0/ 17	0.0% --	D	1E+03	1E+03
93. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
94. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 17	0.0% --	D	6E+02	2E+02
95. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 17	0.0% --	C	6E-01	5E+00
96. Trichloroethylene (TCE)	79-01-6	µg/L	2.6	4.7	4	0.23	13	11/ 17	64.7% √	B2	3E+00	5E+00
97. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.41	0.62	0.37	0.4	0.92	2/ 14	14.3% --	D	2E+03	
98. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0% --	D	7E+02	
99. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0% --	B2	3E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-SD Usage:													
O R G A N I C													
100. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.56	0.8	0.46	0.27	1.7	4/ 16	25.0%	--	D	2E+05	
101. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	--	NA	7E+03	
102. Vinyl chloride (VC)	75-01-4	µg/L	2.7	5.8	6.1	2.2	25	3/ 17	17.6%	√	A	2E-02	2E+00
103. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 16	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-SES Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			8	8		8	8	2/ 2	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 2	0.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 2	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.007	0.016	0.001	0.006	0.008	2/ 2	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.096	0.096		0.096	0.096	1/ 1	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 2	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.29	0.29		0.29	0.29	1/ 1	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 2	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	46	64	2	44	48	2/ 2	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	160	210	6	154	166	2/ 2	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 2	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 2	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 1	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.5	0.5		0.5	0.5	1/ 1	100.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 1	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 2	0.0%	--	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	22	31	1	21	23	2/ 2	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.23	0.32	0.01	0.22	0.24	2/ 2	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 2	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 2	0.0%	--	D	1E-01	1E-01
20. Potassium (K)	7440-09-7	mg/L	5	5		5	5	2/ 2	100.0%	--	ND		
21. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 2	0.0%	--	D	4E-02	5E-02
22. Silver (Ag)	7440-22-4	mg/L						0/ 2	0.0%	--	D	4E-02	5E-02
23. Sodium (Na)	7440-23-5	mg/L	200	240	5.5	190	201	2/ 2	100.0%	--	ND		
24. Sulfate (SO4)	14808-79-8	mg/L	84	88	0.5	83	84	2/ 2	100.0%	--	D	4E+02	
25. Thallium (Tl)	7440-28-0	mg/L						0/ 2	0.0%	--	ND	5E-04	
26. Total Dissolved Solids (TDS)		mg/L	730	790	6.5	724	737	2/ 2	100.0%	--	ND		
27. Zinc and compounds (Zn)	7440-66-6	mg/L						0/ 2	0.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-SES Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 2	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	0.55	1.1	0.86	3.4	3.4	1/ 12	8.3%	√	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 12	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 12	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 12	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 12	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	1	2.1	2.3	7.8	8.5	2/ 22	9.1%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 12	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 10	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.25	0.35	0.16	0.24	0.28	2/ 12	16.7%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.94	1.7	1.1	0.31	3.4	2/ 12	16.7%	√	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 12	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.68	0.87	0.44	2.4	2.4	1/ 22	4.5%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 22	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	1.2	2.1	2	7.1	7.9	2/ 22	9.1%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.41	0.7	0.41	0.55	0.55	1/ 10	10.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.32	0.43	0.18	0.4	0.53	3/ 12	25.0%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 12	0.0%	--	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.26	0.36	0.16	0.27	0.34	2/ 12	16.7%	--	C	6E-02	7E+00
20. 1,2-Dichloroethylene (TOTAL)		µg/L	0.48	2.5	0.23	0.7	0.7	1/ 2	50.0%	--	D	7E+01	
21. cis-1,2-Dichloroethylene	156-59-2	µg/L	0.91	1.8	1.3	0.2	4.5	6/ 10	60.0%	--	D	7E+01	7E+01
22. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 10	0.0%	--	D	1E+02	1E+02
23. Dichloromethane (DCM)	75-09-2	µg/L	1.4	1.8	0.7	2.8	2.8	1/ 12	8.3%	√	B2	5E+00	5E+00
24. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 12	0.0%	--	B2	5E-01	5E+00
25. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 12	0.0%	--	B2		
26. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 12	0.0%	--	B2		
27. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 12	0.0%	--	D	7E+02	7E+02
28. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 2	0.0%	--	B2	4E-04	5E-02
29. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 12	0.0%	--	C	2E-01	
30. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.23	0.34	0.16	0.21	0.21	1/ 12	8.3%	√	B2	7E-01	5E+00
31. Toluene (TOL)	108-88-3	µg/L						0/ 12	0.0%	--	D	1E+03	1E+03
32. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 12	0.0%	--	D	6E+02	2E+02
33. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 12	0.0%	--	C	6E-01	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-SES Usage:													
O R G A N I C													
34. Trichloroethylene (TCE)	79-01-6	µg/L	0.86	1.2	0.52	0.4	1.6	9/ 12	75.0%	✓	B2	3E+00	5E+00
35. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.44	0.71	0.38	0.48	0.48	1/ 10	10.0%	--	D	2E+03	
36. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 12	0.0%	--	D	2E+05	
37. Vinyl chloride (VC)	75-01-4	µg/L	0.38	0.59	0.33	1	1	1/ 12	8.3%	✓	A	2E-02	2E+00
38. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 14	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-WD Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.2	7.4	0.26	6.9	7.6	11/ 11	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.34	0.75	0.62	0.7	2.2	2/ 11	18.2%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 10	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0044	0.006	0.0023	0.005	0.006	3/ 10	30.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.1	0.11	0.0047	0.11	0.11	3/ 9	33.3%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 10	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.46	0.52	0.07	0.38	0.6	8/ 8	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 10	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	47	50	4.5	42	59	11/ 11	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	170	180	10	152	195	11/ 11	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 10	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 10	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 9	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.34	0.43	0.11	0.3	0.6	5/ 9	55.6%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.72	0.96	0.32	0.4	1.3	9/ 9	100.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 10	0.0%	--	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	22	23	1.8	20	27	11/ 11	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.43	0.48	0.075	0.34	0.62	11/ 11	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 10	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 10	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.74	1.1	0.045	0.69	0.78	2/ 2	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	4.8	5.7	1.2	5	7	9/ 11	81.8%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	180	190	12	160	200	11/ 11	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	73	77	6.2	67	90	11/ 11	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 10	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	700	740	55	640	850	11/ 11	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L						0/ 10	0.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-WD Usage:													
O R G A N I C													
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0%	--	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0%	--	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0%	--	D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0%	--	D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L	0.9	1.4	1.2	1.5	1.5	1/ 21	4.8%	✓	A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0%	--	B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0%	--	D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0%	--	D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0%	--	ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0%	--	D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0%	--	B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0%	--	ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 21	0.0%	--	B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0%	--	D		
18. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 21	0.0%	--	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L						0/ 21	0.0%	--	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0%	--	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0%	--	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 21	0.0%	--	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0%	--	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	4.7	6.5	5.5	0.22	22	30/ 38	78.9%	--	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L	1.6	2.6	2.3	0.34	2.3	3/ 21	14.3%	--	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 17	0.0%	--	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.7	1.2	1.1	0.46	0.71	4/ 21	19.0%	✓	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L						0/ 21	0.0%	--	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0%	--	ND		
30. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0%	--	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0%	--	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0%	--	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0%	--	B2	3E-03	2E-01

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: BW-WD Usage:												
O R G A N I C												
34. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0% --	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 21	0.0% --	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0% --	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	15	21	17	1	66	33/ 34	97.1% --	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 34	0.0% --	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	2.2	3.2	2.8	1.1	5.1	9/ 34	26.5% --	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0% --	B2	8E-02	
41. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	2	3.5	2.7	0.88	6.5	7/ 16	43.8% --	D	1E+03	
42. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.4	2.9	1.2	0.99	4.4	16/ 21	76.2% --	C	7E+01	
43. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 21	0.0% --	B2	4E-01	5E+00
44. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	1	1.5	1.1	0.32	1.8	11/ 21	52.4% --	C	6E-02	7E+00
45. 1,2-Dichloroethylene (TOTAL)		µg/L	15	23	6.6	6.9	26	5/ 5	100.0% --	D	7E+01	
46. cis-1,2-Dichloroethylene	156-59-2	µg/L	110	180	130	8	500	16/ 16	100.0% √	D	7E+01	7E+01
47. trans-1,2-Dichloroethylene	156-60-5	µg/L	1.2	2	1.5	0.23	4.1	9/ 16	56.3% --	D	1E+02	1E+02
48. Dichloromethane (DCM)	75-09-2	µg/L	3.4	4.9	3.3	2.2	2.2	2/ 21	9.5% √	B2	5E+00	5E+00
49. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0% --	D	2E+01	
50. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 20	0.0% --	B2	5E-01	5E+00
51. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 21	0.0% --	B2		
52. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 21	0.0% --	B2		
53. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0% --	D	6E+03	5E+03
54. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0% --	B2	3E+00	4E+00
55. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0% --	D	7E+04	
56. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0% --	NA	1E+02	
57. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0% --	ND	1E+01	
58. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0% --	B2	5E-02	
59. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0% --	ND	7E+00	
60. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0% --	ND	1E+02	
61. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 21	0.0% --	D	7E+02	7E+02
62. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 4	0.0% --	B2	4E-04	5E-02
63. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0% --	D	3E+02	
64. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0% --	D	3E+02	
65. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0% --	B2	2E-02	1E+00
66. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0% --	C	5E-01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: BW-WD Usage:												
O R G A N I C												
67. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0% --	D	5E+01	5E+01
68. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0% --	C	3E+00	
69. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0% --	NA		
70. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
71. Isophorone	78-59-1	µg/L						0/ 1	0.0% --	C	4E+01	
72. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0% --	D	4E+03	
73. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0% --	NA	6E+02	
74. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0% --	ND		
75. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0% --	C	4E+01	
76. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0% --	C	4E+01	
77. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0% --	D	3E+02	
78. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0% --	NA	4E-01	
79. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0% --	ND		
80. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0% --	D	4E+00	
81. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0% --	NA		
82. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0% --	ND		
83. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
84. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
85. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
86. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
87. Phenol	108-95-2	µg/L						0/ 1	0.0% --	D	4E+03	
88. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
89. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
90. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 21	0.0% --	C	2E-01	
91. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.74	1.2	1.1	0.24	0.89	8/ 21	38.1% ✓	B2	7E-01	5E+00
92. Toluene (TOL)	108-88-3	µg/L						0/ 21	0.0% --	D	1E+03	1E+03
93. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
94. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.61	1.1	1.1	0.41	0.41	1/ 21	4.8% --	D	6E+02	2E+02
95. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 21	0.0% --	C	6E-01	5E+00
96. Trichloroethylene (TCE)	79-01-6	µg/L	4.3	5.3	2.1	2	7.3	17/ 21	81.0% ✓	B2	3E+00	5E+00
97. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	2.4	3.8	2.7	0.27	8.1	12/ 16	75.0% --	D	2E+03	
98. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0% --	D	7E+02	
99. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0% --	B2	3E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: BW-WD Usage:													
O R G A N I C													
100. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.4	2.3	1.8	0.66	1.4	5/ 20	25.0%	--	D	2E+05	
101. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	--	NA	7E+03	
102. Vinyl chloride (VC)	75-01-4	µg/L	61	97	78	6	340	21/ 21	100.0%	√	A	2E-02	2E+00
103. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 17	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-1 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.1	7.3	0.31	6.7	8	12/ 12	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.23	0.52	0.45	1.7	1.7	1/ 12	8.3%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 12	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0046	0.0059	0.002	0.005	0.009	7/ 12	58.3%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.081	0.095	0.021	0.055	0.062	5/ 11	45.5%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 12	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.36	0.38	0.037	0.3	0.4	10/ 10	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 12	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	69	74	7.8	58	88	12/ 12	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	180	190	16	143	201	12/ 12	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.0062	0.0089	0.0041	0.02	0.02	1/ 12	8.3%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 12	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 11	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.25	0.27	0.037	0.2	0.3	6/ 11	54.5%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.082	0.15	0.1	0.4	0.4	1/ 11	9.1%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 12	0.0%	--	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	29	31	3.1	25	36	12/ 12	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L						0/ 12	0.0%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 12	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 12	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	2.6	3	0.05	2.5	2.6	2/ 2	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	5.3	5.6	0.59	5	7	12/ 12	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L	0.003	0.0037	0.0011	0.006	0.006	1/ 12	8.3%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 12	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	140	150	14	120	160	12/ 12	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	78	82	7.1	59	89	12/ 12	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 12	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	700	740	72	540	797	12/ 12	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.074	0.1	0.042	0.03	0.2	12/ 12	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-1 Usage:												
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0% --	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0% --	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0% --	D	7E+02	
4. Aldrin	309-00-2	µg/L						0/ 1	0.0% --	B2	2E-03	
5. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0% --	D	2E+03	
6. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
7. Benzene (BNZ)	71-43-2	µg/L						0/ 22	0.0% --	A	1E+00	5E+00
8. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0% --	B2	5E-03	2E-01
9. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
10. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0% --	D		
11. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
12. Benzoic acid	65-85-0	µg/L						0/ 1	0.0% --	D	3E+04	
13. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0% --	ND	2E+03	
14. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0% --	D		
15. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0% --	B2	3E-02	
16. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0% --	ND	5E-01	
17. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 22	0.0% --	B2	6E-01	1E+02
18. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0% --	D		
19. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 22	0.0% --	B2	4E+00	1E+02
20. Bromomethane (BMM)	74-83-9	µg/L						0/ 22	0.0% --	D	1E+01	
21. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
22. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0% --	D	7E+02	
23. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 22	0.0% --	B2	3E-01	5E+00
24. Chlordane	57-74-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E+00
25. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0% --	NA	3E+01	
26. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.55	0.75	0.61	0.26	2.2	4/ 39	10.3% --	D	1E+02	1E+02
27. Chloroethane (CE)	75-00-3	µg/L						0/ 22	0.0% --	ND		
28. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 17	0.0% --	ND		
29. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.47	0.78	0.69	0.27	1.3	2/ 22	9.1% ✓	B2	6E+00	1E+02
30. Chloromethane (CM)	74-87-3	µg/L						0/ 22	0.0% --	C	3E+00	
31. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0% --	ND		
32. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0% --	NA	6E+02	
33. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0% --	D	4E+01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-1 Usage:												
O R G A N I C												
34. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0% --	B2	3E+00	2E-01
35. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 1	0.0% --	B2	2E-01	
36. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 1	0.0% --	B2	1E-01	
37. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 1	0.0% --	B2	1E-01	
38. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0% --	B2	3E-03	2E-01
39. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0% --	D		
40. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 22	0.0% --	C	4E-01	1E+02
41. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0% --	D	7E+02	
42. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.99	1.3	1	1.7	3.4	4/ 35	11.4% --	D	6E+02	6E+02
43. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 35	0.0% --	D	6E+02	
44. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 35	0.0% --	C	2E+00	8E+01
45. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0% --	B2	8E-02	
46. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 16	0.0% --	D	1E+03	
47. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.1	1.6	1.1	0.2	3.5	10/ 22	45.5% --	C	7E+01	
48. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 22	0.0% --	B2	4E-01	5E+00
49. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	1.5	2.3	1.9	0.58	7.4	7/ 22	31.8% √	C	6E-02	7E+00
50. 1,2-Dichloroethylene (TOTAL)		µg/L	6.6	10	3.4	3.5	13	6/ 6	100.0% --	D	7E+01	
51. cis-1,2-Dichloroethylene	156-59-2	µg/L	3.3	6	5.1	1	17	7/ 16	43.8% --	D	7E+01	7E+01
52. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 16	0.0% --	D	1E+02	1E+02
53. Dichloromethane (DCM)	75-09-2	µg/L	2.2	3.4	2.7	7.8	7.8	1/ 22	4.5% √	B2	5E+00	5E+00
54. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0% --	D	2E+01	
55. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 21	0.0% --	B2	5E-01	5E+00
56. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 22	0.0% --	B2		
57. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 22	0.0% --	B2		
58. Dieldrin	60-57-1	µg/L						0/ 1	0.0% --	B2	2E-03	
59. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0% --	D	6E+03	5E+03
60. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0% --	B2	3E+00	4E+00
61. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0% --	D	7E+04	
62. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0% --	NA	1E+02	
63. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0% --	ND	1E+01	
64. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0% --	B2	5E-02	
65. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0% --	ND	7E+00	
66. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0% --	ND	1E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-1 Usage:												
O R G A N I C												
67. Endosulfan i	959-98-8	µg/L						0/ 1	0.0% --	D	4E-01	
68. Endosulfan ii	33213-65-9	µg/L						0/ 1	0.0% --	ND		
69. Endosulfan sulfate	1031-07-8	µg/L						0/ 1	0.0% --	ND		
70. Endrin	72-20-8	µg/L						0/ 1	0.0% --	D	2E+00	2E+00
71. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 22	0.0% --	D	7E+02	7E+02
72. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 5	0.0% --	B2	4E-04	5E-02
73. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0% --	D	3E+02	
74. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0% --	D	3E+02	
75. Heptachlor	76-44-8	µg/L						0/ 1	0.0% --	B2	8E-03	4E-01
76. Heptachlor epoxide	1024-57-3	µg/L						0/ 1	0.0% --	B2	4E-03	2E-01
77. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0% --	B2	2E-02	1E+00
78. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0% --	C	5E-01	
79. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L						0/ 1	0.0% --	B2	6E-03	
80. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L						0/ 1	0.0% --	C	2E-02	
81. Delta-hexachlorocyclohexane	319-86-8	µg/L						0/ 1	0.0% --	D		
82. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0% --	D	5E+01	5E+01
83. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0% --	C	3E+00	
84. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0% --	NA		
85. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
86. Isophorone	78-59-1	µg/L						0/ 1	0.0% --	C	4E+01	
87. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L						0/ 1	0.0% --	C	3E-02	2E-01
88. Methoxychlor	72-43-5	µg/L						0/ 1	0.0% --	D	4E+01	4E+01
89. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0% --	D	4E+03	
90. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0% --	NA	6E+02	
91. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0% --	ND		
92. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0% --	C	4E+01	
93. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0% --	C	4E+01	
94. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0% --	D	3E+02	
95. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0% --	NA	4E-01	
96. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0% --	ND		
97. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0% --	D	4E+00	
98. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0% --	NA		
99. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0% --	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-1 Usage:												
O R G A N I C												
100. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
101. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
102. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
103. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
104. Phenol	108-95-2	µg/L						0/ 1	0.0% --	D	4E+03	
105. Polychlorinated biphenyls (PCBs)	1336-36-3	µg/L						0/ 5	0.0% --	B2	5E-03	5E-01
106. Polychlorinated biphenyl - ar	12674-11-2	µg/L						0/ 1	0.0% --	ND	5E-01	
107. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
108. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
109. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 22	0.0% --	C	2E-01	
110. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.43	0.73	0.67	0.24	0.28	3/ 22	13.6% ✓	B2	7E-01	5E+00
111. Toluene (TOL)	108-88-3	µg/L						0/ 22	0.0% --	D	1E+03	1E+03
112. Toxaphene	8001-35-2	µg/L						0/ 1	0.0% --	B2	3E-02	3E+00
113. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
114. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.1	1.6	1.2	1.9	3.2	6/ 22	27.3% --	D	6E+02	2E+02
115. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 22	0.0% --	C	6E-01	5E+00
116. Trichloroethylene (TCE)	79-01-6	µg/L	3.4	5.4	4.5	0.51	18	12/ 22	54.5% ✓	B2	3E+00	5E+00
117. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.46	0.79	0.62	0.31	0.31	1/ 16	6.3% --	D	2E+03	
118. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0% --	D	7E+02	
119. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0% --	B2	3E+00	
120. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.79	1.2	1	0.57	4.3	4/ 21	19.0% --	D	2E+05	
121. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0% --	NA	7E+03	
122. Vinyl chloride (VC)	75-01-4	µg/L	1.6	2.8	2.7	0.4	11	6/ 22	27.3% ✓	A	2E-02	2E+00
123. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 19	0.0% --	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-10 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.4	7.6	0.083	7.3	7.5	4/ 4	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 4	0.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0061	0.01	0.0026	0.005	0.009	3/ 4	75.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 4	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.53	0.59	0.043	0.5	0.6	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.0031	0.0048	0.0011	0.005	0.005	1/ 4	25.0%	√	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	64	70	3.6	59	69	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	230	240	7.1	220	240	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.44	0.61	0.11	0.5	0.5	3/ 4	75.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 4	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0024	0.0048	0.0015	0.005	0.005	1/ 4	25.0%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	27	29	1.4	25	29	4/ 4	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L						0/ 4	0.0%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 4	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	9.8	12	0.2	9.6	10	2/ 2	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	5.5	6.3	0.5	5	6	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	220	240	15	200	240	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	100	110	6.5	95	110	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	880	919.999999	28	830	896	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.21	0.36	0.098	0.09	0.36	4/ 4	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-10 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 14	0.0%	--	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.62	1	0.66	0.71	1.3	4/ 14	28.6%	✓	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 23	0.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.2	1.5	0.51	0.46	2.1	13/ 14	92.9%	✓	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 14	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 14	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.65	0.83	0.41	2.2	2.2	1/ 23	4.3%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	0.64	0.79	0.36	1.9	1.9	1/ 23	4.3%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.64	0.79	0.36	1.9	1.9	1/ 23	4.3%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 14	0.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.7	1	0.56	0.4	1.1	8/ 14	57.1%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.39	0.74	0.61	0.3	0.3	2/ 14	14.3%	✓	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	3.7	4.8	1.9	1.9	8.3	14/ 14	100.0%	✓	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	0.64	0.96	0.56	0.3	0.87	8/ 14	57.1%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 14	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.3	1.8	0.86	4.1	4.1	1/ 14	7.1%	✓	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 14	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.54	0.86	0.56	0.3	0.57	8/ 14	57.1%	✓	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.63	1.1	0.73	0.53	2.3	2/ 14	14.3%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.54	0.88	0.59	0.2	0.8	6/ 14	42.9%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	29	39	17	11	72	14/ 14	100.0%	✓	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 14	0.0%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-10 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	4.6	6.2	2.6	1.5	9.9	13/ 14	92.9%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L						0/ 14	0.0%	-- A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-11 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.3	7.5	0.21	7.1	7.7	7/ 7	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.15	0.2	0.07	0.05	0.23	8/ 10	80.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 10	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0067	0.011	0.0063	0.005	0.007	5/ 10	50.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.095	0.1	0.0088	0.071	0.092	3/ 10	30.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 10	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.21	0.28	0.092	0.12	0.4	8/ 10	80.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.002	0.0026	0.00084	0.0007	0.0012	2/ 10	20.0%	√	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	34	39	7.8	24	50.5	10/ 10	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	96	110	19	75	130	10/ 10	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 10	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 10	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.32	0.36	0.053	0.3	0.4	7/ 10	70.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.11	0.19	0.12	0.056	0.458	5/ 10	50.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0045	0.0082	0.0052	0.008	0.013	2/ 10	20.0%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	16	18	3.6	11	23.2	10/ 10	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	1.2	1.5	0.34	0.54	1.8	10/ 10	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 10	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 10	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.37	0.64	0.17	0.13	0.56	4/ 4	100.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 6	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	4.6	4.9	0.47	3.9	5.3	10/ 10	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	93	100	14	68	114	10/ 10	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	47	49	3.7	42	54	10/ 10	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 10	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	400	440	56	340	520	10/ 10	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.095	0.13	0.044	0.051	0.2	10/ 10	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-11 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	0.34	0.44	0.15	0.7	0.7	1/ 11	9.1% ✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 11	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 11	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 11	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 11	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.43	0.78	0.74	3.5	3.5	1/ 19	5.3% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 11	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 11	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.66	1.7	1.5	5.5	5.5	1/ 11	9.1% ✓	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 11	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 11	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	1	1.6	1.1	1.6	5.3	4/ 19	21.1% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	0.64	0.79	0.32	1.6	1.6	1/ 19	5.3% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.6	0.72	0.24	0.9	0.9	1/ 19	5.3% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 11	0.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 11	0.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 11	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 11	0.0% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	2	3.6	2.4	1	6.9	6/ 11	54.5% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 11	0.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 11	0.0% --	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 11	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 11	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 11	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 11	0.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 11	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.19	0.29	0.15	0.25	0.25	1/ 11	9.1% ✓	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 11	0.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 11	0.0% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 11	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	0.22	0.35	0.19	0.6	0.6	1/ 11	9.1% ✓	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 11	0.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-11 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 11	0.0%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	8.5	18	15	0.99	49	5/ 11	45.5%	√ A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 7	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-12 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.5	7.7	0.25	7.2	8.1	9/ 9	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 14	0.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 14	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0081	0.011	0.0051	0.005	0.011	12/ 14	85.7%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.095	0.1	0.01	0.069	0.081	3/ 14	21.4%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 14	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.39	0.42	0.05	0.3	0.5	14/ 14	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 14	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	65	71	11	49	83.4	14/ 14	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	190	200	27	140	240	14/ 14	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 14	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 14	0.0%	--	D	.3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.3	0.32	0.036	0.3	0.38	11/ 14	78.6%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.11	0.23	0.21	0.026	0.878	4/ 14	28.6%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0071	0.0096	0.0043	0.003	0.014	9/ 14	64.3%	✓	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	26	29	4.6	19	34.2	14/ 14	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L						0/ 14	0.0%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 14	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 14	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	3.9	5.8	2	1.6	6.3	7/ 7	100.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 10	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	5.3	5.6	0.48	4.6	6.3	14/ 14	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	180	190	27	130	226	14/ 14	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	88	96	13	59	110	14/ 14	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 14	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	760	819.999999	110	584	960	14/ 14	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.096	0.12	0.038	0.043	0.19	14/ 14	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-12 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 14	0.0%	--	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 14	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 23	0.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.85	1.2	0.61	0.27	1.5	8/ 14	57.1%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 14	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 14	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 23	0.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 23	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 23	0.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.7	1.4	1.3	0.9	0.9	1/ 14	7.1%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.1	2.7	1.1	0.26	3.4	12/ 14	85.7%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.37	0.72	0.61	0.3	0.3	1/ 14	7.1%	√	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	2.3	3.3	1.8	0.5	5.5	10/ 14	71.4%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	3.8	5.3	2.6	0.6	9.6	13/ 14	92.9%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 14	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 14	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.8	1.3	0.81	0.25	2	6/ 14	42.9%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 14	0.0%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.94	1.4	0.73	0.5	2	7/ 14	50.0%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	12	17	9.5	1.2	31	13/ 14	92.9%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 14	0.0%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-15 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	4.9	7.6	1.7	2	2	1/ 4	25.0%	✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	18	28	8.3	10	29	4/ 5	80.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 4	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0%	--	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	92	110	18	66	120	5/ 5	100.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 5	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	5.4	6.3	0.72	4.5	5	2/ 5	40.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.3	2.6	0.21	2.2	2.2	1/ 4	25.0%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0%	--	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 4	0.0%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	850	1200	190	570	1100	4/ 4	100.0%	✓	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	9.9	18	5.4	7	16	3/ 4	75.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 4	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 4	0.0%	--	D	7E+02	7E+02
27. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 2	0.0%	--	D		
28. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0%	--	C	2E-01	
29. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 4	0.0%	--	B2	7E-01	5E+00
30. Toluene (TOL)	108-88-3	µg/L	8.69999999	22	8.5	23	23	1/ 4	25.0%	--	D	1E+03	1E+03
31. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 4	0.0%	--	D	6E+02	2E+02
32. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0%	--	C	6E-01	5E+00
33. Trichloroethylene (TCE)	79-01-6	µg/L	2.6	3.2	0.43	3.2	3.2	1/ 4	25.0%	✓	B2	3E+00	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-15 Usage:												
O R G A N I C												
34. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 4	0.0%	--	D	2E+03	
35. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 4	0.0%	--	D	2E+05	
36. Vinyl chloride (VC)	75-01-4	µg/L	869.999999	1700	500	459.999999	1700	4/ 4	100.0%	√	A	2E-02	2E+00
37. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 4	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-13 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 14	0.0%	--	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	1.5	3	2.5	1.4	10	4/ 14	28.6%	✓	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.36	0.57	0.48	0.22	0.22	1/ 23	4.3%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	3.9	7	5.4	0.9	22	13/ 14	92.9%	✓	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 14	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 14	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 23	0.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 23	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 23	0.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 14	0.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.66	0.91	0.43	0.33	1.4	9/ 14	64.3%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.28	0.45	0.3	0.3	1.2	2/ 14	14.3%	✓	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	3.6	4.2	1.1	1.5	5.5	14/ 14	100.0%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	0.82	1	0.36	0.31	1.3	12/ 14	85.7%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 14	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 14	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.48	0.82	0.59	0.24	0.6	6/ 14	42.9%	✓	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.48	0.81	0.57	0.51	0.51	1/ 14	7.1%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.52	0.87	0.61	0.24	1.1	5/ 14	35.7%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	44	54	18	19	86	14/ 14	100.0%	✓	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.52	0.89	0.65	0.41	0.41	1/ 14	7.1%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-13 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	4	5.5	2.5	1.3	7.7	12/ 14	85.7%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L						0/ 14	0.0%	-- A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-14 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.5	7.7	0.27	7.2	8.19999999	9/ 9	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 14	0.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 14	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0074	0.01	0.0051	0.005	0.008	11/ 14	78.6%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.1	0.11	0.0072	0.103	0.123	3/ 14	21.4%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 14	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.56	0.61	0.074	0.5	0.7	14/ 14	100.0%	√	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.0026	0.0035	0.0016	0.005	0.005	1/ 14	7.1%	√	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	68	77	16	48	93.8	14/ 14	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	190	200	25	150	230	14/ 14	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 14	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.0094	0.011	0.0019	0.012	0.012	1/ 14	7.1%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.37	0.41	0.074	0.3	0.5	11/ 14	78.6%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.065	0.09	0.043	0.087	0.2	3/ 14	21.4%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0034	0.0056	0.0038	0.003	0.006	3/ 14	21.4%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	29	33	7.6	19	43	14/ 14	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.29	0.4	0.2	0.02	0.59	14/ 14	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 14	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 14	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	1.8	3.1	1.4	0.05	3.8	7/ 7	100.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L	0.022	0.037	0.021	0.02	0.06	4/ 10	40.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	5.6	6	0.63	5	6.9	14/ 14	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	200	220	31	160	257	14/ 14	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	98	110	21	74	150	14/ 14	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 14	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	840	930	150	660	1100	14/ 14	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.15	0.18	0.061	0.064	0.3	14/ 14	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-14 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	6.7	20	23	0.62	93	4/ 15	26.7% ✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 15	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 15	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 15	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L	0.37	0.7	0.6	0.5	0.5	1/ 15	6.7% ✓	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	1.1	1.4	0.79	0.2	2.7	20/ 25	80.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L	0.66	1.3	1.2	0.4	0.67	2/ 15	13.3% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 15	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.68	1	0.59	0.22	1.3	9/ 15	60.0% ✓	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 15	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 15	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	3.2	4.1	2.3	0.79	8.5	22/ 25	88.0% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 25	0.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.72	0.91	0.46	1.2	1.3	2/ 25	8.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.86	1.5	1.2	0.6	1.5	4/ 15	26.7% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	6.9	9.4	4.6	1.2	17	15/ 15	100.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.71	1.1	0.65	0.28	1.9	8/ 15	53.3% ✓	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	4.7	7	4.1	0.9	14	14/ 15	93.3% ✓	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	27	37	17	5.9	55	15/ 15	100.0% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.39	0.72	0.6	0.3	0.7	2/ 15	13.3% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.6	2.6	1.8	8.1	8.1	1/ 15	6.7% ✓	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 15	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 15	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 15	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 15	0.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 15	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	1.7	2.4	1.3	0.2	4.1	12/ 15	80.0% ✓	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.47	0.78	0.55	0.56	0.56	1/ 15	6.7% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.3	1.9	1	1.2	3.5	8/ 15	53.3% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 15	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	16	21	9.8	1.2	29	15/ 15	100.0% ✓	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.61	0.95	0.61	0.2	0.8	6/ 15	40.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or , was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35

8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-14 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.63	1	0.68	0.61	1.6	2/ 15	13.3%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	13	20	12	0.8	39	14/ 15	93.3%	√ A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 11	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-15 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L	13	120	12	24	24	1/ 2	50.0%	--	ND		
2. pH			7.6	7.8	0.082	7.5	7.7	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.087	0.18	0.061	0.03	0.19	4/ 4	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L						0/ 4	0.0%	--	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.066	0.099	0.021	0.049	0.064	3/ 4	75.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.27	0.28	0.011	0.25	0.28	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	76	82	3.8	71.8	82	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	280	300	8.3	270	290	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.41	0.51	0.064	0.36	0.52	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	1.2	3.6	1.5	0.113	3.8	4/ 4	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0026	0.0051	0.0016	0.003	0.005	2/ 4	50.0%	√	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	31	32	0.78	30	32.1	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	0.15	0.32	0.11	0.06	0.33	4/ 4	100.0%	√	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.016	0.027	0.0065	0.025	0.025	1/ 4	25.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L	0.59	0.59		0.59	0.59	1/ 1	100.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L	0.022	0.03	0.0052	0.013	0.013	1/ 4	25.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	7	11	2.4	5.1	11	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	220	230	7.9	208	230	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	61	70	5.9	53	69	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	890	900	9.3	874	900	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.32	0.68	0.22	0.08	0.57	4/ 4	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-16 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.3	7.7	0.14	7.2	7.5	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	9.69999999	12	1.3	8.93	12	4/ 4	100.0%	✓	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.035	0.044	0.0058	0.036	0.04	3/ 4	75.0%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	2	2.1	0.1	1.8	2.08	4/ 4	100.0%	✓	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.37	0.43	0.041	0.31	0.42	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	67	74	4.3	61.3	71.7	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	140	150	6.1	133	150	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.35	0.44	0.058	0.3	0.45	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	2.1	2.6	0.32	1.7	2.51	4/ 4	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0048	0.014	0.0059	0.002	0.002	1/ 4	25.0%	✓	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	39	44	3	35.0999999	43.2	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	4	4.4	0.24	3.66	4.3	4/ 4	100.0%	✓	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 4	0.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 1	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	31	34	2.1	27.3	32.5999999	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	120	130	4.6	118	130	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	3.6	6.7	1.9	7	7	1/ 4	25.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	690	720	19	670	720	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.08	0.12	0.023	0.052	0.109	4/ 4	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-16 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 4	0.0% --	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	41	59	15	24	67	5/ 5	100.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 4	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0% --	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.79	1.2	0.36	1.2	1.2	1/ 5	20.0% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	1.9	3.3	1.1	0.8	3.5	3/ 5	60.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	5.2	7.1	1.5	2.3	6.5	5/ 5	100.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 4	0.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 4	0.0% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 4	0.0% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 4	0.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.7	2.9	0.75	2.8	2.8	1/ 4	25.0% √	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	6.6	23	11	25	25	1/ 4	25.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.38	0.84	0.29	0.8	0.8	1/ 4	25.0% √	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 4	0.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 4	0.0% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 4	0.0% --	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 4	0.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-12 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.9	1.3	0.74	0.46	2.4	4/ 14	28.6%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L						0/ 14	0.0%	-- A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-13 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			7.4	7.6	0.083	7.3	7.5	4/ 4	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 4	0.0% --	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0071	0.013	0.0034	0.006	0.012	3/ 4	75.0% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 4	0.0% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.55	0.69	0.087	0.4	0.6	4/ 4	100.0% --	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.0062	0.013	0.0043	0.007	0.013	2/ 4	50.0% √	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	57	61	2.3	55	61	4/ 4	100.0% --	ND		
9. Chloride (Cl)-		mg/L	230	250	13	220	250	4/ 4	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0% --	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0% --	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.49	0.72	0.14	0.5	0.6	3/ 4	75.0% --	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.52	1.7	0.74	0.2	1.8	2/ 4	50.0% --	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0029	0.0067	0.0024	0.007	0.007	1/ 4	25.0% √	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	25	26	0.87	24	26	4/ 4	100.0% --	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.048	0.12	0.043	0.08	0.1	2/ 4	50.0% √	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0% --	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 4	0.0% --	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	8.4	13	0.55	7.8	8.9	2/ 2	100.0% --	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	5	5		5	5	4/ 4	100.0% --	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0% --	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0% --	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	200	210	7.1	190	210	4/ 4	100.0% --	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	98	110	8.19999999	87	110	4/ 4	100.0% --	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0% --	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	850	890	28	819.999999	896	4/ 4	100.0% --	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.12	0.2	0.05	0.07	0.18	4/ 4	100.0% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-16 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 4	0.0%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L						0/ 4	0.0%	-- A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 4	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-17 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.8	8.3	0.21	7.6	8.1	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.033	0.063	0.019	0.04	0.06	2/ 4	50.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.013	0.025	0.0078	0.006	0.013	3/ 4	75.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.19	0.41	0.14	0.07	0.405	4/ 4	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.37	0.41	0.03	0.33	0.41	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	71	87	10	62.9	88	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	210	220	4.3	210	220	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.013	0.029	0.0098	0.014	0.029	2/ 4	50.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.019	0.043	0.015	0.028	0.039	2/ 4	50.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.45	0.55	0.063	0.38	0.55	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	5.1	15	6.3	0.059	15.6	4/ 4	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.011	0.027	0.01	0.026	0.026	1/ 4	25.0%	√	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	28	31	1.6	26.8	31	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	0.66	1.7	0.67	0.011	1.53	4/ 4	100.0%	√	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.019	0.036	0.011	0.036	0.036	1/ 4	25.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L	8.5	8.5		8.5	8.5	1/ 1	100.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	5.7	7	0.84	5	7.1	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	200	220	7.8	190	210	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	87	92	2.9	84	92	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	810	830	15	792	830	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.16	0.3	0.089	0.071	0.28	4/ 4	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-17 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	1.9	6.5	2.9	6.9	6.9	1/ 4	25.0%	✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 5	0.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 4	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.3	0.55	0.16	0.2	0.4	2/ 4	50.0%	✓	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 5	0.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 5	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 5	0.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.9	1.6	0.41	0.4	1.4	4/ 4	100.0%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0%	--	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	2.9	4.3	0.9	1.7	4.2	4/ 4	100.0%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	1	1.8	0.52	0.6	1.9	4/ 4	100.0%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 4	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 4	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 4	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	1.9	2.9	0.65	1	2.8	4/ 4	100.0%	✓	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.61	1.6	0.63	1.7	1.7	1/ 4	25.0%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.4	0.93	0.33	0.9	0.9	1/ 4	25.0%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	8.6	10	1.2	7.1	10	4/ 4	100.0%	✓	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 4	0.0%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-17 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 4	0.0%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L						0/ 4	0.0%	-- A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 4	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-18 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			7.3	7.5	0.082	7.2	7.4	3/ 3	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	0.93	1.2	0.17	0.74	1.2	4/ 4	100.0% --	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.016	0.025	0.0058	0.01	0.015	3/ 4	75.0% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.61	0.7	0.055	0.546	0.69	4/ 4	100.0% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.66	0.8	0.087	0.54	0.78	4/ 4	100.0% √	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0% --	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	75	80	3	73	80	4/ 4	100.0% --	ND		
9. Chloride (Cl)-		mg/L	200	200	4.3	190	200	4/ 4	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0% --	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.38	0.46	0.051	0.35	0.47	4/ 4	100.0% --	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	0.1	0.16	0.035	0.041	0.125	4/ 4	100.0% --	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0073	0.016	0.0056	0.003	0.01	2/ 4	50.0% √	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	37	39	1.4	35.0999999	39	4/ 4	100.0% --	ND		
16. Manganese (Mn)	7439-96-5	mg/L	3.4	3.9	0.3	3.09	3.9	4/ 4	100.0% √	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0% --	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.056	0.073	0.011	0.041	0.071	4/ 4	100.0% --	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L	0.06	0.06		0.06	0.06	1/ 1	100.0% --	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0% --	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	7.8	8.4	0.38	7.4	8.4	4/ 4	100.0% --	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0% --	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0% --	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	210	220	5.7	204	220	4/ 4	100.0% --	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	34	44	6.3	28	44	4/ 4	100.0% --	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0% --	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	900	940	29	850	927.999999	4/ 4	100.0% --	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.21	0.36	0.094	0.077	0.337	4/ 4	100.0% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-18 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	2.5	3.8	0.83	3.6	3.6	1/ 4	25.0% ✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	34	58	19	5.8	55	5/ 5	100.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 4	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0% --	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	43	72	24	8.19999999	68	5/ 5	100.0% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 5	0.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	5.8	8.8	2.4	3.4	8	4/ 5	80.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.2	2.4	0.71	2.4	2.4	1/ 4	25.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 4	0.0% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	180	340	97	73	330	4/ 4	100.0% ✓	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	3.8	7.8	2.5	2.5	7.7	3/ 4	75.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 4	0.0% --	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 4	0.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 4	0.0% --	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 4	0.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 4	0.0% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	1.2	2	0.54	1.2	2	2/ 4	50.0% ✓	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 4	0.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-18 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 4	0.0%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	390	1100	420	79	1100	4/ 4	100.0%	✓	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 4	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-2 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			7.3	7.5	0.4	6.9	8.19999999	13/ 13	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	0.63	1.2	1.1	0.2	4.6	12/ 15	80.0% --	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 15	0.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.01	0.013	0.0041	0.0061	0.011	14/ 15	93.3% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.1	0.12	0.028	0.085	0.2	7/ 14	50.0% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 15	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.32	0.37	0.07	0.21	0.5	13/ 13	100.0% --	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.0028	0.0035	0.0012	0.0008	0.0064	2/ 15	13.3% √	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	44	47	5	39	53	15/ 15	100.0% --	ND		
9. Chloride (Cl)-		mg/L	150	150	9.5	131	160	15/ 15	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 15	0.0% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.01	0.013	0.0056	0.027	0.027	1/ 15	6.7% --	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 10	0.0% --	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.41	0.47	0.097	0.3	0.6	13/ 14	92.9% --	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.064	0.09	0.046	0.061	0.23	2/ 14	14.3% --	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0036	0.0055	0.0034	0.003	0.005	2/ 15	13.3% √	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	19	20	2.3	17	23	15/ 15	100.0% --	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.56	0.88	0.59	0.05	2.6	15/ 15	100.0% √	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 15	0.0% --	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 15	0.0% --	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	1.4	2.3	0.36	1.1	1.9	3/ 3	100.0% --	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 4	0.0% --	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	5.5	6.3	1.6	5	8	13/ 15	86.7% --	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 15	0.0% --	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 15	0.0% --	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	160	160	6.6	140	170	15/ 15	100.0% --	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	59	62	5.2	54	72	15/ 15	100.0% --	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 15	0.0% --	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	620	650	60	520	760	15/ 15	100.0% --	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.077	0.094	0.031	0.045	0.17	15/ 15	100.0% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: EW-2 Usage:											
O R G A N I C											
1. Acenaphthene (PAH)	83-32-9	µg/L					0/ 1	0.0%	-- ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L					0/ 1	0.0%	-- D	4E+02	
3. Acetone	67-64-1	µg/L					0/ 2	0.0%	-- D	7E+02	
4. Aldrin	309-00-2	µg/L					0/ 1	0.0%	-- B2	2E-03	
5. Anthracene (PAH)	120-12-7	µg/L					0/ 1	0.0%	-- D	2E+03	
6. Benz[a]anthracene (PAH)	56-55-3	µg/L					0/ 1	0.0%	-- B2	3E-02	2E-01
7. Benzene (BNZ)	71-43-2	µg/L					0/ 15	0.0%	-- A	1E+00	5E+00
8. Benzo[a]pyrene (PAH)	50-32-8	µg/L					0/ 1	0.0%	-- B2	5E-03	2E-01
9. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L					0/ 1	0.0%	-- B2	3E-02	2E-01
10. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L					0/ 1	0.0%	-- D		
11. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L					0/ 1	0.0%	-- B2	3E-02	2E-01
12. Benzoic acid	65-85-0	µg/L					0/ 1	0.0%	-- D	3E+04	
13. Benzyl alcohol	100-51-6	µg/L					0/ 1	0.0%	-- ND	2E+03	
14. Bis(2-chloroethoxy)methane	111-91-1	µg/L					0/ 1	0.0%	-- D		
15. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L					0/ 1	0.0%	-- B2	3E-02	
16. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L					0/ 1	0.0%	-- ND	5E-01	
17. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L					0/ 15	0.0%	-- B2	6E-01	1E+02
18. p-Bromodiphenyl ether	101-55-3	µg/L					0/ 1	0.0%	-- D		
19. Bromoform (THM) (BRFM)	75-25-2	µg/L					0/ 15	0.0%	-- B2	4E+00	1E+02
20. Bromomethane (BMM)	74-83-9	µg/L					0/ 15	0.0%	-- D	1E+01	
21. Butyl benzyl phthalate	85-68-7	µg/L					0/ 1	0.0%	-- C	1E+02	1E+02
22. Carbon disulfide	75-15-0	µg/L					0/ 1	0.0%	-- D	7E+02	
23. Carbon tetrachloride (CCL4)	56-23-5	µg/L					0/ 15	0.0%	-- B2	3E-01	5E+00
24. Chlordane	57-74-9	µg/L					0/ 1	0.0%	-- B2	3E-02	2E+00
25. p-Chloroaniline	106-47-8	µg/L					0/ 1	0.0%	-- NA	3E+01	
26. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L					0/ 28	0.0%	-- D	1E+02	1E+02
27. Chloroethane (CE)	75-00-3	µg/L					0/ 15	0.0%	-- ND		
28. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L					0/ 10	0.0%	-- ND		
29. Chloroform (THM) (CLFM)	67-66-3	µg/L					0/ 15	0.0%	-- B2	6E+00	1E+02
30. Chloromethane (CM)	74-87-3	µg/L					0/ 15	0.0%	-- C	3E+00	
31. 4-Chloro-3-methylphenol	59-50-7	µg/L					0/ 1	0.0%	-- ND		
32. beta-Chloronaphthalene	91-58-7	µg/L					0/ 1	0.0%	-- NA	6E+02	
33. 2-Chlorophenol	95-57-8	µg/L					0/ 1	0.0%	-- D	4E+01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-2 Usage:												
O R G A N I C												
34. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0% --	B2	3E+00	2E-01
35. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 1	0.0% --	B2	2E-01	
36. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 1	0.0% --	B2	1E-01	
37. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 1	0.0% --	B2	1E-01	
38. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0% --	B2	3E-03	2E-01
39. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0% --	D		
40. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 15	0.0% --	C	4E-01	1E+02
41. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0% --	D	7E+02	
42. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.79	1.2	0.91	1.1	1.1	1/ 24	4.2% --	D	6E+02	6E+02
43. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 24	0.0% --	D	6E+02	
44. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 24	0.0% --	C	2E+00	8E+01
45. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0% --	B2	8E-02	
46. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 9	0.0% --	D	1E+03	
47. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 15	0.0% --	C	7E+01	
48. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 15	0.0% --	B2	4E-01	5E+00
49. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 15	0.0% --	C	6E-02	7E+00
50. 1,2-Dichloroethylene (TOTAL)		µg/L						0/ 6	0.0% --	D	7E+01	
51. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 9	0.0% --	D	7E+01	7E+01
52. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 9	0.0% --	D	1E+02	1E+02
53. Dichloromethane (DCM)	75-09-2	µg/L	4.2	7.6	6.1	7.3	24	2/ 15	13.3% √	B2	5E+00	5E+00
54. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0% --	D	2E+01	
55. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0% --	B2	5E-01	5E+00
56. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 15	0.0% --	B2		
57. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 15	0.0% --	B2		
58. Dieldrin	60-57-1	µg/L						0/ 1	0.0% --	B2	2E-03	
59. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0% --	D	6E+03	5E+03
60. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0% --	B2	3E+00	4E+00
61. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0% --	D	7E+04	
62. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0% --	NA	1E+02	
63. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0% --	ND	1E+01	
64. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0% --	B2	5E-02	
65. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0% --	ND	7E+00	
66. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0% --	ND	1E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-2 Usage:												
O R G A N I C												
67. Endosulfan i	959-98-8	µg/L						0/ 1	0.0%	-- D	4E-01	
68. Endosülfan ii	33213-65-9	µg/L						0/ 1	0.0%	-- ND		
69. Endosulfan sulfate	1031-07-8	µg/L						0/ 1	0.0%	-- ND		
70. Endrin	72-20-8	µg/L						0/ 1	0.0%	-- D	2E+00	2E+00
71. Ethylbenzene (ETB)	100-41-4	µg/L	0.5	0.84	0.62	1.5	1.5	1/ 15	6.7%	-- D	7E+02	7E+02
72. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 5	0.0%	-- B2	4E-04	5E-02
73. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0%	-- D	3E+02	
74. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0%	-- D	3E+02	
75. Heptachlor	76-44-8	µg/L						0/ 1	0.0%	-- B2	8E-03	4E-01
76. Heptachlor epoxide	1024-57-3	µg/L						0/ 1	0.0%	-- B2	4E-03	2E-01
77. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0%	-- B2	2E-02	1E+00
78. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0%	-- C	5E-01	
79. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L						0/ 1	0.0%	-- B2	6E-03	
80. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L						0/ 1	0.0%	-- C	2E-02	
81. Delta-hexachlorocyclohexane	319-86-8	µg/L						0/ 1	0.0%	-- D		
82. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0%	-- D	5E+01	5E+01
83. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0%	-- C	3E+00	
84. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0%	-- NA		
85. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0%	-- B2	3E-02	2E-01
86. Isophorone	78-59-1	µg/L						0/ 1	0.0%	-- C	4E+01	
87. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L						0/ 1	0.0%	-- C	3E-02	2E-01
88. Methoxychlor	72-43-5	µg/L						0/ 1	0.0%	-- D	4E+01	4E+01
89. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0%	-- D	4E+03	
90. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0%	-- NA	6E+02	
91. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0%	-- ND		
92. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0%	-- C	4E+01	
93. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0%	-- C	4E+01	
94. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0%	-- D	3E+02	
95. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0%	-- NA	4E-01	
96. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0%	-- ND		
97. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0%	-- D	4E+00	
98. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0%	-- NA		
99. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0%	-- ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-2 Usage:												
O R G A N I C												
100. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
101. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
102. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
103. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
104. Phenol	108-95-2	µg/L						0/ 1	0.0% --	D	4E+03	
105. Polychlorinated biphenyls (PCBs)	1336-36-3	µg/L						0/ 5	0.0% --	B2	5E-03	5E-01
106. Polychlorinated biphenyl - ar	12674-11-2	µg/L						0/ 1	0.0% --	ND	5E-01	
107. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
108. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
109. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 15	0.0% --	C	2E-01	
110. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 15	0.0% --	B2	7E-01	5E+00
111. Toluene (TOL)	108-88-3	µg/L	0.5	0.83	0.59	0.57	1.2	2/ 15	13.3% --	D	1E+03	1E+03
112. Toxaphene	8001-35-2	µg/L						0/ 1	0.0% --	B2	3E-02	3E+00
113. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
114. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 15	0.0% --	D	6E+02	2E+02
115. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 15	0.0% --	C	6E-01	5E+00
116. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 15	0.0% --	B2	3E+00	5E+00
117. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 9	0.0% --	D	2E+03	
118. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0% --	D	7E+02	
119. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0% --	B2	3E+00	
120. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.57	1	0.83	3.4	3.4	1/ 14	7.1% --	D	2E+05	
121. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0% --	NA	7E+03	
122. Vinyl chloride (VC)	75-01-4	µg/L						0/ 15	0.0% --	A	2E-02	2E+00
123. Xylenes (total) (XYL)	1330-20-7	µg/L	1.2	2.3	1.8	0.8	7.3	2/ 13	15.4% --	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-3 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.1	7.3	0.38	6.4	8.1	12/ 12	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 14	0.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 14	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0059	0.007	0.002	0.005	0.008	11/ 14	78.6%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.071	0.091	0.032	0.023	0.059	6/ 13	46.2%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 14	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.15	0.17	0.04	0.08	0.2	11/ 12	91.7%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 14	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	40	47	12	23	68.3	14/ 14	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	140	150	20	110	180	14/ 14	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.0061	0.0083	0.0039	0.02	0.02	1/ 14	7.1%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.0096	0.012	0.0035	0.01	0.015	2/ 14	14.3%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L	0.0067	0.01	0.0047	0.02	0.02	1/ 9	11.1%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.32	0.36	0.064	0.3	0.43	9/ 13	69.2%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.14	0.29	0.25	0.1	1	4/ 13	30.8%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0039	0.0059	0.0035	0.003	0.013	2/ 14	14.3%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	17	20	5.2	10	29.9	14/ 14	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.005	0.0063	0.0023	0.005	0.005	1/ 14	7.1%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L	0.00011	0.00012	0.000026	0.0002	0.0002	1/ 14	7.1%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 14	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	4.5	17	1.5	3	5.9	2/ 2	100.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L	0.011	0.024	0.0082	0.01	0.01	1/ 4	25.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	3.7	4.3	1.2	4	6	8/ 14	57.1%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	120	120	14	82	134	14/ 14	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	59	64	9.69999999	46	78	14/ 14	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 14	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	530	580	84	396	698	14/ 14	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.094	0.13	0.056	0.03	0.201	14/ 14	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-3 Usage:												
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0% --	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0% --	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 2	0.0% --	D	7E+02	
4. Aldrin	309-00-2	µg/L						0/ 1	0.0% --	B2	2E-03	
5. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0% --	D	2E+03	
6. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
7. Benzene (BNZ)	71-43-2	µg/L						0/ 14	0.0% --	A	1E+00	5E+00
8. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0% --	B2	5E-03	2E-01
9. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
10. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0% --	D		
11. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
12. Benzoic acid	65-85-0	µg/L						0/ 1	0.0% --	D	3E+04	
13. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0% --	ND	2E+03	
14. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0% --	D		
15. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0% --	B2	3E-02	
16. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0% --	ND	5E-01	
17. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.52	0.86	0.59	0.72	0.72	1/ 14	7.1% ✓	B2	6E-01	1E+02
18. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0% --	D		
19. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0% --	B2	4E+00	1E+02
20. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0% --	D	1E+01	
21. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
22. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0% --	D	7E+02	
23. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0% --	B2	3E-01	5E+00
24. Chlordane	57-74-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E+00
25. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0% --	NA	3E+01	
26. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 25	0.0% --	D	1E+02	1E+02
27. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0% --	ND		
28. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 9	0.0% --	ND		
29. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.48	0.82	0.59	0.45	0.79	3/ 14	21.4% ✓	B2	6E+00	1E+02
30. Chloromethane (CM)	74-87-3	µg/L						0/ 14	0.0% --	C	3E+00	
31. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0% --	ND		
32. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0% --	NA	6E+02	
33. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0% --	D	4E+01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-3 Usage:													
O R G A N I C													
34. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0%	--	B2	3E+00	2E-01
35. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 1	0.0%	--	B2	2E-01	
36. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 1	0.0%	--	B2	1E-01	
37. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 1	0.0%	--	B2	1E-01	
38. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0%	--	B2	3E-03	2E-01
39. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0%	--	D		
40. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L	0.56	0.91	0.61	0.34	0.34	1/ 14	7.1%	--	C	4E-01	1E+02
41. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0%	--	D	7E+02	
42. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 21	0.0%	--	D	6E+02	6E+02
43. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 21	0.0%	--	D	6E+02	
44. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 21	0.0%	--	C	2E+00	8E+01
45. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0%	--	B2	8E-02	
46. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 8	0.0%	--	D	1E+03	
47. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 14	0.0%	--	C	7E+01	
48. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 14	0.0%	--	B2	4E-01	5E+00
49. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 14	0.0%	--	C	6E-02	7E+00
50. 1,2-Dichloroethylene (TOTAL)		µg/L						0/ 6	0.0%	--	D	7E+01	
51. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 8	0.0%	--	D	7E+01	7E+01
52. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 8	0.0%	--	D	1E+02	1E+02
53. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0%	--	B2	5E+00	5E+00
54. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0%	--	D	2E+01	
55. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 13	0.0%	--	B2	5E-01	5E+00
56. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
57. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
58. Dieldrin	60-57-1	µg/L						0/ 1	0.0%	--	B2	2E-03	
59. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0%	--	D	6E+03	5E+03
60. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L	30	30		30	30	1/ 1	100.0%	✓	B2	3E+00	4E+00
61. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0%	--	D	7E+04	
62. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0%	--	NA	1E+02	
63. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0%	--	ND	1E+01	
64. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0%	--	B2	5E-02	
65. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0%	--	ND	7E+00	
66. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0%	--	ND	1E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: EW-3 Usage:											
O R G A N I C											
67. Endosulfan i	959-98-8	µg/L					0/ 1	0.0% --	D	4E-01	
68. Endosulfan ii	33213-65-9	µg/L					0/ 1	0.0% --	ND		
69. Endosulfan sulfate	1031-07-8	µg/L					0/ 1	0.0% --	ND		
70. Endrin	72-20-8	µg/L					0/ 1	0.0% --	D	2E+00	2E+00
71. Ethylbenzene (ETB)	100-41-4	µg/L					0/ 14	0.0% --	D	7E+02	7E+02
72. Ethylene dibromide (EDB)	106-93-4	µg/L					0/ 5	0.0% --	B2	4E-04	5E-02
73. Fluoranthene (PAH)	206-44-0	µg/L					0/ 1	0.0% --	D	3E+02	
74. Fluorene (PAH)	86-73-7	µg/L					0/ 1	0.0% --	D	3E+02	
75. Heptachlor	76-44-8	µg/L					0/ 1	0.0% --	B2	8E-03	4E-01
76. Heptachlor epoxide	1024-57-3	µg/L					0/ 1	0.0% --	B2	4E-03	2E-01
77. Hexachlorobenzene	118-74-1	µg/L					0/ 1	0.0% --	B2	2E-02	1E+00
78. Hexachlorobutadiene	87-68-3	µg/L					0/ 1	0.0% --	C	5E-01	
79. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L					0/ 1	0.0% --	B2	6E-03	
80. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L					0/ 1	0.0% --	C	2E-02	
81. Delta-hexachlorocyclohexane	319-86-8	µg/L					0/ 1	0.0% --	D		
82. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L					0/ 1	0.0% --	D	5E+01	5E+01
83. Hexachloroethane	67-72-1	µg/L					0/ 1	0.0% --	C	3E+00	
84. 2-Hexanone	591-78-6	µg/L					0/ 1	0.0% --	NA		
85. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L					0/ 1	0.0% --	B2	3E-02	2E-01
86. Isophorone	78-59-1	µg/L					0/ 1	0.0% --	C	4E+01	
87. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L					0/ 1	0.0% --	C	3E-02	2E-01
88. Methoxychlor	72-43-5	µg/L					0/ 1	0.0% --	D	4E+01	4E+01
89. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L					0/ 1	0.0% --	D	4E+03	
90. Methyl isobutyl ketone	108-10-1	µg/L					0/ 1	0.0% --	NA	6E+02	
91. 2-methylnaphthalene	91-57-6	µg/L					0/ 1	0.0% --	ND		
92. 2-Methylphenol (o-Cresol)	95-48-7	µg/L					0/ 1	0.0% --	C	4E+01	
93. 4-methylphenol	106-44-5	µg/L					0/ 1	0.0% --	C	4E+01	
94. Naphthalene (PAH)	91-20-3	µg/L					0/ 1	0.0% --	D	3E+02	
95. 2-Nitroaniline	88-74-4	µg/L					0/ 1	0.0% --	NA	4E-01	
96. m-Nitroaniline	99-09-2	µg/L					0/ 1	0.0% --	ND		
97. Nitrobenzene	98-95-3	µg/L					0/ 1	0.0% --	D	4E+00	
98. p-Nitrophenol	100-02-7	µg/L					0/ 1	0.0% --	NA		
99. 2-NITROPHENOL (UG/L)	88-75-5	µg/L					0/ 1	0.0% --	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-4 Usage:												
O R G A N I C												
34. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0% --	B2	3E+00	2E-01
35. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 1	0.0% --	B2	2E-01	
36. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 1	0.0% --	B2	1E-01	
37. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 1	0.0% --	B2	1E-01	
38. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0% --	B2	3E-03	2E-01
39. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0% --	D		
40. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 23	0.0% --	C	4E-01	1E+02
41. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0% --	D	7E+02	
42. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	8	10	6.6	1.1	27	32/ 37	86.5% --	D	6E+02	6E+02
43. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 37	0.0% --	D	6E+02	
44. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	1	1.3	0.9	1.1	3	10/ 37	27.0% --	C	2E+00	8E+01
45. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0% --	B2	8E-02	
46. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	1.4	2.1	1.4	1.7	3.6	6/ 17	35.3% --	D	1E+03	
47. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.3	3.2	1.9	0.9	6.6	13/ 23	56.5% --	C	7E+01	
48. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 23	0.0% --	B2	4E-01	5E+00
49. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	1.9	2.8	2	0.2	6.4	13/ 23	56.5% --	C	6E-02	7E+00
50. 1,2-Dichloroethylene (TOTAL)		µg/L	18	25	7.2	10	33	6/ 6	100.0% --	D	7E+01	
51. cis-1,2-Dichloroethylene	156-59-2	µg/L	39	61	44	0.77	130	17/ 17	100.0% √	D	7E+01	7E+01
52. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.85	1.2	0.73	0.45	2.2	9/ 17	52.9% --	D	1E+02	1E+02
53. Dichloromethane (DCM)	75-09-2	µg/L	3.1	5	4.3	7.2	19	2/ 23	8.7% √	B2	5E+00	5E+00
54. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0% --	D	2E+01	
55. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L	0.39	0.61	0.5	0.4	0.4	1/ 22	4.5% √	B2	5E-01	5E+00
56. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 23	0.0% --	B2		
57. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 23	0.0% --	B2		
58. Dieldrin	60-57-1	µg/L						0/ 1	0.0% --	B2	2E-03	
59. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0% --	D	6E+03	5E+03
60. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0% --	B2	3E+00	4E+00
61. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0% --	D	7E+04	
62. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0% --	NA	1E+02	
63. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0% --	ND	1E+01	
64. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0% --	B2	5E-02	
65. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0% --	ND	7E+00	
66. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0% --	ND	1E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: EW-4 Usage:											
O R G A N I C											
67. Endosulfan i	959-98-8	µg/L					0/ 1	0.0% --	D	4E-01	
68. Endosulfan ii	33213-65-9	µg/L					0/ 1	0.0% --	ND		
69. Endosulfan sulfate	1031-07-8	µg/L					0/ 1	0.0% --	ND		
70. Endrin	72-20-8	µg/L					0/ 1	0.0% --	D	2E+00	2E+00
71. Ethylbenzene (ETB)	100-41-4	µg/L					0/ 23	0.0% --	D	7E+02	7E+02
72. Ethylene dibromide (EDB)	106-93-4	µg/L					0/ 5	0.0% --	B2	4E-04	5E-02
73. Fluoranthene (PAH)	206-44-0	µg/L					0/ 1	0.0% --	D	3E+02	
74. Fluorene (PAH)	86-73-7	µg/L					0/ 1	0.0% --	D	3E+02	
75. Heptachlor	76-44-8	µg/L					0/ 1	0.0% --	B2	8E-03	4E-01
76. Heptachlor epoxide	1024-57-3	µg/L					0/ 1	0.0% --	B2	4E-03	2E-01
77. Hexachlorobenzene	118-74-1	µg/L					0/ 1	0.0% --	B2	2E-02	1E+00
78. Hexachlorobutadiene	87-68-3	µg/L					0/ 1	0.0% --	C	5E-01	
79. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L					0/ 1	0.0% --	B2	6E-03	
80. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L					0/ 1	0.0% --	C	2E-02	
81. Delta-hexachlorocyclohexane	319-86-8	µg/L					0/ 1	0.0% --	D		
82. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L					0/ 1	0.0% --	D	5E+01	5E+01
83. Hexachloroethane	67-72-1	µg/L					0/ 1	0.0% --	C	3E+00	
84. 2-Hexanone	591-78-6	µg/L					0/ 1	0.0% --	NA		
85. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L					0/ 1	0.0% --	B2	3E-02	2E-01
86. Isophorone	78-59-1	µg/L					0/ 1	0.0% --	C	4E+01	
87. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L					0/ 1	0.0% --	C	3E-02	2E-01
88. Methoxychlor	72-43-5	µg/L					0/ 1	0.0% --	D	4E+01	4E+01
89. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L					0/ 1	0.0% --	D	4E+03	
90. Methyl isobutyl ketone	108-10-1	µg/L					0/ 1	0.0% --	NA	6E+02	
91. 2-methylnaphthalene	91-57-6	µg/L					0/ 1	0.0% --	ND		
92. 2-Methylphenol (o-Cresol)	95-48-7	µg/L					0/ 1	0.0% --	C	4E+01	
93. 4-methylphenol	106-44-5	µg/L					0/ 1	0.0% --	C	4E+01	
94. Naphthalene (PAH)	91-20-3	µg/L					0/ 1	0.0% --	D	3E+02	
95. 2-Nitroaniline	88-74-4	µg/L					0/ 1	0.0% --	NA	4E-01	
96. m-Nitroaniline	99-09-2	µg/L					0/ 1	0.0% --	ND		
97. Nitrobenzene	98-95-3	µg/L					0/ 1	0.0% --	D	4E+00	
98. p-Nitrophenol	100-02-7	µg/L					0/ 1	0.0% --	NA		
99. 2-NITROPHENOL (UG/L)	88-75-5	µg/L					0/ 1	0.0% --	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-5 Usage:												
I N O R G A N I C												
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.051	0.066	0.025	0.02	0.1	12/ 13	92.3% --	D	2E+00	
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0% --	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0% --	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0% --	D	7E+02	
4. Aldrin	309-00-2	µg/L						0/ 1	0.0% --	B2	2E-03	
5. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0% --	D	2E+03	
6. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
7. Benzene (BNZ)	71-43-2	µg/L	0.92	1.4	1.2	0.62	1.7	3/ 22	13.6% ✓	A	1E+00	5E+00
8. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0% --	B2	5E-03	2E-01
9. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
10. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0% --	D		
11. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
12. Benzoic acid	65-85-0	µg/L						0/ 1	0.0% --	D	3E+04	
13. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0% --	ND	2E+03	
14. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0% --	D		
15. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0% --	B2	3E-02	
16. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0% --	ND	5E-01	
17. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 22	0.0% --	B2	6E-01	1E+02
18. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0% --	D		
19. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 22	0.0% --	B2	4E+00	1E+02
20. Bromomethane (BMM)	74-83-9	µg/L						0/ 22	0.0% --	D	1E+01	
21. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
22. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0% --	D	7E+02	
23. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 22	0.0% --	B2	3E-01	5E+00
24. Chlordane	57-74-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E+00
25. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0% --	NA	3E+01	
26. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	4.6	6.8	6.8	0.32	27	23/ 40	57.5% --	D	1E+02	1E+02
27. Chloroethane (CE)	75-00-3	µg/L	1.5	2.5	2.2	0.51	0.51	1/ 22	4.5% --	ND		
28. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 17	0.0% --	ND		
29. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.64	1.1	1.1	0.53	0.6	2/ 22	9.1% ✓	B2	6E+00	1E+02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-5 Usage:													
ORGANIC													
30. Chloromethane (CM)	74-87-3	µg/L	1.5	2.5	2.2	0.3	0.46	2/ 22	9.1%	--	C	3E+00	
31. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0%	--	ND		
32. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0%	--	NA	6E+02	
33. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0%	--	D	4E+01	
34. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0%	--	B2	3E+00	2E-01
35. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 1	0.0%	--	B2	2E-01	
36. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 1	0.0%	--	B2	1E-01	
37. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 1	0.0%	--	B2	1E-01	
38. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0%	--	B2	3E-03	2E-01
39. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0%	--	D		
40. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 22	0.0%	--	C	4E-01	1E+02
41. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0%	--	D	7E+02	
42. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	15	20	17	1.4	58	29/ 36	80.6%	--	D	6E+02	6E+02
43. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	1.8	2.6	2.5	3.4	3.4	1/ 36	2.8%	--	D	6E+02	
44. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	2.1	3	2.5	0.8	4.8	7/ 36	19.4%	--	C	2E+00	8E+01
45. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0%	--	B2	8E-02	
46. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	1	2.3	2.3	0.72	0.9	2/ 16	12.5%	--	D	1E+03	
47. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.96	1.4	1.1	0.25	1.9	13/ 22	59.1%	--	C	7E+01	
48. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 22	0.0%	--	B2	4E-01	5E+00
49. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.77	1.2	1.1	0.25	1.5	7/ 22	31.8%	--	C	6E-02	7E+00
50. 1,2-Dichloroethylene (TOTAL)		µg/L	22	27	4.9	18	31	6/ 6	100.0%	--	D	7E+01	
51. cis-1,2-Dichloroethylene	156-59-2	µg/L	160	230	130	23	490	16/ 16	100.0%	✓	D	7E+01	7E+01
52. trans-1,2-Dichloroethylene	156-60-5	µg/L	2.5	3.8	2.5	0.24	9.1	13/ 16	81.3%	--	D	1E+02	1E+02
53. Dichloromethane (DCM)	75-09-2	µg/L	3.4	5	3.6	5.3	5.3	1/ 22	4.5%	✓	B2	5E+00	5E+00
54. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0%	--	D	2E+01	
55. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 21	0.0%	--	B2	5E-01	5E+00
56. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L	1.1	2	2	0.5	0.5	1/ 22	4.5%	✓	B2		
57. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 22	0.0%	--	B2		
58. Dieldrin	60-57-1	µg/L						0/ 1	0.0%	--	B2	2E-03	
59. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0%	--	D	6E+03	5E+03
60. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0%	--	B2	3E+00	4E+00
61. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0%	--	D	7E+04	
62. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0%	--	NA	1E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-5 Usage:												
O R G A N I C												
63. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0% --	ND	1E+01	
64. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0% --	B2	5E-02	
65. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0% --	ND	7E+00	
66. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0% --	ND	1E+02	
67. Endosulfan i	959-98-8	µg/L						0/ 1	0.0% --	D	4E-01	
68. Endosulfan ii	33213-65-9	µg/L						0/ 1	0.0% --	ND		
69. Endosulfan sulfate	1031-07-8	µg/L						0/ 1	0.0% --	ND		
70. Endrin	72-20-8	µg/L						0/ 1	0.0% --	D	2E+00	2E+00
71. Ethylbenzene (ETB)	100-41-4	µg/L	0.87	1.4	1.2	1.6	1.6	1/ 22	4.5% --	D	7E+02	7E+02
72. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 5	0.0% --	B2	4E-04	5E-02
73. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0% --	D	3E+02	
74. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0% --	D	3E+02	
75. Heptachlor	76-44-8	µg/L						0/ 1	0.0% --	B2	8E-03	4E-01
76. Heptachlor epoxide	1024-57-3	µg/L						0/ 1	0.0% --	B2	4E-03	2E-01
77. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0% --	B2	2E-02	1E+00
78. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0% --	C	5E-01	
79. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L						0/ 1	0.0% --	B2	6E-03	
80. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L						0/ 1	0.0% --	C	2E-02	
81. Delta-hexachlorocyclohexane	319-86-8	µg/L						0/ 1	0.0% --	D		
82. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0% --	D	5E+01	5E+01
83. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0% --	C	3E+00	
84. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0% --	NA		
85. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
86. Isophorone	78-59-1	µg/L						0/ 1	0.0% --	C	4E+01	
87. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L						0/ 1	0.0% --	C	3E-02	2E-01
88. Methoxychlor	72-43-5	µg/L						0/ 1	0.0% --	D	4E+01	4E+01
89. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0% --	D	4E+03	
90. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0% --	NA	6E+02	
91. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0% --	ND		
92. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0% --	C	4E+01	
93. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0% --	C	4E+01	
94. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0% --	D	3E+02	
95. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0% --	NA	4E-01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-5 Usage:												
O R G A N I C												
96. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0% --	ND		
97. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0% --	D	4E+00	
98. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0% --	NA		
99. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0% --	ND		
100. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
101. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
102. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 2	0.0% --	D		
103. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
104. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
105. Phenol	108-95-2	µg/L						0/ 1	0.0% --	D	4E+03	
106. Polychlorinated biphenyls (PCBs)	1336-36-3	µg/L						0/ 5	0.0% --	B2	5E-03	5E-01
107. Polychlorinated biphenyl - ar	12674-11-2	µg/L						0/ 1	0.0% --	ND	5E-01	
108. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
109. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
110. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 22	0.0% --	C	2E-01	
111. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.63	1.1	1.1	0.3	0.38	3/ 22	13.6% ✓	B2	7E-01	5E+00
112. Toluene (TOL)	108-88-3	µg/L	0.87	1.4	1.2	1.6	1.6	1/ 22	4.5% --	D	1E+03	1E+03
113. Toxaphene	8001-35-2	µg/L						0/ 1	0.0% --	B2	3E-02	3E+00
114. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
115. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 22	0.0% --	D	6E+02	2E+02
116. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 22	0.0% --	C	6E-01	5E+00
117. Trichloroethylene (TCE)	79-01-6	µg/L	6.2	7.8	3.7	0.66	16	20/ 22	90.9% ✓	B2	3E+00	5E+00
118. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	1.6	2.8	2.3	0.61	2.3	8/ 16	50.0% --	D	2E+03	
119. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0% --	D	7E+02	
120. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0% --	B2	3E+00	
121. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.1	1.6	1	0.2	1.8	10/ 21	47.6% --	D	2E+05	
122. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0% --	NA	7E+03	
123. Vinyl chloride (VC)	75-01-4	µg/L	110	190	190	2	910	19/ 22	86.4% ✓	A	2E-02	2E+00
124. Xylenes (total) (XYL)	1330-20-7	µg/L	1.5	2.7	2.6	7.4	7.4	1/ 19	5.3% --	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-5TM Usage:												
I N O R G A N I C												
1. Antimony (Sb)	7440-36-0	mg/L						0/ 1	0.0% --	D	3E-03	1E-02
2. Arsenic, inorganic (As)	7440-38-2	mg/L	0.008	0.008		0.008	0.008	1/ 1	100.0% √	A	2E-05	5E-02
3. Barium (Ba)	7440-39-3	mg/L	0.076	0.076		0.076	0.076	1/ 1	100.0% --	D	5E-01	2E+00
4. Beryllium (Be)	7440-41-7	mg/L						0/ 1	0.0% --	B2	8E-06	1E-03
5. Boron and borates only (B)	7440-42-8	mg/L	0.26	0.26		0.26	0.26	1/ 1	100.0% --	D	6E-01	
6. Cadmium (Cd)	7440-43-9	mg/L						0/ 1	0.0% --	B1	4E-03	5E-03
7. Chromium(III)	16065-83-1	mg/L						0/ 1	0.0% --	NA	7E+00	1E-01
8. Copper (Cu)	7440-50-8	mg/L						0/ 1	0.0% --	D	3E-01	
9. Iron (Fe)	7439-89-6	mg/L						0/ 1	0.0% --	ND		
10. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 1	0.0% --	B2	5E-03	
11. Manganese (Mn)	7439-96-5	mg/L	0.3	0.3		0.297	0.297	1/ 1	100.0% √	D	4E-02	
12. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 1	0.0% --	D	2E-03	2E-03
13. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 1	0.0% --	D	1E-01	1E-01
14. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
15. Silver (Ag)	7440-22-4	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
16. Thallium (Tl)	7440-28-0	mg/L						0/ 1	0.0% --	ND	5E-04	
17. Zinc and compounds (Zn)	7440-66-6	mg/L	0.028	0.028		0.028	0.028	1/ 1	100.0% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-6 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. Biological Oxygen Demand (BOD)		mg/L	1.3	2.5	0.47	2	2	1/ 3	33.3% --	ND		
2. pH			7.1	7.3	0.21	6.9	7.5	14/ 14	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	0.55	0.95	0.69	0.1	2.44	11/ 14	78.6% --	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 14	0.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0096	0.011	0.0032	0.006	0.017	14/ 14	100.0% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.13	0.19	0.089	0.068	0.33	8/ 13	61.5% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 14	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.29	0.33	0.057	0.2	0.4	13/ 13	100.0% --	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 14	0.0% --	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	39	43	6.9	31	54.4	14/ 14	100.0% --	ND		
9. Chloride (Cl)-		mg/L	160	170	13	143	185	14/ 14	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 14	0.0% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 14	0.0% --	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L	0.0086	0.015	0.01	0.01	0.04	2/ 11	18.2% --	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.41	0.47	0.093	0.3	0.6	12/ 13	92.3% --	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.12	0.21	0.15	0.1	0.556	3/ 13	23.1% --	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0031	0.0048	0.0028	0.01	0.01	1/ 14	7.1% √	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	17	19	3.7	14	25.8	14/ 14	100.0% --	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.72	1.2	0.78	0.13	2.41	14/ 14	100.0% √	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 14	0.0% --	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 14	0.0% --	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	2	2.4	0.05	1.9	2	2/ 2	100.0% --	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 2	0.0% --	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	4.4	5.5	2	4	8.6	8/ 14	57.1% --	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 14	0.0% --	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 14	0.0% --	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	150	160	12	130	180	14/ 14	100.0% --	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	59	62	5.8	50	70	14/ 14	100.0% --	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 14	0.0% --	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	600	650	73	459.999999	730	14/ 14	100.0% --	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-6 Usage:													
I N O R G A N I C													
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.076	0.1	0.049	0.02	0.2	14/ 14	100.0%	--	D	2E+00	
O R G A N I C													
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0%	--	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0%	--	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0%	--	D	7E+02	
4. Aldrin	309-00-2	µg/L						0/ 1	0.0%	--	B2	2E-03	
5. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0%	--	D	2E+03	
6. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
7. Benzene (BNZ)	71-43-2	µg/L	5.8	8.6	6.4	12	12	1/ 23	4.3%	✓	A	1E+00	5E+00
8. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0%	--	B2	5E-03	2E-01
9. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
10. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0%	--	D		
11. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
12. Benzoic acid	65-85-0	µg/L						0/ 1	0.0%	--	D	3E+04	
13. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0%	--	ND	2E+03	
14. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0%	--	D		
15. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0%	--	B2	3E-02	
16. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0%	--	ND	5E-01	
17. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 22	0.0%	--	B2	6E-01	1E+02
18. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0%	--	D		
19. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 22	0.0%	--	B2	4E+00	1E+02
20. Bromomethane (BMM)	74-83-9	µg/L						0/ 22	0.0%	--	D	1E+01	
21. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0%	--	C	1E+02	1E+02
22. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0%	--	D	7E+02	
23. Carbon tetrachloride (CCL4)	56-23-5	µg/L	3.1	4.7	3.8	6	6	1/ 23	4.3%	✓	B2	3E-01	5E+00
24. Chlordane	57-74-9	µg/L						0/ 1	0.0%	--	B2	3E-02	2E+00
25. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0%	--	NA	3E+01	
26. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	38	59	67	0.88	280	32/ 41	78.0%	✓	D	1E+02	1E+02
27. Chloroethane (CE)	75-00-3	µg/L						0/ 22	0.0%	--	ND		
28. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 17	0.0%	--	ND		
29. Chloroform (THM) (CLFM)	67-66-3	µg/L	3.1	4.7	3.8	0.72	6.4	2/ 23	8.7%	✓	B2	6E+00	1E+02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-6 Usage:													
O R G A N I C													
30. Chloromethane (CM)	74-87-3	µg/L	3.9	6.2	5.2	7.7	7.7	1/ 22	4.5%	√	C	3E+00	
31. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0%	--	ND		
32. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0%	--	NA	6E+02	
33. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0%	--	D	4E+01	
34. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0%	--	B2	3E+00	2E-01
35. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 1	0.0%	--	B2	2E-01	
36. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 1	0.0%	--	B2	1E-01	
37. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 1	0.0%	--	B2	1E-01	
38. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0%	--	B2	3E-03	2E-01
39. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0%	--	D		
40. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 22	0.0%	--	C	4E-01	1E+02
41. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0%	--	D	7E+02	
42. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	260	450	550	3.3	2500	31/ 35	88.6%	√	D	6E+02	6E+02
43. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	110	240	400	4.2	1900	4/ 35	11.4%	√	D	6E+02	
44. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	110	250	409.999999	1.2	1900	6/ 35	17.1%	√	C	2E+00	8E+01
45. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0%	--	B2	8E-02	
46. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	4.1	7.3	5.9	3.1	3.1	1/ 16	6.3%	--	D	1E+03	
47. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.7	4.1	3.2	0.3	5.4	3/ 22	13.6%	--	C	7E+01	
48. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	3.1	4.8	3.8	6.4	6.4	1/ 23	4.3%	√	B2	4E-01	5E+00
49. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	3	4.6	3.7	0.24	3.6	2/ 23	8.7%	--	C	6E-02	7E+00
50. 1,2-Dichloroethylene (TOTAL)		µg/L	27	33	5.4	21	36	6/ 6	100.0%	--	D	7E+01	
51. cis-1,2-Dichloroethylene	156-59-2	µg/L	1100	1900	1600	16	6700	16/ 16	100.0%	√	D	7E+01	7E+01
52. trans-1,2-Dichloroethylene	156-60-5	µg/L	16	27	20	0.61	75	13/ 16	81.3%	--	D	1E+02	1E+02
53. Dichloromethane (DCM)	75-09-2	µg/L	27	43	38	70	150	2/ 22	9.1%	√	B2	5E+00	5E+00
54. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0%	--	D	2E+01	
55. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 21	0.0%	--	B2	5E-01	5E+00
56. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 22	0.0%	--	B2		
57. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 22	0.0%	--	B2		
58. Dieldrin	60-57-1	µg/L						0/ 1	0.0%	--	B2	2E-03	
59. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0%	--	D	6E+03	5E+03
60. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0%	--	B2	3E+00	4E+00
61. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0%	--	D	7E+04	
62. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0%	--	NA	1E+02	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-6 Usage:												
O R G A N I C												
63. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0%	-- ND	1E+01	
64. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0%	-- B2	5E-02	
65. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0%	-- ND	7E+00	
66. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0%	-- ND	1E+02	
67. Endosulfan i	959-98-8	µg/L						0/ 1	0.0%	-- D	4E-01	
68. Endosulfan ii	33213-65-9	µg/L						0/ 1	0.0%	-- ND		
69. Endosulfan sulfate	1031-07-8	µg/L						0/ 1	0.0%	-- ND		
70. Endrin	72-20-8	µg/L						0/ 1	0.0%	-- D	2E+00	2E+00
71. Ethylbenzene (ETB)	100-41-4	µg/L	20	41	47	68	210	3/ 22	13.6%	-- D	7E+02	7E+02
72. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 5	0.0%	-- B2	4E-04	5E-02
73. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0%	-- D	3E+02	
74. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0%	-- D	3E+02	
75. Heptachlor	76-44-8	µg/L						0/ 1	0.0%	-- B2	8E-03	4E-01
76. Heptachlor epoxide	1024-57-3	µg/L						0/ 1	0.0%	-- B2	4E-03	2E-01
77. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0%	-- B2	2E-02	1E+00
78. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0%	-- C	5E-01	
79. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L						0/ 1	0.0%	-- B2	6E-03	
80. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L						0/ 1	0.0%	-- C	2E-02	
81. Delta-hexachlorocyclohexane	319-86-8	µg/L						0/ 1	0.0%	-- D		
82. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0%	-- D	5E+01	5E+01
83. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0%	-- C	3E+00	
84. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0%	-- NA		
85. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0%	-- B2	3E-02	2E-01
86. Isophorone	78-59-1	µg/L						0/ 1	0.0%	-- C	4E+01	
87. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L						0/ 1	0.0%	-- C	3E-02	2E-01
88. Methoxychlor	72-43-5	µg/L						0/ 1	0.0%	-- D	4E+01	4E+01
89. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0%	-- D	4E+03	
90. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0%	-- NA	6E+02	
91. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0%	-- ND		
92. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0%	-- C	4E+01	
93. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0%	-- C	4E+01	
94. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0%	-- D	3E+02	
95. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0%	-- NA	4E-01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-6 Usage:													
O R G A N I C													
96. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0%	--	ND		
97. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0%	--	D	4E+00	
98. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0%	--	NA		
99. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0%	--	ND		
100. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0%	--	B2	5E-03	
101. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0%	--	B2	7E+00	
102. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 3	0.0%	--	D		
103. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0%	--	B2	3E-01	1E+00
104. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0%	--	D		
105. Phenol	108-95-2	µg/L						0/ 1	0.0%	--	D	4E+03	
106. Polychlorinated biphenyls (PCBs)	1336-36-3	µg/L						0/ 5	0.0%	--	B2	5E-03	5E-01
107. Polychlorinated biphenyl - ar	12674-11-2	µg/L						0/ 1	0.0%	--	ND	5E-01	
108. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0%	--	D	2E+02	
109. Styrene	100-42-5	µg/L						0/ 1	0.0%	--	C	1E+02	1E+02
110. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 22	0.0%	--	C	2E-01	
111. Tetrachloroethylene (PCE)	127-18-4	µg/L	3	4.6	3.7	0.27	1.7	2/ 23	8.7%	√	B2	7E-01	5E+00
112. Toluene (TOL)	108-88-3	µg/L	6.1	9.5	7.7	5.6	28	3/ 22	13.6%	--	D	1E+03	1E+03
113. Toxaphene	8001-35-2	µg/L						0/ 1	0.0%	--	B2	3E-02	3E+00
114. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0%	--	D	7E+01	9E+00
115. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	5	9.69999999	11	14	50	2/ 22	9.1%	--	D	6E+02	2E+02
116. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 22	0.0%	--	C	6E-01	5E+00
117. Trichloroethylene (TCE)	79-01-6	µg/L	5.6	8.19999999	6	1.1	22	10/ 23	43.5%	√	B2	3E+00	5E+00
118. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	7	11	8.3	0.36	29	6/ 16	37.5%	--	D	2E+03	
119. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0%	--	D	7E+02	
120. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0%	--	B2	3E+00	
121. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	6.9	12	12	0.33	4.8	4/ 21	19.0%	--	D	2E+05	
122. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	--	NA	7E+03	
123. Vinyl chloride (VC)	75-01-4	µg/L	910	1600	1700	51	7600	23/ 23	100.0%	√	A	2E-02	2E+00
124. Xylenes (total) (XYL)	1330-20-7	µg/L	23	46	48	33	170	3/ 19	15.8%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-6TM Usage:												
I N O R G A N I C												
1. Antimony (Sb)	7440-36-0	mg/L						0/ 1	0.0% --	D	3E-03	1E-02
2. Arsenic, inorganic (As)	7440-38-2	mg/L	0.012	0.012		0.012	0.012	1/ 1	100.0% ✓	A	2E-05	5E-02
3. Barium (Ba)	7440-39-3	mg/L	0.29	0.29		0.294	0.294	1/ 1	100.0% --	D	5E-01	2E+00
4. Beryllium (Be)	7440-41-7	mg/L						0/ 1	0.0% --	B2	8E-06	1E-03
5. Boron and borates only (B)	7440-42-8	mg/L	0.3	0.3		0.3	0.3	1/ 1	100.0% --	D	6E-01	
6. Cadmium (Cd)	7440-43-9	mg/L	0.0006	0.0006		0.0006	0.0006	1/ 1	100.0% ✓	B1	4E-03	5E-03
7. Chromium(III)	16065-83-1	mg/L						0/ 1	0.0% --	NA	7E+00	1E-01
8. Copper (Cu)	7440-50-8	mg/L	0.015	0.015		0.015	0.015	1/ 1	100.0% --	D	3E-01	
9. Iron (Fe)	7439-89-6	mg/L	0.6	0.6		0.602	0.602	1/ 1	100.0% --	ND		
10. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.011	0.011		0.011	0.011	1/ 1	100.0% ✓	B2	5E-03	
11. Manganese (Mn)	7439-96-5	mg/L	2.1	2.1		2.06	2.06	1/ 1	100.0% ✓	D	4E-02	
12. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 1	0.0% --	D	2E-03	2E-03
13. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.024	0.024		0.024	0.024	1/ 1	100.0% --	D	1E-01	1E-01
14. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
15. Silver (Ag)	7440-22-4	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
16. Thallium (Tl)	7440-28-0	mg/L						0/ 1	0.0% --	ND	5E-04	
17. Zinc and compounds (Zn)	7440-66-6	mg/L	4.6	4.6		4.6	4.6	1/ 1	100.0% ✓	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-7 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			7.5	7.6	0.079	7.4	7.7	9/ 9	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	0.06	0.11	0.079	0.066	0.066	1/ 14	7.1% --	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 14	0.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0076	0.011	0.0051	0.005	0.008	11/ 14	78.6% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.088	0.1	0.023	0.042	0.048	3/ 14	21.4% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 14	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.28	0.3	0.034	0.2	0.31	14/ 14	100.0% --	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 14	0.0% --	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	45	46	2.6	39	48	14/ 14	100.0% --	ND		
9. Chloride (Cl)-		mg/L	160	180	34	44	190	14/ 14	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 14	0.0% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 14	0.0% --	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0% --	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.41	0.46	0.087	0.39	0.6	12/ 14	85.7% --	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.061	0.1	0.068	0.04	0.3	2/ 14	14.3% --	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0048	0.0069	0.0037	0.002	0.009	9/ 14	64.3% √	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	18	19	1.1	16	19.8	14/ 14	100.0% --	ND		
17. Manganese (Mn)	7439-96-5	mg/L						0/ 14	0.0% --	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 14	0.0% --	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 14	0.0% --	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	3.3	4	0.73	2.6	4.9	7/ 7	100.0% --	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 10	0.0% --	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	4.6	4.8	0.37	4	5	14/ 14	100.0% --	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 14	0.0% --	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 14	0.0% --	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	170	170	10	140	179	14/ 14	100.0% --	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	70	74	6.2	60	80	14/ 14	100.0% --	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 14	0.0% --	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	640	660	23	612	690	14/ 14	100.0% --	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.088	0.13	0.082	0.028	0.32	13/ 14	92.9% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-7 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 14	0.0%	--	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 14	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 24	0.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.41	0.75	0.6	0.26	0.4	3/ 14	21.4%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 14	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 14	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 24	0.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 24	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 24	0.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 14	0.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.44	0.8	0.62	0.59	0.82	2/ 14	14.3%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 14	0.0%	--	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.51	0.85	0.58	0.28	0.7	6/ 14	42.9%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	2.2	4	3.1	2.9	8.3	4/ 14	28.6%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 14	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.6	2.5	1.7	7.5	7.5	1/ 14	7.1%	√	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 14	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.38	0.73	0.61	0.26	0.27	2/ 14	14.3%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.48	0.81	0.57	0.51	0.51	1/ 14	7.1%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 14	0.0%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	1.5	2.1	0.88	0.6	3.5	14/ 14	100.0%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.53	0.9	0.64	0.32	0.37	2/ 14	14.3%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %		WoE	HBGL	MCL
Water Sample												
Sample Site: EW-7 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1	1.5	0.77	0.63	2.9	6/ 14	42.9%	--	D	2E+05
35. Vinyl chloride (VC)	75-01-4	µg/L	0.73	1.5	1.3	2.3	2.3	1/ 14	7.1%	✓	A	2E-02 2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	--	D	1E+04 1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ1 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L	13	80	7.5	5	20	2/ 2	100.0%	--	ND		
2. pH			7.4	7.5	0.047	7.3	7.4	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.7	1.4	0.44	0.26	1.4	4/ 4	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0095	0.024	0.0092	0.008	0.008	1/ 4	25.0%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.28	0.57	0.18	0.052	0.56	4/ 4	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.42	0.52	0.067	0.33	0.51	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	58	63	3.1	55.2	63	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	200	200	5	190	200	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.45	0.54	0.056	0.39	0.54	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	1.3	4.9	2.2	0.022	5.2	4/ 4	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 4	0.0%	--	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	27	30	2	24.9	30	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	1.3	3.4	1.3	0.082	3.5	4/ 4	100.0%	✓	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.015	0.023	0.005	0.02	0.02	1/ 4	25.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 1	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	6.6	8.4	1.1	5.5	8.3	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	200	210	3.4	201	210	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	59	83	15	37	80	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	770	800	21	740	796	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.067	0.21	0.089	0.026	0.22	2/ 4	50.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-OE Usage:												
O R G A N I C												
34. Endosulfan sulfate	1031-07-8	µg/L						0/ 2	0.0% --	ND		
35. Endrin	72-20-8	µg/L						0/ 2	0.0% --	D	2E+00	2E+00
36. Ethylbenzene (ETB)	100-41-4	µg/L	0.48	0.89	0.67	2.8	2.8	1/ 13	7.7% --	D	7E+02	7E+02
37. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 3	0.0% --	B2	4E-04	5E-02
38. Heptachlor	76-44-8	µg/L						0/ 2	0.0% --	B2	8E-03	4E-01
39. Heptachlor epoxide	1024-57-3	µg/L						0/ 2	0.0% --	B2	4E-03	2E-01
40. alpha-Hexachlorocyclohexane (alpha-HCH)	319-84-6	µg/L						0/ 2	0.0% --	B2	6E-03	
41. beta-Hexachlorocyclohexane (beta-HCH)	319-85-7	µg/L						0/ 2	0.0% --	C	2E-02	
42. Delta-hexachlorocyclohexane	319-86-8	µg/L						0/ 2	0.0% --	D		
43. Lindane (gamma-hexachlorocycl (gamma-HCH)	58-89-9	µg/L						0/ 2	0.0% --	C	3E-02	2E-01
44. Methoxychlor	72-43-5	µg/L						0/ 2	0.0% --	D	4E+01	4E+01
45. Polychlorinated biphenyls (PCBs)	1336-36-3	µg/L						0/ 10	0.0% --	B2	5E-03	5E-01
46. Polychlorinated biphenyl - ar	12674-11-2	µg/L						0/ 2	0.0% --	ND	5E-01	
47. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 13	0.0% --	C	2E-01	
48. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 13	0.0% --	B2	7E-01	5E+00
49. Toluene (TOL)	108-88-3	µg/L	0.44	0.63	0.3	0.65	0.87	2/ 13	15.4% --	D	1E+03	1E+03
50. Toxaphene	8001-35-2	µg/L						0/ 2	0.0% --	B2	3E-02	3E+00
51. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 13	0.0% --	D	6E+02	2E+02
52. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 13	0.0% --	C	6E-01	5E+00
53. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 13	0.0% --	B2	3E+00	5E+00
54. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 10	0.0% --	D	2E+03	
55. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.46	0.79	0.55	2	2	1/ 13	7.7% --	D	2E+05	
56. Vinyl chloride (VC)	75-01-4	µg/L	0.92	1.7	1.3	0.8	4.8	3/ 13	23.1% ✓	A	2E-02	2E+00
57. Xylenes (total) (XYL)	1330-20-7	µg/L	2	4.7	4.2	16	16	1/ 12	8.3% --	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-OE Usage:													
O R G A N I C													
1. Aldrin	309-00-2	µg/L						0/ 2	0.0%	--	B2	2E-03	
2. Benzene (BNZ)	71-43-2	µg/L	3.7	6.9	5.4	2.4	16	5/ 13	38.5%	✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 13	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 13	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 13	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 13	0.0%	--	B2	3E-01	5E+00
7. Chlordane	57-74-9	µg/L						0/ 2	0.0%	--	B2	3E-02	2E+00
8. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	36	54	44	25	130	14/ 26	53.8%	--	D	1E+02	1E+02
9. Chloroethane (CE)	75-00-3	µg/L						0/ 13	0.0%	--	ND		
10. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 10	0.0%	--	ND		
11. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.31	0.49	0.31	0.4	0.4	1/ 13	7.7%	✓	B2	6E+00	1E+02
12. Chloromethane (CM)	74-87-3	µg/L						0/ 13	0.0%	--	C	3E+00	
13. DDD (p,p'-dichlorodiphenyldic (DDD)	72-54-8	µg/L						0/ 2	0.0%	--	B2	2E-01	
14. DDE (p,p'-dichlorodiphenyldic (DDE)	72-55-9	µg/L						0/ 2	0.0%	--	B2	1E-01	
15. DDT (p,p'-dichlorodiphenyltri (DDT)	50-29-3	µg/L						0/ 2	0.0%	--	B2	1E-01	
16. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 13	0.0%	--	C	4E-01	1E+02
17. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.95	1.3	0.7	1.1	2.7	4/ 24	16.7%	--	D	6E+02	6E+02
18. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	0.87	1.1	0.57	1.1	1.3	4/ 24	16.7%	--	D	6E+02	
19. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	2.1	2.8	1.6	1.7	5.1	12/ 24	50.0%	--	C	2E+00	8E+01
20. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 10	0.0%	--	D	1E+03	
21. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 13	0.0%	--	C	7E+01	
22. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 13	0.0%	--	B2	4E-01	5E+00
23. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 13	0.0%	--	C	6E-02	7E+00
24. 1,2-Dichloroethylene (TOTAL)		µg/L						0/ 3	0.0%	--	D	7E+01	
25. cis-1,2-Dichloroethylene	156-59-2	µg/L	1	2.3	1.8	0.21	6.2	3/ 10	30.0%	--	D	7E+01	7E+01
26. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.33	0.57	0.34	0.24	0.28	2/ 10	20.0%	--	D	1E+02	1E+02
27. Dichloromethane (DCM)	75-09-2	µg/L	2.3	3.5	2	3.7	8.6	2/ 13	15.4%	✓	B2	5E+00	5E+00
28. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 13	0.0%	--	B2	5E-01	5E+00
29. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 13	0.0%	--	B2		
30. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 13	0.0%	--	B2		
31. Dieldrin	60-57-1	µg/L						0/ 2	0.0%	--	B2	2E-03	
32. Endosulfan i	959-98-8	µg/L						0/ 2	0.0%	--	D	4E-01	
33. Endosulfan ii	33213-65-9	µg/L						0/ 2	0.0%	--	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-OE Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.3	7.7	0.39	6.9	8	7/ 7	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	1.9	3.5	2.2	1.4	6.5	5/ 10	50.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 10	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.018	0.028	0.014	0.005	0.044	9/ 10	90.0%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.41	0.7	0.4	0.085	1.1	7/ 10	70.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 10	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.34	0.39	0.081	0.24	0.51	10/ 10	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 10	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	54	69	21	36	88	10/ 10	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	150	160	12	128	170	10/ 10	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.0065	0.0097	0.0045	0.02	0.02	1/ 10	10.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 10	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 6	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.44	0.48	0.05	0.4	0.51	10/ 10	100.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	4.2	7.8	5	0.2	12	6/ 10	60.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0045	0.0075	0.0041	0.004	0.0094	3/ 10	30.0%	✓	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	25	33	11	15	43	10/ 10	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	1.9	3.6	2.3	0.08	7.6	10/ 10	100.0%	✓	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 10	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.023	0.029	0.009	0.05	0.05	1/ 10	10.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.78	2.5	1.1	0.48	2.6	2/ 4	50.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L	0.026	0.085	0.037	0.09	0.09	1/ 4	25.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	6.9	10	4.4	4	14	7/ 10	70.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	140	160	16	120	180	10/ 10	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	42	62	27	7	74	8/ 10	80.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 10	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	640	720	110	509.999999	900	10/ 10	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.11	0.16	0.07	0.01	0.25	10/ 10	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-NW Usage:													
O R G A N I C													
100. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.9	1.5	1.4	0.44	0.44	1/ 22	4.5%	--	D	2E+05	
101. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	--	NA	7E+03	
102. Vinyl chloride (VC)	75-01-4	µg/L	170	270	220	0.29	910	20/ 23	87.0%	✓	A	2E-02	2E+00
103. Xylenes (total) (XYL)	1330-20-7	µg/L	0.77	1.2	0.97	0.7	0.7	1/ 21	4.8%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-NW Usage:												
O R G A N I C												
67. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0% --	D	5E+01	5E+01
68. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0% --	C	3E+00	
69. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0% --	NA		
70. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
71. Isophorone	78-59-1	µg/L						0/ 1	0.0% --	C	4E+01	
72. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0% --	D	4E+03	
73. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0% --	NA	6E+02	
74. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0% --	ND		
75. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0% --	C	4E+01	
76. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0% --	C	4E+01	
77. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0% --	D	3E+02	
78. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0% --	NA	4E-01	
79. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0% --	ND		
80. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0% --	D	4E+00	
81. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0% --	NA		
82. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0% --	ND		
83. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
84. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
85. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
86. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
87. Phenol	108-95-2	µg/L	40	40		40	40	1/ 1	100.0% --	D	4E+03	
88. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
89. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
90. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 23	0.0% --	C	2E-01	
91. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.66	1.2	1.1	0.47	0.47	1/ 23	4.3% ✓	B2	7E-01	5E+00
92. Toluene (TOL)	108-88-3	µg/L	0.61	1.1	1	0.7	0.7	1/ 23	4.3% --	D	1E+03	1E+03
93. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
94. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.79	1.3	1.2	1.3	2.3	2/ 23	8.7% --	D	6E+02	2E+02
95. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 23	0.0% --	C	6E-01	5E+00
96. Trichloroethylene (TCE)	79-01-6	µg/L	0.89	1.4	1.2	0.25	2.1	7/ 23	30.4% ✓	B2	3E+00	5E+00
97. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.69	1.1	0.75	0.4	2.4	5/ 16	31.3% --	D	2E+03	
98. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0% --	D	7E+02	
99. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0% --	B2	3E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-NW Usage:													
O R G A N I C													
34. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0%	--	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 23	0.0%	--	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0%	--	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	18	24	20	2.2	60	23/ 37	62.2%	--	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	0.87	1.4	1.6	0.9	2.1	2/ 37	5.4%	--	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	2	2.6	2	1	5.1	14/ 37	37.8%	--	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0%	--	B2	8E-02	
41. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.29	0.47	0.35	0.4	0.4	1/ 16	6.3%	--	D	1E+03	
42. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1	1.6	1.2	0.4	2.5	8/ 23	34.8%	--	C	7E+01	
43. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.97	1.7	1.6	0.57	0.57	1/ 23	4.3%	✓	B2	4E-01	5E+00
44. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.73	1.2	1.2	2.2	2.2	1/ 23	4.3%	--	C	6E-02	7E+00
45. 1,2-Dichloroethylene (TOTAL)		µg/L	22	27	5	13	29	7/ 7	100.0%	--	D	7E+01	
46. cis-1,2-Dichloroethylene	156-59-2	µg/L	12	22	18	0.51	69	12/ 16	75.0%	--	D	7E+01	7E+01
47. trans-1,2-Dichloroethylene	156-60-5	µg/L	1.2	2	1.6	0.52	5.6	7/ 16	43.8%	--	D	1E+02	1E+02
48. Dichloromethane (DCM)	75-09-2	µg/L	5.7	9.4	8.69999999	20	20	1/ 23	4.3%	✓	B2	5E+00	5E+00
49. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0%	--	D	2E+01	
50. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 22	0.0%	--	B2	5E-01	5E+00
51. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 23	0.0%	--	B2		
52. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 23	0.0%	--	B2		
53. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0%	--	D	6E+03	5E+03
54. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L	26	26		26	26	1/ 1	100.0%	✓	B2	3E+00	4E+00
55. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0%	--	D	7E+04	
56. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0%	--	NA	1E+02	
57. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0%	--	ND	1E+01	
58. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0%	--	B2	5E-02	
59. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0%	--	ND	7E+00	
60. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0%	--	ND	1E+02	
61. Ethylbenzene (ETB)	100-41-4	µg/L	1.1	2.3	2.7	13	13	1/ 23	4.3%	--	D	7E+02	7E+02
62. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 6	0.0%	--	B2	4E-04	5E-02
63. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0%	--	D	3E+02	
64. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0%	--	D	3E+02	
65. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0%	--	B2	2E-02	1E+00
66. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0%	--	C	5E-01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-NW Usage:												
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0% --	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0% --	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0% --	D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0% --	D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L	0.83	1.3	1.1	0.5	2.4	6/ 23	26.1% √	A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0% --	B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0% --	D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0% --	D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0% --	ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0% --	D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0% --	B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0% --	ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 23	0.0% --	B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0% --	D		
18. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 23	0.0% --	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L	3.8	6.9	7.2	2.5	2.5	1/ 23	4.3% --	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0% --	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 23	0.0% --	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0% --	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	6.7	10	11	0.25	51	23/ 41	56.1% --	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L	4	7.1	7.2	1.3	5	3/ 23	13.0% --	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 17	0.0% --	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.83	1.4	1.3	0.2	3.4	4/ 23	17.4% √	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L	3.7	6.8	7.3	1	1	1/ 23	4.3% --	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0% --	ND		
30. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0% --	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0% --	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0% --	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0% --	B2	3E-03	2E-01

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-NW Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.1	7.2	0.23	6.6	7.6	18/ 18	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.56	0.77	0.5	0.16	2.7	22/ 23	95.7%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 22	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.006	0.0081	0.0049	0.005	0.01	12/ 22	54.5%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.18	0.21	0.069	0.2	0.282	12/ 21	57.1%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L	0.0026	0.0033	0.0017	0.003	0.003	2/ 22	9.1%	√	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.34	0.42	0.16	0.1	0.58	18/ 20	90.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 22	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	49	54	12	27	75.4	23/ 23	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	130	140	26	79	170	23/ 23	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 22	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 22	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 11	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.28	0.31	0.056	0.2	0.46	16/ 21	76.2%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.55	0.66	0.24	0.2	1	21/ 21	100.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0031	0.0046	0.0033	0.003	0.003	2/ 22	9.1%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	22	25	5.5	13	35.2	23/ 23	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	2.9	3.1	0.63	1.7	4.09	23/ 23	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 22	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.026	0.031	0.012	0.025	0.06	6/ 22	27.3%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.16	0.33	0.18	0.08	0.57	4/ 7	57.1%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 10	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	5.6	6	0.81	4.1	8	23/ 23	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 22	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 22	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	130	150	37	74	186	23/ 23	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	59	65	13	35	85	22/ 23	95.7%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 22	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	600	680	170	310	986	23/ 23	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.11	0.13	0.056	0.01	0.26	22/ 22	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-NE Usage:												
O R G A N I C												
96. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 23	0.0%	-- C	6E-01	5E+00
97. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 23	0.0%	-- B2	3E+00	5E+00
98. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 16	0.0%	-- D	2E+03	
99. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0%	-- D	7E+02	
100. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0%	-- B2	3E+00	
101. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 22	0.0%	-- D	2E+05	
102. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	-- NA	7E+03	
103. Vinyl chloride (VC)	75-01-4	µg/L						0/ 23	0.0%	-- A	2E-02	2E+00
104. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 21	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-NE Usage:												
O R G A N I C												
63. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0% --	D	3E+02	
64. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0% --	D	3E+02	
65. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0% --	B2	2E-02	1E+00
66. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0% --	C	5E-01	
67. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0% --	D	5E+01	5E+01
68. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0% --	C	3E+00	
69. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0% --	NA		
70. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
71. Isophorone	78-59-1	µg/L						0/ 1	0.0% --	C	4E+01	
72. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0% --	D	4E+03	
73. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0% --	NA	6E+02	
74. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0% --	ND		
75. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0% --	C	4E+01	
76. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0% --	C	4E+01	
77. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0% --	D	3E+02	
78. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0% --	NA	4E-01	
79. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0% --	ND		
80. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0% --	D	4E+00	
81. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0% --	NA		
82. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0% --	ND		
83. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
84. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
85. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 2	0.0% --	D		
86. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
87. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
88. Phenol	108-95-2	µg/L	37	37		37	37	1/ 1	100.0% --	D	4E+03	
89. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
90. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
91. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 23	0.0% --	C	2E-01	
92. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 23	0.0% --	B2	7E-01	5E+00
93. Toluene (TOL)	108-88-3	µg/L	0.58	0.89	0.73	0.51	2.3	2/ 23	8.7% --	D	1E+03	1E+03
94. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
95. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.31	0.52	0.49	0.3	0.3	1/ 23	4.3% --	D	6E+02	2E+02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-NE Usage:												
O R G A N I C												
30. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0% --	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0% --	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0% --	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0% --	B2	3E-03	2E-01
34. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0% --	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 23	0.0% --	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0% --	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 38	0.0% --	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 38	0.0% --	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 38	0.0% --	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0% --	B2	8E-02	
41. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 16	0.0% --	D	1E+03	
42. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 23	0.0% --	C	7E+01	
43. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 23	0.0% --	B2	4E-01	5E+00
44. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 23	0.0% --	C	6E-02	7E+00
45. 1,2-Dichloroethylene (TOTAL)		µg/L						0/ 7	0.0% --	D	7E+01	
46. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 16	0.0% --	D	7E+01	7E+01
47. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.18	0.27	0.16	0.22	0.22	1/ 16	6.3% --	D	1E+02	1E+02
48. Dichloromethane (DCM)	75-09-2	µg/L	2	3	2.4	3.9	3.9	1/ 23	4.3% ✓	B2	5E+00	5E+00
49. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0% --	D	2E+01	
50. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 22	0.0% --	B2	5E-01	5E+00
51. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 23	0.0% --	B2		
52. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 23	0.0% --	B2		
53. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0% --	D	6E+03	5E+03
54. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L	22	22		22	22	1/ 1	100.0% ✓	B2	3E+00	4E+00
55. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0% --	D	7E+04	
56. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0% --	NA	1E+02	
57. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0% --	ND	1E+01	
58. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0% --	B2	5E-02	
59. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0% --	ND	7E+00	
60. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0% --	ND	1E+02	
61. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 23	0.0% --	D	7E+02	7E+02
62. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 6	0.0% --	B2	4E-04	5E-02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-NE Usage:													
I N O R G A N I C													
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.085	0.1	0.037	0.026	0.17	22/ 22	100.0%	--	D	2E+00	
O R G A N I C													
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0%	--	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0%	--	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0%	--	D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0%	--	D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L						0/ 23	0.0%	--	A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0%	--	B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0%	--	D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0%	--	D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0%	--	ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0%	--	D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0%	--	B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0%	--	ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.37	0.58	0.49	0.32	0.32	1/ 23	4.3%	√	B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0%	--	D		
18. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 23	0.0%	--	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L						0/ 23	0.0%	--	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0%	--	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0%	--	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 23	0.0%	--	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0%	--	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.52	0.7	0.6	1.2	2	2/ 42	4.8%	--	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L						0/ 23	0.0%	--	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 17	0.0%	--	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.41	0.62	0.48	0.23	0.72	7/ 23	30.4%	√	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L	1.1	1.6	1.3	0.26	0.26	1/ 23	4.3%	--	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0%	--	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-NE Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L						0/ 2	0.0%	--	ND		
2. pH			7.2	7.4	0.38	6.7	8.3	18/ 18	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L						0/ 22	0.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 22	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0063	0.0083	0.0045	0.005	0.0081	16/ 22	72.7%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.077	0.091	0.029	0.03	0.052	8/ 21	38.1%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 22	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.16	0.18	0.033	0.1	0.2	18/ 20	90.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 22	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	39	42	7.6	28	52	23/ 23	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	140	140	16	94	160	23/ 23	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.008	0.014	0.014	0.07	0.07	1/ 22	4.5%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 22	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 11	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.33	0.37	0.081	0.3	0.6	17/ 21	81.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.16	0.22	0.14	0.1	0.446	11/ 21	52.4%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.003	0.0044	0.0032	0.003	0.004	3/ 22	13.6%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	17	18	3.3	11	22.8	23/ 23	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.007	0.0084	0.0032	0.005	0.016	7/ 23	30.4%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 22	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 22	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	4.3	7.3	3.3	1.8	12	7/ 7	100.0%	√	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 9	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	3.8	4.2	0.91	4	5	16/ 23	69.6%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 22	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 22	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	120	130	8.1	110	142	23/ 23	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	57	60	7.6	43	72	23/ 23	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 22	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	530	560	75	400	700	23/ 23	100.0%	--	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-E Usage:													
O R G A N I C													
96. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 21	0.0%	--	C	6E-01	5E+00
97. Trichloroethylene (TCE)	79-01-6	µg/L	11	16	13	2.2	41	11/ 21	52.4%	✓	B2	3E+00	5E+00
98. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	12	26	25	3.1	15	7/ 14	50.0%	--	D	2E+03	
99. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0%	--	D	7E+02	
100. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0%	--	B2	3E+00	
101. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	5.9	11	11	0.21	2.4	4/ 20	20.0%	--	D	2E+05	
102. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	--	NA	7E+03	
103. Vinyl chloride (VC)	75-01-4	µg/L	1200	1600	840	180	3200	21/ 21	100.0%	✓	A	2E-02	2E+00
104. Xylenes (total) (XYL)	1330-20-7	µg/L	17	39	46	1.2	210	12/ 19	63.2%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-ETM Usage:												
I N O R G A N I C												
1. Antimony (Sb)	7440-36-0	mg/L						0/ 1	0.0% --	D	3E-03	1E-02
2. Arsenic, inorganic (As)	7440-38-2	mg/L	0.088	0.088		0.088	0.088	1/ 1	100.0% √	A	2E-05	5E-02
3. Barium (Ba)	7440-39-3	mg/L	0.48	0.48		0.484	0.484	1/ 1	100.0% --	D	5E-01	2E+00
4. Beryllium (Be)	7440-41-7	mg/L						0/ 1	0.0% --	B2	8E-06	1E-03
5. Boron and borates only (B)	7440-42-8	mg/L	0.37	0.37		0.37	0.37	1/ 1	100.0% --	D	6E-01	
6. Cadmium (Cd)	7440-43-9	mg/L						0/ 1	0.0% --	B1	4E-03	5E-03
7. Chromium(III)	16065-83-1	mg/L						0/ 1	0.0% --	NA	7E+00	1E-01
8. Copper (Cu)	7440-50-8	mg/L	0.042	0.042		0.042	0.042	1/ 1	100.0% --	D	3E-01	
9. Iron (Fe)	7439-89-6	mg/L	3.5	3.5		3.49	3.49	1/ 1	100.0% --	ND		
10. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.016	0.016		0.016	0.016	1/ 1	100.0% √	B2	5E-03	
11. Manganese (Mn)	7439-96-5	mg/L	1.8	1.8		1.84	1.84	1/ 1	100.0% √	D	4E-02	
12. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 1	0.0% --	D	2E-03	2E-03
13. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 1	0.0% --	D	1E-01	1E-01
14. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
15. Silver (Ag)	7440-22-4	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
16. Thallium (Tl)	7440-28-0	mg/L						0/ 1	0.0% --	ND	5E-04	
17. Zinc and compounds (Zn)	7440-66-6	mg/L	0.46	0.46		0.461	0.461	1/ 1	100.0% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-E Usage:												
O R G A N I C												
63. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0% --	D	3E+02	
64. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0% --	D	3E+02	
65. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0% --	B2	2E-02	1E+00
66. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0% --	C	5E-01	
67. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0% --	D	5E+01	5E+01
68. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0% --	C	3E+00	
69. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0% --	NA		
70. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
71. Isophorone	78-59-1	µg/L						0/ 1	0.0% --	C	4E+01	
72. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0% --	D	4E+03	
73. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0% --	NA	6E+02	
74. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0% --	ND		
75. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0% --	C	4E+01	
76. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0% --	C	4E+01	
77. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0% --	D	3E+02	
78. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0% --	NA	4E-01	
79. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0% --	ND		
80. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0% --	D	4E+00	
81. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0% --	NA		
82. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0% --	ND		
83. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0% --	B2	5E-03	
84. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0% --	B2	7E+00	
85. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 2	0.0% --	D		
86. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0% --	B2	3E-01	1E+00
87. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0% --	D		
88. Phenol	108-95-2	µg/L	37	37		37	37	1/ 1	100.0% --	D	4E+03	
89. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0% --	D	2E+02	
90. Styrene	100-42-5	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
91. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 21	0.0% --	C	2E-01	
92. Tetrachloroethylene (PCE)	127-18-4	µg/L	4.6	9.4	10	0.21	2.3	4/ 21	19.0% √	B2	7E-01	5E+00
93. Toluene (TOL)	108-88-3	µg/L	6.1	11	11	0.72	6.7	10/ 21	47.6% --	D	1E+03	1E+03
94. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0% --	D	7E+01	9E+00
95. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	4.4	9.19999999	11	0.3	0.3	1/ 21	4.8% --	D	6E+02	2E+02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-E Usage:													
O R G A N I C													
30. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0%	--	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0%	--	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0%	--	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0%	--	B2	3E-03	2E-01
34. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0%	--	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 21	0.0%	--	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0%	--	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	100	140	98	16	450	35/ 35	100.0%	--	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	11	19	23	1.1	1.3	7/ 35	20.0%	--	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	14	22	22	2.3	20	16/ 35	45.7%	--	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0%	--	B2	8E-02	
41. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	9.6	24	25	0.77	13	3/ 14	21.4%	--	D	1E+03	
42. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	5.2	9.9	10	1.8	5.4	6/ 21	28.6%	--	C	7E+01	
43. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 21	0.0%	--	B2	4E-01	5E+00
44. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	4.6	9.4	10	0.28	1.7	5/ 21	23.8%	--	C	6E-02	7E+00
45. 1,2-Dichloroethylene (TOTAL)		µg/L	200	320	130	110	509.999999	7/ 7	100.0%	✓	D	7E+01	
46. cis-1,2-Dichloroethylene	156-59-2	µg/L	800	1200	610	87	2000	14/ 14	100.0%	✓	D	7E+01	7E+01
47. trans-1,2-Dichloroethylene	156-60-5	µg/L	13	21	14	2.1	35	10/ 14	71.4%	--	D	1E+02	1E+02
48. Dichloromethane (DCM)	75-09-2	µg/L	25	36	24	27	42	2/ 21	9.5%	✓	B2	5E+00	5E+00
49. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0%	--	D	2E+01	
50. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 20	0.0%	--	B2	5E-01	5E+00
51. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 21	0.0%	--	B2		
52. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 21	0.0%	--	B2		
53. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0%	--	D	6E+03	5E+03
54. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L	32	32		32	32	1/ 1	100.0%	✓	B2	3E+00	4E+00
55. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0%	--	D	7E+04	
56. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0%	--	NA	1E+02	
57. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0%	--	ND	1E+01	
58. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0%	--	B2	5E-02	
59. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0%	--	ND	7E+00	
60. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0%	--	ND	1E+02	
61. Ethylbenzene (ETB)	100-41-4	µg/L	23	55	70	7.8	330	4/ 21	19.0%	--	D	7E+02	7E+02
62. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 6	0.0%	--	B2	4E-04	5E-02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-E Usage:													
I N O R G A N I C													
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.1	0.12	0.048	0.02	0.2	19/ 19	100.0%	--	D	2E+00	
O R G A N I C													
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0%	--	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0%	--	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0%	--	D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L	5.5	10	11	0.55	0.89	3/ 21	14.3%	√	A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0%	--	B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0%	--	D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0%	--	D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0%	--	ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0%	--	D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0%	--	B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0%	--	ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 21	0.0%	--	B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0%	--	D		
18. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 21	0.0%	--	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L						0/ 21	0.0%	--	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0%	--	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0%	--	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 21	0.0%	--	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0%	--	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	32	50	55	3.7	290	31/ 39	79.5%	√	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L	13	22	22	1.9	8	3/ 21	14.3%	--	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 15	0.0%	--	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 21	0.0%	--	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L						0/ 21	0.0%	--	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0%	--	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-E Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L						0/ 2	0.0%	--	ND		
2. pH			7.1	7.3	0.34	6.5	7.9	17/ 17	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	3	5	4.2	0.26	15	20/ 20	100.0%	✓	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 19	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.049	0.058	0.019	0.023	0.083	19/ 19	100.0%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.55	0.73	0.36	0.2	1.4	17/ 18	94.4%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 19	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.49	0.55	0.13	0.36	0.8	18/ 18	100.0%	✓	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 19	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	56	65	19	37	100	20/ 20	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	170	180	35	120	250	20/ 20	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 19	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 19	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 11	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.35	0.39	0.086	0.3	0.6	14/ 18	77.8%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	2.3	3.1	1.7	0.6	7.4	18/ 18	100.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0029	0.0045	0.0032	0.002	0.016	4/ 19	21.1%	✓	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	28	33	10	18	51	20/ 20	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	2.3	2.8	1.1	1.1	4.5	20/ 20	100.0%	✓	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 19	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.024	0.031	0.015	0.05	0.08	2/ 19	10.5%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.078	0.16	0.082	0.13	0.24	2/ 6	33.3%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 7	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	10	15	9.19999999	5	37	20/ 20	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 19	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 19	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	180	190	16	150	220	20/ 20	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	51	60	19	32	77	18/ 20	90.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 19	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	760	840	170	540	1200	20/ 20	100.0%	--	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-9 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.9	3.6	2.8	2.9	2.9	1/ 14	7.1%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	85	150	110	0.44	340	12/ 14	85.7%	✓	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-9 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 13	0.0% --	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 13	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 13	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 13	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 13	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	7.7	14	14	0.54	53	14/ 22	63.6% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 13	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 13	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.64	1.1	0.86	2.8	2.8	1/ 14	7.1% √	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 14	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 14	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	6.4	11	11	1.1	45	12/ 23	52.2% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 22	0.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	1.2	1.8	1.2	2	3.1	4/ 22	18.2% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 14	0.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 14	0.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 14	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.63	1.1	0.8	0.24	0.24	1/ 14	7.1% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	17	29	20	0.45	58	12/ 14	85.7% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	1.3	2.3	1.7	1	6	4/ 14	28.6% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0% --	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 14	0.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 14	0.0% --	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 14	0.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 14	0.0% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	2.4	3.9	2.6	0.58	8.5	7/ 14	50.0% √	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 14	0.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-9 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.3	7.4	0.18	7	7.6	9/ 9	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	3.6	4.1	1	1.9	5.3	14/ 14	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 14	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.034	0.04	0.01	0.015	0.048	12/ 14	85.7%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.32	0.38	0.1	0.2	0.489	13/ 14	92.9%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 14	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.33	0.38	0.091	0.2	0.5	14/ 14	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.0064	0.011	0.0085	0.0012	0.035	7/ 14	50.0%	√	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	45	54	15	20	70.0999999	14/ 14	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	150	160	31	77	180	14/ 14	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 14	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.011	0.013	0.0029	0.011	0.021	3/ 14	21.4%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.39	0.44	0.078	0.3	0.53	13/ 14	92.9%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.12	0.15	0.058	0.1	0.232	10/ 14	71.4%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0039	0.0062	0.0039	0.003	0.009	4/ 14	28.6%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	23	28	7.9	11	36.4	14/ 14	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	3.4	4	1.1	1.6	5.11	14/ 14	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 14	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.03	0.038	0.014	0.036	0.06	5/ 14	35.7%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L						0/ 7	0.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 10	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	9.9	11	1.3	8	12.1	14/ 14	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	140	160	31	88	188	14/ 14	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	60	71	19	24	89	14/ 14	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 14	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	600	680	140	392	840	14/ 14	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.11	0.13	0.036	0.06	0.18	14/ 14	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-8 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 14	0.0%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.71	1.5	1.4	0.26	5.5	3/ 14	21.4%	✓	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L	0.92	1.8	1.2	4.4	4.4	1/ 10	10.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-8 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	-- D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 14	0.0%	-- A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 14	0.0%	-- B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	-- B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	-- D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	-- B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.27	0.33	0.14	0.27	0.27	1/ 25	4.0%	-- D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	-- ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	-- ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 14	0.0%	-- B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 14	0.0%	-- C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 14	0.0%	-- C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.66	0.87	0.49	2.8	2.8	1/ 25	4.0%	-- D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	0.67	0.9	0.55	3.1	3.1	1/ 25	4.0%	-- D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 25	0.0%	-- C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 14	0.0%	-- D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.24	0.38	0.24	0.89	0.89	1/ 14	7.1%	-- C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 14	0.0%	-- B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.2	0.29	0.16	0.23	0.23	1/ 14	7.1%	-- C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	0.24	0.37	0.22	0.22	0.76	2/ 14	14.3%	-- D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.2	0.29	0.16	0.24	0.24	1/ 14	7.1%	-- D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0%	-- B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	-- B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	-- B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	-- B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 14	0.0%	-- D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	-- C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 14	0.0%	-- B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.53	0.84	0.55	0.56	2.4	3/ 14	21.4%	-- D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.1	2	1.6	0.36	6.2	7/ 14	50.0%	-- D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	-- C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 14	0.0%	-- B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 14	0.0%	-- D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-8 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			8.9	9.19999999	0.39	8.6	9.9	9/ 9	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.063	0.11	0.081	0.04	0.07	2/ 13	15.4%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 14	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.013	0.016	0.0045	0.007	0.018	12/ 14	85.7%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.083	0.1	0.034	0.013	0.028	3/ 14	21.4%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 14	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.23	0.25	0.04	0.19	0.3	14/ 14	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L	0.003	0.0045	0.0026	0.0007	0.011	2/ 14	14.3%	√	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	4.8	5.1	0.54	4	6	14/ 14	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	97	100	4.9	89	110	14/ 14	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.081	0.097	0.028	0.02	0.12	14/ 14	100.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 14	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	2.9	3.1	0.22	2.5	3.2	14/ 14	100.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.8	1.4	1.1	0.3	3.7	9/ 14	64.3%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0029	0.0049	0.0035	0.002	0.004	4/ 14	28.6%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	0.53	0.56	0.059	0.6	0.7	3/ 14	21.4%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.013	0.02	0.013	0.01	0.041	5/ 14	35.7%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 14	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 14	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.38	0.48	0.11	0.24	0.54	7/ 7	100.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 10	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	2.4	2.9	0.93	1.5	5	14/ 14	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 14	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	120	120	7	100	124	14/ 14	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	29	33	6.5	24	50	14/ 14	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 14	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	340	360	40	218	401.999999	14/ 14	100.0%	--	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.033	0.054	0.036	0.03	0.13	6/ 14	42.9%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ6 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	6.2	12	3.8	2.2	5.1	3/ 4	75.0%	√	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	85	140	42	33	130	5/ 5	100.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L	1.6	4.8	2	0.4	0.4	1/ 4	25.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0%	--	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	78	110	25	48	110	5/ 5	100.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	3.2	9	4.6	1.4	1.4	1/ 5	20.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	7.4	11	3.1	4.4	9.5	4/ 5	80.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.3	5	1.7	1.4	2.2	2/ 4	50.0%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0%	--	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 4	0.0%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	13	26	8.3	6.6	26	3/ 4	75.0%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	7.4	11	2.3	5.7	11	3/ 4	75.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	15	47	20	6	6	1/ 4	25.0%	√	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 4	0.0%	--	D	7E+02	7E+02
27. Parachlorophenyl methyl sulfide	123-09-1	mg/L	0.15	1.2	0.12	0.27	0.27	1/ 2	50.0%	--	D		
28. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0%	--	C	2E-01	
29. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 4	0.0%	--	B2	7E-01	5E+00
30. Toluene (TOL)	108-88-3	µg/L	3.9	12	5	1.3	1.4	2/ 4	50.0%	--	D	1E+03	1E+03
31. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 4	0.0%	--	D	6E+02	2E+02
32. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0%	--	C	6E-01	5E+00
33. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 4	0.0%	--	B2	3E+00	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ6 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L	22	67	5	17	27	2/ 2	100.0%	--	ND		
2. pH			7.2	7.6	0.16	7	7.4	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	7	8.69999999	1	5.3	7.96	4/ 4	100.0%	√	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.025	0.033	0.0047	0.021	0.033	3/ 4	75.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.43	0.66	0.14	0.25	0.65	4/ 4	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.79	0.85	0.033	0.74	0.83	4/ 4	100.0%	√	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	75	79	2.5	71.1	78	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	190	210	11	180	210	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.02	0.06	0.026	0.064	0.064	1/ 4	25.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.36	0.4	0.029	0.31	0.39	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	1.3	4.2	1.8	0.043	4.4	4/ 4	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 4	0.0%	--	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	43	47	2.6	40	45.7	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	3	4.3	0.81	1.68	3.9	4/ 4	100.0%	√	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.073	0.089	0.01	0.058	0.086	4/ 4	100.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 1	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	14	16	1.1	12	15.2	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	230	240	8	216	238	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	13	20	4.9	5.4	19	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	910	1100	91	786	1000	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.04	0.068	0.018	0.045	0.056	3/ 4	75.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ6 Usage:													
O R G A N I C													
34. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	4.7	12	4.5	2.7	2.7	2/ 4	50.0%	--	D	2E+03	
35. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	14	47	21	1.2	1.2	1/ 4	25.0%	--	D	2E+05	
36. Vinyl chloride (VC)	75-01-4	µg/L	720	900	120	570	860	4/ 4	100.0%	✓	A	2E-02	2E+00
37. Xylenes (total) (XYL)	1330-20-7	µg/L	4.5	12	4.7	1.5	3	2/ 4	50.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-RW1 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			7.3	8	0.43	6.7	7.9	4/ 4	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	3.4	6.7	3.1	0.33	8.6	5/ 6	83.3% √	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 6	0.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.067	0.12	0.047	0.01	0.14	6/ 6	100.0% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.57	1	0.43	0.4	1.3	4/ 6	66.7% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 6	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.59	0.81	0.21	0.3	0.9	6/ 6	100.0% √	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 6	0.0% --	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	82	120	35	38	130	6/ 6	100.0% --	ND		
9. Chloride (Cl)-		mg/L	230	300	72	150	340	6/ 6	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L	0.0058	0.0078	0.0019	0.01	0.01	1/ 6	16.7% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.013	0.021	0.0075	0.03	0.03	1/ 6	16.7% --	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 3	0.0% --	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.38	0.46	0.08	0.3	0.5	5/ 6	83.3% --	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	2.6	5.1	2.3	2.5	6.9	4/ 6	66.7% --	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0048	0.0091	0.0042	0.004	0.013	3/ 6	50.0% √	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	42	62	20	17	69	6/ 6	100.0% --	ND		
17. Manganese (Mn)	7439-96-5	mg/L	4.7	7.9	3.1	0.59	8.6	6/ 6	100.0% √	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 6	0.0% --	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.17	0.36	0.19	0.08	0.48	3/ 6	50.0% √	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.63	1.7	0.45	0.77	1.1	2/ 3	66.7% --	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L	0.03	0.12	0.035	0.08	0.08	1/ 3	33.3% --	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	16	28	12	4	38	6/ 6	100.0% --	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 6	0.0% --	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 6	0.0% --	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	200	240	42	140	270	6/ 6	100.0% --	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	58	88	28	38	84	5/ 6	83.3% --	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 6	0.0% --	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	940	1300	350	630	1620	6/ 6	100.0% --	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.3	0.5	0.19	0.08	0.65	6/ 6	100.0% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-RW1 Usage:													
O R G A N I C													
34. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	25	61	34	3.6	25	4/ 6	66.7%	--	D	2E+03	
35. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	20	58	36	0.29	2.2	2/ 6	33.3%	--	D	2E+05	
36. Vinyl chloride (VC)	75-01-4	µg/L	1800	3700	2100	350	6700	7/ 7	100.0%	√	A	2E-02	2E+00
37. Xylenes (total) (XYL)	1330-20-7	µg/L	340	980	400	17	1000	3/ 4	75.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-RW1 Usage:													
O R G A N I C													
1. Benzene (BNZ)	71-43-2	µg/L	42	120	85	6.8	6.8	1/ 7	14.3%	✓	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 6	0.0%	--	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 6	0.0%	--	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 6	0.0%	--	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 7	0.0%	--	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	84	170	130	6.8	140	11/ 12	91.7%	✓	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 6	0.0%	--	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 5	0.0%	--	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 7	0.0%	--	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 6	0.0%	--	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 6	0.0%	--	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	350	600	380	29	1000	11/ 11	100.0%	✓	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 11	0.0%	--	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	61	150	140	1.7	2	4/ 11	36.4%	--	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	32	76	43	83	83	1/ 6	16.7%	--	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	20	58	36	1.7	1.9	2/ 6	33.3%	--	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 7	0.0%	--	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	19	50	33	1.5	1.7	2/ 7	28.6%	--	C	6E-02	7E+00
19. 1,2-Dichloroethylene (TOTAL)		µg/L						0/ 1	0.0%	--	D	7E+01	
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	4500	8700	4000	340	12000	6/ 6	100.0%	✓	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	42	80	35	9.8	81	5/ 6	83.3%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 6	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 6	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 6	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 6	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	110	240	130	8.8	310	3/ 6	50.0%	--	D	7E+02	7E+02
27. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 1	0.0%	--	B2	4E-04	5E-02
28. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 6	0.0%	--	C	2E-01	
29. Tetrachloroethylene (PCE)	127-18-4	µg/L	19	50	34	0.33	0.86	2/ 7	28.6%	✓	B2	7E-01	5E+00
30. Toluene (TOL)	108-88-3	µg/L	49	140	91	0.76	0.76	1/ 6	16.7%	--	D	1E+03	1E+03
31. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 6	0.0%	--	D	6E+02	2E+02
32. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 6	0.0%	--	C	6E-01	5E+00
33. Trichloroethylene (TCE)	79-01-6	µg/L	28	58	32	28	42	2/ 7	28.6%	✓	B2	3E+00	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-RW2 Usage:													
O R G A N I C													
1. Benzene (BNZ)	71-43-2	µg/L						0/ 3	0.0%	--	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 3	0.0%	--	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 3	0.0%	--	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 3	0.0%	--	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 3	0.0%	--	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	11	21	9.5	3.3	25	4/ 6	66.7%	--	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 3	0.0%	--	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 3	0.0%	--	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 3	0.0%	--	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 3	0.0%	--	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 3	0.0%	--	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	43	81	36	5.6	92	5/ 6	83.3%	--	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 6	0.0%	--	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	8.8	17	8.3	6.5	6.5	1/ 6	16.7%	--	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 3	0.0%	--	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 3	0.0%	--	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 3	0.0%	--	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 3	0.0%	--	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L	150	440	120	35	310	3/ 3	100.0%	✓	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L	6.4	17	4.3	0.38	8.69999999	2/ 3	66.7%	--	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 3	0.0%	--	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 3	0.0%	--	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 3	0.0%	--	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 3	0.0%	--	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 3	0.0%	--	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 3	0.0%	--	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 3	0.0%	--	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 3	0.0%	--	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 3	0.0%	--	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 3	0.0%	--	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	3.8	15	4.4	0.49	0.49	1/ 3	33.3%	✓	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 3	0.0%	--	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 3	0.0%	--	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35

8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-RW2 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			8	8		8	8	1/ 1	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	4.3	8.4	1.6	2.1	5.9	3/ 3	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 3	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.038	0.053	0.0063	0.029	0.044	3/ 3	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.45	0.89	0.18	0.2	0.6	3/ 3	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 3	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.57	0.7	0.052	0.5	0.62	3/ 3	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 3	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	59	91	13	42	73	3/ 3	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	180	250	29	140	210	3/ 3	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 3	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.017	0.04	0.0094	0.03	0.03	1/ 3	33.3%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.39	0.43	0.014	0.37	0.4	3/ 3	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	0.34	0.6	0.1	0.2	0.43	3/ 3	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0035	0.0072	0.0015	0.004	0.005	2/ 3	66.7%	√	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	29	46	6.8	20	36	3/ 3	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	2.7	4.2	0.6	1.9	3.3	3/ 3	100.0%	√	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 3	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.042	0.084	0.017	0.047	0.06	2/ 3	66.7%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 2	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 3	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	12	18	2.6	8	14	3/ 3	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	180	230	17	160	200	3/ 3	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	70	89	7.4	62	80	3/ 3	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 3	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	710	860	58	644	786	3/ 3	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.065	0.1	0.015	0.044	0.08	3/ 3	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-4 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			7.2	7.3	0.3	6.7	8	17/ 17	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	0.36	0.61	0.56	0.09	2.9	19/ 22	86.4% --	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 22	0.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0082	0.012	0.0084	0.005	0.041	17/ 22	77.3% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.11	0.11	0.012	0.11	0.139	8/ 21	38.1% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 22	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.5	0.53	0.076	0.33	0.6	20/ 20	100.0% --	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 22	0.0% --	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	56	61	11	40	78.8999999	22/ 22	100.0% --	ND		
9. Chloride (Cl)-		mg/L	160	170	20	120	200	22/ 22	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 22	0.0% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.24	0.71	1.1	5.1	5.1	1/ 22	4.5% √	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 11	0.0% --	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.31	0.33	0.05	0.29	0.4	16/ 21	76.2% --	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.053	0.062	0.019	0.025	0.116	4/ 21	19.0% --	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.011	0.022	0.026	0.004	0.11	4/ 22	18.2% √	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	24	26	4.8	17	34.3	22/ 22	100.0% --	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.92	1	0.24	0.33	1.29	22/ 22	100.0% √	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 22	0.0% --	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 22	0.0% --	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	1.3	2.1	0.89	0.23	2.7	6/ 7	85.7% --	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 10	0.0% --	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	5.6	5.9	0.69	4	7	22/ 22	100.0% --	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 22	0.0% --	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 22	0.0% --	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	180	190	25	130	207	22/ 22	100.0% --	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	71	76	9.6	53	87	22/ 22	100.0% --	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 22	0.0% --	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	720	770	100	520	892	22/ 22	100.0% --	ND		
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.21	0.47	0.59	0.03	2.9	22/ 22	100.0% √	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-3 Usage:												
O R G A N I C												
100. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0%	-- B2	5E-03	
101. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0%	-- B2	7E+00	
102. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0%	-- B2	3E-01	1E+00
103. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0%	-- D		
104. Phenol	108-95-2	µg/L						0/ 1	0.0%	-- D	4E+03	
105. Polychlorinated biphenyls (PCBs)	1336-36-3	µg/L						0/ 5	0.0%	-- B2	5E-03	5E-01
106. Polychlorinated biphenyl - ar	12674-11-2	µg/L						0/ 1	0.0%	-- ND	5E-01	
107. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0%	-- D	2E+02	
108. Styrene	100-42-5	µg/L						0/ 1	0.0%	-- C	1E+02	1E+02
109. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	-- C	2E-01	
110. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 14	0.0%	-- B2	7E-01	5E+00
111. Toluene (TOL)	108-88-3	µg/L	0.48	0.82	0.58	0.74	0.74	1/ 14	7.1%	-- D	1E+03	1E+03
112. Toxaphene	8001-35-2	µg/L						0/ 1	0.0%	-- B2	3E-02	3E+00
113. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0%	-- D	7E+01	9E+00
114. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.4	0.74	0.6	0.3	0.3	1/ 14	7.1%	-- D	6E+02	2E+02
115. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	-- C	6E-01	5E+00
116. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 14	0.0%	-- B2	3E+00	5E+00
117. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 8	0.0%	-- D	2E+03	
118. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0%	-- D	7E+02	
119. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0%	-- B2	3E+00	
120. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 12	0.0%	-- D	2E+05	
121. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	-- NA	7E+03	
122. Vinyl chloride (VC)	75-01-4	µg/L						0/ 14	0.0%	-- A	2E-02	2E+00
123. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 13	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-4 Usage:												
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0% --	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0% --	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 4	0.0% --	D	7E+02	
4. Aldrin	309-00-2	µg/L						0/ 1	0.0% --	B2	2E-03	
5. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0% --	D	2E+03	
6. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
7. Benzene (BNZ)	71-43-2	µg/L	0.56	0.83	0.64	0.6	0.7	2/ 23	8.7% ✓	A	1E+00	5E+00
8. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0% --	B2	5E-03	2E-01
9. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
10. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0% --	D		
11. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
12. Benzoic acid	65-85-0	µg/L						0/ 1	0.0% --	D	3E+04	
13. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0% --	ND	2E+03	
14. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0% --	D		
15. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0% --	B2	3E-02	
16. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0% --	ND	5E-01	
17. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 23	0.0% --	B2	6E-01	1E+02
18. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0% --	D		
19. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 23	0.0% --	B2	4E+00	1E+02
20. Bromomethane (BMM)	74-83-9	µg/L						0/ 23	0.0% --	D	1E+01	
21. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
22. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0% --	D	7E+02	
23. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 23	0.0% --	B2	3E-01	5E+00
24. Chlordane	57-74-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E+00
25. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0% --	NA	3E+01	
26. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	2.6	3.7	3.4	0.7	16	23/ 41	56.1% --	D	1E+02	1E+02
27. Chloroethane (CE)	75-00-3	µg/L	1.5	2.2	1.6	0.2	4.9	4/ 23	17.4% --	ND		
28. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 18	0.0% --	ND		
29. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.6	0.94	0.78	0.42	1.2	3/ 23	13.0% ✓	B2	6E+00	1E+02
30. Chloromethane (CM)	74-87-3	µg/L	1.2	1.8	1.5	0.24	0.24	1/ 23	4.3% --	C	3E+00	
31. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0% --	ND		
32. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0% --	NA	6E+02	
33. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0% --	D	4E+01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-PZ1 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	30	72	26	7.8	7.8	1/ 4	25.0% √	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	70	110	35	20	120	3/ 5	60.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 4	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0% --	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	320	560	190	140	590	4/ 5	80.0% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	24	57	26	3.5	3.7	2/ 5	40.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	40	85	36	5.2	100	4/ 5	80.0% √	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	13	29	10	4	4	1/ 4	25.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	14	28	8.3	5.2	7.6	2/ 4	50.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	16	27	6.6	7.6	13	2/ 4	50.0% √	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	4700	8100	2100	2800	8300	4/ 4	100.0% √	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	50	97	30	29	100	3/ 4	75.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	120	290	110	6	6	1/ 4	25.0% √	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	49	97	30	83	83	1/ 4	25.0% --	D	7E+02	7E+02
27. Parachlorophenyl methyl sulfide	123-09-1	mg/L	0.16	0.97	0.09	0.07	0.07	1/ 2	50.0% --	D		
28. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0% --	C	2E-01	
29. Tetrachloroethylene (PCE)	127-18-4	µg/L	12	29	11	1	2	2/ 4	50.0% √	B2	7E-01	5E+00
30. Toluene (TOL)	108-88-3	µg/L	30	72	26	8	8	1/ 4	25.0% --	D	1E+03	1E+03
31. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 4	0.0% --	D	6E+02	2E+02
32. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0% --	C	6E-01	5E+00
33. Trichloroethylene (TCE)	79-01-6	µg/L	58	120	38	28	120	3/ 4	75.0% √	B2	3E+00	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ1 Usage:													
O R G A N I C													
34. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	34	72	24	22	22	1/ 4	25.0%	--	D	2E+03	
35. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	120	290	110	6.7	6.7	1/ 4	25.0%	--	D	2E+05	
36. Vinyl chloride (VC)	75-01-4	µg/L	3800	8400	2900	980	8100	4/ 4	100.0%	√	A	2E-02	2E+00
37. Xylenes (total) (XYL)	1330-20-7	µg/L	49	98	30	84	84	1/ 4	25.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ2 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L	26	93	7.5	18	33	2/ 2	100.0%	--	ND		
2. pH			7.7	8.6	0.1	7.6	7.8	2/ 2	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	2.9	3.7	0.33	2.5	3.28	3/ 3	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 3	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.021	0.028	0.0029	0.018	0.02	2/ 3	66.7%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.22	0.46	0.096	0.23	0.334	2/ 3	66.7%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 3	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.62	0.65	0.012	0.61	0.64	3/ 3	100.0%	✓	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 3	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	64	84	7.8	54	72.6999999	3/ 3	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	180	200	8.19999999	170	190	3/ 3	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L	0.007	0.014	0.0028	0.011	0.011	1/ 3	33.3%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 3	0.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.6	0.89	0.12	0.47	0.75	3/ 3	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	0.097	0.33	0.096	0.23	0.23	1/ 3	33.3%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 3	0.0%	--	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	32	48	6.5	23	37.4	3/ 3	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	1.1	2.4	0.5	0.39	1.49	3/ 3	100.0%	✓	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 3	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 3	0.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 1	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 3	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	15	18	1.4	12.9	16.2	3/ 3	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	200	230	9.9	190	211	3/ 3	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	38	69	12	29	56	3/ 3	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 3	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	840	969.999999	51	774	890	3/ 3	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.019	0.049	0.012	0.036	0.036	1/ 3	33.3%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ2 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 2	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	3.7	11	2.9	1	7.7	2/ 3	66.7%	✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 3	0.0%	--	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 3	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 3	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 3	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	130	200	42	59	170	4/ 4	100.0%	✓	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L	4.7	13	3.3	4	9	2/ 3	66.7%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 3	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 3	0.0%	--	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 3	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 3	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	130	260	79	24	220	4/ 4	100.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	1.5	2.8	0.81	2.1	2.1	1/ 4	25.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	9.69999999	15	3.4	3.8	12	4/ 4	100.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 3	0.0%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.3	3.3	0.8	0.5	2.4	2/ 3	66.7%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 3	0.0%	--	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 3	0.0%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	140	560	170	8.19999999	380	3/ 3	100.0%	✓	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	6.6	19	5	0.8	13	3/ 3	100.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	6.4	15	3.3	7.3	7.3	1/ 3	33.3%	✓	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 3	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 3	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 3	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	22	86	26	8	58	2/ 3	66.7%	--	D	7E+02	7E+02
27. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 2	0.0%	--	D		
28. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 3	0.0%	--	C	2E-01	
29. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 3	0.0%	--	B2	7E-01	5E+00
30. Toluene (TOL)	108-88-3	µg/L	2.4	6.2	1.5	4.2	4.2	1/ 3	33.3%	--	D	1E+03	1E+03
31. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 3	0.0%	--	D	6E+02	2E+02
32. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 3	0.0%	--	C	6E-01	5E+00
33. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 3	0.0%	--	B2	3E+00	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ2 Usage:													
O R G A N I C													
34. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	2.6	6.1	1.4	4.4	4.4	1/ 3	33.3%	--	D	2E+03	
35. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 3	0.0%	--	D	2E+05	
36. Vinyl chloride (VC)	75-01-4	µg/L	1000	3700	1100	82	2500	3/ 3	100.0%	√	A	2E-02	2E+00
37. Xylenes (total) (XYL)	1330-20-7	µg/L	56	240	74	7	160	2/ 3	66.7%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ3 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L	6.5	38	3.5	10	10	1/ 2	50.0%	--	ND		
2. pH			7.2	7.4	0.047	7.2	7.3	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	2.4	3.6	0.81	1.41	3.6	4/ 4	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.018	0.028	0.0061	0.01	0.023	3/ 4	75.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.42	0.56	0.086	0.32	0.55	4/ 4	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.47	0.6	0.084	0.33	0.54	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	62	73	7.2	51.2	71	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	180	190	4.3	180	190	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.42	0.49	0.05	0.38	0.5	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	1.2	4.1	1.8	0.034	4.3	4/ 4	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 4	0.0%	--	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	30	35	3	25.1	33	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	3.3	4.5	0.76	2.34	4.4	4/ 4	100.0%	√	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 4	0.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 1	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	11	15	2.9	7.5	15	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	190	200	4.9	183	195	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	36	75	25	8.69999999	75	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	770	860	55	680	819.999999	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.34	1.1	0.5	0.036	1.2	4/ 4	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-PZ3 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	11	25	9.1	12	12	1/ 4	25.0% ✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	110	220	94	3.3	220	4/ 5	80.0% ✓	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L	4	9.6	3.5	0.9	2.5	2/ 4	50.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0% --	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	280	630	280	13	670	4/ 5	80.0% ✓	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	8.4	19	8.5	4.9	5.5	2/ 5	40.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	16	30	11	24	26	2/ 5	40.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	4.6	10	3.6	0.5	5.3	2/ 4	50.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 4	0.0% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	130	280	96	27	240	4/ 4	100.0% ✓	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	13	30	10	2.3	30	3/ 4	75.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 4	0.0% --	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	9.6	24	9.19999999	6.5	6.5	1/ 4	25.0% --	D	7E+02	7E+02
27. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 2	0.0% --	D		
28. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0% --	C	2E-01	
29. Tetrachloroethylene (PCE)	127-18-4	µg/L	3.5	9.6	3.9	1.1	1.1	1/ 4	25.0% ✓	B2	7E-01	5E+00
30. Toluene (TOL)	108-88-3	µg/L	9.8	24	9.19999999	7.5	7.5	1/ 4	25.0% --	D	1E+03	1E+03
31. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	3.5	9.6	3.9	1.1	1.1	1/ 4	25.0% --	D	6E+02	2E+02
32. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0% --	C	6E-01	5E+00
33. Trichloroethylene (TCE)	79-01-6	µg/L	4.4	10	3.5	4.7	4.7	1/ 4	25.0% ✓	B2	3E+00	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ3 Usage:													
O R G A N I C													
34. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	8.6	24	9.69999999	2.1	2.1	1/ 4	25.0%	--	D	2E+03	
35. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 4	0.0%	--	D	2E+05	
36. Vinyl chloride (VC)	75-01-4	µg/L	2900	9400	4100	210	10000	4/ 4	100.0%	✓	A	2E-02	2E+00
37. Xylenes (total) (XYL)	1330-20-7	µg/L	13	29	9.9	20	20	1/ 4	25.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ4 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.5	8.4	0.39	7.1	8	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	8.4	9.9	0.96	7.54	10	4/ 4	100.0%	✓	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.017	0.024	0.0049	0.013	0.014	3/ 4	75.0%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	2.5	2.9	0.25	2.23	2.8	4/ 4	100.0%	✓	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.35	0.4	0.036	0.3	0.4	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	83	94	7	71.2	90.3	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	140	140	4.8	130	140	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.34	0.37	0.022	0.3	0.36	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	0.053	0.079	0.016	0.036	0.08	3/ 4	75.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.005	0.014	0.0058	0.003	0.003	1/ 4	25.0%	✓	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	39	44	3.4	33.3	42.7	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	3.5	4.1	0.38	3.06	4	4/ 4	100.0%	✓	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 4	0.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 1	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	26	29	1.6	24	28	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	110	120	4.2	110	121	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L						0/ 4	0.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	690	720	18	670	720	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.034	0.071	0.024	0.025	0.073	3/ 4	75.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-PZ4 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 4	0.0% --	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	49	65	13	30	66	5/ 5	100.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 4	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0% --	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.81	1.2	0.34	0.6	1.2	2/ 5	40.0% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L	2.7	3.7	0.77	2	3.9	5/ 5	100.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	6.1	8	1.5	3.8	7.6	5/ 5	100.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 4	0.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 4	0.0% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 4	0.0% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 4	0.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 4	0.0% --	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	8	29	13	31	31	1/ 4	25.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 4	0.0% --	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 4	0.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 4	0.0% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 4	0.0% --	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 4	0.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-PZ4 Usage:												
O R G A N I C												
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 4	0.0%	-- D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L						0/ 4	0.0%	-- A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 4	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-PZ5 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L	32	81	5.5	26	37	2/ 2	100.0%	--	ND		
2. pH			7.6	7.7	0.047	7.5	7.6	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	4.9	6.1	0.73	4.05	5.8	4/ 4	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.011	0.024	0.0081	0.006	0.007	3/ 4	75.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.2	0.42	0.14	0.102	0.44	4/ 4	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.91	1.1	0.13	0.72	1.08	4/ 4	100.0%	√	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	56	96	26	38.4	100	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	210	230	11	200	230	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.0098	0.023	0.0082	0.024	0.024	1/ 4	25.0%	--	D	3E-01	
12. Fluoride (F)	7782-41-4	mg/L	0.29	0.38	0.059	0.22	0.38	4/ 4	100.0%	--	D	4E-01	4E+00
13. Iron (Fe)	7439-89-6	mg/L	2.6	9	4	0.098	9.6	4/ 4	100.0%	--	ND		
14. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0048	0.014	0.0059	0.002	0.002	1/ 4	25.0%	√	B2	5E-03	
15. Magnesium (Mg)	7439-95-4	mg/L	39	48	5.9	30.6	46	4/ 4	100.0%	--	ND		
16. Manganese (Mn)	7439-96-5	mg/L	2.3	5.4	2	1.08	5.7	4/ 4	100.0%	√	D	4E-02	
17. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
18. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.041	0.084	0.027	0.022	0.081	3/ 4	75.0%	--	D	1E-01	1E-01
19. Nitrate/Nitrite (total)		mg/L						0/ 1	0.0%	--	D	1E+01	1E+01
20. Nitrite	14797-65-0	mg/L						0/ 4	0.0%	--	D	7E-01	1E+00
21. Potassium (K)	7440-09-7	mg/L	19	24	3.2	14	22.4	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	230	240	7.2	222	240	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	27	33	4.3	21	32	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	869.999999	969.999999	65	770	952	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.024	0.041	0.011	0.022	0.04	3/ 4	75.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-PZ5 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	1.9	3.2	0.84	2	2.6	2/ 4	50.0% √	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 4	0.0% --	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 4	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 4	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 4	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	34	54	16	15	56	5/ 5	100.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L	0.75	1.4	0.38	0.9	0.9	1/ 4	25.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 4	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L						0/ 4	0.0% --	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 4	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 4	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	25	33	6.3	18	35	5/ 5	100.0% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 5	0.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	2.1	3.4	1.1	2	3.9	2/ 5	40.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 4	0.0% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.68	1.3	0.4	1.1	1.1	1/ 4	25.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 4	0.0% --	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L						0/ 4	0.0% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	27	38	7.3	21	39	4/ 4	100.0% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	2	3.6	1	2	3.4	3/ 4	75.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	6.8	15	5.4	14	14	1/ 4	25.0% √	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 4	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 4	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 4	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 4	0.0% --	D	7E+02	7E+02
27. Parachlorophenyl methyl sulfide	123-09-1	mg/L	2.2	15	1.5	0.68	3.62	2/ 2	100.0% --	D		
28. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 4	0.0% --	C	2E-01	
29. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 4	0.0% --	B2	7E-01	5E+00
30. Toluene (TOL)	108-88-3	µg/L						0/ 4	0.0% --	D	1E+03	1E+03
31. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 4	0.0% --	D	6E+02	2E+02
32. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 4	0.0% --	C	6E-01	5E+00
33. Trichloroethylene (TCE)	79-01-6	µg/L						0/ 4	0.0% --	B2	3E+00	5E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-PZ5 Usage:												
O R G A N I C												
34. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	1.2	2.5	0.81	1.2	1.2	1/ 4	25.0%	-- D	2E+03	
35. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	6.8	15	5.4	14	14	1/ 4	25.0%	-- D	2E+05	
36. Vinyl chloride (VC)	75-01-4	µg/L	150	250	67	86	260	4/ 4	100.0%	√ A	2E-02	2E+00
37. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 4	0.0%	-- D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

:er Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
'E: EW-4	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
NORGANIC	Units mg/L							Units mg/L						
rsenic, inorganic (As)	0.0082	4.6E-06	6.9E-06	11		8.0E-05	2.7E-01	0.012	4.2E-05	6.3E-05	11		1.2E-04	3.9E-01
opper (Cu)	0.24	1.3E-04				2.3E-03	6.3E-02	0.71	2.5E-03				6.9E-03	1.9E-01
ead and compounds (inorganic) (Pb)	0.011	6.2E-06				1.1E-04		0.022	7.7E-05				2.2E-04	
langanese (Mn)	0.92	5.1E-04				9.0E-03	1.8E+00	1	3.5E-03				9.8E-03	2.0E+00
inc and compounds (Zn)	0.21	1.2E-04				2.1E-03	6.8E-03	0.47	1.6E-03				4.6E-03	1.5E-02
RGANIC	Units ug/L							Units ug/L						
enzene (BNZ)	0.56	3.1E-07	9.1E-09			5.5E-06		0.7«	2.4E-06	7.1E-08			6.8E-06	
hloroform (THM) (CLFM)	0.6	3.4E-07	2.0E-09			5.9E-06	5.9E-04	0.94	3.3E-06	2.0E-08			9.2E-06	9.2E-04
is-1,2-Dichloroethylene	39	2.2E-05				3.8E-04	3.8E-02	61	2.1E-04				6.0E-04	6.0E-02
ichloromethane (DCM)	3.1	1.7E-06	1.3E-08			3.0E-05	5.1E-04	5	1.7E-05	1.3E-07			4.9E-05	8.2E-04
,2-Dichloropropane (DCP2)	0.39	2.2E-07	1.5E-08			3.8E-06		0.4«	1.4E-06	9.5E-08			3.9E-06	
,1,2,2-Tetrachloroethane (TET)	0.51	2.9E-07	5.7E-08			5.0E-06		0.79	2.8E-06	5.5E-07			7.7E-06	
etrachloroethylene (PCE)	0.68	3.8E-07	1.9E-08			6.7E-06	6.7E-04	1.1	3.8E-06	1.9E-07			1.1E-05	1.1E-03
richloroethylene (TCE)	3.3	1.8E-06	2.0E-08			3.2E-05		4.5	1.6E-05	1.7E-07			4.4E-05	
inyl chloride (VC)	54	3.0E-05	5.7E-05	89		5.3E-04		73	2.6E-04	4.8E-04	88		7.1E-04	
TOTALS	- -	6E-05				- -	2.2E+00	TOTALS	- -	5E-04			- -	2.6E+00
w/o Arsenic	- -	6E-05			- -	- -	- -	w/o Arsenic	- -	5E-04		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
ADHS35
aft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ater Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
ITE: EW-5	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
INORGANIC	Units mg/L							Units mg/L						
Arsenic, inorganic (As)	0.0084	4.7E-06	7.0E-06	6		8.2E-05	2.7E-01	0.0092	3.2E-05	4.8E-05	4		9.0E-05	3.0E-01
Lead and compounds (inorganic) (Pb)	0.0028	1.6E-06				2.7E-05		0.004«	1.4E-05				3.9E-05	
Manganese (Mn)	0.15	8.4E-05				1.5E-03	2.9E-01	0.23	8.0E-04				2.3E-03	4.5E-01
ORGANIC	Units ug/L							Units ug/L						
Benzene (BNZ)	0.92	5.1E-07	1.5E-08			9.0E-06		1.4	4.9E-06	1.4E-07			1.4E-05	
Chloroform (THM) (CLFM)	0.6«	3.4E-07	2.0E-09			5.9E-06	5.9E-04	0.6«	2.1E-06	1.3E-08			5.9E-06	5.9E-04
cis-1,2-Dichloroethylene	160	8.9E-05				1.6E-03	1.6E-01	230	8.0E-04				2.3E-03	2.3E-01
Dichloromethane (DCM)	3.4	1.9E-06	1.4E-08			3.3E-05	5.5E-04	5	1.7E-05	1.3E-07			4.9E-05	8.2E-04
cis-1,3-Dichloropropene (cDCP3)	0.5«	2.8E-07				4.9E-06		0.5«	1.7E-06				4.9E-06	
Tetrachloroethylene (PCE)	0.38«	2.1E-07	1.1E-08			3.7E-06	3.7E-04	0.38«	1.3E-06	6.6E-08			3.7E-06	3.7E-04
Trichloroethylene (TCE)	6.2	3.5E-06	3.8E-08			6.1E-05		7.8	2.7E-05	3.0E-07			7.6E-05	
Vinyl chloride (VC)	110	6.2E-05	1.2E-04	94		1.1E-03		190	6.6E-04	1.3E-03	96		1.9E-03	
TOTALS		- -	1E-04			- -	7.3E-01	TOTALS	- -	1E-03			- -	9.8E-01
w/o Arsenic		- -	1E-04		- -	- -	- -	w/o Arsenic	- -	1E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
Units mg/L							Units mg/L						
0.008	4.5E-06	6.7E-06	100		7.8E-05	2.6E-01	0.008	2.8E-05	4.2E-05	100		7.8E-05	2.6E-01
0.297«	1.7E-04				2.9E-03	5.8E-01	0.297«	1.0E-03				2.9E-03	5.8E-01
TOTALS w/o Arsenic	- -	7E-06		- -	- -	8.4E-01	TOTALS w/o Arsenic	- -	4E-05		- -	- -	8.4E-01
	- -	0E+00			- -	- -		- -	0E+00			- -	- -

er Sample

:: EW-5TM

IORGANIC
rsenic, inorganic (As)
anganese (Mn)

' One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

\DHS35
ift 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

ater Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
ITE: EW-6	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0096	5.4E-06	8.1E-06	1		9.4E-05	3.1E-01	0.011	3.8E-05	5.8E-05	1		1.1E-04	3.6E-01
Lead and compounds (inorganic) (Pb)	0.0031	1.7E-06				3.0E-05		0.0048	1.7E-05				4.7E-05	
Manganese (Mn)	0.72	4.0E-04				7.0E-03	1.4E+00	1.2	4.2E-03				1.2E-02	2.3E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	5.8	3.2E-06	9.4E-08			5.7E-05		8.6	3.0E-05	8.7E-07			8.4E-05	
Carbon tetrachloride (CCL4)	3.1	1.7E-06	2.3E-07			3.0E-05	4.3E-02	4.7	1.6E-05	2.1E-06			4.6E-05	6.6E-02
Chlorobenzene (monochlorobenzene) (MCB)	38	2.1E-05				3.7E-04	1.9E-02	59	2.1E-04				5.8E-04	2.9E-02
Chloroform (THM) (CLFM)	3.1	1.7E-06	1.1E-08			3.0E-05	3.0E-03	4.7	1.6E-05	1.0E-07			4.6E-05	4.6E-03
Chloromethane (CM)	3.9	2.2E-06	2.8E-08			3.8E-05	9.5E-03	6.2	2.2E-05	2.8E-07			6.1E-05	1.5E-02
1,2-Dichlorobenzene (DCB2)	260	1.5E-04				2.5E-03	2.8E-02	450	1.6E-03				4.4E-03	4.9E-02
1,3-Dichlorobenzene (DCB3)	110	6.2E-05				1.1E-03	1.2E-02	240	8.4E-04				2.3E-03	2.6E-02
1,4-Dichlorobenzene (DCB4)	110	6.2E-05	1.5E-06			1.1E-03	1.1E-02	250	8.7E-04	2.1E-05			2.4E-03	2.4E-02
1,2-Dichloroethane (DCA2)	3.1	1.7E-06	1.6E-07			3.0E-05		4.8	1.7E-05	1.5E-06			4.7E-05	
cis-1,2-Dichloroethylene	1100	6.2E-04				1.1E-02	1.1E+00	1900	6.6E-03				1.9E-02	1.9E+00
Dichloromethane (DCM)	27	1.5E-05	1.1E-07			2.6E-04	4.4E-03	43	1.5E-04	1.1E-06			4.2E-04	7.0E-03
Tetrachloroethylene (PCE)	1.7«	9.5E-07	4.8E-08			1.7E-05	1.7E-03	1.7«	5.9E-06	3.0E-07			1.7E-05	1.7E-03
Trichloroethylene (TCE)	5.6	3.1E-06	3.4E-08			5.5E-05		8.2	2.9E-05	3.2E-07			8.0E-05	
Vinyl chloride (VC)	910	5.1E-04	9.7E-04	99		8.9E-03		1600	5.6E-03	1.1E-02	99		1.6E-02	
TOTALS		- -	1E-03			- -	2.9E+00	TOTALS	- -	1E-02			- -	4.8E+00
w/o Arsenic		- -	1E-03		- -	- -	- -	w/o Arsenic	- -	1E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
TE: EW-6TM	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
INORGANIC	Units mg/L							Units mg/L						
Arsenic, inorganic (As)	0.012	6.7E-06	1.0E-05	100		1.2E-04	3.9E-01	0.012	4.2E-05	6.3E-05	100		1.2E-04	3.9E-01
Cadmium (Cd)	0.0006	3.4E-07				5.9E-06	1.2E-02	0.0006	2.1E-06				5.9E-06	1.2E-02
Lead and compounds (inorganic) (Pb)	0.011	6.2E-06				1.1E-04		0.011	3.8E-05				1.1E-04	
Manganese (Mn)	2.06«	1.2E-03				2.0E-02	4.0E+00	2.06«	7.2E-03				2.0E-02	4.0E+00
Zinc and compounds (Zn)	4.6	2.6E-03				4.5E-02	1.5E-01	4.6	1.6E-02				4.5E-02	1.5E-01
TOTALS		- -	1E-05			- -	4.6E+00	TOTALS	- -	6E-05			- -	4.6E+00
w/o Arsenic		- -	0E+00		- -	- -	- -	w/o Arsenic	- -	0E+00		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
ADHS35
Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ater Sample

ITE: EW-7

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0076	4.2E-06	6.4E-06	89		7.4E-05	2.5E-01	0.008«	2.8E-05	4.2E-05	80		7.8E-05	2.6E-01
Lead and compounds (inorganic) (Pb)	0.0048	2.7E-06				4.7E-05		0.0069	2.4E-05				6.8E-05	
	Units ug/L							Units ug/L						
ORGANIC														
Chloroform (THM) (CLFM)	0.4«	2.2E-07	1.4E-09			3.9E-06	3.9E-04	0.4«	1.4E-06	8.5E-09			3.9E-06	3.9E-04
Dichloromethane (DCM)	1.6	8.9E-07	6.7E-09			1.6E-05	2.6E-04	2.5	8.7E-06	6.6E-08			2.4E-05	4.1E-04
Tetrachloroethylene (PCE)	0.27«	1.5E-07	7.5E-09			2.6E-06	2.6E-04	0.27«	9.4E-07	4.7E-08			2.6E-06	2.6E-04
Trichloroethylene (TCE)	1.5	8.4E-07	9.2E-09			1.5E-05		2.1	7.3E-06	8.1E-08			2.1E-05	
Vinyl chloride (VC)	0.73	4.1E-07	7.8E-07	11		7.1E-06		1.5	5.2E-06	1.0E-05	19		1.5E-05	
TOTALS		- -	7E-06			- -	2.5E-01	TOTALS	- -	5E-05			- -	2.6E-01
w/o Arsenic		- -	8E-07		- -	- -	- -	w/o Arsenic	- -	1E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

r Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
: EW-PZ1	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
ORGANIC	Units mg/L							Units mg/L						
senic, inorganic (As)	0.008«	4.5E-06	6.7E-06			7.8E-05	2.6E-01	0.008«	2.8E-05	4.2E-05			7.8E-05	2.6E-01
nganese (Mn)	1.3	7.3E-04				1.3E-02	2.5E+00	3.4	1.2E-02				3.3E-02	6.7E+00
IGANIC	Units ug/L							Units ug/L						
enzene (BNZ)	7.8«	4.4E-06	1.3E-07			7.6E-05		7.8«	2.7E-05	7.9E-07			7.6E-05	
4-Dichlorobenzene (DC84)	40	2.2E-05	5.4E-07			3.9E-04	3.9E-03	85	3.0E-04	7.1E-06			8.3E-04	8.3E-03
1-Dichloroethylene (DCE)	13«	7.3E-06	4.4E-06			1.3E-04	1.4E-02	13«	4.5E-05	2.7E-05			1.3E-04	1.4E-02
is-1,2-Dichloroethylene	4700	2.6E-03				4.6E-02	4.6E+00	8100	2.8E-02				7.9E-02	7.9E+00
ichloromethane (DCM)	6«	3.4E-06	2.5E-08			5.9E-05	9.8E-04	6«	2.1E-05	1.6E-07			5.9E-05	9.8E-04
etrachloroethylene (PCE)	2«	1.1E-06	5.6E-08			2.0E-05	2.0E-03	2«	7.0E-06	3.5E-07			2.0E-05	2.0E-03
richloroethylene (TCE)	58	3.2E-05	3.6E-07			5.7E-04		120	4.2E-04	4.6E-06			1.2E-03	
inyl chloride (VC)	3800	2.1E-03	4.0E-03	100		3.7E-02		8100«	2.8E-02	5.4E-02	100		7.9E-02	
	TOTALS	- -	4E-03			- -	7.4E+00	TOTALS	- -	5E-02			- -	1.5E+01
	w/o Arsenic	- -	4E-03		- -	- -	- -	w/o Arsenic	- -	5E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

ADHS35

aft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TE: EW-PZ2														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.02«	1.1E-05	1.7E-05	2		2.0E-04	6.5E-01	0.02«	7.0E-05	1.0E-04	1		2.0E-04	6.5E-01
Boron and borates only (B)	0.62	3.5E-04				6.1E-03	6.7E-02	0.64«	2.2E-03				6.3E-03	7.0E-02
Manganese (Mn)	1.1	6.2E-04				1.1E-02	2.2E+00	1.49«	5.2E-03				1.5E-02	2.9E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	3.7	2.1E-06	6.0E-08			3.6E-05		7.7«	2.7E-05	7.8E-07			7.5E-05	
Chlorobenzene (monochlorobenzene) (MCB)	130	7.3E-05				1.3E-03	6.4E-02	170«	5.9E-04				1.7E-03	8.3E-02
cis-1,2-Dichloroethylene	140	7.8E-05				1.4E-03	1.4E-01	380«	1.3E-03				3.7E-03	3.7E-01
Dichloromethane (DCM)	6.4	3.6E-06	2.7E-08			6.3E-05	1.0E-03	7.3«	2.6E-05	1.9E-07			7.1E-05	1.2E-03
Vinyl chloride (VC)	1000	5.6E-04	1.1E-03	98		9.8E-03		2500«	8.7E-03	1.7E-02	99		2.4E-02	
TOTALS		- -	1E-03			- -	3.1E+00	TOTALS	- -	2E-02			- -	4.1E+00
w/o Arsenic		- -	1E-03		- -	- -	- -	w/o Arsenic	- -	2E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-3 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L	9.1	9.1		9.1	9.1	1/ 1	100.0% √	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 2	0.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	3	3		3	3	1/ 1	100.0% √	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 2	0.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 2	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 2	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 1	0.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 1	0.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 1	0.0% --	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	8.3	8.3	0.00000005	8.3	8.3	1/ 1	100.0% √	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 1	0.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 1	0.0% --	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 1	0.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	1.2	1.2		1.2	1.2	1/ 1	100.0% √	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 1	0.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 1	0.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-WTM Usage:													
I N O R G A N I C													
1. Antimony (Sb)	7440-36-0	mg/L						0/ 1	0.0%	--	D	3E-03	1E-02
2. Arsenic, inorganic (As)	7440-38-2	mg/L	0.042	0.042		0.042	0.042	1/ 1	100.0%	✓	A	2E-05	5E-02
3. Barium (Ba)	7440-39-3	mg/L	0.56	0.56		0.559	0.559	1/ 1	100.0%	--	D	5E-01	2E+00
4. Beryllium (Be)	7440-41-7	mg/L						0/ 1	0.0%	--	B2	8E-06	1E-03
5. Boron and borates only (B)	7440-42-8	mg/L	0.61	0.61		0.61	0.61	1/ 1	100.0%	--	D	6E-01	
6. Cadmium (Cd)	7440-43-9	mg/L						0/ 1	0.0%	--	B1	4E-03	5E-03
7. Chromium(III)	16065-83-1	mg/L						0/ 1	0.0%	--	NA	7E+00	1E-01
8. Copper (Cu)	7440-50-8	mg/L						0/ 1	0.0%	--	D	3E-01	
9. Iron (Fe)	7439-89-6	mg/L	0.49	0.49		0.487	0.487	1/ 1	100.0%	--	ND		
10. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 1	0.0%	--	B2	5E-03	
11. Manganese (Mn)	7439-96-5	mg/L	3.2	3.2	0.00000002	3.16	3.16	1/ 1	100.0%	✓	D	4E-02	
12. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 1	0.0%	--	D	2E-03	2E-03
13. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.048	0.048		0.048	0.048	1/ 1	100.0%	--	D	1E-01	1E-01
14. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 1	0.0%	--	D	4E-02	5E-02
15. Silver (Ag)	7440-22-4	mg/L						0/ 1	0.0%	--	D	4E-02	5E-02
16. Thallium (Tl)	7440-28-0	mg/L						0/ 1	0.0%	--	ND	5E-04	
17. Zinc and compounds (Zn)	7440-66-6	mg/L	0.11	0.11		0.108	0.108	1/ 1	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-6 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 12	0.0%	--	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.53	0.97	0.68	0.3	2.5	3/ 12	25.0%	√	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 12	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 12	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 12	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 21	0.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 12	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 12	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.7	2	0.46	1.2	2.6	11/ 12	91.7%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.51	0.96	0.7	0.87	0.87	1/ 12	8.3%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 12	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.9	1.2	0.72	2.1	2.1	2/ 21	9.5%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 21	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 21	0.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.7	1.1	0.71	0.33	1.5	4/ 12	33.3%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.3	1.6	0.46	0.9	2.1	10/ 12	83.3%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.35	0.55	0.32	0.2	0.5	4/ 12	33.3%	√	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	7.1	9.19999999	3.3	2.9	15	12/ 12	100.0%	√	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	1.8	2.8	1.4	0.59	5	11/ 12	91.7%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.28	0.48	0.33	0.26	0.26	1/ 12	8.3%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.5	2.1	0.97	3	3.9	2/ 12	16.7%	√	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 12	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 12	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 12	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 12	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 12	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.68	0.86	0.29	0.41	1	8/ 12	66.7%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 12	0.0%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.4	2.2	1.3	0.4	4.6	10/ 12	83.3%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 12	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	50	65	23	24	93	12/ 12	100.0%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 12	0.0%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: SB-5 Usage:											
O R G A N I C											
34. Vinyl chloride (VC)	75-01-4	µg/L					0/ 1	0.0%	-- A	2E-02	2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.2	7.9	0.29	6.8	7.5	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.83	3.3	0.98	2.2	2.2	1/ 3	33.3%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.013	0.043	0.012	0.005	0.005	1/ 3	33.3%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0087	0.016	0.0031	0.006	0.013	3/ 3	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 3	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 3	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.47	0.58	0.047	0.4	0.5	3/ 3	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 3	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	59	61	0.82	58	60	3/ 3	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	200	220	4.7	200	210	3/ 3	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 3	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 3	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 3	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.5	0.5		0.5	0.5	3/ 3	100.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 3	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0098	0.027	0.0067	0.018	0.018	1/ 3	33.3%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	24	26	0.82	23	25	3/ 3	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.012	0.027	0.0062	0.02	0.02	1/ 3	33.3%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 3	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 3	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	8	8		8	8	1/ 1	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	5.3	6.5	0.47	5	6	3/ 3	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	200	220	4.7	200	210	3/ 3	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	92	110	7.1	82	98	3/ 3	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 3	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	790	860	27	750	810	3/ 3	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.09	0.29	0.08	0.06	0.2	2/ 3	66.7%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: SB-7 Usage:											
O R G A N I C											
34. Vinyl chloride (VC)	75-01-4	µg/L					0/ 1	0.0%	-- A	2E-02	2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-7 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 1	0.0% --	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 2	0.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.94	0.94		0.94	0.94	1/ 1	100.0% ✓	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 2	0.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 2	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 2	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 1	0.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.48	0.48		0.48	0.48	1/ 1	100.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 1	0.0% --	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	18	18		18	18	1/ 1	100.0% ✓	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 1	0.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.24	0.24		0.24	0.24	1/ 1	100.0% ✓	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.3	0.3		0.3	0.3	1/ 1	100.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	46	46		46	46	1/ 1	100.0% ✓	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 1	0.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	3.8	3.8	0.00000002	3.8	3.8	1/ 1	100.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-6 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	3.8	5.8	3.1	0.32	13	11/ 12	91.7%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.41	0.83	0.66	0.66	0.66	1/ 12	8.3%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-W Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. Biological Oxygen Demand (BOD)		mg/L						0/ 2	0.0%	--	ND		
2. pH			7.1	7.2	0.32	6.5	8.1	17/ 17	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	4.7	6.4	3.5	1.3	11	18/ 19	94.7%	√	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 19	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.038	0.042	0.0078	0.021	0.054	19/ 19	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.46	0.52	0.13	0.3	0.76	18/ 18	100.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L	0.0026	0.0035	0.0019	0.003	0.003	2/ 19	10.5%	√	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.59	0.68	0.16	0.4	1.1	17/ 17	100.0%	√	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 19	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	55	60	11	41	82	20/ 20	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	170	190	28	130	240	20/ 20	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 19	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.0098	0.012	0.0038	0.011	0.02	2/ 19	10.5%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L	0.0055	0.0064	0.0014	0.01	0.01	1/ 11	9.1%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.31	0.34	0.051	0.3	0.4	13/ 18	72.2%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.56	0.92	0.73	0.2	3.5	18/ 18	100.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.003	0.0049	0.0041	0.003	0.02	3/ 19	15.8%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	30	33	7.4	23	47	20/ 20	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	3	3.2	0.52	2.3	4.6	20/ 20	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 19	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L	0.027	0.035	0.016	0.037	0.075	4/ 19	21.1%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.095	0.21	0.091	0.15	0.15	1/ 5	20.0%	--	D	1E+01	1E+01
21. Nitrite	14797-65-0	mg/L						0/ 6	0.0%	--	D	7E-01	1E+00
22. Potassium (K)	7440-09-7	mg/L	15	20	11	7.2	59	20/ 20	100.0%	--	ND		
23. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 19	0.0%	--	D	4E-02	5E-02
24. Silver (Ag)	7440-22-4	mg/L						0/ 19	0.0%	--	D	4E-02	5E-02
25. Sodium (Na)	7440-23-5	mg/L	180	190	23	130	225	20/ 20	100.0%	--	ND		
26. Sulfate (SO4)	14808-79-8	mg/L	70	82	27	21	140	20/ 20	100.0%	--	D	4E+02	
27. Thallium (Tl)	7440-28-0	mg/L						0/ 19	0.0%	--	ND	5E-04	
28. Total Dissolved Solids (TDS)		mg/L	780	840	130	500	1090	20/ 20	100.0%	--	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-RW2 Usage:													
O R G A N I C													
34. Vinyl chloride (VC)	75-01-4	µg/L	250	650	160	39	420	3/ 3	100.0%	√	A	2E-02	2E+00
35. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 3	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample

		AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
TE: EW-E	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	3	1.7E-03				2.9E-02	2.9E-02	5	1.7E-02				4.9E-02	4.9E-02
Arsenic, inorganic (As)	0.049	2.7E-05	4.1E-05	3		4.8E-04	1.6E+00	0.058	2.0E-04	3.0E-04	3		5.7E-04	1.9E+00
Boron and borates only (B)	0.49	2.7E-04				4.8E-03	5.3E-02	0.55	1.9E-03				5.4E-03	6.0E-02
Lead and compounds (inorganic) (Pb)	0.0029	1.6E-06				2.8E-05		0.0045	1.6E-05				4.4E-05	
Manganese (Mn)	2.3	1.3E-03				2.3E-02	4.5E+00	2.8	9.8E-03				2.7E-02	5.5E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.89«	5.0E-07	1.4E-08			8.7E-06		0.89«	3.1E-06	9.0E-08			8.7E-06	
Chlorobenzene (monochlorobenzene) (MCB)	32	1.8E-05				3.1E-04	1.6E-02	50	1.7E-04				4.9E-04	2.4E-02
1,2-Dichloroethylene (TOTAL)	200	1.1E-04				2.0E-03	2.0E-01	320	1.1E-03				3.1E-03	3.1E-01
cis-1,2-Dichloroethylene	800	4.5E-04				7.8E-03	7.8E-01	1200	4.2E-03				1.2E-02	1.2E+00
Dichloromethane (DCM)	25	1.4E-05	1.0E-07			2.4E-04	4.1E-03	36	1.3E-04	9.4E-07			3.5E-04	5.9E-03
Di(2-ethylhexyl) Phthalate (DEHP)	32	1.8E-05	2.5E-07			3.1E-04	1.6E-02	32	1.1E-04	1.6E-06			3.1E-04	1.6E-02
Tetrachloroethylene (PCE)	2.3«	1.3E-06	6.4E-08			2.3E-05	2.3E-03	2.3«	8.0E-06	4.0E-07			2.3E-05	2.3E-03
Trichloroethylene (TCE)	11	6.2E-06	6.8E-08			1.1E-04		16	5.6E-05	6.2E-07			1.6E-04	
Vinyl chloride (VC)	1200	6.7E-04	1.3E-03	97		1.2E-02		1600	5.6E-03	1.1E-02	97		1.6E-02	
TOTALS w/o Arsenic		- -	1E-03		- -	- -	7.2E+00	TOTALS w/o Arsenic	- -	1E-02		- -	- -	9.0E+00
		- -	1E-03			- -	- -		- -	1E-02			- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
E: EW-18														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.015«	8.4E-06	1.3E-05	3		1.5E-04	4.9E-01	0.015«	5.2E-05	7.9E-05	1		1.5E-04	4.9E-01
Boron and borates only (B)	0.66	3.7E-04				6.5E-03	7.2E-02	0.78«	2.7E-03				7.6E-03	8.5E-02
Lead and compounds (inorganic) (Pb)	0.0073	4.1E-06				7.1E-05		0.01«	3.5E-05				9.8E-05	
Manganese (Mn)	3.4	1.9E-03				3.3E-02	6.7E+00	3.9	1.4E-02				3.8E-02	7.6E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	2.5	1.4E-06	4.1E-08			2.4E-05		3.6«	1.3E-05	3.6E-07			3.5E-05	
cis-1,2-Dichloroethylene	180	1.0E-04				1.8E-03	1.8E-01	330«	1.2E-03				3.2E-03	3.2E-01
Trichloroethylene (TCE)	1.2	6.7E-07	7.4E-09			1.2E-05		2	7.0E-06	7.7E-08			2.0E-05	
Vinyl chloride (VC)	390	2.2E-04	4.1E-04	97		3.8E-03		1100	3.8E-03	7.3E-03	99		1.1E-02	
	TOTALS	- -	4E-04			- -	7.4E+00	TOTALS	- -	7E-03			- -	8.5E+00
	w/o Arsenic	- -	4E-04		- -	- -	- -	w/o Arsenic	- -	7E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

:er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
E: EW-17														
	Units mg/L							Units mg/L						
NORGANIC														
rsenic, inorganic (As)	0.013	7.3E-06	1.1E-05	99		1.3E-04	4.2E-01	0.013«	4.5E-05	6.8E-05	98		1.3E-04	4.2E-01
ead and compounds (inorganic) (Pb)	0.011	6.2E-06				1.1E-04		0.026«	9.1E-05				2.5E-04	
langanese (Mn)	0.66	3.7E-04				6.5E-03	1.3E+00	1.53«	5.3E-03				1.5E-02	3.0E+00
	Units ug/L							Units ug/L						
RGANIC														
lenzene (BNZ)	1.9	1.1E-06	3.1E-08			1.9E-05		6.5	2.3E-05	6.6E-07	1		6.4E-05	
hloroform (THM) (CLFM)	0.3	1.7E-07	1.0E-09			2.9E-06	2.9E-04	0.4«	1.4E-06	8.5E-09			3.9E-06	3.9E-04
etrachloroethylene (PCE)	1.9	1.1E-06	5.3E-08			1.9E-05	1.9E-03	2.8«	9.8E-06	4.9E-07	1		2.7E-05	2.7E-03
richloroethylene (TCE)	8.6	4.8E-06	5.3E-08			8.4E-05		10	3.5E-05	3.8E-07	1		9.8E-05	
	TOTALS	- -	1E-05			- -	1.7E+00	TOTALS	- -	7E-05			- -	3.4E+00
	w/o Arsenic	- -	1E-07		- -	- -	- -	w/o Arsenic	- -	2E-06		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
EW-16														
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	9.7	5.4E-03				9.5E-02	9.5E-02	12	4.2E-02				1.2E-01	1.2E-01
Arsenic, inorganic (As)	0.035	2.0E-05	2.9E-05	100		3.4E-04	1.1E+00	0.04«	1.4E-04	2.1E-04	100		3.9E-04	1.3E+00
Barium (Ba)	2	1.1E-03				2.0E-02	2.8E-01	2.08«	7.3E-03				2.0E-02	2.9E-01
Lead and compounds (inorganic) (Pb)	0.002«	1.1E-06				2.0E-05		0.002«	7.0E-06				2.0E-05	
Manganese (Mn)	4	2.2E-03				3.9E-02	7.8E+00	4.3«	1.5E-02				4.2E-02	8.4E+00
	Units ug/L							Units ug/L						
ORGANIC														
Dichloromethane (DCM)	1.7	9.5E-07	7.1E-09			1.7E-05	2.8E-04	2.8«	9.8E-06	7.3E-08			2.7E-05	4.6E-04
Tetrachloroethylene (PCE)	0.38	2.1E-07	1.1E-08			3.7E-06	3.7E-04	0.8«	2.8E-06	1.4E-07			7.8E-06	7.8E-04
TOTALS		- -	3E-05			- -	9.3E+00	TOTALS	- -	2E-04			- -	1.0E+01
w/o Arsenic		- -	2E-08		- -	- -	- -	w/o Arsenic	- -	2E-07		- -	- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

DHS35

aft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
E: EW-15	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
NORGANIC	Units mg/L							Units mg/L						
ead and compounds (inorganic) (Pb)	0.0026	1.5E-06				2.5E-05		0.005«	1.7E-05				4.9E-05	
anganese (Mn)	0.15	8.4E-05				1.5E-03	2.9E-01	0.32	1.1E-03				3.1E-03	6.3E-01
RGANIC	Units ug/L							Units ug/L						
enzene (BNZ)	2«	1.1E-06	3.2E-08			2.0E-05		2«	7.0E-06	2.0E-07			2.0E-05	
is-1,2-Dichloroethylene	850	4.8E-04				8.3E-03	8.3E-01	1100«	3.8E-03				1.1E-02	1.1E+00
richloroethylene (TCE)	2.6	1.5E-06	1.6E-08			2.5E-05		3.2	1.1E-05	1.2E-07			3.1E-05	
inyl chloride (VC)	870	4.9E-04	9.2E-04	100		8.5E-03		1700	5.9E-03	1.1E-02	100		1.7E-02	
	TOTALS	- -	9E-04			- -	1.1E+00	TOTALS	- -	1E-02			- -	1.7E+00
	w/o Arsenic	- -	9E-04		- -	- -	- -	w/o Arsenic	- -	1E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
EW-14														
RGANIC	Units mg/L							Units mg/L						
enic, inorganic (As)	0.0074	4.1E-06	6.2E-06	28		7.2E-05	2.4E-01	0.008«	2.8E-05	4.2E-05	22		7.8E-05	2.6E-01
on and borates only (B)	0.56	3.1E-04				5.5E-03	6.1E-02	0.61	2.1E-03				6.0E-03	6.6E-02
mium (Cd)	0.0026	1.5E-06				2.5E-05	5.1E-02	0.0035	1.2E-05				3.4E-05	6.8E-02
d and compounds (inorganic) (Pb)	0.0034	1.9E-06				3.3E-05		0.0056	2.0E-05				5.5E-05	
ganese (Mn)	0.29	1.6E-04				2.8E-03	5.7E-01	0.4	1.4E-03				3.9E-03	7.8E-01
ANIC	Units ug/L							Units ug/L						
zene (BNZ)	6.7	3.7E-06	1.1E-07			6.6E-05		20	7.0E-05	2.0E-06	1		2.0E-04	
bon tetrachloride (CCL4)	0.37	2.1E-07	2.7E-08			3.6E-06	5.2E-03	0.5«	1.7E-06	2.3E-07			4.9E-06	7.0E-03
oroform (THM) (CLFM)	0.68	3.8E-07	2.3E-09			6.7E-06	6.7E-04	1	3.5E-06	2.1E-08			9.8E-06	9.8E-04
-Dichloroethane (DCA2)	0.71	4.0E-07	3.6E-08			6.9E-06		1.1	3.8E-06	3.5E-07			1.1E-05	
-Dichloroethylene (DCE)	4.7	2.6E-06	1.6E-06	7		4.6E-05	5.1E-03	7	2.4E-05	1.5E-05	8		6.8E-05	7.6E-03
hloromethane (DCM)	1.6	8.9E-07	6.7E-09			1.6E-05	2.6E-04	2.6	9.1E-06	6.8E-08			2.5E-05	4.2E-04
rachloroethylene (PCE)	1.7	9.5E-07	4.8E-08			1.7E-05	1.7E-03	2.4	8.4E-06	4.2E-07			2.3E-05	2.3E-03
chloroethylene (TCE)	16	8.9E-06	9.8E-08			1.6E-04		21	7.3E-05	8.1E-07			2.1E-04	
yl chloride (VC)	13	7.3E-06	1.4E-05	63		1.3E-04		20	7.0E-05	1.3E-04	69		2.0E-04	
TOTALS		- -	2E-05			- -	9.3E-01	TOTALS	- -	2E-04			- -	1.2E+00
w/o Arsenic		- -	2E-05		- -	- -	- -	w/o Arsenic	- -	2E-04		- -	- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
)HS35
ft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-13														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0071	4.0E-06	6.0E-06	94		6.9E-05	2.3E-01	0.012«	4.2E-05	6.3E-05	95		1.2E-04	3.9E-01
Cadmium (Cd)	0.0062	3.5E-06				6.1E-05	1.2E-01	0.013	4.5E-05				1.3E-04	2.5E-01
Lead and compounds (inorganic) (Pb)	0.0029	1.6E-06				2.8E-05		0.0067	2.3E-05				6.6E-05	
Manganese (Mn)	0.048	2.7E-05				4.7E-04	9.4E-02	0.1«	3.5E-04				9.8E-04	2.0E-01
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	1.5	8.4E-07	5.2E-08	1		1.5E-05	7.3E-04	3	1.0E-05	6.5E-07	1		2.9E-05	1.5E-03
Chloroform (THM) (CLFM)	3.9	2.2E-06	1.3E-08			3.8E-05	3.8E-03	7	2.4E-05	1.5E-07			6.8E-05	6.8E-03
1,2-Dichloroethane (DCA2)	0.28	1.6E-07	1.4E-08			2.7E-06		0.45	1.6E-06	1.4E-07			4.4E-06	
Tetrachloroethylene (PCE)	0.48	2.7E-07	1.3E-08			4.7E-06	4.7E-04	0.6«	2.1E-06	1.0E-07			5.9E-06	5.9E-04
Trichloroethylene (TCE)	44	2.5E-05	2.7E-07	4		4.3E-04		54	1.9E-04	2.1E-06	3		5.3E-04	
TOTALS		- -	6E-06			- -	4.5E-01	TOTALS	- -	7E-05			- -	8.5E-01
w/o Arsenic		- -	4E-07		- -	- -	- -	w/o Arsenic	- -	3E-06		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
EW-12														
	Units mg/L							Units mg/L						
RGANIC														
enic, inorganic (As)	0.0081	4.5E-06	6.8E-06	98		7.9E-05	2.6E-01	0.011	3.8E-05	5.8E-05	98		1.1E-04	3.6E-01
d and compounds (inorganic) (Pb)	0.0071	4.0E-06				6.9E-05		0.0096	3.4E-05				9.4E-05	
	Units ug/L							Units ug/L						
ANIC														
oroform (THM) (CLFM)	0.85	4.8E-07	2.9E-09			8.3E-06	8.3E-04	1.2	4.2E-06	2.6E-08			1.2E-05	1.2E-03
-Dichloroethane (DCA2)	0.3«	1.7E-07	1.5E-08			2.9E-06		0.3«	1.0E-06	9.5E-08			2.9E-06	
rachloroethylene (PCE)	0.8	4.5E-07	2.2E-08			7.8E-06	7.8E-04	1.3	4.5E-06	2.3E-07			1.3E-05	1.3E-03
chloroethylene (TCE)	12	6.7E-06	7.4E-08	1		1.2E-04		17	5.9E-05	6.5E-07	1		1.7E-04	
TOTALS		- -	7E-06			- -	2.7E-01	TOTALS	- -	6E-05			- -	3.6E-01
w/o Arsenic		- -	1E-07		- -	- -	- -	w/o Arsenic	- -	1E-06		- -	- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
HS35
t 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
TE: EW-11	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0067	3.7E-06	5.6E-06	38		6.6E-05	2.2E-01	0.007«	2.4E-05	3.7E-05	23		6.8E-05	2.3E-01
Cadmium (Cd)	0.0012«	6.7E-07				1.2E-05	2.3E-02	0.0012«	4.2E-06				1.2E-05	2.3E-02
Lead and compounds (inorganic) (Pb)	0.0045	2.5E-06				4.4E-05		0.0082	2.9E-05				8.0E-05	
Manganese (Mn)	1.2	6.7E-04				1.2E-02	2.3E+00	1.5	5.2E-03				1.5E-02	2.9E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.34	1.9E-07	5.5E-09			3.3E-06		0.44	1.5E-06	4.5E-08			4.3E-06	
Chloroform (THM) (CLFM)	0.66	3.7E-07	2.3E-09			6.5E-06	6.5E-04	1.7	5.9E-06	3.6E-08			1.7E-05	1.7E-03
Tetrachloroethylene (PCE)	0.19	1.1E-07	5.3E-09			1.9E-06	1.9E-04	0.25«	8.7E-07	4.4E-08			2.4E-06	2.4E-04
Trichloroethylene (TCE)	0.22	1.2E-07	1.4E-09			2.2E-06		0.35	1.2E-06	1.3E-08			3.4E-06	
Vinyl chloride (VC)	8.5	4.8E-06	9.0E-06	62		8.3E-05		18	6.3E-05	1.2E-04	76		1.8E-04	
TOTALS		- -	1E-05			- -	2.6E+00	TOTALS	- -	2E-04			- -	3.2E+00
w/o Arsenic		- -	9E-06		- -	- -	- -	w/o Arsenic	- -	1E-04		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TE: EW-10														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0061	3.4E-06	5.1E-06	78		6.0E-05	2.0E-01	0.009«	3.1E-05	4.7E-05	80		8.8E-05	2.9E-01
Cadmium (Cd)	0.0031	1.7E-06				3.0E-05	6.1E-02	0.0048	1.7E-05				4.7E-05	9.4E-02
Lead and compounds (inorganic) (Pb)	0.0024	1.3E-06				2.3E-05		0.0048	1.7E-05				4.7E-05	
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	0.62	3.5E-07	2.1E-08			6.1E-06	3.0E-04	1	3.5E-06	2.2E-07			9.8E-06	4.9E-04
Chloroform (THM) (CLFM)	1.2	6.7E-07	4.1E-09			1.2E-05	1.2E-03	1.5	5.2E-06	3.2E-08			1.5E-05	1.5E-03
1,2-Dichloroethane (DCA2)	0.3«	1.7E-07	1.5E-08			2.9E-06		0.3«	1.0E-06	9.5E-08			2.9E-06	
1,1-Dichloroethylene (DCE)	3.7	2.1E-06	1.2E-06	19		3.6E-05	4.0E-03	4.8	1.7E-05	1.0E-05	17		4.7E-05	5.2E-03
Dichloromethane (DCM)	1.3	7.3E-07	5.5E-09			1.3E-05	2.1E-04	1.8	6.3E-06	4.7E-08			1.8E-05	2.9E-04
Tetrachloroethylene (PCE)	0.54	3.0E-07	1.5E-08			5.3E-06	5.3E-04	0.57«	2.0E-06	1.0E-07			5.6E-06	5.6E-04
Trichloroethylene (TCE)	29	1.6E-05	1.8E-07	3		2.8E-04		39	1.4E-04	1.5E-06	3		3.8E-04	
TOTALS		- -	7E-06			- -	2.7E-01	TOTALS	- -	6E-05			- -	4.0E-01
w/o Arsenic		- -	1E-06		- -	- -	- -	w/o Arsenic	- -	1E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-3 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.48	0.81	0.6	2.3	2.3	1/ 15	6.7%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	5.7	10	8.4	0.6	30	10/ 15	66.7%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L	1.2	2.3	1.5	3	5.2	2/ 10	20.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: TW-3 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	0.54	0.88	0.61	1.7	2.4	2/ 15	13.3% √	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.27	0.46	0.34	0.55	1.4	2/ 15	13.3% √	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 15	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 15	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 15	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.76	1.1	0.76	0.34	2.7	10/ 27	37.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 15	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 15	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.4	0.63	0.43	0.6	1.4	4/ 15	26.7% √	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.3	0.49	0.36	0.35	0.35	1/ 15	6.7% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 15	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	2.1	3	2.2	1	8.3	12/ 26	46.2% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 26	0.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.61	0.7	0.23	0.8	0.8	1/ 26	3.8% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.42	0.7	0.51	0.43	1.8	2/ 15	13.3% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.5	2.5	1.8	1.4	6.2	7/ 15	46.7% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.23	0.32	0.18	0.2	0.53	2/ 15	13.3% √	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.6	1.3	1.3	0.25	5.5	4/ 15	26.7% --	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	3.4	5.7	4.2	0.28	13	11/ 15	73.3% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.21	0.3	0.16	0.3	0.35	2/ 15	13.3% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.1	1.3	0.32	2.3	2.3	1/ 15	6.7% √	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 15	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 15	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 15	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	0.36	0.48	0.22	1.1	1.1	1/ 15	6.7% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 15	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.29	0.39	0.18	0.2	0.63	6/ 15	40.0% √	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.73	1.3	1.1	0.67	4.2	3/ 15	20.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.26	0.43	0.3	1.2	1.2	1/ 15	6.7% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 15	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	1.7	3.4	3	0.67	9.6	6/ 15	40.0% √	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.39	0.59	0.36	0.58	0.83	2/ 15	13.3% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-3 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.1	7.5	0.25	6.7	7.4	4/ 4	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.57	1.6	0.66	0.06	1.7	2/ 4	50.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0079	0.015	0.0046	0.006	0.008	2/ 4	50.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 4	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.6	0.71	0.071	0.5	0.7	4/ 4	100.0%	√	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	59	63	3	55	62	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	170	210	25	140	210	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L						0/ 4	0.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L	0.24	0.75	0.32	0.8	0.8	1/ 4	25.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0066	0.015	0.0051	0.004	0.006	2/ 4	50.0%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	27	29	1.3	25	28	4/ 4	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	1.5	1.9	0.28	1	1.7	4/ 4	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 4	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	1.3	1.3		1.3	1.3	1/ 1	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	6	6		6	6	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	190	210	15	170	200	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	79	89	6.8	73	90	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	710	770	37	650	750	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.075	0.14	0.04	0.02	0.13	4/ 4	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: TW-2 Usage:												
O R G A N I C												
34. Vinyl chloride (VC)	75-01-4	µg/L	5.8	5.8	0.00000005	5.8	5.8	1/ 1	100.0% √	A	2E-02	2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: TW-2 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 1	0.0% --	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	1.3	2.6	0.15	1.1	1.4	2/ 2	100.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.49	0.49		0.49	0.49	1/ 1	100.0% √	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	2.7	2.7		2.7	2.7	1/ 1	100.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 1	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 1	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.93	0.93		0.93	0.93	1/ 1	100.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	9.8	9.8	0.00000008	9.8	9.8	1/ 1	100.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	1.5	1.5		1.5	1.5	1/ 1	100.0% √	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	7.1	7.1	0.00000004	7.1	7.1	1/ 1	100.0% √	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.5	7.5		7.5	7.5	1/ 1	100.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.48	0.48		0.48	0.48	1/ 1	100.0% √	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	2	2		2	2	1/ 1	100.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	11	11		11	11	1/ 1	100.0% √	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	1.2	1.2		1.2	1.2	1/ 1	100.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 1	0.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35

8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-2 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			6.7	6.7		6.7	6.7	1/ 1	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	1.3	1.3		1.3	1.3	1/ 1	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.006	0.006		0.006	0.006	1/ 1	100.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.006	0.006		0.006	0.006	1/ 1	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 1	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 1	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.6	0.6		0.6	0.6	1/ 1	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 1	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	60	60		60	60	1/ 1	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	180	180		180	180	1/ 1	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 1	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 1	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 1	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L						0/ 1	0.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 1	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 1	0.0%	--	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	25	25		25	25	1/ 1	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.18	0.18		0.18	0.18	1/ 1	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 1	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 1	0.0%	--	D	1E-01	1E-01
20. Potassium (K)	7440-09-7	mg/L	5	5		5	5	1/ 1	100.0%	--	ND		
21. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 1	0.0%	--	D	4E-02	5E-02
22. Silver (Ag)	7440-22-4	mg/L						0/ 1	0.0%	--	D	4E-02	5E-02
23. Sodium (Na)	7440-23-5	mg/L	200	200		200	200	1/ 1	100.0%	--	ND		
24. Sulfate (SO4)	14808-79-8	mg/L	70	70		70	70	1/ 1	100.0%	--	D	4E+02	
25. Thallium (Tl)	7440-28-0	mg/L						0/ 1	0.0%	--	ND	5E-04	
26. Total Dissolved Solids (TDS)		mg/L	710	710		710	710	1/ 1	100.0%	--	ND		
27. Zinc and compounds (Zn)	7440-66-6	mg/L	0.06	0.06		0.06	0.06	1/ 1	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.5	2.4	1.5	0.21	4.6	8/ 14	57.1%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.75	1.8	1.8	0.2	7.2	3/ 14	21.4%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L	2	3.9	2.8	6.8	8	2/ 10	20.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	1.3	2.9	2.8	3.7	11	2/ 14	14.3%	✓	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.39	0.65	0.44	0.21	1.7	5/ 14	35.7%	✓	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.29	0.35	0.15	0.32	0.58	2/ 25	8.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.6	2.2	1	0.7	4.1	14/ 14	100.0%	✓	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.31	0.52	0.37	0.32	0.32	1/ 14	7.1%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L	0.32	0.53	0.36	0.26	0.32	2/ 14	14.3%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.8	1	0.52	1.1	2.2	4/ 24	16.7%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 24	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.62	0.73	0.27	1.1	1.1	1/ 24	4.2%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.5	0.95	0.78	3	3	1/ 14	7.1%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.9	4.4	2.5	0.59	7.5	12/ 14	85.7%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.24	0.35	0.19	0.28	0.59	2/ 14	14.3%	✓	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	2.4	3.4	1.8	0.4	7.3	12/ 14	85.7%	✓	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.6	12	8.4	0.34	24	13/ 14	92.9%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 14	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	0.66	1.1	0.76	1.4	2.8	3/ 14	21.4%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	1.1	1.7	1.1	0.26	4.1	12/ 14	85.7%	✓	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	1.3	2.7	2.4	0.65	8.69999999	4/ 14	28.6%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.2	1.8	0.96	0.4	3.4	11/ 14	78.6%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	13	17	7.2	1.4	25	14/ 14	100.0%	✓	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.36	0.57	0.36	0.63	0.63	1/ 14	7.1%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-W Usage:													
O R G A N I C													
30. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0%	--	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0%	--	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0%	--	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0%	--	B2	3E-03	2E-01
34. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0%	--	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 21	0.0%	--	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0%	--	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	40	51	33	1.4	100	35/ 35	100.0%	--	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 35	0.0%	--	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	3.6	4.4	2.4	1.7	7.8	21/ 35	60.0%	--	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0%	--	B2	8E-02	
41. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.61	0.84	0.4	0.3	1.2	5/ 14	35.7%	--	D	1E+03	
42. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.5	2.1	1.1	1.1	3.9	8/ 21	38.1%	--	C	7E+01	
43. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	1.2	2	1.7	2.2	2.2	1/ 21	4.8%	✓	B2	4E-01	5E+00
44. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.89	1.3	0.97	0.21	2.7	3/ 21	14.3%	--	C	6E-02	7E+00
45. 1,2-Dichloroethylene (TOTAL)		µg/L	16	22	5.7	10	26	7/ 7	100.0%	--	D	7E+01	
46. cis-1,2-Dichloroethylene	156-59-2	µg/L	58	110	88	0.62	320	14/ 14	100.0%	✓	D	7E+01	7E+01
47. trans-1,2-Dichloroethylene	156-60-5	µg/L	1.7	2.8	1.9	1	6.3	6/ 14	42.9%	--	D	1E+02	1E+02
48. Dichloromethane (DCM)	75-09-2	µg/L	7.6	11	8.19999999	11	11	1/ 21	4.8%	✓	B2	5E+00	5E+00
49. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0%	--	D	2E+01	
50. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 20	0.0%	--	B2	5E-01	5E+00
51. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 21	0.0%	--	B2		
52. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 21	0.0%	--	B2		
53. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0%	--	D	6E+03	5E+03
54. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L	87	87		87	87	1/ 1	100.0%	✓	B2	3E+00	4E+00
55. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0%	--	D	7E+04	
56. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0%	--	NA	1E+02	
57. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0%	--	ND	1E+01	
58. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0%	--	B2	5E-02	
59. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0%	--	ND	7E+00	
60. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0%	--	ND	1E+02	
61. Ethylbenzene (ETB)	100-41-4	µg/L	0.88	1.3	0.95	1.3	1.3	1/ 21	4.8%	--	D	7E+02	7E+02
62. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 6	0.0%	--	B2	4E-04	5E-02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-W Usage:												
I N O R G A N I C												
29. Zinc and compounds (Zn)	7440-66-6	mg/L	0.1	0.12	0.038	0.06	0.19	19/ 19	100.0% --	D	2E+00	
O R G A N I C												
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0% --	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0% --	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0% --	D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L	1	1.5	1	0.5	3.3	5/ 21	23.8% ✓	A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0% --	B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0% --	D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0% --	B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0% --	D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0% --	ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0% --	D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0% --	B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0% --	ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 21	0.0% --	B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0% --	D		
18. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 21	0.0% --	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L						0/ 21	0.0% --	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0% --	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0% --	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 21	0.0% --	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0% --	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	14	19	18	2.3	110	36/ 39	92.3% --	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L	4.7	8.5	8.4	0.94	5	2/ 21	9.5% --	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 15	0.0% --	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.81	1.2	0.88	0.62	0.62	1/ 21	4.8% ✓	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L						0/ 21	0.0% --	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0% --	ND		

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: EW-W Usage:												
O R G A N I C												
63. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0%	-- D	3E+02	
64. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0%	-- D	3E+02	
65. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0%	-- B2	2E-02	1E+00
66. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0%	-- C	5E-01	
67. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0%	-- D	5E+01	5E+01
68. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0%	-- C	3E+00	
69. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0%	-- NA		
70. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0%	-- B2	3E-02	2E-01
71. Isophorone	78-59-1	µg/L						0/ 1	0.0%	-- C	4E+01	
72. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0%	-- D	4E+03	
73. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0%	-- NA	6E+02	
74. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0%	-- ND		
75. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0%	-- C	4E+01	
76. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0%	-- C	4E+01	
77. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0%	-- D	3E+02	
78. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0%	-- NA	4E-01	
79. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0%	-- ND		
80. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0%	-- D	4E+00	
81. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0%	-- NA		
82. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0%	-- ND		
83. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0%	-- B2	5E-03	
84. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0%	-- B2	7E+00	
85. Parachlorophenyl methyl sulfide	123-09-1	mg/L						0/ 2	0.0%	-- D		
86. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0%	-- B2	3E-01	1E+00
87. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0%	-- D		
88. Phenol	108-95-2	µg/L	74	74		74	74	1/ 1	100.0%	-- D	4E+03	
89. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0%	-- D	2E+02	
90. Styrene	100-42-5	µg/L						0/ 1	0.0%	-- C	1E+02	1E+02
91. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L	1.3	2.2	1.8	4.4	4.4	1/ 21	4.8%	✓ C	2E-01	
92. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 21	0.0%	-- B2	7E-01	5E+00
93. Toluene (TOL)	108-88-3	µg/L	1.1	1.8	1.6	0.53	7	4/ 21	19.0%	-- D	1E+03	1E+03
94. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0%	-- D	7E+01	9E+00
95. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.76	1.2	0.9	0.36	0.36	1/ 21	4.8%	-- D	6E+02	2E+02

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: EW-W Usage:													
O R G A N I C													
96. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 21	0.0%	--	C	6E-01	5E+00
97. Trichloroethylene (TCE)	79-01-6	µg/L	1.3	1.9	1.1	0.76	4.1	7/ 21	33.3%	√	B2	3E+00	5E+00
98. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	1.5	2.4	1.4	1.2	5.3	5/ 14	35.7%	--	D	2E+03	
99. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0%	--	D	7E+02	
100. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0%	--	B2	3E+00	
101. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	2.1	3.6	3.1	2.3	2.3	1/ 20	5.0%	--	D	2E+05	
102. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	--	NA	7E+03	
103. Vinyl chloride (VC)	75-01-4	µg/L	340	490	330	5.2	1300	21/ 21	100.0%	√	A	2E-02	2E+00
104. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 19	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
TE: EW-9	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
INORGANIC	Units mg/L							Units mg/L						
Arsenic, inorganic (As)	0.034	1.9E-05	2.9E-05	24		3.3E-04	1.1E+00	0.04	1.4E-04	2.1E-04	17		3.9E-04	1.3E+00
Cadmium (Cd)	0.0064	3.6E-06				6.3E-05	1.3E-01	0.011	3.8E-05				1.1E-04	2.2E-01
Lead and compounds (inorganic) (Pb)	0.0039	2.2E-06				3.8E-05		0.0062	2.2E-05				6.1E-05	
Manganese (Mn)	3.4	1.9E-03				3.3E-02	6.7E+00	4	1.4E-02				3.9E-02	7.8E+00
ORGANIC	Units ug/L							Units ug/L						
Chloroform (THM) (CLFM)	0.64	3.6E-07	2.2E-09			6.3E-06	6.3E-04	1.1	3.8E-06	2.3E-08			1.1E-05	1.1E-03
Trichloroethylene (TCE)	2.4	1.3E-06	1.5E-08			2.3E-05		3.9	1.4E-05	1.5E-07			3.8E-05	
Vinyl chloride (VC)	85	4.8E-05	9.0E-05	76		8.3E-04		150	5.2E-04	1.0E-03	83		1.5E-03	
TOTALS	- -		1E-04			- -	7.9E+00	TOTALS	- -	1E-03			- -	9.3E+00
w/o Arsenic	- -		9E-05		- -	- -	- -	w/o Arsenic	- -	1E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

)4ADHS35

)raft 8/95

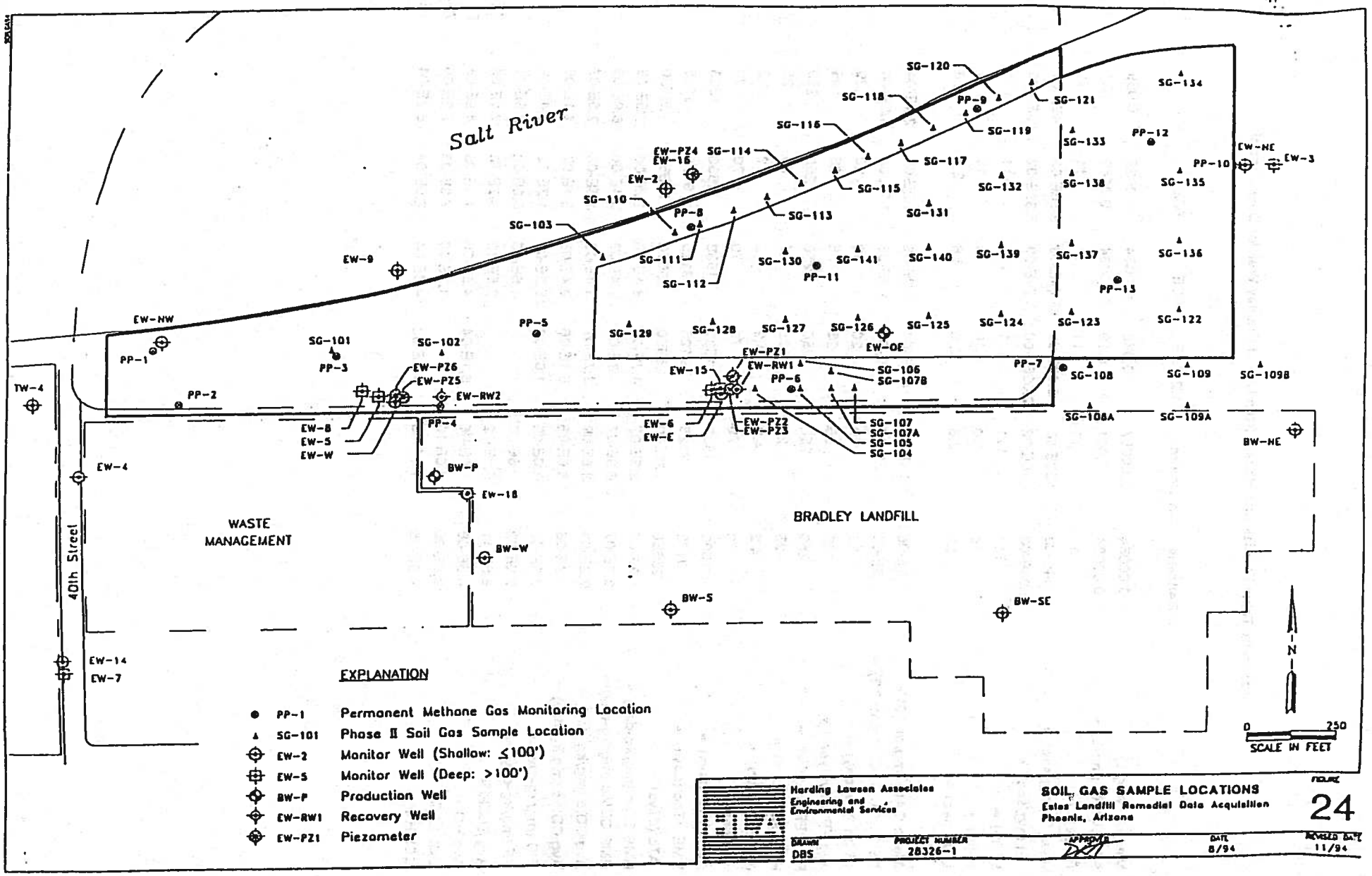
Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
E: EW-8	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
NORGANIC	Units mg/L							Units mg/L						
rsenic, inorganic (As)	0.013	7.3E-06	1.1E-05	94		1.3E-04	4.2E-01	0.016	5.6E-05	8.4E-05	89		1.6E-04	5.2E-01
admium (Cd)	0.003	1.7E-06				2.9E-05	5.9E-02	0.0045	1.6E-05				4.4E-05	8.8E-02
ead and compounds (inorganic) (Pb)	0.0029	1.6E-06				2.8E-05		0.004«	1.4E-05				3.9E-05	
anganese (Mn)	0.013	7.3E-06				1.3E-04	2.5E-02	0.02	7.0E-05				2.0E-04	3.9E-02
RGANIC	Units ug/L							Units ug/L						
inyl chloride (VC)	0.71	4.0E-07	7.5E-07	6		6.9E-06		1.5	5.2E-06	1.0E-05	11		1.5E-05	
	TOTALS	- -	1E-05			- -	5.1E-01	TOTALS	- -	9E-05			- -	6.5E-01
	w/o Arsenic	- -	8E-07		- -	- -	- -	w/o Arsenic	- -	1E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
ADHS35
aft 8/95

Appendix Table F - Risk and Hazard from Use of Bradley Well for Dust Control

	Benzene	Chloroform	c-1,2 DCE	PCE	TCE	VC	
Mean Ci (mg/L)	0.00054	0.00087	0.088	0.00034	0.0035	0.059	
95%UCL Ci (mg/L) =	0.00054	0.001	0.19	0.00034	0.0049	0.1	
R (L/sec)=	11	11	11	11	11	11	
Mean Ei (mg/sec) =	5.94E-03	9.57E-03	9.68E-01	3.74E-03	3.85E-02	6.49E-01	
Ei (mg/sec) =	5.94E-03	1.10E-02	2.09E+00	3.74E-03	5.39E-02	1.10E+00	
W (m) =	111	111	111	111	111	111	
H (m) =	10	10	10	10	10	10	
U (m/sec) =	2.8	2.8	2.8	2.8	2.8	2.8	
Mean OACI (mg/m^3) =	1.9E-06	3.1E-06	3.1E-04	1.2E-06	1.2E-05	2.1E-04	
95% UCL OACI (mg/m^3) =	1.9E-06	3.5E-06	6.7E-04	1.2E-06	1.7E-05	3.5E-04	
IR (m^/wkday) =	20	20	20	20	20	20	
Avg EF (days/year) =	25	25	25	25	25	25	
RME EF (days/yr) =	250	250	250	250	250	250	
RME ED (years) =	25	25	25	25	25	25	
Avg ED (years) =	4.2	4.2	4.2	4.2	4.2	4.2	
BW (kg) =	70	70	70	70	70	70	
Avg ATnc (days) =	1533	1533	1533	1533	1533	1533	
RME ATnc (days) =	9125	9125	9125	9125	9125	9125	
ATc (days) =	25550	25550	25550	25550	25550	25550	
RME CDIc (mg/kg-day) =	1.3E-07	2.5E-07	4.7E-05	8.4E-08	1.2E-06	2.5E-05	
RME CDInc (mg/kg-day) =	3.7E-07	6.9E-07	1.3E-04	2.4E-07	3.4E-06	6.9E-05	
Avg CDIc (mg/kg-day) =	2.2E-09	3.6E-09	3.7E-07	1.4E-09	1.5E-08	2.5E-07	
Avg CDInc (mg/kg-day) =	3.7E-08	6.0E-08	6.1E-06	2.4E-08	2.4E-07	4.1E-06	
RfD (mg/kg-day) =	8.3E-03	6.0E-02	1.0E-02	5.2E-04	1.7E-02	8.4E-02	
SF (mg/kg-day) =	2.9E-02	1.6E-03		1.8E-03	6.0E-02	2.9E-01	
Avg ELCR =	6.5E-11	5.8E-12		2.5E-12	8.7E-10	7.1E-08	7E-08
Avg HQ =	4.5E-06	1.0E-06	6.1E-04	4.5E-05	1.4E-05	4.9E-05	7E-04
UCL ELCR =	3.9E-09	4.0E-10		1.5E-10	7.3E-08	7.2E-06	7E-06
UCL HQ =	4.5E-05	1.2E-05	1.3E-02	4.5E-04	2.0E-04	8.2E-04	1E-02



Harding Lawson Associates
Engineering and Environmental Services

SOIL GAS SAMPLE LOCATIONS
Estes Landfill Remedial Data Acquisition
Phoenix, Arizona

FIGURE 24

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
DBS	28326-1	DKT	8/94	11/94

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

ter Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
TE: EW-WE	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0063	3.5E-06	5.3E-06	96		6.2E-05	2.1E-01	0.0081«	2.8E-05	4.2E-05	97		7.9E-05	2.6E-01
Lead and compounds (inorganic) (Pb)	0.003	1.7E-06				2.9E-05		0.004«	1.4E-05				3.9E-05	
Nitrate/Nitrite (total)	4.3	2.4E-03				4.2E-02	2.6E-02	7.3	2.6E-02				7.1E-02	4.5E-02
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	0.32«	1.8E-07	1.1E-08			3.1E-06	1.6E-04	0.32«	1.1E-06	6.9E-08			3.1E-06	1.6E-04
Chloroform (THM) (CLFM)	0.41	2.3E-07	1.4E-09			4.0E-06	4.0E-04	0.62	2.2E-06	1.3E-08			6.1E-06	6.1E-04
Dichloromethane (DCM)	2	1.1E-06	8.4E-09			2.0E-05	3.3E-04	3	1.0E-05	7.9E-08			2.9E-05	4.9E-04
Di(2-ethylhexyl) Phthalate (DEHP)	22	1.2E-05	1.7E-07	3		2.2E-04	1.1E-02	22	7.7E-05	1.1E-06	2		2.2E-04	1.1E-02
TOTALS		- -	5E-06			- -	2.4E-01	TOTALS	- -	4E-05			- -	3.2E-01
w/o Arsenic		- -	2E-07		- -	- -	- -	w/o Arsenic	- -	1E-06		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

:r Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
:: EW-ETM	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
IORGANIC														
rsenic, inorganic (As)	0.088	4.9E-05	7.4E-05	100		8.6E-04	2.9E+00	0.088	3.1E-04	4.6E-04	100		8.6E-04	2.9E+00
ead and compounds (inorganic) (Pb)	0.016	8.9E-06				1.6E-04		0.016	5.6E-05				1.6E-04	
anganese (Mn)	1.8	1.0E-03				1.8E-02	3.5E+00	1.8	6.3E-03				1.8E-02	3.5E+00
	TOTALS w/o Arsenic	- -	7E-05		- -	- -	6.4E+00	TOTALS w/o Arsenic	- -	5E-04		- -	- -	6.4E+00
		- -	0E+00			- -	- -		- -	0E+00			- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample

TE: EW-OE

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.018	1.0E-05	1.5E-05	94		1.8E-04	5.9E-01	0.028	9.8E-05	1.5E-04	92		2.7E-04	9.1E-01
Lead and compounds (inorganic) (Pb)	0.0045	2.5E-06				4.4E-05		0.0075	2.6E-05				7.3E-05	
Manganese (Mn)	1.9	1.1E-03				1.9E-02	3.7E+00	3.6	1.3E-02				3.5E-02	7.0E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	3.7	2.1E-06	6.0E-08			3.6E-05		6.9	2.4E-05	7.0E-07			6.8E-05	
Chloroform (THM) (CLFM)	0.31	1.7E-07	1.1E-09			3.0E-06	3.0E-04	0.4«	1.4E-06	8.5E-09			3.9E-06	3.9E-04
Dichloromethane (DCM)	2.3	1.3E-06	9.6E-09			2.3E-05	3.8E-04	3.5	1.2E-05	9.2E-08			3.4E-05	5.7E-04
Vinyl chloride (VC)	0.92	5.1E-07	9.8E-07	6		9.0E-06		1.7	5.9E-06	1.1E-05	7		1.7E-05	
TOTALS		- -	2E-05			- -	4.3E+00	TOTALS	- -	2E-04			- -	8.0E+00
w/o Arsenic		- -	1E-06		- -	- -	- -	w/o Arsenic	- -	1E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

)4ADHS35

raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

r Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
: EW-NW													
Units mg/L							Units mg/L						
IORGANIC													
rsenic, inorganic (As) 0.006	3.4E-06	5.0E-06	3		5.9E-05	2.0E-01	0.0081	2.8E-05	4.2E-05	2		7.9E-05	2.6E-01
eryllium (Be) 0.0026	1.5E-06	6.3E-06	3		2.5E-05	5.1E-03	0.003«	1.0E-05	4.5E-05	2		2.9E-05	5.9E-03
ead and compounds (inorganic) (Pb) 0.003«	1.7E-06				2.9E-05		0.003«	1.0E-05				2.9E-05	
anganese (Mn) 2.9	1.6E-03				2.8E-02	5.7E+00	3.1	1.1E-02				3.0E-02	6.1E+00
Units ug/L							Units ug/L						
RGANIC													
enzene (BNZ) 0.83	4.6E-07	1.3E-08			8.1E-06		1.3	4.5E-06	1.3E-07			1.3E-05	
hloroform (THM) (CLFM) 0.83	4.6E-07	2.8E-09			8.1E-06	8.1E-04	1.4	4.9E-06	3.0E-08			1.4E-05	1.4E-03
,2-Dichloroethane (DCA2) 0.57«	3.2E-07	2.9E-08			5.6E-06		0.57«	2.0E-06	1.8E-07			5.6E-06	
ichloromethane (DCM) 5.7	3.2E-06	2.4E-08			5.6E-05	9.3E-04	9.4	3.3E-05	2.5E-07			9.2E-05	1.5E-03
i(2-ethylhexyl) Phthalate (DEHP) 26	1.5E-05	2.0E-07			2.5E-04	1.3E-02	26	9.1E-05	1.3E-06			2.5E-04	1.3E-02
etrachloroethylene (PCE) 0.47«	2.6E-07	1.3E-08			4.6E-06	4.6E-04	0.47«	1.6E-06	8.2E-08			4.6E-06	4.6E-04
richloroethylene (TCE) 0.89	5.0E-07	5.5E-09			8.7E-06		1.4	4.9E-06	5.4E-08			1.4E-05	
inyl chloride (VC) 170	9.5E-05	1.8E-04	94		1.7E-03		270	9.4E-04	1.8E-03	95		2.6E-03	
TOTALS	- -	2E-04			- -	5.9E+00	TOTALS	- -	2E-03			- -	6.4E+00
w/o Arsenic	- -	2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

4ADHS35

raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

later Sample

ITE: EW-RW2

	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.038	2.1E-05	3.2E-05	11		3.7E-04	1.2E+00	0.044«	1.5E-04	2.3E-04	8		4.3E-04	1.4E+00
Lead and compounds (inorganic) (Pb)	0.0035	2.0E-06				3.4E-05		0.005«	1.7E-05				4.9E-05	
Manganese (Mn)	2.7	1.5E-03				2.6E-02	5.3E+00	3.3«	1.2E-02				3.2E-02	6.5E+00
	Units ug/L							Units ug/L						
ORGANIC														
cis-1,2-Dichloroethylene	150	8.4E-05				1.5E-03	1.5E-01	310«	1.1E-03				3.0E-03	3.0E-01
Trichloroethylene (TCE)	0.49«	2.7E-07	3.0E-09			4.8E-06		0.49«	1.7E-06	1.9E-08			4.8E-06	
Vinyl chloride (VC)	250	1.4E-04	2.7E-04	89		2.4E-03		420«	1.5E-03	2.8E-03	92		4.1E-03	
TOTALS		- -	3E-04			- -	6.7E+00	TOTALS	- -	3E-03			- -	8.2E+00
w/o Arsenic		- -	3E-04		- -	- -	- -	w/o Arsenic	- -	3E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
SITE: EW-RW1	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	3.4	1.9E-03				3.3E-02	3.3E-02	6.7	2.3E-02				6.6E-02	6.6E-02
Arsenic, inorganic (As)	0.067	3.7E-05	5.6E-05	3		6.6E-04	2.2E+00	0.12	4.2E-04	6.3E-04	2		1.2E-03	3.9E+00
Boron and borates only (B)	0.59	3.3E-04				5.8E-03	6.4E-02	0.81	2.8E-03				7.9E-03	8.8E-02
Lead and compounds (inorganic) (Pb)	0.0048	2.7E-06				4.7E-05		0.0091	3.2E-05				8.9E-05	
Manganese (Mn)	4.7	2.6E-03				4.6E-02	9.2E+00	7.9	2.8E-02				7.7E-02	1.5E+01
Nickel, soluble salts (Ni)	0.17	9.5E-05				1.7E-03	8.3E-02	0.36	1.3E-03				3.5E-03	1.8E-01
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	6.8«	3.8E-06	1.1E-07			6.7E-05		6.8«	2.4E-05	6.9E-07			6.7E-05	
Chlorobenzene (monochlorobenzene) (MCB)	84	4.7E-05				8.2E-04	4.1E-02	140«	4.9E-04				1.4E-03	6.8E-02
1,2-Dichlorobenzene (DCB2)	350	2.0E-04				3.4E-03	3.8E-02	600	2.1E-03				5.9E-03	6.5E-02
cis-1,2-Dichloroethylene	4500	2.5E-03				4.4E-02	4.4E+00	8700	3.0E-02				8.5E-02	8.5E+00
Tetrachloroethylene (PCE)	0.86«	4.8E-07	2.4E-08			8.4E-06	8.4E-04	0.86«	3.0E-06	1.5E-07			8.4E-06	8.4E-04
Trichloroethylene (TCE)	28	1.6E-05	1.7E-07			2.7E-04		42«	1.5E-04	1.6E-06			4.1E-04	
Vinyl chloride (VC)	1800	1.0E-03	1.9E-03	97		1.8E-02		3700	1.3E-02	2.5E-02	97		3.6E-02	
TOTALS		- -	2E-03			- -	1.6E+01	TOTALS	- -	3E-02			- -	2.8E+01
w/o Arsenic		- -	2E-03		- -	- -	- -	w/o Arsenic	- -	2E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
SITE: EW-PZ6	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	7	3.9E-03				6.8E-02	6.8E-02	7.96«	2.8E-02				7.8E-02	7.8E-02
Arsenic, inorganic (As)	0.025	1.4E-05	2.1E-05	3		2.4E-04	8.2E-01	0.033	1.2E-04	1.7E-04	3		3.2E-04	1.1E+00
Boron and borates only (B)	0.79	4.4E-04				7.7E-03	8.6E-02	0.83«	2.9E-03				8.1E-03	9.0E-02
Manganese (Mn)	3	1.7E-03				2.9E-02	5.9E+00	3.9«	1.4E-02				3.8E-02	7.6E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	5.1«	2.9E-06	8.3E-08			5.0E-05		5.1«	1.8E-05	5.2E-07			5.0E-05	
Dichloromethane (DCM)	6«	3.4E-06	2.5E-08			5.9E-05	9.8E-04	6«	2.1E-05	1.6E-07			5.9E-05	9.8E-04
Vinyl chloride (VC)	720	4.0E-04	7.6E-04	97		7.0E-03		860«	3.0E-03	5.7E-03	97		8.4E-03	
TOTALS		- -	8E-04			- -	6.8E+00	TOTALS	- -	6E-03			- -	8.9E+00
w/o Arsenic		- -	8E-04		- -	- -	- -	w/o Arsenic	- -	6E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
E: EW-PZ5	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units							Units						
NORGANIC	mg/L							mg/L						
rsenic, inorganic (As)	0.007«	3.9E-06	5.9E-06	4		6.8E-05	2.3E-01	0.007«	2.4E-05	3.7E-05	2		6.8E-05	2.3E-01
oron and borates only (B)	0.91	5.1E-04				8.9E-03	9.9E-02	1.08«	3.8E-03				1.1E-02	1.2E-01
ead and compounds (inorganic) (Pb)	0.002«	1.1E-06				2.0E-05		0.002«	7.0E-06				2.0E-05	
anganese (Mn)	2.3	1.3E-03				2.3E-02	4.5E+00	5.4	1.9E-02				5.3E-02	1.1E+01
	Units							Units						
RGANIC	ug/L							ug/L						
enzene (BNZ)	1.9	1.1E-06	3.1E-08			1.9E-05		2.6«	9.1E-06	2.6E-07			2.5E-05	
ichloromethane (DCM)	6.8	3.8E-06	2.9E-08			6.7E-05	1.1E-03	14«	4.9E-05	3.7E-07			1.4E-04	2.3E-03
inyl chloride (VC)	150	8.4E-05	1.6E-04	96		1.5E-03		250	8.7E-04	1.7E-03	98		2.4E-03	
TOTALS	- -		2E-04			- -	4.8E+00	TOTALS	- -	2E-03			- -	1.1E+01
w/o Arsenic	- -		2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	1.3	2.9	2.8	3.7	11	2/ 14	14.3%	√	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.39	0.65	0.44	0.21	1.7	5/ 14	35.7%	√	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.29	0.35	0.15	0.32	0.58	2/ 25	8.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.6	2.2	1	0.7	4.1	14/ 14	100.0%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.31	0.52	0.37	0.32	0.32	1/ 14	7.1%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L	0.32	0.53	0.36	0.26	0.32	2/ 14	14.3%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.8	1	0.52	1.1	2.2	4/ 24	16.7%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 24	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.62	0.73	0.27	1.1	1.1	1/ 24	4.2%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.5	0.95	0.78	3	3	1/ 14	7.1%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.9	4.4	2.5	0.59	7.5	12/ 14	85.7%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.24	0.35	0.19	0.28	0.59	2/ 14	14.3%	√	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	2.4	3.4	1.8	0.4	7.3	12/ 14	85.7%	√	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.6	12	8.4	0.34	24	13/ 14	92.9%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 14	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	0.66	1.1	0.76	1.4	2.8	3/ 14	21.4%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	1.1	1.7	1.1	0.26	4.1	12/ 14	85.7%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	1.3	2.7	2.4	0.65	8.69999999	4/ 14	28.6%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.2	1.8	0.96	0.4	3.4	11/ 14	78.6%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	13	17	7.2	1.4	25	14/ 14	100.0%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.36	0.57	0.36	0.63	0.63	1/ 14	7.1%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.5	2.4	1.5	0.21	4.6	8/ 14	57.1%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.75	1.8	1.8	0.2	7.2	3/ 14	21.4%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L	2	3.9	2.8	6.8	8	2/ 10	20.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.2	7.9	0.29	6.8	7.5	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.83	3.3	0.98	2.2	2.2	1/ 3	33.3%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.013	0.043	0.012	0.005	0.005	1/ 3	33.3%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0087	0.016	0.0031	0.006	0.013	3/ 3	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 3	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 3	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.47	0.58	0.047	0.4	0.5	3/ 3	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 3	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	59	61	0.82	58	60	3/ 3	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	200	220	4.7	200	210	3/ 3	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 3	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 3	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 3	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.5	0.5		0.5	0.5	3/ 3	100.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 3	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0098	0.027	0.0067	0.018	0.018	1/ 3	33.3%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	24	26	0.82	23	25	3/ 3	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.012	0.027	0.0062	0.02	0.02	1/ 3	33.3%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 3	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 3	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	8	8		8	8	1/ 1	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	5.3	6.5	0.47	5	6	3/ 3	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	200	220	4.7	200	210	3/ 3	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	92	110	7.1	82	98	3/ 3	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 3	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	790	860	27	750	810	3/ 3	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.09	0.29	0.08	0.06	0.2	2/ 3	66.7%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-7 Usage:												
O R G A N I C												
34. Vinyl chloride (VC)	75-01-4	µg/L						0/ 1	0.0%	--	A	2E-02	2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-6 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	3.8	5.8	3.1	0.32	13	11/ 12	91.7%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.41	0.83	0.66	0.66	0.66	1/ 12	8.3%	✓	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-7 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 1	0.0% --	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 2	0.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.94	0.94		0.94	0.94	1/ 1	100.0% ✓	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 2	0.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 2	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 2	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 1	0.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.48	0.48		0.48	0.48	1/ 1	100.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 1	0.0% --	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	18	18		18	18	1/ 1	100.0% ✓	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 1	0.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.24	0.24		0.24	0.24	1/ 1	100.0% ✓	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.3	0.3		0.3	0.3	1/ 1	100.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	46	46		46	46	1/ 1	100.0% ✓	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 1	0.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	3.8	3.8	0.00000002	3.8	3.8	1/ 1	100.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-4 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.4	2.1	0.97	0.45	3.3	8/ 12	66.7%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.58	1.2	1	0.32	3.9	2/ 12	16.7%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-5 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L	8.3	8.3	0.00000005	8.3	8.3	1/ 1	100.0% ✓	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 2	0.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	2.3	2.3		2.3	2.3	1/ 1	100.0% ✓	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 2	0.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 2	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 2	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 1	0.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 1	0.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 1	0.0% --	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	16	16		16	16	1/ 1	100.0% ✓	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 1	0.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 1	0.0% --	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 1	0.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	1.3	1.3		1.3	1.3	1/ 1	100.0% ✓	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 1	0.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 1	0.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-5 Usage:												
O R G A N I C												
34. Vinyl chloride (VC)	75-01-4	µg/L						0/ 1	0.0%	--	A	2E-02 2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-6 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 12	0.0%	--	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.53	0.97	0.68	0.3	2.5	3/ 12	25.0%	√	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 12	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 12	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 12	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 21	0.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 12	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 12	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.7	2	0.46	1.2	2.6	11/ 12	91.7%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.51	0.96	0.7	0.87	0.87	1/ 12	8.3%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 12	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.9	1.2	0.72	2.1	2.1	2/ 21	9.5%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 21	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 21	0.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.7	1.1	0.71	0.33	1.5	4/ 12	33.3%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.3	1.6	0.46	0.9	2.1	10/ 12	83.3%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.35	0.55	0.32	0.2	0.5	4/ 12	33.3%	√	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	7.1	9.19999999	3.3	2.9	15	12/ 12	100.0%	√	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	1.8	2.8	1.4	0.59	5	11/ 12	91.7%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.28	0.48	0.33	0.26	0.26	1/ 12	8.3%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.5	2.1	0.97	3	3.9	2/ 12	16.7%	√	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 12	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 12	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 12	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 12	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 12	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.68	0.86	0.29	0.41	1	8/ 12	66.7%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 12	0.0%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.4	2.2	1.3	0.4	4.6	10/ 12	83.3%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 12	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	50	65	23	24	93	12/ 12	100.0%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 12	0.0%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-3 Usage:												
O R G A N I C												
34. Vinyl chloride (VC)	75-01-4	µg/L						0/ 1	0.0%	--	A	2E-02	2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-4 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	0.39	0.56	0.27	1.2	1.2	1/ 12	8.3% √	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.28	0.43	0.24	0.3	0.86	2/ 12	16.7% √	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 12	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 12	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 12	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 21	0.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 12	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 12	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.2	1.3	0.31	0.8	1.6	11/ 12	91.7% √	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 12	0.0% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 12	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.69	0.84	0.34	1.3	1.4	2/ 21	9.5% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 21	0.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 21	0.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.46	0.73	0.42	0.79	0.98	2/ 12	16.7% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	3.7	5.5	2.8	1.1	11	12/ 12	100.0% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.24	0.35	0.17	0.2	0.35	3/ 12	25.0% √	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	4.6	5.7	1.8	2.7	7.3	11/ 12	91.7% √	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.9	12	6.6	0.6	21	12/ 12	100.0% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.24	0.34	0.16	0.21	0.28	3/ 12	25.0% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.1	1.4	0.39	2.4	2.4	1/ 12	8.3% √	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L	0.22	0.33	0.17	0.3	0.3	1/ 12	8.3% √	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 12	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 12	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 12	0.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 12	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	2.7	3.9	1.9	0.42	6.7	12/ 12	100.0% √	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 12	0.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.4	1.8	0.55	0.5	2.7	12/ 12	100.0% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 12	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	22	26	6.2	13	38	12/ 12	100.0% √	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.44	0.65	0.34	0.3	0.49	3/ 12	25.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

:er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
'E: EW-W	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	4.7	2.6E-03				4.6E-02	4.6E-02	6.4	2.2E-02				6.3E-02	6.3E-02
Arsenic, inorganic (As)	0.038	2.1E-05	3.2E-05	8		3.7E-04	1.2E+00	0.042	1.5E-04	2.2E-04	6		4.1E-04	1.4E+00
Beryllium (Be)	0.0026	1.5E-06	6.3E-06	2		2.5E-05	5.1E-03	0.003«	1.0E-05	4.5E-05	1		2.9E-05	5.9E-03
Boron and borates only (B)	0.59	3.3E-04				5.8E-03	6.4E-02	0.68	2.4E-03				6.7E-03	7.4E-02
Lead and compounds (inorganic) (Pb)	0.003	1.7E-06				2.9E-05		0.0049	1.7E-05				4.8E-05	
Manganese (Mn)	3	1.7E-03				2.9E-02	5.9E+00	3.2	1.1E-02				3.1E-02	6.3E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	1	5.6E-07	1.6E-08			9.8E-06		1.5	5.2E-06	1.5E-07			1.5E-05	
Chloroform (THM) (CLFM)	0.62«	3.5E-07	2.1E-09			6.1E-06	6.1E-04	0.62«	2.2E-06	1.3E-08			6.1E-06	6.1E-04
1,2-Dichloroethane (DCA2)	1.2	6.7E-07	6.1E-08			1.2E-05		2	7.0E-06	6.4E-07			2.0E-05	
cis-1,2-Dichloroethylene	58	3.2E-05				5.7E-04	5.7E-02	110	3.8E-04				1.1E-03	1.1E-01
Dichloromethane (DCM)	7.6	4.2E-06	3.2E-08			7.4E-05	1.2E-03	11	3.8E-05	2.9E-07			1.1E-04	1.8E-03
Di(2-ethylhexyl) Phthalate (DEHP)	87	4.9E-05	6.8E-07			8.5E-04	4.3E-02	87	3.0E-04	4.3E-06			8.5E-04	4.3E-02
1,1,2,2-Tetrachloroethane (TET)	1.3	7.3E-07	1.5E-07			1.3E-05		2.2	7.7E-06	1.5E-06			2.2E-05	
Trichloroethylene (TCE)	1.3	7.3E-07	8.0E-09			1.3E-05		1.9	6.6E-06	7.3E-08			1.9E-05	
Vinyl chloride (VC)	340	1.9E-04	3.6E-04	90		3.3E-03		490	1.7E-03	3.3E-03	92		4.8E-03	
TOTALS		- -	4E-04			- -	7.3E+00	TOTALS	- -	4E-03			- -	7.9E+00
w/o Arsenic		- -	4E-04		- -	- -	- -	w/o Arsenic	- -	3E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

4ADHS35
raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-WTM														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.042	2.3E-05	3.5E-05	100		4.1E-04	1.4E+00	0.042	1.5E-04	2.2E-04	100		4.1E-04	1.4E+00
Manganese (Mn)	3.16«	1.8E-03				3.1E-02	6.2E+00	3.16«	1.1E-02				3.1E-02	6.2E+00
TOTALS		- -	4E-05			- -	7.6E+00	TOTALS	- -	2E-04			- -	7.6E+00
w/o Arsenic		- -	0E+00		- -	- -	- -	w/o Arsenic	- -	0E+00		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: SB-3													
Units ug/L							Units ug/L						
ORGANIC													
Carbon tetrachloride (CCL4) 9.1	5.1E-06	6.6E-07	19		8.9E-05	1.3E-01	9.1	3.2E-05	4.1E-06	19		8.9E-05	1.3E-01
Chloroform (THM) (CLFM) 3	1.7E-06	1.0E-08			2.9E-05	2.9E-03	3	1.0E-05	6.4E-08			2.9E-05	2.9E-03
1,1-Dichloroethylene (DCE) 8.3	4.6E-06	2.8E-06	80		8.1E-05	9.0E-03	8.3	2.9E-05	1.7E-05	80		8.1E-05	9.0E-03
Trichloroethylene (TCE) 1.2	6.7E-07	7.4E-09			1.2E-05		1.2	4.2E-06	4.6E-08			1.2E-05	
TOTALS	- -	3E-06			- -	1.4E-01	TOTALS	- -	2E-05			- -	1.4E-01
w/o Arsenic	- -	3E-06		- -	- -	- -	w/o Arsenic	- -	2E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
SITE: SB-4	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.39	2.2E-07	6.3E-09			3.8E-06		0.56	2.0E-06	5.7E-08			5.5E-06	
Bromodichloromethane (THM) (BDCM)	0.28	1.6E-07	9.7E-09			2.7E-06	1.4E-04	0.43	1.5E-06	9.3E-08			4.2E-06	2.1E-04
Chloroform (THM) (CLFM)	1.2	6.7E-07	4.1E-09			1.2E-05	1.2E-03	1.3	4.5E-06	2.8E-08			1.3E-05	1.3E-03
1,2-Dichloroethane (DCA2)	0.24	1.3E-07	1.2E-08	1		2.3E-06		0.35	1.2E-06	1.1E-07	1		3.4E-06	
1,1-Dichloroethylene (DCE)	4.6	2.6E-06	1.5E-06	64		4.5E-05	5.0E-03	5.7	2.0E-05	1.2E-05	54		5.6E-05	6.2E-03
Dichloromethane (DCM)	1.1	6.2E-07	4.6E-09			1.1E-05	1.8E-04	1.4	4.9E-06	3.7E-08			1.4E-05	2.3E-04
1,2-Dichloropropane (DCP2)	0.22	1.2E-07	8.4E-09			2.2E-06		0.3«	1.0E-06	7.1E-08			2.9E-06	
Tetrachloroethylene (PCE)	2.7	1.5E-06	7.5E-08	3		2.6E-05	2.6E-03	3.9	1.4E-05	6.8E-07	3		3.8E-05	3.8E-03
Trichloroethylene (TCE)	22	1.2E-05	1.4E-07	6		2.2E-04		26	9.1E-05	1.0E-06	5		2.5E-04	
Vinyl chloride (VC)	0.58	3.2E-07	6.2E-07	26		5.7E-06		1.2	4.2E-06	8.0E-06	36		1.2E-05	
TOTALS		- -	2E-06			- -	9.1E-03	TOTALS	- -	2E-05			- -	1.2E-02
w/o Arsenic		- -	2E-06		- -	- -	- -	w/o Arsenic	- -	2E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: SB-5													
Units ug/L							Units ug/L						
ORGANIC													
Carbon tetrachloride (CCL4) 8.3	4.6E-06	6.0E-07	10		8.1E-05	1.2E-01	8.3	2.9E-05	3.8E-06	10		8.1E-05	1.2E-01
Chloroform (THM) (CLFM) 2.3	1.3E-06	7.8E-09			2.3E-05	2.3E-03	2.3	8.0E-06	4.9E-08			2.3E-05	2.3E-03
1,1-Dichloroethylene (DCE) 16	8.9E-06	5.4E-06	90		1.6E-04	1.7E-02	16	5.6E-05	3.4E-05	90		1.6E-04	1.7E-02
Trichloroethylene (TCE) 1.3	7.3E-07	8.0E-09			1.3E-05		1.3	4.5E-06	5.0E-08			1.3E-05	
TOTALS	- -	6E-06			- -	1.4E-01	TOTALS	- -	4E-05			- -	1.4E-01
w/o Arsenic	- -	6E-06		- -	- -	- -	w/o Arsenic	- -	4E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
SITE: SB-6	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	0.53	3.0E-07	1.8E-08	1		5.2E-06	2.6E-04	0.97	3.4E-06	2.1E-07	1		9.5E-06	4.7E-04
Chloroform (THM) (CLFM)	1.7	9.5E-07	5.8E-09			1.7E-05	1.7E-03	2	7.0E-06	4.3E-08			2.0E-05	2.0E-03
1,2-Dichloroethane (DCA2)	0.35	2.0E-07	1.8E-08	1		3.4E-06		0.5«	1.7E-06	1.6E-07	1		4.9E-06	
1,1-Dichloroethylene (DCE)	7.1	4.0E-06	2.4E-06	75		6.9E-05	7.7E-03	9.2	3.2E-05	1.9E-05	72		9.0E-05	1.0E-02
Dichloromethane (DCM)	1.5	8.4E-07	6.3E-09			1.5E-05	2.4E-04	2.1	7.3E-06	5.5E-08			2.1E-05	3.4E-04
Tetrachloroethylene (PCE)	0.68	3.8E-07	1.9E-08	1		6.7E-06	6.7E-04	0.86	3.0E-06	1.5E-07	1		8.4E-06	8.4E-04
Trichloroethylene (TCE)	50	2.8E-05	3.1E-07	10		4.9E-04		65	2.3E-04	2.5E-06	9		6.4E-04	
Vinyl chloride (VC)	0.41	2.3E-07	4.4E-07	14		4.0E-06		0.66«	2.3E-06	4.4E-06	16		6.5E-06	
TOTALS		- -	3E-06			- -	1.1E-02	TOTALS	- -	3E-05			- -	1.4E-02
w/o Arsenic		- -	3E-06		- -	- -	- -	w/o Arsenic	- -	3E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site,
Estes Landfill_Risk Assessment

Water Sample

	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
SITE: SB-7	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units ug/L							Units ug/L						
ORGANIC														
Chloroform (THM) (CLFM)	0.94	5.3E-07	3.2E-09			9.2E-06	9.2E-04	0.94	3.3E-06	2.0E-08			9.2E-06	9.2E-04
1,1-Dichloroethylene (DCE)	18	1.0E-05	6.0E-06	95		1.8E-04	2.0E-02	18	6.3E-05	3.8E-05	95		1.8E-04	2.0E-02
Tetrachloroethylene (PCE)	0.24	1.3E-07	6.7E-09			2.3E-06	2.3E-04	0.24	8.4E-07	4.2E-08			2.3E-06	2.3E-04
Trichloroethylene (TCE)	46	2.6E-05	2.8E-07	4		4.5E-04		46	1.6E-04	1.8E-06	4		4.5E-04	
TOTALS		- -	6E-06			- -	2.1E-02	TOTALS	- -	4E-05			- -	2.1E-02
w/o Arsenic		- -	6E-06		- -	- -	- -	w/o Arsenic	- -	4E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	CDI**	HZD QTNT
SITE: TW-1												
	Units mg/L						Units mg/L					
INORGANIC												
Arsenic, inorganic (As)	0.0087	4.9E-06	7.3E-06	81	8.5E-05	2.8E-01	0.013«	4.5E-05	6.8E-05	77	1.3E-04	4.2E-01
Lead and compounds (inorganic) (Pb)	0.0098	5.5E-06			9.6E-05		0.018«	6.3E-05			1.8E-04	
	Units ug/L						Units ug/L					
ORGANIC												
Benzene (BNZ)	1.3	7.3E-07	2.1E-08		1.3E-05		2.9	1.0E-05	2.9E-07		2.8E-05	
Bromodichloromethane (THM) (BDCM)	0.39	2.2E-07	1.4E-08		3.8E-06	1.9E-04	0.65	2.3E-06	1.4E-07		6.4E-06	3.2E-04
Chloroform (THM) (CLFM)	1.6	8.9E-07	5.5E-09		1.6E-05	1.6E-03	2.2	7.7E-06	4.7E-08		2.2E-05	2.2E-03
1,2-Dichloroethane (DCA2)	0.24	1.3E-07	1.2E-08		2.3E-06		0.35	1.2E-06	1.1E-07		3.4E-06	
1,1-Dichloroethylene (DCE)	2.4	1.3E-06	8.1E-07	9	2.3E-05	2.6E-03	3.4	1.2E-05	7.1E-06	8	3.3E-05	3.7E-03
Tetrachloroethylene (PCE)	1.1	6.2E-07	3.1E-08		1.1E-05	1.1E-03	1.7	5.9E-06	3.0E-07		1.7E-05	1.7E-03
Trichloroethylene (TCE)	13	7.3E-06	8.0E-08	1	1.3E-04		17	5.9E-05	6.5E-07	1	1.7E-04	
Vinyl chloride (VC)	0.75	4.2E-07	8.0E-07	9	7.3E-06		1.8	6.3E-06	1.2E-05	13	1.8E-05	
TOTALS		- -	9E-06		- -	2.9E-01	TOTALS	- -	9E-05		- -	4.3E-01
w/o Arsenic		- -	2E-06		- -	- -	w/o Arsenic	- -	2E-05		- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
E: TW-2	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
NORGANIC														
rsenic, inorganic (As)	0.006	3.4E-06	5.0E-06	37		5.9E-05	2.0E-01	0.006	2.1E-05	3.1E-05	37		5.9E-05	2.0E-01
anganese (Mn)	0.18	1.0E-04				1.8E-03	3.5E-01	0.18	6.3E-04				1.8E-03	3.5E-01
	Units ug/L							Units ug/L						
RGANIC														
hloroform (THM) (CLFM)	0.49	2.7E-07	1.7E-09			4.8E-06	4.8E-04	0.49	1.7E-06	1.0E-08			4.8E-06	4.8E-04
,2-Dichloroethane (DCA2)	1.5	8.4E-07	7.6E-08	1		1.5E-05		1.5	5.2E-06	4.8E-07	1		1.5E-05	
,1-Dichloroethylene (DCE)	7.1	4.0E-06	2.4E-06	17		6.9E-05	7.7E-03	7.1	2.5E-05	1.5E-05	17		6.9E-05	7.7E-03
etrachloroethylene (PCE)	0.48	2.7E-07	1.3E-08			4.7E-06	4.7E-04	0.48	1.7E-06	8.4E-08			4.7E-06	4.7E-04
richloroethylene (TCE)	11	6.2E-06	6.8E-08			1.1E-04		11	3.8E-05	4.2E-07			1.1E-04	
inyl chloride (VC)	5.8	3.2E-06	6.2E-06	45		5.7E-05		5.8	2.0E-05	3.9E-05	45		5.7E-05	
TOTALS		- -	1E-05			- -	5.6E-01	TOTALS	- -	9E-05			- -	5.6E-01
w/o Arsenic		- -	9E-06		- -	- -	- -	w/o Arsenic	- -	5E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

ADHS35

aft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
SITE: TW-3	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0079	4.4E-06	6.6E-06	52		7.7E-05	2.6E-01	0.008«	2.8E-05	4.2E-05	39		7.8E-05	2.6E-01
Boron and borates only (B)	0.6	3.4E-04				5.9E-03	6.5E-02	0.7«	2.4E-03				6.8E-03	7.6E-02
Lead and compounds (inorganic) (Pb)	0.006«	3.4E-06				5.9E-05		0.006«	2.1E-05				5.9E-05	
Manganese (Mn)	1.5	8.4E-04				1.5E-02	2.9E+00	1.7«	5.9E-03				1.7E-02	3.3E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.54	3.0E-07	8.8E-09			5.3E-06		0.88	3.1E-06	8.9E-08			8.6E-06	
Bromodichloromethane (THM) (BDCM)	0.27	1.5E-07	9.4E-09			2.6E-06	1.3E-04	0.46	1.6E-06	1.0E-07			4.5E-06	2.3E-04
Chloroform (THM) (CLFM)	0.4	2.2E-07	1.4E-09			3.9E-06	3.9E-04	0.63	2.2E-06	1.3E-08			6.2E-06	6.2E-04
1,2-Dichloroethane (DCA2)	0.23	1.3E-07	1.2E-08			2.3E-06		0.32	1.1E-06	1.0E-07			3.1E-06	
Dichloromethane (DCM)	1.1	6.2E-07	4.6E-09			1.1E-05	1.8E-04	1.3	4.5E-06	3.4E-08			1.3E-05	2.1E-04
Tetrachloroethylene (PCE)	0.29	1.6E-07	8.1E-09			2.8E-06	2.8E-04	0.39	1.4E-06	6.8E-08			3.8E-06	3.8E-04
Trichloroethylene (TCE)	1.7	9.5E-07	1.0E-08			1.7E-05		3.4	1.2E-05	1.3E-07			3.3E-05	
Vinyl chloride (VC)	5.7	3.2E-06	6.1E-06	48		5.6E-05		10	3.5E-05	6.6E-05	61		9.8E-05	
TOTALS	- -		1E-05			- -	3.3E+00	TOTALS	- -	1E-04			- -	3.7E+00
w/o Arsenic	- -		6E-06		- -	- -	- -	w/o Arsenic	- -	7E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ıter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TE: TW-4														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0076	4.2E-06	6.4E-06	57		7.4E-05	2.5E-01	0.008«	2.8E-05	4.2E-05	43		7.8E-05	2.6E-01
Lead and compounds (inorganic) (Pb)	0.0045	2.5E-06				4.4E-05		0.005«	1.7E-05				4.9E-05	
Manganese (Mn)	0.3	1.7E-04				2.9E-03	5.9E-01	0.95	3.3E-03				9.3E-03	1.9E+00
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	0.25	1.4E-07	8.7E-09			2.4E-06	1.2E-04	0.42	1.5E-06	9.1E-08			4.1E-06	2.1E-04
Chloroform (THM) (CLFM)	0.66	3.7E-07	2.3E-09			6.5E-06	6.5E-04	1.5	5.2E-06	3.2E-08			1.5E-05	1.5E-03
Tetrachloroethylene (PCE)	0.19	1.1E-07	5.3E-09			1.9E-06	1.9E-04	0.28	9.8E-07	4.9E-08			2.7E-06	2.7E-04
Trichloroethylene (TCE)	0.34	1.9E-07	2.1E-09			3.3E-06		0.67	2.3E-06	2.6E-08			6.6E-06	
Vinyl chloride (VC)	4.6	2.6E-06	4.9E-06	43		4.5E-05		8.4	2.9E-05	5.6E-05	57		8.2E-05	
TOTALS		- -	1E-05			- -	8.4E-01	TOTALS	- -	1E-04			- -	2.1E+00
w/o Arsenic		- -	5E-06		- -	- -	- -	w/o Arsenic	- -	6E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: TW-P														
	Units mg/L							Units mg/L						
INORGANIC														
Antimony (Sb)	0.042	2.3E-05				4.1E-04	1.0E+00	0.05«	1.7E-04				4.9E-04	1.2E+00
Arsenic, inorganic (As)	0.0064	3.6E-06	5.4E-06	57		6.3E-05	2.1E-01	0.0074	2.6E-05	3.9E-05	51		7.2E-05	2.4E-01
Lead and compounds (inorganic) (Pb)	0.0049	2.7E-06				4.8E-05		0.0068	2.4E-05				6.7E-05	
Manganese (Mn)	0.034	1.9E-05				3.3E-04	6.7E-02	0.046	1.6E-04				4.5E-04	9.0E-02
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	0.5«	2.8E-07	1.7E-08			4.9E-06	2.4E-04	0.5«	1.7E-06	1.1E-07			4.9E-06	2.4E-04
Chloroform (THM) (CLFM)	0.66	3.7E-07	2.3E-09			6.5E-06	6.5E-04	1.1	3.8E-06	2.3E-08			1.1E-05	1.1E-03
Tetrachloroethylene (PCE)	0.69	3.9E-07	1.9E-08			6.8E-06	6.8E-04	1.1	3.8E-06	1.9E-07			1.1E-05	1.1E-03
Trichloroethylene (TCE)	3.8	2.1E-06	2.3E-08			3.7E-05		4.9	1.7E-05	1.9E-07			4.8E-05	
Vinyl chloride (VC)	3.8	2.1E-06	4.0E-06	43		3.7E-05		5.5	1.9E-05	3.7E-05	48		5.4E-05	
TOTALS		- -	9E-06			- -	1.3E+00	TOTALS	- -	8E-05			- -	1.6E+00
w/o Arsenic		- -	4E-06		- -	- -	- -	w/o Arsenic	- -	4E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95

MEAN - Arithmatic average of samples including Sample Quantitation Limits (SQLs)

CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - CARCINOGENIC EXPOSURE x slope factor(chemical specific)

CARCINOGENIC HAZARD INDEX - (CARCINOGENIC EXPOSURE) + (reference dose(Rfd) + safety factor(10))

NON-CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(4 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - NON-CARCINOGENIC EXPOSURE + reference dose(Rfd)

RME - Reasonable Maximum Exposure using 95% upper confidence limit (UCL) of mean concentration

CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - same as above

CARCINGOENIC HAZARD INDEX - same as above

NON-CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(25 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - same as above

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks,
and non-cancer hazards for all groundwater sampling sites,
Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	1.3	7.3E-04				1.3E-02	1.3E-02	1.5	5.2E-03				1.5E-02	1.5E-02
Antimony (Sb)	0.022	1.2E-05				2.2E-04	5.4E-01	0.024	8.4E-05				2.3E-04	5.9E-01
Arsenic, inorganic (As)	0.015	8.4E-06	1.3E-05	5		1.5E-04	4.9E-01	0.017	5.9E-05	8.9E-05	4		1.7E-04	5.5E-01
Barium (Ba)	0.24	1.3E-04				2.3E-03	3.4E-02	0.28	9.8E-04				2.7E-03	3.9E-02
Beryllium (Be)	0.0024	1.3E-06	5.8E-06	2		2.3E-05	4.7E-03	0.0026	9.1E-06	3.9E-05	2		2.5E-05	5.1E-03
Boron and borates only (B)	0.39	2.2E-04				3.8E-03	4.2E-02	0.41	1.4E-03				4.0E-03	4.5E-02
Cadmium (Cd)	0.0026	1.5E-06				2.5E-05	5.1E-02	0.0028	9.8E-06				2.7E-05	5.5E-02
Copper (Cu)	0.024	1.3E-05				2.3E-04	6.3E-03	0.051	1.8E-04				5.0E-04	1.3E-02
Lead and compounds (inorganic) (Pb)	0.0044	2.5E-06				4.3E-05		0.0052	1.8E-05				5.1E-05	
Manganese (Mn)	1.2	6.7E-04				1.2E-02	2.3E+00	1.4	4.9E-03				1.4E-02	2.7E+00
Mercury (inorganic) (Hg)	0.00011	6.2E-08				1.1E-06	3.6E-03	0.00012	4.2E-07				1.2E-06	3.9E-03
Nickel, soluble salts (Ni)	0.024	1.3E-05				2.3E-04	1.2E-02	0.027	9.4E-05				2.6E-04	1.3E-02
Nitrate/Nitrite (total)	1.8	1.0E-03				1.8E-02		2.3	8.0E-03				2.3E-02	
Zinc and compounds (Zn)	0.11	6.2E-05				1.1E-03	3.6E-03	0.15	5.2E-04				1.5E-03	4.9E-03
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	2.3	1.3E-06	3.7E-08			2.3E-05		3.4	1.2E-05	3.4E-07			3.3E-05	
Bromodichloromethane (THM) (BDCM)	1.1	6.2E-07	3.8E-08			1.1E-05	5.4E-04	1.6	5.6E-06	3.5E-07			1.6E-05	7.8E-04
Carbon tetrachloride (CCL4)	1.1	6.2E-07	8.0E-08			1.1E-05	1.5E-02	1.6	5.6E-06	7.3E-07			1.6E-05	2.2E-02
Chlorobenzene (monochlorobenzene) (MCB)	10	5.6E-06				9.8E-05	4.9E-03	12	4.2E-05				1.2E-04	5.9E-03
Chloroform (THM) (CLFM)	1.4	7.8E-07	4.8E-09			1.4E-05	1.4E-03	1.9	6.6E-06	4.1E-08			1.9E-05	1.9E-03
Chloromethane (CM)	2.1	1.2E-06	1.5E-08			2.1E-05	5.1E-03	2.7	9.4E-06	1.2E-07			2.6E-05	6.6E-03
1,2-Dichlorobenzene (DCB2)	30	1.7E-05				2.9E-04	3.3E-03	40	1.4E-04				3.9E-04	4.3E-03
1,3-Dichlorobenzene (DCB3)	6.7	3.7E-06				6.6E-05	7.4E-04	12	4.2E-05				1.2E-04	1.3E-03
1,4-Dichlorobenzene (DCB4)	7.5	4.2E-06	1.0E-07			7.3E-05	7.3E-04	13	4.5E-05	1.1E-06			1.3E-04	1.3E-03
1,2-Dichloroethane (DCA2)	1.2	6.7E-07	6.1E-08			1.2E-05		1.6	5.6E-06	5.1E-07			1.6E-05	
1,1-Dichloroethylene (DCE)	2.1	1.2E-06	7.0E-07			2.1E-05	2.3E-03	2.6	9.1E-06	5.5E-06			2.5E-05	2.8E-03
1,2-Dichloroethylene (TOTAL)	27	1.5E-05				2.6E-04		41	1.4E-04				4.0E-04	
cis-1,2-Dichloroethylene	200	1.1E-04				2.0E-03	2.0E-01	290	1.0E-03				2.8E-03	2.8E-01
Dichloromethane (DCM)	8.1	4.5E-06	3.4E-08			7.9E-05	1.3E-03	12	4.2E-05	3.1E-07			1.2E-04	2.0E-03
1,2-Dichloropropane (DCP2)	0.4«	2.2E-07	1.5E-08			3.9E-06		0.4«	1.4E-06	9.5E-08			3.9E-06	
cis-1,3-Dichloropropene (cDCP3)	0.5«	2.8E-07				4.9E-06		0.5«	1.7E-06				4.9E-06	

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks,
and non-cancer hazards for all groundwater sampling sites,
Estes Landfill Risk Assessment

er Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
i(2-ethylhexyl) Phthalate (DEHP)	19	1.1E-05	1.5E-07			1.9E-04	9.3E-03	31	1.1E-04	1.5E-06			3.0E-04	1.5E-02
,1,2,2-Tetrachloroethane (TET)	1.1	6.2E-07	1.2E-07			1.1E-05		1.5	5.2E-06	1.0E-06			1.5E-05	
etrachloroethylene (PCE)	1.3	7.3E-07	3.6E-08			1.3E-05	1.3E-03	1.7	5.9E-06	3.0E-07			1.7E-05	1.7E-03
richloroethylene (TCE)	7.8	4.4E-06	4.8E-08			7.6E-05		9.1	3.2E-05	3.5E-07			8.9E-05	
inyl chloride (VC)	220	1.2E-04	2.3E-04	92		2.2E-03		290	1.0E-03	1.9E-03	93		2.8E-03	
TOTALS		- -	3E-04			- -	3.8E+00	TOTALS	- -	2E-03			- -	4.4E+00
w/o Arsenic		- -	2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
ADHS35
aft 8/95

MEAN - Arithmatic average of samples including Sample Quantitation Limits (SQLs)

$$\text{CARCINOGENIC CDI} = \frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$$

CARCINOGENIC RISK - CARCINOGENIC EXPOSURE X slope factor(chemical specific)

CARCINOGENIC HAZARD INDEX - (CARCINOGENIC EXPOSURE) ÷ (reference dose(Rfd) + safety factor(10))

$$\text{NON-CARCINOGENIC CDI} = \frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(4 yrs x 365 d/yr))}}$$

NON-CARCINOGENIC HAZARD QUOTIENT - NON-CARCINOGENIC EXPOSURE ÷ reference dose(Rfd)

RME - Reasonable Maximum Exposure using 95% upper confidence limit (UCL) of mean concentration

$$\text{CARCINOGENIC CDI} = \frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$$

CARCINOGENIC RISK - same as above

CARCINGOENIC HAZARD INDEX - same as above

$$\text{NON-CARCINOGENIC CDI} = \frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(25 yrs x 365 d/yr))}}$$

NON-CARCINOGENIC HAZARD QUOTIENT - same as above

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks, and non-cancer hazards for all groundwater sampling sites, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	1.3	7.3E-04				1.3E-02	1.3E-02	1.5	5.2E-03				1.5E-02	1.5E-02
Antimony (Sb)	0.022	1.2E-05				2.2E-04	5.4E-01	0.024	8.4E-05				2.3E-04	5.9E-01
Arsenic, inorganic (As)	0.015	8.4E-06	1.3E-05	5		1.5E-04	4.9E-01	0.017	5.9E-05	8.9E-05	4		1.7E-04	5.5E-01
Barium (Ba)	0.24	1.3E-04				2.3E-03	3.4E-02	0.28	9.8E-04				2.7E-03	3.9E-02
Beryllium (Be)	0.0024	1.3E-06	5.8E-06	2		2.3E-05	4.7E-03	0.0026	9.1E-06	3.9E-05	2		2.5E-05	5.1E-03
Boron and borates only (B)	0.39	2.2E-04				3.8E-03	4.2E-02	0.41	1.4E-03				4.0E-03	4.5E-02
Cadmium (Cd)	0.0026	1.5E-06				2.5E-05	5.1E-02	0.0028	9.8E-06				2.7E-05	5.5E-02
Copper (Cu)	0.024	1.3E-05				2.3E-04	6.3E-03	0.051	1.8E-04				5.0E-04	1.3E-02
Lead and compounds (inorganic) (Pb)	0.0044	2.5E-06				4.3E-05		0.0052	1.8E-05				5.1E-05	
Manganese (Mn)	1.2	6.7E-04				1.2E-02	2.3E+00	1.4	4.9E-03				1.4E-02	2.7E+00
Mercury (inorganic) (Hg)	0.00011	6.2E-08				1.1E-06	3.6E-03	0.00012	4.2E-07				1.2E-06	3.9E-03
Nickel, soluble salts (Ni)	0.024	1.3E-05				2.3E-04	1.2E-02	0.027	9.4E-05				2.6E-04	1.3E-02
Nitrate/Nitrite (total)	1.8	1.0E-03				1.8E-02		2.3	8.0E-03				2.3E-02	
Zinc and compounds (Zn)	0.11	6.2E-05				1.1E-03	3.6E-03	0.15	5.2E-04				1.5E-03	4.9E-03
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	2.3	1.3E-06	3.7E-08			2.3E-05		3.4	1.2E-05	3.4E-07			3.3E-05	
Bromodichloromethane (THM) (BDCM)	1.1	6.2E-07	3.8E-08			1.1E-05	5.4E-04	1.6	5.6E-06	3.5E-07			1.6E-05	7.8E-04
Carbon tetrachloride (CCL4)	1.1	6.2E-07	8.0E-08			1.1E-05	1.5E-02	1.6	5.6E-06	7.3E-07			1.6E-05	2.2E-02
Chlorobenzene (monochlorobenzene) (MCB)	10	5.6E-06				9.8E-05	4.9E-03	12	4.2E-05				1.2E-04	5.9E-03
Chloroform (THM) (CLFM)	1.4	7.8E-07	4.8E-09			1.4E-05	1.4E-03	1.9	6.6E-06	4.1E-08			1.9E-05	1.9E-03
Chloromethane (CM)	2.1	1.2E-06	1.5E-08			2.1E-05	5.1E-03	2.7	9.4E-06	1.2E-07			2.6E-05	6.6E-03
1,2-Dichlorobenzene (DCB2)	30	1.7E-05				2.9E-04	3.3E-03	40	1.4E-04				3.9E-04	4.3E-03
1,3-Dichlorobenzene (DCB3)	6.7	3.7E-06				6.6E-05	7.4E-04	12	4.2E-05				1.2E-04	1.3E-03
1,4-Dichlorobenzene (DCB4)	7.5	4.2E-06	1.0E-07			7.3E-05	7.3E-04	13	4.5E-05	1.1E-06			1.3E-04	1.3E-03
1,2-Dichloroethane (DCA2)	1.2	6.7E-07	6.1E-08			1.2E-05		1.6	5.6E-06	5.1E-07			1.6E-05	
1,1-Dichloroethylene (DCE)	2.1	1.2E-06	7.0E-07			2.1E-05	2.3E-03	2.6	9.1E-06	5.5E-06			2.5E-05	2.8E-03
1,2-Dichloroethylene (TOTAL)	27	1.5E-05				2.6E-04		41	1.4E-04				4.0E-04	
cis-1,2-Dichloroethylene	200	1.1E-04				2.0E-03	2.0E-01	290	1.0E-03				2.8E-03	2.8E-01
Dichloromethane (DCM)	8.1	4.5E-06	3.4E-08			7.9E-05	1.3E-03	12	4.2E-05	3.1E-07			1.2E-04	2.0E-03
1,2-Dichloropropane (DCP2)	0.4«	2.2E-07	1.5E-08			3.9E-06		0.4«	1.4E-06	9.5E-08			3.9E-06	
cis-1,3-Dichloropropene (cDCP3)	0.5«	2.8E-07				4.9E-06		0.5«	1.7E-06				4.9E-06	

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks, and non-cancer hazards for all groundwater sampling sites, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
Di(2-ethylhexyl) Phthalate (DEHP)	19	1.1E-05	1.5E-07			1.9E-04	9.3E-03	31	1.1E-04	1.5E-06			3.0E-04	1.5E-02
1,1,2,2-Tetrachloroethane (TET)	1.1	6.2E-07	1.2E-07			1.1E-05		1.5	5.2E-06	1.0E-06			1.5E-05	
Tetrachloroethylene (PCE)	1.3	7.3E-07	3.6E-08			1.3E-05	1.3E-03	1.7	5.9E-06	3.0E-07			1.7E-05	1.7E-03
Trichloroethylene (TCE)	7.8	4.4E-06	4.8E-08			7.6E-05		9.1	3.2E-05	3.5E-07			8.9E-05	
Vinyl chloride (VC)	220	1.2E-04	2.3E-04	92		2.2E-03		290	1.0E-03	1.9E-03	93		2.8E-03	
TOTALS	- -		3E-04			- -	3.8E+00	TOTALS	- -	2E-03			- -	4.4E+00
w/o Arsenic	- -		2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL.

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

** Units equal mg/kg-day

94ADHS35
Draft 8/95

MEAN - Arithmatic average of samples including Sample Quantitation Limits (SQLs)

$$\text{CARCINOGENIC CDI} = \frac{(\text{MEAN Concentration (mg/L)} \times \text{ingestion rate(1 L/d)} \times \text{frequency(250 d/yr)} \times \text{duration(4 yrs)})}{(\text{body weight(70 kg)} \times \text{averaging time(70 yrs x 365 d/yr)})}$$

$$\text{CARCINOGENIC RISK} = \text{CARCINOGENIC EXPOSURE} \times \text{slope factor(chemical specific)}$$

$$\text{CARCINOGENIC HAZARD INDEX} = (\text{CARCINOGENIC EXPOSURE}) \div (\text{reference dose(Rfd)} \div \text{safety factor(10)})$$

$$\text{NON-CARCINOGENIC CDI} = \frac{(\text{MEAN Concentration (mg/L)} \times \text{ingestion rate(1 L/d)} \times \text{frequency(250 d/yr)} \times \text{duration(4 yrs)})}{(\text{body weight(70 kg)} \times \text{averaging time(4 yrs x 365 d/yr)})}$$

$$\text{NON-CARCINOGENIC HAZARD QUOTIENT} = \text{NON-CARCINOGENIC EXPOSURE} \div \text{reference dose(Rfd)}$$

RME - Reasonable Maximum Exposure using 95% upper confidence limit (UCL) of mean concentration

$$\text{CARCINOGENIC CDI} = \frac{(\text{RME Concentration (mg/L)} \times \text{ingestion rate(1 L/d)} \times \text{frequency(250 d/yr)} \times \text{duration(25 yrs)})}{(\text{body weight(70 kg)} \times \text{averaging time(70 yrs x 365 d/yr)})}$$

CARCINOGENIC RISK - same as above

CARCINGOENIC HAZARD INDEX - same as above

$$\text{NON-CARCINOGENIC CDI} = \frac{(\text{RME Concentration (mg/L)} \times \text{ingestion rate(1 L/d)} \times \text{frequency(250 d/yr)} \times \text{duration(25 yrs)})}{(\text{body weight(70 kg)} \times \text{averaging time(25 yrs x 365 d/yr)})}$$

NON-CARCINOGENIC HAZARD QUOTIENT - same as above

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table D.- Worksheet for Calculating Risk and Hazard from Inhalation of Fugitive Dust, Estes Landfill Risk Assessment

	A	B	C	D	E	F	G	H	J	K	M																
	8/30/94	8/30/94	8/30/94	8/30/94	8/31/94	8/31/94	8/30/94	8/31/94	8/31/94	8/31/94	8/30/94	Mean	n	Std Dev	95% UC	EF	ED	IR	PEF	1/PEF	BW	ATc	ATnc	SF	RfD	ELCR	HQ
Silver	0.14	0.08	0.04	0.04	0.05	0.03	0.015	0.015	0.15	0.015	0.05	0.06	3.32	0.05	0.09	250	25	20	1.4E+10	7.4E-11	70	25550	10950		5E-03		2E-10
Arsenic	3.3	3.7	2.9	2.8	4.2	4.3	2.6	3.3	3.6	2.9	2.8	3.30	3.32	0.58	3.69	250	25	20	1.4E+10	7.4E-11	70	25550	10950	1.8	3E-04	3E-11	1E-07
Barium	106	95.1	58.5	56.6	69.5	59	51.9	47.5	69.6	61.9	126	71.96	3.32	24.39	88.35	250	25	20	1.4E+10	7.4E-11	70	25550	10950		7E-02		2E-08
Beryllium	0.35	0.37	0.38	0.26	0.37	0.35	0.26	0.27	0.15	0.25	0.32	0.28	3.32	0.07	0.34	250	25	20	1.4E+10	7.4E-11	70	25550	10950	4.3	5E-03	9E-12	9E-10
Cadmium	0.8	0.32	0.19	0.17	0.1	0.1	0.08	0.17	0.42	0.08	0.08	0.22	3.32	0.22	0.37	250	25	20	1.4E+10	7.4E-11	70	25550	10950	6.3	5E-04	1E-11	9E-09
Chromium	7.1	5.3	3.7	7.8	8.7	5.7	2.6	7.4	5.1	4.3	3.4	5.85	3.32	2.16	7.10	250	25	20	1.4E+10	7.4E-11	70	25550	10950		1E+00		9E-11
Copper	258	25	16.1	15	15.4	19.4	11.3	12	20.2	9.5	181	52.89	3.32	84.22	109.57	250	25	20	1.4E+10	7.4E-11	70	25550	10950		4E-02		4E-08
Manganese	269	255	197	16.4	218	184	154	169	200	162	217	184.86	3.32	66.18	229.31	250	25	20	1.4E+10	7.4E-11	70	25550	10950		5E-03		6E-07
Nickel	18.1	16.4	13.5	12.2	16.8	13.6	11	11.3	14.3	15.4	8.1	13.68	3.32	2.92	15.84	250	25	20	1.4E+10	7.4E-11	70	25550	10950		2E-02		9E-09
Lead	109	84	17	11.6	17	18	8.2	10	50	5.3	7.9	30.73	3.32	35.14	64.33	250	25	20	1.4E+10	7.4E-11	70	25550	10950				
Beta-BHC	0.125	0.0125	0.0025	0.012	0.0025	0.038	0.0025	0.0025	0.023	0.0025	0.0025	0.02	3.32	0.04	0.05	250	25	20	1.4E+10	7.4E-11	70	25550	10950				
4,4'-DDD	0.25	0.025	0.005	0.025	0.005	0.05	0.005	0.005	0.06	0.005	0.005	0.04	3.32	0.07	0.09	250	25	20	1.4E+10	7.4E-11	70	25550	10950	1.3	3E-04	3E-13	2E-09
4,4'-DDE	0.7	0.44	0.02	0.18	0.02	0.07	0.005	0.07	0.13	0.005	0.005	0.15	3.32	0.22	0.30	250	25	20	1.4E+10	7.4E-11	70	25550	10950	0.24		1E-13	
4,4'-DDT	0.8	0.13	0.01	0.07	0.02	0.03	0.005	0.04	0.1	0.005	0.01	0.09	3.32	0.17	0.21	250	25	20	1.4E+10	7.4E-11	70	25550	10950	0.34		5E-13	
Aroclor12	0.75	0.075	0.015	0.075	0.015	0.08	0.015	0.08	0.075	0.015	0.015	0.11	3.32	0.21	0.25	250	25	20	1.4E+10	7.4E-11	70	25550	10950	0.34	6E-04	4E-13	5E-09
Bis	0.085	0.085	0.085	0.085	0.085	0.085	0.27	0.085	0.085	0.085	0.085	0.10	3.32	0.06	0.14	250	25	20	1.4E+10	7.4E-11	70	25550	10950	7.7		1E-11	
																								0.014	2E-02	1E-14	9E-11
																										7E-11	9E-07

endix Table E Worksheet for Calculating Soil Gas Risk Central Tendency Exposure

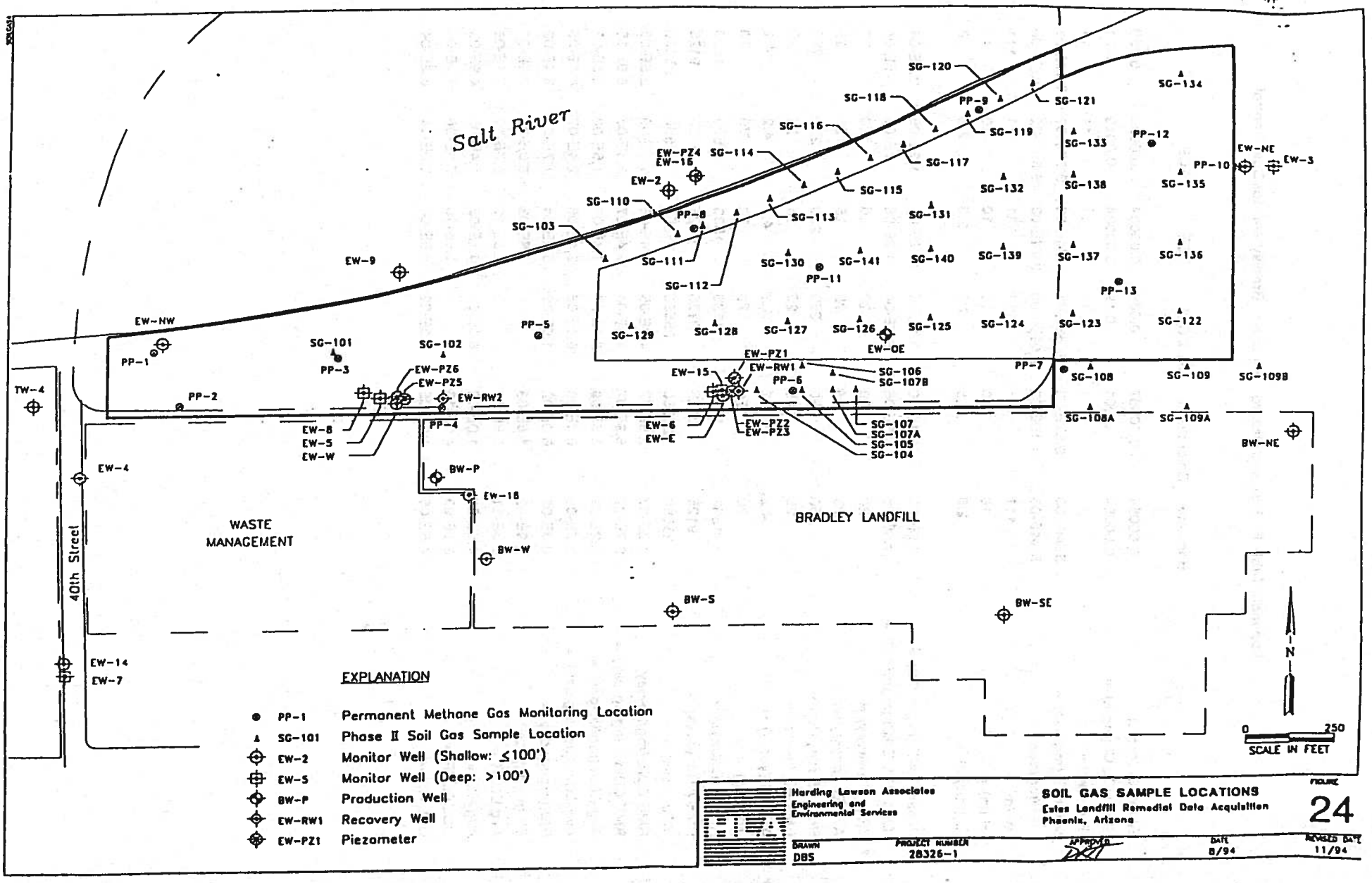
	CH2CL2 UG/L	FREON 11 UG/L	1,1 DCE UG/L	1,1 DCA UG/L	1,2 DCE UG/L	CHCL3 UG/L	FREON 11	1,2 DCA UG/L	TCA UG/L	CCL4 UG/L	TCE UG/L	PCE UG/L	BENZENE UG/L	TOLUENE UG/L	CHLORO BENZENE UG/L	ETHYL BENZENE UG/L	TOTAL XYLENES UG/L		1,3/1,4 DCB UG/L	1,2 DCB UG/L	VINYL CHLORIDE UG/L	METHANE UG/L
101	0 01	0 001	0 005	0 05	0 05	0 00025	0 001	0 001	0 0001	3 5E-05	0 001	0 0008	14	9	0 15	20	90		10	0 4	0 01	61000
102	0 01	0 0006	0 005	0 05	0 05	0 00025	0 00025	0 001	0 0001	3 5E-05	0 009	0 004	2	2	0 15	1	14		0 5	0 4	0 01	120000
103	0 5	0 001	0 1	0 05	2	0 00025	0 00025	0 001	0 0001	3 5E-05	0 2	0 002	0 05	0 2	0 15	0 5	0 05		0 5	0 4	2	500
104	0 01	0 0004	0 01	0 5	0 2	0 00025	0 00025	0 001	0 0001	3 5E 05	0 009	0 002	3	0 9	0 15	5	3		0 5	0 4	0 5	42000
105	0 01	0 1	0 005	0 5	0 1	0 00025	0 3	0 001	0 0001	3 5E 05	0 04	0 02	16	1	2	22	10		0 5	0 4	0 3	44000
106	0 01	0 003	0 005	30	0 1	0 00025	0 00025	0 001	0 05	3 5E-05	0 02	0 09	0 5	2	0 15	1	41			0 4	2	500
107	0 025	0 3	0 01	0 4	2	0 0005	0 04	0 005	0 02	0 0001	0 9	0 3	2	2	0 4	3	5		1 5	1	0 6	26000
107A	0 005	0 006	0 1	0 2	0 25	0 1	0 001	0 005	0 0015	0 0002	0 9	0 01	0 05	0 8	0 5	1	16		0 15	0 1	0 6	49000
107B	0 05	0 05	0 05	0 3	0 1	0 05	0 05	0 05	0 05	0 05	0 2	0 1	2	1	0 05	0 05	2		0 05	0 05	0 05	
108	0 025	0 002	0 01	0 15	0 15	0 0005	0 0005	0 05	0 00025	0 0001	0 0005	0 002	0 4	0 5	0 15	2	2		0 5	1	0 01	32000
108A	0 1	0 00015	0 03	0 25	0 2	0 001	0 01	1	0 01	0 002	0 02	0 002	1 5	0 3	1 5	0 1	3			0 1	1	26000
109	0 025	0 002	0 01	0 15	0 15	0 0005	0 0005	0 05	0 00025	0 0001	0 0005	0 001	0 35	0 5	2 5	0 5	1		10	12 5	0 01	1300
108A	0 1	0 00015	0 03	1	1	0 0035	0 003	0 03	0 002	0 0005	0 01	0 03	0 05	0 2	0 15	0 25	11		0 3	3 5	0 3	22000
108B	0 035	0 003	0 01	0 4	0 3	0 0015	0 001	0 1	0 001	0 0002	0 0003	0 02	0 05	0 1	0 15	0 1	0 1		0 15	0 1	0 01	1300
110	0 01	0 0005	0 005	0 05	0 05	0 00025	0 00025	0 02	0 0001	3 5E-05	0 01	0 0003	0 02	0 04	0 15	0 035	5		0 5	1	0 06	43000
111	0 005	0 00025	0 01	0 4	0 3	0 0015	0 001	0 1	0 001	0 0002	0 007	0 009	0 05	0 1	0 15	0 1	0 1		0 5	0 1	0 01	1300
112	0 15	0 00025	0 05	0 4	0 3	0 0015	0 001	0 1	0 001	0 0002	0 07	0 0015	0 05	0 1	0 15	2	0 1		0	0 1		
113	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 1	0 006	1	0 1	1 5	0 1	6		0 15	0 1	0 4	46000
114	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 02	0 003	0 8	0 1	1 5	0 1	12		0 15	0 1	0 2	46000
115	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 07	0 004							0 15	0 1	0 01	47000
116	0 005	0 0003	0 05	0 1	0 25	0 00015	0 001	0 03	0 0015	0 0002	0 1	0 0003	0 05	0 1	0 15	0 1	1		0 15	0 1	0 01	1300
117	0 3	0 0005	0 1	0 1	0 5	0 0003	0 002	0 05	0 0025	0 0005	0 5	0 0015	0 05	0 4	0 15	2	0 9		0 15	0 3	0 01	120000
118	0 3	0 0002	0 05	0 05	0 1	5E-05	0 0005	0 015	0 0005	0 0001	0 6	0 009	0 05		0 15	2	0 9		3	0 4	0 01	47000
119	0 005	0 0003	0 1	0 1	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 05	0 0005	0 05	0 1	0 15	0 1	0 1		0 15	0 1	0 01	1300
120	0 005	0 0003	0 1	0 1	0 25	0 00015	0 001	0 035	0 0015	0 0002	5	0 03	0 05	0 1	0 15	2	2		3	0 2	0 01	20000
121	0 005	0 001	0 1	0 1	0 25	0 00015	0 004	0 035	0 0015	0 0003	0 05	0 0003	0 05	0 1	0 15	0 1	0 1		0 15	0 1	0 01	1300
122	0 2	0 0003	0 05	0 05	0 1	5E-05	0 0005	0 015	0 0005	0 0001	0 4	0 001	0 05	0 1	0 15	0 1	0 1		0 15	0 1	0 07	84000
123	0 005	0 0003	0 1	0 1	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 05	0 0003	4	0 1	0 15	0 1	20		0 15	0 1	0 2	88000
124	0 1	0 002	0 05	0 05	0 25	0 00015	0 001	0 07	0 04	0 0002	0 02	0 01	0 025	0 4	1	0 5	0 5		0 5	0 5	0 04	50000
125	0 2	0 0008	0 025	0 05	0 1	5E-05	0 0005	0 015	0 0005	0 0001	0 02	0 002	4	0 1	14	0 1	0 1		34	48	0 1	32000
126	0 2	0 0003	0 05	0 05	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 02	0 004	8	0 1	11	0 1	2		0 15	14	0 2	65000
127	0 4	0 0003	0 05	0 05	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 02	0 003	8	0 1	21	0 1	14		72	0 1	0 04	57000
128	0 005	0 0003	0 05	0 05	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 00015	0 0005	0 05	0 1	0 15	0 1	0 1		0 15	0 1	0 01	1300
129	0 2	0 0003	0 05	0 05	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 02	0 01	3	0 1	2	1	3		20	17	0 2	73000
130	0 2	0 0003	0 05	0 05	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 0015	0 0005	13	0 1	20	0 1	10		1 5	1	0 01	61000
131	0 01	0 0003	0 05	0 05	0 25	0 00015	0 001	0 035	0 0015	0 0002	0 01	0 01	0	0 1	26	0 1	6		1	31	0 01	90000
132	0 002	0 00015	0 025	0 03	0 1	0 0005	0 0005	0 015	0 0005	0 0001	0 007	0 003	29	0 1	39	0 1	5		0 15	31	0 01	37000
133	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 03	0 01	2	0 1	0	0 5	12		0 15	0 1	0 01	37000
134	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 01	0 009	0 7	0 1	1	0 5	3		0 15	34	0 01	190000
135	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 02	0 004	0 9	0 1	0 6	0 1	0 35		0 15	7	0 01	62000
136	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 04	0 01	3	0 1	4	3	10				0 2	62000
137	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 01	0 004	0 8	0 1	6	3	15		6	4	0 1	44000
138	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 0015	0 0005	1	0 1		0 1	2			0 1	0 01	58000
139	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 00025	0 02	0 005	1	0 1	0 15	0 1	6		6	4	0 2	64000
140	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 02	0 02	0 4	0 1	0 15	0 1	0 1		0 15	0 1	0 6	51000
141	0 005	0 0003	0 05	0 05	0 25	0 0015	0 001	0 035	0 0015	0 0002	0 0015	0 0005	0 05	0 1	0 15	0 1	0 1		0 15	0 1	0 1	1300
n (mg/m ^ 3)	0 07	0 01	0 03	0 07	0 31	0 00	0 01	0 05	0 00	0 00	0 21	0 02	2 90	0 59	4 25	1 67	7 02		4 17	5 88	0 23	43827 27
ov	0 12	0 03	0 03	3 36	0 39	0 02	0 04	0 14	0 01	0 01	0 75	0 03	3 60	1 40	10 41	4 36	11 80		12 40	13 44	0 44	36098 01
	46	46	46	46	46	46	46	46	46	46	46	46	45	44	44	46	45		42	45	45	44
13	0 79	0 79	0 79	0 79	0 79	0 79	0 79	0 79	0 79	0 79	0 79	0 79	0 71	0 83	0 83	0 71	0 71		0 48	0 71	0 71	0 83
	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01	2 01		2 01	2 01	2 01	2 01
UCL	0 11	0 02	0 05	3 83	0 42	0 01	0 02	0 10	0 01	0 00	0 43	0 03	4 64	0 87	7 41	2 98	10 56		8 02	9 71	0 36	54825 47
s/sec)	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05	1 0E-05		1 0E-05	1 0E-05	1 0E-05	1 0E-05
^ 2)	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05	1 0E+05		1 0E+05	1 0E+05	1 0E+05	1 0E+05
g/sec)	0 19	0 02	0 12	2 91	0 80	0 01	0 02	0 14	0 01	0 00	0 54	0 04	7 07	1 42	11 01	4 34	19 17	0 00	10 80	14 72	0 60	*********
s)	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34	402 34		402 34	402 34	402 34	402 34
s)	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00	10 00
s/sec)	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80	2 80		2 80	2 80	2 80	2 80
: (mg/m ^ 3)	1 7E-05	1 9E-06	1 0E-05	2 2E-04	7 1E-05	9 1E-07	2 2E-06	1 3E-05	1 1E-06	3 0E-07	4 9E-06	3 7E-06	8 6E-04	1 3E-04	8 8E-04	3 6E-04	1 6E-03		8 6E-04	1 3E-03	9 3E-05	1 0E+01
^ 3/day)	20																					
days/yr)	250																					
yr)	6																					
[kg]	70																					
c (days)	1533																					
(days)	25000																					
: (mg/kg dy)	1 8E-07	2 2E-08	1 2E-07	2 6E-06	8 3E-07	1 1E-08	2 6E-08	1 5E-07	1 3E-08	3 5E-09	5 6E-07	4 4E-08	8 0E-06	1 5E-06	1 1E-05	4 5E-06	1 9E-05	0 0E+00	1 1E-05	1 5E-05	6 2E-07	1 2E-01
ac (mg/kg dy)	3 2E-06	3 7E-07	2 0E-06	4 4E-05	1 4E-05	1 8E-07	4 3E-07	2 5E-06	2 1E-07	5 9E-08	9 3E-06	7 3E-07	1 3E-04	2 5E-05	1 8E-04	7 5E-05	3 2E-04	0 0E+00	1 8E-04	2 6E-04	1 0E-05	2 0E+00
(mg/kg dy)	8 0E-02	3 0E-01	9 0E-03		9 0E-03	1 0E-02				7 0E-04		1 0E-02		2 0E-01	2 0E-02	1 0E-01	2 0E+00			9 0E-02		
	4 7E-04		9 0E-02			2 3E-02		2 0E-02		1 5E-02	1 7E-02	9 3E-04	9 3E-03								8 4E-02	
mg/kg dy) ^ 1	1 0E-03		1 0E 01			1 1E-02		9 1E-02		3 3E-02	6 0E-02	1 0E-03	2 0E-02								2 0E 01	
R	3E 10		3E 09			9E 10		1E-09		3E-10	3E-09	9E 11	2E-07								8E-07	9E 07
	9 4E-05	1 2E 06	0 000228		0 001943	1 7E-06				0 37E-06		7 3E-06		0 000123	0 000861	0 000753	0 000139			0 002941		2E 02

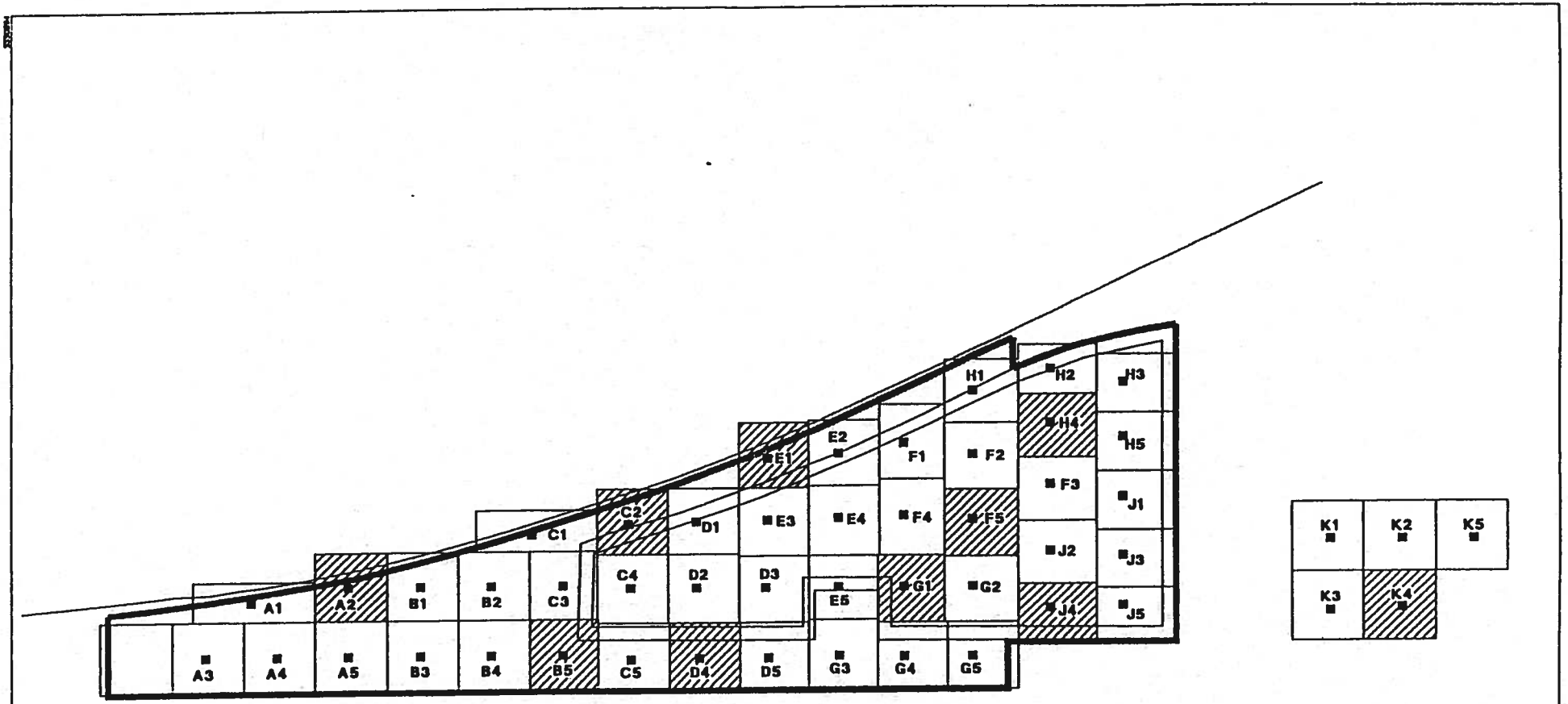
Appendix Table E Worksheet for Calculating Soil Gas Risk Maximal Exposure

	CH2CL2 UG/L	FREON 11 UG/L	1,1 DCE UG/L	1,1 DCA UG/L	1,2 DCE UG/L	CHCL3 UG/L	FREON 11	1,2 DCA UG/L	TCA UG/L	CCL4 UG/L	TCE UG/L	PCE UG/L	BENZENE UG/L	TOLUENE UG/L	CHLORO BENZENE UG/L	ETHYL BENZENE UG/L	TOTAL XYLENES UG/L		1,3/1,4 DCB UG/L	1,2 DCB UG/L	VINYL CHLORIDE UG/L	METHANE UG/L
SG-101	0.01	0.001	0.005	0.05	0.05	0.00025	0.001	0.001	0.0001	3.5E-05	0.001	0.0005	14	9	0.15	20	86		10	0.4	0.01	61000
SG-102	0.01	0.0005	0.005	0.05	0.05	0.00025	0.00025	0.001	0.0001	3.5E-05	0.005	0.004	2	2	0.15	1	14		0.5	0.4	0.01	120000
SG-103	0.5	0.001	0.1	0.05	2	0.00025	0.00025	0.001	0.0001	3.5E-05	0.2	0.002	0.05	0.2	0.15	0.5	0.05		0.5	0.4	2	500
SG-104	0.01	0.0004	0.01	0.5	0.2	0.00025	0.00025	0.001	0.0001	3.5E-05	0.005	0.002	3	0.5	0.15	5	3		0.5	0.4	0.4	42000
SG-105	0.01	0.1	0.005	0.5	0.1	0.00025	0.5	0.001	0.0001	3.5E-05	0.04	0.02	18	1	2	22	10		0.5	0.4	0.3	44000
SG-106	0.01	0.002	0.005	30	0.1	0.00025	0.00025	0.001	0.05	3.5E-05	0.02	0.05	0.5	2	0.15	1	41			0.4	2	500
SG-107	0.025	0.2	0.01	0.4	2	0.0005	0.04	0.005	0.02	0.0001	0.5	0.3	2	2	0.4	3	3		1.5	1	0.8	29000
SG-107A	0.005	0.005	0.1	0.2	0.25	0.1	0.001	0.005	0.0015	0.0002	0.5	0.01	0.05	0.5	0.5	1	10		0.15	0.1	0.5	48000
SG-107B	0.05	0.05	0.05	0.3	0.1	0.05	0.05	0.05	0.05	0.05	0.2	0.1	2	1	0.05	0.05	2		0.05	0.05	0.05	
SG-108	0.025	0.002	0.01	0.15	0.15	0.0005	0.0005	0.01	0.00025	0.0001	0.0005	0.002	0.4	0.5	0.15	2	2		0.5	1	0.01	32000
SG-108A	0.1	0.00015	0.03	0.25	0.2	0.001	0.01	1	0.01	0.002	0.02	0.002	1.5	0.3	1.5	0.1	5			0.1	1	29000
SG-109	0.025	0.002	0.01	0.15	0.15	0.0005	0.0005	0.05	0.00025	0.0001	0.0005	0.001	0.35	0.5	2.5	0.5	1		10	12.5	0.01	1300
SG-109A	0.1	0.00015	0.03	1	1	0.0005	0.005	0.05	0.002	0.0005	0.01	0.03	0.05	0.2	0.15	0.25	11		0.3	3.5	0.3	22000
SG-109B	0.035	0.003	0.01	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.0003	0.02	0.05	0.1	0.15	0.1	0.1		0.15	0.1	0.01	1300
SG-110	0.01	0.0005	0.005	0.05	0.05	0.00025	0.00025	0.02	0.0001	3.5E-05	0.01	0.0003	0.02	0.04	0.15	0.005	5		0.5	1	0.05	43000
SG-111	0.035	0.00035	0.01	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.007	0.005	0.05	0.1	0.15	0.1	0.1		0.5	0.1	0.01	1300
SG-112	0.15	0.00025	0.05	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.07	0.0015	0.05	0.1	0.15	2	0.1		0	0.1		
SG-113	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.1	0.005	1	0.1	1.5	0.1	5		0.15	0.1	0.4	48000
SG-114	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.02	0.003	0.5	0.1	1.5	0.1	12		0.15	0.1	0.2	48000
SG-115	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.07	0.004							0.15	0.1	0.01	47000
SG-116	0.005	0.0003	0.05	0.1	0.25	0.00015	0.001	0.01	0.0015	0.0002	0.1	0.0005	0.05	0.1	0.15	0.1	1		0.15	0.1	0.01	1300
SG-117	0.3	0.0005	0.1	0.1	0.5	0.0002	0.002	0.05	0.0025	0.0005	0.5	0.0015	0.05	0.4	0.15	2	0.5		0.15	0.3	0.01	120000
SG-118	0.3	0.0003	0.05	0.05	0.1	5E-05	0.0005	0.015	0.0005	0.0001	0.5	0.005	0.05		0.15	2	0.5		3	0.4	0.01	47000
SG-119	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.05	0.0005	0.05	0.1	0.15	0.1	0.1		0.15	0.1	0.01	1300
SG-120	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.005	0.0015	0.0002	5	0.03	0.05	0.1	0.15	2	2		3	0.2	0.01	20000
SG-121	0.005	0.001	0.1	0.1	0.25	0.00015	0.004	0.005	0.0015	0.0005	0.05	0.0005	0.05	0.1	0.15	0.1	0.1		0.15	0.1	0.01	1300
SG-122	0.2	0.0003	0.05	0.05	0.1	5E-05	0.0005	0.015	0.0005	0.0001	0.4	0.001	0.05	0.1	0.15	0.1	0.1		0.15	0.1	0.07	84000
SG-123	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.05	0.0005	4	0.1	0.15	0.1	20		0.15	0.1	0.2	98000
SG-124	0.1	0.002	0.05	0.05	0.25	0.00015	0.001	0.07	0.04	0.0002	0.02	0.01	0.025	0.4	1	0.5	0.5		0.5	0.5	0.04	90000
SG-125	0.2	0.0005	0.005	0.05	0.1	5E-05	0.0005	0.015	0.0005	0.0001	0.02	0.002	4	0.1	14	0.1	0.1		34	48	0.1	32000
SG-126	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.02	0.004	9	0.1	11	0.1	2		0.15	14	0.2	65000
SG-127	0.4	0.0003	0.05	0.05	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.02	0.005	9	0.1	21	0.1	14		72	0.1	0.04	57000
SG-128	0.005	0.0003	0.05	0.05	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.00015	0.0005	0.05	0.1	0.15	0.1	0.1		0.15	0.1	0.01	1300
SG-129	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.02	0.01	3	0.1	2	1	3		20	17	0.2	73000
SG-130	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.0015	0.0005	13	0.1	20	0.1	10		1.5	1	0.01	61000
SG-131	0.01	0.0003	0.05	0.05	0.25	0.00015	0.001	0.005	0.0015	0.0002	0.01	0.01	0	0.1	26	0.1	6		1	51	0.01	50000
SG-132	0.003	0.00015	0.025	0.02	0.1	0.0005	0.0005	0.015	0.0005	0.0001	0.007	0.003	29	0.1	39	0.1	5		0.15	51	0.01	37000
SG-133	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.03	0.01	2	0.1	6	0.5	12		0.15	0.1	0.01	37000
SG-134	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.01	0.005	0.7	0.1	1	0.5	3		0.15	34	0.01	190000
SG-135	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.02	0.004	0.5	0.1	0.5	0.1	0.35		0.15	7	0.01	62000
SG-136	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.04	0.01	3	0.1	4	3	10				0.2	62000
SG-137	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.01	0.004	0.5	0.1	0	3	15		0	4	0.1	44000
SG-138	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.0015	0.0005	1	0.1		0.1	2			0.1	0.01	58000
SG-139	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.00025	0.02	0.005	1	0.1	0.15	0.1	6		0	4	0.2	84000
SG-140	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.02	0.02	0.4	0.1	0.15	0.1	0.1		0.15	0.1	0.5	51000
SG-141	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.0015	0.0005	0.05	0.1	0.15	0.1	0.1		0.15	0.1	0.1	1300
mean (mg/m^3)	0.07	0.01	0.05	0.07	0.31	0.00	0.01	0.05	0.00	0.00	0.21	0.02	2.66	0.55	4.25	1.67	7.02		4.17	5.68	0.23	43827.27
std dev	0.12	0.03	0.03	0.58	0.38	0.02	0.04	0.14	0.01	0.01	0.75	0.05	3.60	1.40	10.41	4.38	11.80		12.40	13.44	0.44	36369.01
n	46	46	46	46	46	46	46	46	46	46	46	46	45	44	44	45	45		43	45	45	44
n^0.5	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.71	6.63	6.63	6.71	6.71		6.48	6.71	6.71	6.63
t	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01		2.01	2.01	2.01	2.01
95% UCL	0.11	0.02	0.05	2.63	0.42	0.01	0.02	0.10	0.01	0.00	0.43	0.03	4.84	0.97	7.41	2.66	10.56		8.02	9.71	0.36	84823.47
V (m/sec)	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05		1.0E-05	1.0E-05	1.0E-05	1.0E-05
A (m^2)	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05	1.0E+05		1.0E+05	1.0E+05	1.0E+05	1.0E+05
E (mg/sec)	0.59	0.05	0.14	6.80	1.10	0.02	0.06	0.25	0.02	0.01	1.11	0.08	12.01	2.52	19.19	7.72	27.34		20.78	23.16	0.94	1.4E+05
W (m)	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34		402.34	402.34	402.34	402.34
H (m)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
U (m/sec)	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80		2.80	2.80	2.80	2.80
OAC (mg/m^3)	2.5E-05	4.2E-06	1.2E-05	6.0E-04	9.8E-05	2.0E-06	5.3E-06	2.2E-03	1.9E-06	9.0E-07	8.9E-05	8.9E-06	1.1E-03	2.2E-04	1.7E-03	6.9E-04	2.4E-03		1.6E-03	2.2E-03	8.4E-05	1.3E+01
IR (m^3/day)	20																					
EF (days/yr)	250																					
ED (yr)	25																					
BW (kg)	70																					
ATnc (days)	9125																					
ATc (days)	25000																					
CDIc (mg/kg dy)	1.7E-06	2.9E-07	8.7E-07	4.2E-05	6.9E-06	1.4E-07	3.7E-07	1.6E-06	1.3E-07	5.9E-08	6.9E-06	4.8E-07	7.5E-05	1.6E-05	1.2E-04	4.8E-05	1.7E-04	0.0E+00	1.3E-04	1.6E-04	5.9E-06	8.9E-01
CDInc (mg/kg dy)	4.8E-06	8.1E-07	2.4E-06	1.2E-04	1.9E-05	4.0E-07	1.0E-06	4.4E-06	3.7E-07	1.6E-07	1.9E-05	1.4E-06	2.1E-04	4.4E-05	3.3E-04	1.3E-04	4.7E-04	0.0E+00	3.6E-04	4.4E-04	1.6E-05	2.5E+00
RfC																						
RfD (mg/kg dy)	8.0E-02	3.0E-01	8.0E-03		9.0E-03	1.0E-02				7.0E-04		1.0E-02		2.0E-01	2.0E-02	1.0E-01	2.0E+00			8.0E-02		
URI	4.7E-04		5.0E-06			2.3E-02		2.6E-02		1.5E-02	1.7E-02	5.2E-04	8.3E-03								0.4E-02	
SF (mg/kg dy)^-1	1.9E-03		1.9E-01			0.1E-02		0.1E-02		8.3E-02	6.0E-02	1.9E-03	2.9E-02								2.9E-01	
ELCR	3E-06		2E-07			1E-06		1E-07		3E-06	4E-07	9E-10	2E-06								2E-06	9E-06
HQ	7.8E-05	2.72E-06	0.000271		0.002134	2.8E-05				0.000224		0.000135		0.000219	0.010663	0.001341	0.000337			0.004858		3E-02

Appendix Table F - Risk and Hazard from Use of Bradley Well for Dust Control

	Benzene	Chloroform	c-1,2 DCE	PCE	TCE	VC	
Mean Ci (mg/L)	0.00054	0.00087	0.088	0.00034	0.0035	0.059	
95%UCL Ci (mg/L) =	0.00054	0.001	0.19	0.00034	0.0049	0.1	
R (L/sec)=	11	11	11	11	11	11	
Mean Ei (mg/sec) =	5.94E-03	9.57E-03	9.68E-01	3.74E-03	3.85E-02	6.49E-01	
Ei (mg/sec) =	5.94E-03	1.10E-02	2.09E+00	3.74E-03	5.39E-02	1.10E+00	
W (m) =	111	111	111	111	111	111	
H (m) =	10	10	10	10	10	10	
U (m/sec) =	2.8	2.8	2.8	2.8	2.8	2.8	
Mean OACi (mg/m^3) =	1.9E-06	3.1E-06	3.1E-04	1.2E-06	1.2E-05	2.1E-04	
95% UCL OACi (mg/m^3) =	1.9E-06	3.5E-06	6.7E-04	1.2E-06	1.7E-05	3.5E-04	
IR (m^/wkday) =	20	20	20	20	20	20	
Avg EF (days/year) =	25	25	25	25	25	25	
RME EF (days/yr) =	250	250	250	250	250	250	
RME ED (years) =	25	25	25	25	25	25	
Avg ED (years) =	4.2	4.2	4.2	4.2	4.2	4.2	
BW (kg) =	70	70	70	70	70	70	
Avg ATnc (days) =	1533	1533	1533	1533	1533	1533	
RME ATnc (days) =	9125	9125	9125	9125	9125	9125	
ATc (days) =	25550	25550	25550	25550	25550	25550	
RME CDIc (mg/kg-day) =	1.3E-07	2.5E-07	4.7E-05	8.4E-08	1.2E-06	2.5E-05	
RME CDInc (mg/kg-day) =	3.7E-07	6.9E-07	1.3E-04	2.4E-07	3.4E-06	6.9E-05	
Avg CDIc (mg/kg-day) =	2.2E-09	3.6E-09	3.7E-07	1.4E-09	1.5E-08	2.5E-07	
Avg CDInc (mg/kg-day) =	3.7E-08	6.0E-08	6.1E-06	2.4E-08	2.4E-07	4.1E-06	
RfD (mg/kg-day) =	8.3E-03	6.0E-02	1.0E-02	5.2E-04	1.7E-02	8.4E-02	
SF (mg/kg-day) =	2.9E-02	1.6E-03		1.8E-03	6.0E-02	2.9E-01	
Avg ELCR =	6.5E-11	5.8E-12		2.5E-12	8.7E-10	7.1E-08	7E-08
Avg HQ =	4.5E-06	1.0E-06	6.1E-04	4.5E-05	1.4E-05	4.9E-05	7E-04
UCL ELCR =	3.9E-09	4.0E-10		1.5E-10	7.3E-08	7.2E-06	7E-06
UCL HQ =	4.5E-05	1.2E-05	1.3E-02	4.5E-04	2.0E-04	8.2E-04	1E-02


Salt River
SG-120
SG-118
PP-9
SG-121
SG-134
SG-116
SG-119
SG-133
PP-12
EW-NE
EW-3
EW-PZ4
EW-16
SG-114
SG-117
PP-10
EW-2
SG-115
SG-132
SG-138
SG-135
SG-110
PP-8
SG-113
SG-131
SG-103
EW-9
SG-111
SG-130
PP-11
SG-141
SG-140
SG-139
SG-137
SG-136
SG-112
PP-13
EW-NW
PP-5
SG-129
SG-128
SG-127
SG-126
SG-125
SG-124
SG-123
SG-122
SG-101
SG-102
EW-OE
PP-1
PP-3
EW-PZ1
EW-PZ6
EW-15
EW-RW1
SG-106
PP-7
SG-108
SG-109
SG-109B
TW-4
EW-PZ5
PP-6
SG-107B
PP-2
EW-RW2
SG-108A
SG-109A
EW-8
EW-6
EW-PZ2
SG-107
BW-NE
EW-5
EW-E
EW-PZ3
SG-107A
PP-4
EW-W
SG-105
EW-4
BW-P
SG-104
EW-18
WASTE
MANAGEMENT
BRADLEY LANDFILL
40th Street
BW-W
BW-S
BW-SE
EW-14
EW-7
N
0
250
SCALE IN FEET
EXPLANATION
PP-1 Permanent Methane Gas Monitoring Location
SG-101 Phase II Soil Gas Sample Location
EW-2 Monitor Well (Shallow: ≤100')
EW-3 Monitor Well (Deep: >100')
BW-P Production Well
EW-RW1 Recovery Well
EW-PZ1 Piezometer
Harding Lawson Associates
Engineering and
Environmental Services
SOIL GAS SAMPLE LOCATIONS
Cotes Landfill Remedial Data Acquisition
Phoenix, Arizona
FIGURE
24
DRAWN
DBS
PROJECT NUMBER
28326-1
APPROVED
DATE
8/94
REVISED DATE
11/94



EXPLANATION

- Surface Soil Sample Location
- Area Randomly Selected for Descrete Sampling
- A3 — 1 Acre Subparcel
- Area of Relocated Refuse

Harding Lawson Associates
Engineering and
Environmental Services

SURFACE SOIL SAMPLE LOCATIONS
August, 1994
Estes Landfill
Phoenix, Arizona

FIGURE 2

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
DBS	28324-1		1/95	

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest Detects	Det %	WoE	HBGL	MCL
Water Sample											
Sample Site: SB-3 Usage:											
O R G A N I C											
34. Vinyl chloride (VC)	75-01-4	µg/L					0/ 1	0.0%	--	A	2E-02	2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-4 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	0.39	0.56	0.27	1.2	1.2	1/ 12	8.3%	√	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.28	0.43	0.24	0.3	0.86	2/ 12	16.7%	√	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 12	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 12	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 12	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 21	0.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 12	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 12	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.2	1.3	0.31	0.8	1.6	11/ 12	91.7%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 12	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 12	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.69	0.84	0.34	1.3	1.4	2/ 21	9.5%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 21	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 21	0.0%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.46	0.73	0.42	0.79	0.98	2/ 12	16.7%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	3.7	5.5	2.8	1.1	11	12/ 12	100.0%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.24	0.35	0.17	0.2	0.35	3/ 12	25.0%	√	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	4.6	5.7	1.8	2.7	7.3	11/ 12	91.7%	√	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.9	12	6.6	0.6	21	12/ 12	100.0%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.24	0.34	0.16	0.21	0.28	3/ 12	25.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.1	1.4	0.39	2.4	2.4	1/ 12	8.3%	√	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L	0.22	0.33	0.17	0.3	0.3	1/ 12	8.3%	√	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 12	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 12	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 12	0.0%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 12	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	2.7	3.9	1.9	0.42	6.7	12/ 12	100.0%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 12	0.0%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.4	1.8	0.55	0.5	2.7	12/ 12	100.0%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 12	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	22	26	6.2	13	38	12/ 12	100.0%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.44	0.65	0.34	0.3	0.49	3/ 12	25.0%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-4 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.4	2.1	0.97	0.45	3.3	8/ 12	66.7%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.58	1.2	1	0.32	3.9	2/ 12	16.7%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-5 Usage:													
O R G A N I C													
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0%	--	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0%	--	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0%	--	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 1	0.0%	--	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L	8.3	8.3	0.00000005	8.3	8.3	1/ 1	100.0%	✓	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 2	0.0%	--	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0%	--	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0%	--	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	2.3	2.3		2.3	2.3	1/ 1	100.0%	✓	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 1	0.0%	--	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0%	--	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 2	0.0%	--	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 2	0.0%	--	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 2	0.0%	--	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 1	0.0%	--	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L						0/ 1	0.0%	--	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 1	0.0%	--	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	16	16		16	16	1/ 1	100.0%	✓	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 1	0.0%	--	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0%	--	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0%	--	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0%	--	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0%	--	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0%	--	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0%	--	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0%	--	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L						0/ 1	0.0%	--	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0%	--	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 1	0.0%	--	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0%	--	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	1.3	1.3		1.3	1.3	1/ 1	100.0%	✓	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 1	0.0%	--	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 1	0.0%	--	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-5 Usage:												
O R G A N I C												
34. Vinyl chloride (VC)	75-01-4	µg/L						0/ 1	0.0%	--	A	2E-02 2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-6 Usage:												
O R G A N I C												
1. Acetone	67-64-1	µg/L						0/ 3	0.0% --	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 12	0.0% --	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.53	0.97	0.68	0.3	2.5	3/ 12	25.0% √	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 12	0.0% --	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 12	0.0% --	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 12	0.0% --	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 21	0.0% --	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 12	0.0% --	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 12	0.0% --	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.7	2	0.46	1.2	2.6	11/ 12	91.7% √	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.51	0.96	0.7	0.87	0.87	1/ 12	8.3% --	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 12	0.0% --	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.9	1.2	0.72	2.1	2.1	2/ 21	9.5% --	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 21	0.0% --	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 21	0.0% --	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.7	1.1	0.71	0.33	1.5	4/ 12	33.3% --	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.3	1.6	0.46	0.9	2.1	10/ 12	83.3% --	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.35	0.55	0.32	0.2	0.5	4/ 12	33.3% √	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	7.1	9.19999999	3.3	2.9	15	12/ 12	100.0% √	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	1.8	2.8	1.4	0.59	5	11/ 12	91.7% --	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.28	0.48	0.33	0.26	0.26	1/ 12	8.3% --	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L	1.5	2.1	0.97	3	3.9	2/ 12	16.7% √	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 12	0.0% --	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 12	0.0% --	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 12	0.0% --	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 12	0.0% --	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 12	0.0% --	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.68	0.86	0.29	0.41	1	8/ 12	66.7% √	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L						0/ 12	0.0% --	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.4	2.2	1.3	0.4	4.6	10/ 12	83.3% --	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 12	0.0% --	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	50	65	23	24	93	12/ 12	100.0% √	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 12	0.0% --	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: SB-6 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	3.8	5.8	3.1	0.32	13	11/ 12	91.7%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.41	0.83	0.66	0.66	0.66	1/ 12	8.3%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 10	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-7 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (BMM)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 1	0.0% --	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L						0/ 2	0.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.94	0.94		0.94	0.94	1/ 1	100.0% √	B2	6E+00	1E+02
10. Chloromethane (CM)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L						0/ 2	0.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 2	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 2	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L						0/ 1	0.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.48	0.48		0.48	0.48	1/ 1	100.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 1	0.0% --	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	18	18		18	18	1/ 1	100.0% √	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L						0/ 1	0.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.24	0.24		0.24	0.24	1/ 1	100.0% √	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	0.3	0.3		0.3	0.3	1/ 1	100.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	46	46		46	46	1/ 1	100.0% √	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L						0/ 1	0.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	3.8	3.8	0.00000002	3.8	3.8	1/ 1	100.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.2	7.9	0.29	6.8	7.5	3/ 3	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.83	3.3	0.98	2.2	2.2	1/ 3	33.3%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.013	0.043	0.012	0.005	0.005	1/ 3	33.3%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0087	0.016	0.0031	0.006	0.013	3/ 3	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 3	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 3	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.47	0.58	0.047	0.4	0.5	3/ 3	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 3	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	59	61	0.82	58	60	3/ 3	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	200	220	4.7	200	210	3/ 3	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 3	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 3	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 3	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.5	0.5		0.5	0.5	3/ 3	100.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 3	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0098	0.027	0.0067	0.018	0.018	1/ 3	33.3%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	24	26	0.82	23	25	3/ 3	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.012	0.027	0.0062	0.02	0.02	1/ 3	33.3%	--	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 3	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 3	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	8	8		8	8	1/ 1	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	5.3	6.5	0.47	5	6	3/ 3	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 3	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	200	220	4.7	200	210	3/ 3	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	92	110	7.1	82	98	3/ 3	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 3	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	790	860	27	750	810	3/ 3	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.09	0.29	0.08	0.06	0.2	2/ 3	66.7%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: SB-7 Usage:												
O R G A N I C												
34. Vinyl chloride (VC)	75-01-4	µg/L						0/ 1	0.0%	--	A	2E-02 2E+00

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L	1.3	2.9	2.8	3.7	11	2/ 14	14.3%	√	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.39	0.65	0.44	0.21	1.7	5/ 14	35.7%	√	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 14	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 14	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 14	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.29	0.35	0.15	0.32	0.58	2/ 25	8.0%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L						0/ 14	0.0%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 14	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	1.6	2.2	1	0.7	4.1	14/ 14	100.0%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L	0.31	0.52	0.37	0.32	0.32	1/ 14	7.1%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L	0.32	0.53	0.36	0.26	0.32	2/ 14	14.3%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	0.8	1	0.52	1.1	2.2	4/ 24	16.7%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 24	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.62	0.73	0.27	1.1	1.1	1/ 24	4.2%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.5	0.95	0.78	3	3	1/ 14	7.1%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	2.9	4.4	2.5	0.59	7.5	12/ 14	85.7%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	0.24	0.35	0.19	0.28	0.59	2/ 14	14.3%	√	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	2.4	3.4	1.8	0.4	7.3	12/ 14	85.7%	√	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.6	12	8.4	0.34	24	13/ 14	92.9%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 14	0.0%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 14	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 14	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 14	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 14	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	0.66	1.1	0.76	1.4	2.8	3/ 14	21.4%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 14	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	1.1	1.7	1.1	0.26	4.1	12/ 14	85.7%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	1.3	2.7	2.4	0.65	8.69999999	4/ 14	28.6%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.2	1.8	0.96	0.4	3.4	11/ 14	78.6%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 14	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	13	17	7.2	1.4	25	14/ 14	100.0%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.36	0.57	0.36	0.63	0.63	1/ 14	7.1%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A-- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-1 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	1.5	2.4	1.5	0.21	4.6	8/ 14	57.1%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	0.75	1.8	1.8	0.2	7.2	3/ 14	21.4%	√	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L	2	3.9	2.8	6.8	8	2/ 10	20.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: TW-2 Usage:												
ORGANIC/INORGANIC : NOT SPECIFIED												
1. pH			6.7	6.7		6.7	6.7	1/ 1	100.0% --	ND		
I N O R G A N I C												
1. Ammonia (NH3)	7664-41-7	mg/L	1.3	1.3		1.3	1.3	1/ 1	100.0% --	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.006	0.006		0.006	0.006	1/ 1	100.0% --	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.006	0.006		0.006	0.006	1/ 1	100.0% √	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 1	0.0% --	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 1	0.0% --	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.6	0.6		0.6	0.6	1/ 1	100.0% --	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 1	0.0% --	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	60	60		60	60	1/ 1	100.0% --	ND		
9. Chloride (Cl)-		mg/L	180	180		180	180	1/ 1	100.0% --	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 1	0.0% --	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 1	0.0% --	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 1	0.0% --	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L						0/ 1	0.0% --	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 1	0.0% --	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 1	0.0% --	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	25	25		25	25	1/ 1	100.0% --	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.18	0.18		0.18	0.18	1/ 1	100.0% √	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 1	0.0% --	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 1	0.0% --	D	1E-01	1E-01
20. Potassium (K)	7440-09-7	mg/L	5	5		5	5	1/ 1	100.0% --	ND		
21. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
22. Silver (Ag)	7440-22-4	mg/L						0/ 1	0.0% --	D	4E-02	5E-02
23. Sodium (Na)	7440-23-5	mg/L	200	200		200	200	1/ 1	100.0% --	ND		
24. Sulfate (SO4)	14808-79-8	mg/L	70	70		70	70	1/ 1	100.0% --	D	4E+02	
25. Thallium (Tl)	7440-28-0	mg/L						0/ 1	0.0% --	ND	5E-04	
26. Total Dissolved Solids (TDS)		mg/L	710	710		710	710	1/ 1	100.0% --	ND		
27. Zinc and compounds (Zn)	7440-66-6	mg/L	0.06	0.06		0.06	0.06	1/ 1	100.0% --	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: TW-2 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (CM1)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 1	0.0% --	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	1.3	2.6	0.15	1.1	1.4	2/ 2	100.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CL3M)	67-66-3	µg/L	0.49	0.49		0.49	0.49	1/ 1	100.0% ✓	B2	6E+00	1E+02
10. Chloromethane (CL)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	2.7	2.7		2.7	2.7	1/ 1	100.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 1	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 1	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.93	0.93		0.93	0.93	1/ 1	100.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	9.8	9.8	0.00000008	9.8	9.8	1/ 1	100.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	1.5	1.5		1.5	1.5	1/ 1	100.0% ✓	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	7.1	7.1	0.00000004	7.1	7.1	1/ 1	100.0% ✓	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.5	7.5		7.5	7.5	1/ 1	100.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.48	0.48		0.48	0.48	1/ 1	100.0% ✓	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	2	2		2	2	1/ 1	100.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	11	11		11	11	1/ 1	100.0% ✓	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	1.2	1.2		1.2	1.2	1/ 1	100.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 1	0.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADR535
8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-17														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.013	7.3E-06	1.1E-05	99		1.3E-04	4.2E-01	0.013«	4.5E-05	6.8E-05	98		1.3E-04	4.2E-01
Lead and compounds (inorganic) (Pb)	0.011	6.2E-06				1.1E-04		0.026«	9.1E-05				2.5E-04	
Manganese (Mn)	0.66	3.7E-04				6.5E-03	1.3E+00	1.53«	5.3E-03				1.5E-02	3.0E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	1.9	1.1E-06	3.1E-08			1.9E-05		6.5	2.3E-05	6.6E-07	1		6.4E-05	
Chloroform (THM) (CLFM)	0.3	1.7E-07	1.0E-09			2.9E-06	2.9E-04	0.4«	1.4E-06	8.5E-09			3.9E-06	3.9E-04
Tetrachloroethylene (PCE)	1.9	1.1E-06	5.3E-08			1.9E-05	1.9E-03	2.8«	9.8E-06	4.9E-07	1		2.7E-05	2.7E-03
Trichloroethylene (TCE)	8.6	4.8E-06	5.3E-08			8.4E-05		10	3.5E-05	3.8E-07	1		9.8E-05	
TOTALS		- -	1E-05			- -	1.7E+00	TOTALS	- -	7E-05			- -	3.4E+00
w/o Arsenic		- -	1E-07		- -	- -	- -	w/o Arsenic	- -	2E-06		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ater Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
ITE: EW-16	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	9.7	5.4E-03				9.5E-02	9.5E-02	12	4.2E-02				1.2E-01	1.2E-01
Arsenic, inorganic (As)	0.035	2.0E-05	2.9E-05	100		3.4E-04	1.1E+00	0.04«	1.4E-04	2.1E-04	100		3.9E-04	1.3E+00
Barium (Ba)	2	1.1E-03				2.0E-02	2.8E-01	2.08«	7.3E-03				2.0E-02	2.9E-01
Lead and compounds (inorganic) (Pb)	0.002«	1.1E-06				2.0E-05		0.002«	7.0E-06				2.0E-05	
Manganese (Mn)	4	2.2E-03				3.9E-02	7.8E+00	4.3«	1.5E-02				4.2E-02	8.4E+00
	Units ug/L							Units ug/L						
ORGANIC														
Dichloromethane (DCM)	1.7	9.5E-07	7.1E-09			1.7E-05	2.8E-04	2.8«	9.8E-06	7.3E-08			2.7E-05	4.6E-04
Tetrachloroethylene (PCE)	0.38	2.1E-07	1.1E-08			3.7E-06	3.7E-04	0.8«	2.8E-06	1.4E-07			7.8E-06	7.8E-04
TOTALS		- -	3E-05			- -	9.3E+00	TOTALS	- -	2E-04			- -	1.0E+01
w/o Arsenic		- -	2E-08		- -	- -	- -	w/o Arsenic	- -	2E-07		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks, and non-cancer hazards for all groundwater sampling sites, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
IGANIC														
onia (NH3)	1.3	7.3E-04				1.3E-02	1.3E-02	1.5	5.2E-03				1.5E-02	1.5E-02
imony (Sb)	0.022	1.2E-05				2.2E-04	5.4E-01	0.024	8.4E-05				2.3E-04	5.9E-01
enic, inorganic (As)	0.015	8.4E-06	1.3E-05	5		1.5E-04	4.9E-01	0.017	5.9E-05	8.9E-05	4		1.7E-04	5.5E-01
ium (Ba)	0.24	1.3E-04				2.3E-03	3.4E-02	0.28	9.8E-04				2.7E-03	3.9E-02
yllium (Be)	0.0024	1.3E-06	5.8E-06	2		2.3E-05	4.7E-03	0.0026	9.1E-06	3.9E-05	2		2.5E-05	5.1E-03
on and borates only (B)	0.39	2.2E-04				3.8E-03	4.2E-02	0.41	1.4E-03				4.0E-03	4.5E-02
mium (Cd)	0.0026	1.5E-06				2.5E-05	5.1E-02	0.0028	9.8E-06				2.7E-05	5.5E-02
per (Cu)	0.024	1.3E-05				2.3E-04	6.3E-03	0.051	1.8E-04				5.0E-04	1.3E-02
d and compounds (inorganic) (Pb)	0.0044	2.5E-06				4.3E-05		0.0052	1.8E-05				5.1E-05	
ganese (Mn)	1.2	6.7E-04				1.2E-02	2.3E+00	1.4	4.9E-03				1.4E-02	2.7E+00
cury (inorganic) (Hg)	0.00011	6.2E-08				1.1E-06	3.6E-03	0.00012	4.2E-07				1.2E-06	3.9E-03
kel, soluble salts (Ni)	0.024	1.3E-05				2.3E-04	1.2E-02	0.027	9.4E-05				2.6E-04	1.3E-02
rate/Nitrite (total)	1.8	1.0E-03				1.8E-02		2.3	8.0E-03				2.3E-02	
c and compounds (Zn)	0.11	6.2E-05				1.1E-03	3.6E-03	0.15	5.2E-04				1.5E-03	4.9E-03
	Units ug/L							Units ug/L						
ANIC														
zene (BNZ)	2.3	1.3E-06	3.7E-08			2.3E-05		3.4	1.2E-05	3.4E-07			3.3E-05	
modichloromethane (THM) (BDCM)	1.1	6.2E-07	3.8E-08			1.1E-05	5.4E-04	1.6	5.6E-06	3.5E-07			1.6E-05	7.8E-04
bon tetrachloride (CCL4)	1.1	6.2E-07	8.0E-08			1.1E-05	1.5E-02	1.6	5.6E-06	7.3E-07			1.6E-05	2.2E-02
orobenzene (monochlorobenzene) (MCB)	10	5.6E-06				9.8E-05	4.9E-03	12	4.2E-05				1.2E-04	5.9E-03
oroform (THM) (CLFM)	1.4	7.8E-07	4.8E-09			1.4E-05	1.4E-03	1.9	6.6E-06	4.1E-08			1.9E-05	1.9E-03
oromethane (CM)	2.1	1.2E-06	1.5E-08			2.1E-05	5.1E-03	2.7	9.4E-06	1.2E-07			2.6E-05	6.6E-03
-Dichlorobenzene (DCB2)	30	1.7E-05				2.9E-04	3.3E-03	40	1.4E-04				3.9E-04	4.3E-03
-Dichlorobenzene (DCB3)	6.7	3.7E-06				6.6E-05	7.4E-04	12	4.2E-05				1.2E-04	1.3E-03
-Dichlorobenzene (DCB4)	7.5	4.2E-06	1.0E-07			7.3E-05	7.3E-04	13	4.5E-05	1.1E-06			1.3E-04	1.3E-03
2-Dichloroethane (DCA2)	1.2	6.7E-07	6.1E-08			1.2E-05		1.6	5.6E-06	5.1E-07			1.6E-05	
1-Dichloroethylene (DCE)	2.1	1.2E-06	7.0E-07			2.1E-05	2.3E-03	2.6	9.1E-06	5.5E-06			2.5E-05	2.8E-03
2-Dichloroethylene (TOTAL)	27	1.5E-05				2.6E-04		41	1.4E-04				4.0E-04	
s-1,2-Dichloroethylene	200	1.1E-04				2.0E-03	2.0E-01	290	1.0E-03				2.8E-03	2.8E-01
chloromethane (DCM)	8.1	4.5E-06	3.4E-08			7.9E-05	1.3E-03	12	4.2E-05	3.1E-07			1.2E-04	2.0E-03
2-Dichloropropane (DCP2)	0.4«	2.2E-07	1.5E-08			3.9E-06		0.4«	1.4E-06	9.5E-08			3.9E-06	
s-1,3-Dichloropropene (cDCP3)	0.5«	2.8E-07				4.9E-06		0.5«	1.7E-06				4.9E-06	

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

DHS35
ft 8/95

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks, and non-cancer hazards for all groundwater sampling sites, Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
i(2-ethylhexyl) Phthalate (DEHP)	19	1.1E-05	1.5E-07			1.9E-04	9.3E-03	31	1.1E-04	1.5E-06			3.0E-04	1.5E-02
,1,2,2-Tetrachloroethane (TET)	1.1	6.2E-07	1.2E-07			1.1E-05		1.5	5.2E-06	1.0E-06			1.5E-05	
etrachloroethylene (PCE)	1.3	7.3E-07	3.6E-08			1.3E-05	1.3E-03	1.7	5.9E-06	3.0E-07			1.7E-05	1.7E-03
richloroethylene (TCE)	7.8	4.4E-06	4.8E-08			7.6E-05		9.1	3.2E-05	3.5E-07			8.9E-05	
inyl chloride (VC)	220	1.2E-04	2.3E-04	92		2.2E-03		290	1.0E-03	1.9E-03	93		2.8E-03	
TOTALS		- -	3E-04			- -	3.8E+00	TOTALS	- -	2E-03			- -	4.4E+00
w/o Arsenic		- -	2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
ADHS35
aft 8/95

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks, and non-cancer hazards for all groundwater sampling sites, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
-ethylhexyl) Phthalate (DEHP)	19	1.1E-05	1.5E-07			1.9E-04	9.3E-03	31	1.1E-04	1.5E-06			3.0E-04	1.5E-02
2,2-Tetrachloroethane (TET)	1.1	6.2E-07	1.2E-07			1.1E-05		1.5	5.2E-06	1.0E-06			1.5E-05	
achloroethylene (PCE)	1.3	7.3E-07	3.6E-08			1.3E-05	1.3E-03	1.7	5.9E-06	3.0E-07			1.7E-05	1.7E-03
hloroethylene (TCE)	7.8	4.4E-06	4.8E-08			7.6E-05		9.1	3.2E-05	3.5E-07			8.9E-05	
l chloride (VC)	220	1.2E-04	2.3E-04	92		2.2E-03		290	1.0E-03	1.9E-03	93		2.8E-03	
TOTALS		- -	3E-04			- -	3.8E+00	TOTALS	- -	2E-03			- -	4.4E+00
w/o Arsenic		- -	2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

HS35
t 8/95

MEAN - Arithmatic average of samples including Sample Quantitation Limits (SQLs)

CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - CARCINOGENIC EXPOSURE X slope factor(chemical specific)

CARCINOGENIC HAZARD INDEX - (CARCINOGENIC EXPOSURE) + (reference dose(Rfd) + safety factor(10))

NON-CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(4 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - NON-CARCINOGENIC EXPOSURE + reference dose(Rfd)

RME - Reasonable Maximum Exposure using 95% upper confidence limit (UCL) of mean concentration

CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - same as above

CARCINGOENIC HAZARD INDEX - same as above

NON-CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(25 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - same as above

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

MEAN - Arithmatic average of samples including Sample Quantitation Limits (SQLs)

CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - CARCINOGENIC EXPOSURE x slope factor(chemical specific)

CARCINOGENIC HAZARD INDEX - (CARCINOGENIC EXPOSURE) ÷ (reference dose(Rfd) + safety factor(10))

NON-CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(4 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - NON-CARCINOGENIC EXPOSURE ÷ reference dose(Rfd)

RME - Reasonable Maximum Exposure using 95% upper confidence limit (UCL) of mean concentration

CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - same as above

CARCINGOENIC HAZARD INDEX - same as above

NON-CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(25 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - same as above

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
ADHS35
aft 8/95

Appendix Table C - Worksheet for calculating ingestion CDI, carcinogenic risks,
and non-cancer hazards for all groundwater sampling sites,
Estes Landfill Risk Assessment

:er Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
NORGANIC														
ımmonia (NH3)	1.3	7.3E-04				1.3E-02	1.3E-02	1.5	5.2E-03				1.5E-02	1.5E-02
ıntimony (Sb)	0.022	1.2E-05				2.2E-04	5.4E-01	0.024	8.4E-05				2.3E-04	5.9E-01
ırsenic, inorganic (As)	0.015	8.4E-06	1.3E-05	5		1.5E-04	4.9E-01	0.017	5.9E-05	8.9E-05	4		1.7E-04	5.5E-01
ıarium (Ba)	0.24	1.3E-04				2.3E-03	3.4E-02	0.28	9.8E-04				2.7E-03	3.9E-02
ieryllium (Be)	0.0024	1.3E-06	5.8E-06	2		2.3E-05	4.7E-03	0.0026	9.1E-06	3.9E-05	2		2.5E-05	5.1E-03
ıoron and borates only (B)	0.39	2.2E-04				3.8E-03	4.2E-02	0.41	1.4E-03				4.0E-03	4.5E-02
:admium (Cd)	0.0026	1.5E-06				2.5E-05	5.1E-02	0.0028	9.8E-06				2.7E-05	5.5E-02
:opper (Cu)	0.024	1.3E-05				2.3E-04	6.3E-03	0.051	1.8E-04				5.0E-04	1.3E-02
.ead and compounds (inorganic) (Pb)	0.0044	2.5E-06				4.3E-05		0.0052	1.8E-05				5.1E-05	
ıanganese (Mn)	1.2	6.7E-04				1.2E-02	2.3E+00	1.4	4.9E-03				1.4E-02	2.7E+00
ıercury (inorganic) (Hg)	0.00011	6.2E-08				1.1E-06	3.6E-03	0.00012	4.2E-07				1.2E-06	3.9E-03
ıickel, soluble salts (Ni)	0.024	1.3E-05				2.3E-04	1.2E-02	0.027	9.4E-05				2.6E-04	1.3E-02
ıitrate/Nitrite (total)	1.8	1.0E-03				1.8E-02		2.3	8.0E-03				2.3E-02	
:inc and compounds (Zn)	0.11	6.2E-05				1.1E-03	3.6E-03	0.15	5.2E-04				1.5E-03	4.9E-03
RGANIC	Units ug/L							Units ug/L						
ıenzene (BNZ)	2.3	1.3E-06	3.7E-08			2.3E-05		3.4	1.2E-05	3.4E-07			3.3E-05	
ıromodichloromethane (THM) (BDCM)	1.1	6.2E-07	3.8E-08			1.1E-05	5.4E-04	1.6	5.6E-06	3.5E-07			1.6E-05	7.8E-04
:arbon tetrachloride (CCL4)	1.1	6.2E-07	8.0E-08			1.1E-05	1.5E-02	1.6	5.6E-06	7.3E-07			1.6E-05	2.2E-02
:hlorobenzene (monochlorobenzene) (MCB)	10	5.6E-06				9.8E-05	4.9E-03	12	4.2E-05				1.2E-04	5.9E-03
:hloroform (THM) (CLFM)	1.4	7.8E-07	4.8E-09			1.4E-05	1.4E-03	1.9	6.6E-06	4.1E-08			1.9E-05	1.9E-03
:hloromethane (CM)	2.1	1.2E-06	1.5E-08			2.1E-05	5.1E-03	2.7	9.4E-06	1.2E-07			2.6E-05	6.6E-03
,2-Dichlorobenzene (DCB2)	30	1.7E-05				2.9E-04	3.3E-03	40	1.4E-04				3.9E-04	4.3E-03
,3-Dichlorobenzene (DCB3)	6.7	3.7E-06				6.6E-05	7.4E-04	12	4.2E-05				1.2E-04	1.3E-03
,4-Dichlorobenzene (DCB4)	7.5	4.2E-06	1.0E-07			7.3E-05	7.3E-04	13	4.5E-05	1.1E-06			1.3E-04	1.3E-03
,2-Dichloroethane (DCA2)	1.2	6.7E-07	6.1E-08			1.2E-05		1.6	5.6E-06	5.1E-07			1.6E-05	
,1-Dichloroethylene (DCE)	2.1	1.2E-06	7.0E-07			2.1E-05	2.3E-03	2.6	9.1E-06	5.5E-06			2.5E-05	2.8E-03
,2-Dichloroethylene (TOTAL)	27	1.5E-05				2.6E-04		41	1.4E-04				4.0E-04	
:is-1,2-Dichloroethylene	200	1.1E-04				2.0E-03	2.0E-01	290	1.0E-03				2.8E-03	2.8E-01
)ichloromethane (DCM)	8.1	4.5E-06	3.4E-08			7.9E-05	1.3E-03	12	4.2E-05	3.1E-07			1.2E-04	2.0E-03
,2-Dichloropropane (DCP2)	0.4«	2.2E-07	1.5E-08			3.9E-06		0.4«	1.4E-06	9.5E-08			3.9E-06	
:is-1,3-Dichloropropene (cDCP3)	0.5«	2.8E-07				4.9E-06		0.5«	1.7E-06				4.9E-06	

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TW-4														
	Units mg/L							Units mg/L						
RGANIC														
enic, inorganic (As)	0.0076	4.2E-06	6.4E-06	57		7.4E-05	2.5E-01	0.008«	2.8E-05	4.2E-05	43		7.8E-05	2.6E-01
d and compounds (inorganic) (Pb)	0.0045	2.5E-06				4.4E-05		0.005«	1.7E-05				4.9E-05	
ganese (Kn)	0.3	1.7E-04				2.9E-03	5.9E-01	0.95	3.3E-03				9.3E-03	1.9E+00
	Units ug/L							Units ug/L						
ANIC														
modichloromethane (THM) (BDCM)	0.25	1.4E-07	8.7E-09			2.4E-06	1.2E-04	0.42	1.5E-06	9.1E-08			4.1E-06	2.1E-04
loroform (THM) (CLFM)	0.66	3.7E-07	2.3E-09			6.5E-06	6.5E-04	1.5	5.2E-06	3.2E-08			1.5E-05	1.5E-03
trachloroethylene (PCE)	0.19	1.1E-07	5.3E-09			1.9E-06	1.9E-04	0.28	9.8E-07	4.9E-08			2.7E-06	2.7E-04
ichloroethylene (TCE)	0.34	1.9E-07	2.1E-09			3.3E-06		0.67	2.3E-06	2.6E-08			6.6E-06	
nyl chloride (VC)	4.6	2.6E-06	4.9E-06	43		4.5E-05		8.4	2.9E-05	5.6E-05	57		8.2E-05	
TOTALS		- -	1E-05			- -	8.4E-01	TOTALS	- -	1E-04			- -	2.1E+00
w/o Arsenic		- -	5E-06		- -	- -	- -	w/o Arsenic	- -	6E-05		- -	- -	- -

' One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
\DHS35
ift 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ater Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
ITE: TW-P	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Antimony (Sb)	0.042	2.3E-05				4.1E-04	1.0E+00	0.05«	1.7E-04				4.9E-04	1.2E+00
Arsenic, inorganic (As)	0.0064	3.6E-06	5.4E-06	57		6.3E-05	2.1E-01	0.0074	2.6E-05	3.9E-05	51		7.2E-05	2.4E-01
Lead and compounds (inorganic) (Pb)	0.0049	2.7E-06				4.8E-05		0.0068	2.4E-05				6.7E-05	
Manganese (Mn)	0.034	1.9E-05				3.3E-04	6.7E-02	0.046	1.6E-04				4.5E-04	9.0E-02
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	0.5«	2.8E-07	1.7E-08			4.9E-06	2.4E-04	0.5«	1.7E-06	1.1E-07			4.9E-06	2.4E-04
Chloroform (THM) (CLFM)	0.66	3.7E-07	2.3E-09			6.5E-06	6.5E-04	1.1	3.8E-06	2.3E-08			1.1E-05	1.1E-03
Tetrachloroethylene (PCE)	0.69	3.9E-07	1.9E-08			6.8E-06	6.8E-04	1.1	3.8E-06	1.9E-07			1.1E-05	1.1E-03
Trichloroethylene (TCE)	3.8	2.1E-06	2.3E-08			3.7E-05		4.9	1.7E-05	1.9E-07			4.8E-05	
Vinyl chloride (VC)	3.8	2.1E-06	4.0E-06	43		3.7E-05		5.5	1.9E-05	3.7E-05	48		5.4E-05	
TOTALS		- -	9E-06			- -	1.3E+00	TOTALS	- -	8E-05			- -	1.6E+00
w/o Arsenic		- -	4E-06		- -	- -	- -	w/o Arsenic	- -	4E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TW-2													
	Units mg/L						Units mg/L						
ANIC													
ic, inorganic (As)	0.006	3.4E-06	5.0E-06	37		5.9E-05	2.0E-01	0.006	2.1E-05	3.1E-05	37		5.9E-05	2.0E-01
anese (Mn)	0.18	1.0E-04				1.8E-03	3.5E-01	0.18	6.3E-04				1.8E-03	3.5E-01
	Units ug/L						Units ug/L						
NIC													
roform (THM) (CLFM)	0.49	2.7E-07	1.7E-09			4.8E-06	4.8E-04	0.49	1.7E-06	1.0E-08			4.8E-06	4.8E-04
Dichloroethane (DCA2)	1.5	8.4E-07	7.6E-08	1		1.5E-05		1.5	5.2E-06	4.8E-07	1		1.5E-05	
Dichloroethylene (DCE)	7.1	4.0E-06	2.4E-06	17		6.9E-05	7.7E-03	7.1	2.5E-05	1.5E-05	17		6.9E-05	7.7E-03
achloroethylene (PCE)	0.48	2.7E-07	1.3E-08			4.7E-06	4.7E-04	0.48	1.7E-06	8.4E-08			4.7E-06	4.7E-04
hloroethylene (TCE)	11	6.2E-06	6.8E-08			1.1E-04		11	3.8E-05	4.2E-07			1.1E-04	
l chloride (VC)	5.8	3.2E-06	6.2E-06	45		5.7E-05		5.8	2.0E-05	3.9E-05	45		5.7E-05	
TOTALS w/o Arsenic	- -	1E-05			- -	- -	5.6E-01	TOTALS w/o Arsenic	- -	9E-05		- -	- -	5.6E-01
	- -	9E-06				- -	- -		- -	5E-05			- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
HS35
t 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
E: TW-3														
	Units mg/L							Units mg/L						
NORGANIC														
rsenic, inorganic (As)	0.0079	4.4E-06	6.6E-06	52		7.7E-05	2.6E-01	0.008«	2.8E-05	4.2E-05	39		7.8E-05	2.6E-01
loron and borates only (B)	0.6	3.4E-04				5.9E-03	6.5E-02	0.7«	2.4E-03				6.8E-03	7.6E-02
ead and compounds (inorganic) (Pb)	0.006«	3.4E-06				5.9E-05		0.006«	2.1E-05				5.9E-05	
langanese (Mn)	1.5	8.4E-04				1.5E-02	2.9E+00	1.7«	5.9E-03				1.7E-02	3.3E+00
	Units ug/L							Units ug/L						
RGANIC														
enzene (BNZ)	0.54	3.0E-07	8.8E-09			5.3E-06		0.88	3.1E-06	8.9E-08			8.6E-06	
romodichloromethane (THM) (BDCM)	0.27	1.5E-07	9.4E-09			2.6E-06	1.3E-04	0.46	1.6E-06	1.0E-07			4.5E-06	2.3E-04
hloroform (THM) (CLFM)	0.4	2.2E-07	1.4E-09			3.9E-06	3.9E-04	0.63	2.2E-06	1.3E-08			6.2E-06	6.2E-04
1,2-Dichloroethane (DCA2)	0.23	1.3E-07	1.2E-08			2.3E-06		0.32	1.1E-06	1.0E-07			3.1E-06	
ichloromethane (DCM)	1.1	6.2E-07	4.6E-09			1.1E-05	1.8E-04	1.3	4.5E-06	3.4E-08			1.3E-05	2.1E-04
etrachloroethylene (PCE)	0.29	1.6E-07	8.1E-09			2.8E-06	2.8E-04	0.39	1.4E-06	6.8E-08			3.8E-06	3.8E-04
richloroethylene (TCE)	1.7	9.5E-07	1.0E-08			1.7E-05		3.4	1.2E-05	1.3E-07			3.3E-05	
inyl chloride (VC)	5.7	3.2E-06	6.1E-06	48		5.6E-05		10	3.5E-05	6.6E-05	61		9.8E-05	
TOTALS	- -		1E-05			- -	3.3E+00	TOTALS	- -	1E-04			- -	3.7E+00
w/o Arsenic	- -		6E-06		- -	- -	- -	w/o Arsenic	- -	7E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TE: SB-7														
	Units ug/L							Units ug/L						
ORGANIC														
Chloroform (THM) (CLFM)	0.94	5.3E-07	3.2E-09			9.2E-06	9.2E-04	0.94	3.3E-06	2.0E-08			9.2E-06	9.2E-04
1,1-Dichloroethylene (DCE)	18	1.0E-05	6.0E-06	95		1.8E-04	2.0E-02	18	6.3E-05	3.8E-05	95		1.8E-04	2.0E-02
Tetrachloroethylene (PCE)	0.24	1.3E-07	6.7E-09			2.3E-06	2.3E-04	0.24	8.4E-07	4.2E-08			2.3E-06	2.3E-04
Trichloroethylene (TCE)	46	2.6E-05	2.8E-07	4		4.5E-04		46	1.6E-04	1.8E-06	4		4.5E-04	
TOTALS		- -	6E-06			- -	2.1E-02	TOTALS	- -	4E-05			- -	2.1E-02
w/o Arsenic		- -	6E-06		- -	- -	- -	w/o Arsenic	- -	4E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC		
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
IE: TW-1														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0087	4.9E-06	7.3E-06	81		8.5E-05	2.8E-01	0.013«	4.5E-05	6.8E-05	77		1.3E-04	4.2E-01
Lead and compounds (inorganic) (Pb)	0.0098	5.5E-06				9.6E-05		0.018«	6.3E-05				1.8E-04	
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	1.3	7.3E-07	2.1E-08			1.3E-05		2.9	1.0E-05	2.9E-07			2.8E-05	
Bromodichloromethane (THM) (BDCM)	0.39	2.2E-07	1.4E-08			3.8E-06	1.9E-04	0.65	2.3E-06	1.4E-07			6.4E-06	3.2E-04
Chloroform (THM) (CLFM)	1.6	8.9E-07	5.5E-09			1.6E-05	1.6E-03	2.2	7.7E-06	4.7E-08			2.2E-05	2.2E-03
1,2-Dichloroethane (DCA2)	0.24	1.3E-07	1.2E-08			2.3E-06		0.35	1.2E-06	1.1E-07			3.4E-06	
1,1-Dichloroethylene (DCE)	2.4	1.3E-06	8.1E-07	9		2.3E-05	2.6E-03	3.4	1.2E-05	7.1E-06	8		3.3E-05	3.7E-03
Tetrachloroethylene (PCE)	1.1	6.2E-07	3.1E-08			1.1E-05	1.1E-03	1.7	5.9E-06	3.0E-07			1.7E-05	1.7E-03
Trichloroethylene (TCE)	13	7.3E-06	8.0E-08	1		1.3E-04		17	5.9E-05	6.5E-07	1		1.7E-04	
Vinyl chloride (VC)	0.75	4.2E-07	8.0E-07	9		7.3E-06		1.8	6.3E-06	1.2E-05	13		1.8E-05	
TOTALS		- -	9E-06			- -	2.9E-01	TOTALS	- -	9E-05			- -	4.3E-01
w/o Arsenic		- -	2E-06		- -	- -	- -	w/o Arsenic	- -	2E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

4ADHS35

raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
E: SB-5	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
RGANIC	Units ug/L							Units ug/L						
arbon tetrachloride (CCL4)	8.3	4.6E-06	6.0E-07	10		8.1E-05	1.2E-01	8.3	2.9E-05	3.8E-06	10		8.1E-05	1.2E-01
hloroform (THM) (CLFM)	2.3	1.3E-06	7.8E-09			2.3E-05	2.3E-03	2.3	8.0E-06	4.9E-08			2.3E-05	2.3E-03
,1-Dichloroethylene (DCE)	16	8.9E-06	5.4E-06	90		1.6E-04	1.7E-02	16	5.6E-05	3.4E-05	90		1.6E-04	1.7E-02
richloroethylene (TCE)	1.3	7.3E-07	8.0E-09			1.3E-05		1.3	4.5E-06	5.0E-08			1.3E-05	
	TOTALS	- -	6E-06			- -	1.4E-01	TOTALS	- -	4E-05			- -	1.4E-01
	w/o Arsenic	- -	6E-06		- -	- -	- -	w/o Arsenic	- -	4E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
E: SB-6	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
RGANIC	Units ug/L							Units ug/L						
romodichloromethane (THM) (BDCM)	0.53	3.0E-07	1.8E-08	1		5.2E-06	2.6E-04	0.97	3.4E-06	2.1E-07	1		9.5E-06	4.7E-04
hloroform (THM) (CLFM)	1.7	9.5E-07	5.8E-09			1.7E-05	1.7E-03	2	7.0E-06	4.3E-08			2.0E-05	2.0E-03
,2-Dichloroethane (DCA2)	0.35	2.0E-07	1.8E-08	1		3.4E-06		0.5«	1.7E-06	1.6E-07	1		4.9E-06	
,1-Dichloroethylene (DCE)	7.1	4.0E-06	2.4E-06	75		6.9E-05	7.7E-03	9.2	3.2E-05	1.9E-05	72		9.0E-05	1.0E-02
ichloromethane (DCM)	1.5	8.4E-07	6.3E-09			1.5E-05	2.4E-04	2.1	7.3E-06	5.5E-08			2.1E-05	3.4E-04
etrachloroethylene (PCE)	0.68	3.8E-07	1.9E-08	1		6.7E-06	6.7E-04	0.86	3.0E-06	1.5E-07	1		8.4E-06	8.4E-04
richloroethylene (TCE)	50	2.8E-05	3.1E-07	10		4.9E-04		65	2.3E-04	2.5E-06	9		6.4E-04	
inyl chloride (VC)	0.41	2.3E-07	4.4E-07	14		4.0E-06		0.66«	2.3E-06	4.4E-06	16		6.5E-06	
TOTALS w/o Arsenic		- -	3E-06		- -	- -	1.1E-02	TOTALS w/o Arsenic	- -	3E-05		- -	- -	1.4E-02
		- -	3E-06			- -	- -		- -	3E-05			- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

ADHS35
aft 8/95

ble E Worksheet for Calculating Soil Gas Risk Central Tendency Exposure

	CH2CL2 UG/L	FREON 11 UG/L	1,1 DCE UG/L	1,1 DCA UG/L	1,2 DCE UG/L	CHCL3 UG/L	FREON 11	1,2 DCA UG/L	TCA UG/L	CCL4 UG/L	TCE UG/L	PCE UG/L	BENZENE UG/L	TOLUENE UG/L	CHLORO BENZENE UG/L	ETHYL BENZENE UG/L	TOTAL XYLENES UG/L	1,2/1,4 DCB UG/L	1,2 DCB UG/L	VINYL CHLORIDE UG/L	METHANE UG/L
	0.01	0.001	0.005	0.05	0.05	0.00025	0.001	0.001	0.0001	3.5E-05	0.001	0.0008	14	8	0.15	20	66	10	0.4	0.01	61000
	0.01	0.0006	0.005	0.05	0.05	0.00025	0.00025	0.001	0.0001	3.5E-05	0.009	0.004	2	2	0.15	1	14	0.5	0.4	0.01	120000
	0.5	0.001	0.1	0.05	2	0.00025	0.00025	0.001	0.0001	3.5E-05	0.2	0.002	0.05	0.2	0.15	0.5	0.05	0.5	0.4	2	500
	0.01	0.0004	0.01	0.5	0.2	0.00025	0.00025	0.001	0.0001	3.5E-05	0.005	0.002	3	0.5	0.15	5	3	0.5	0.4	0.5	42000
	0.01	0.1	0.005	0.5	0.1	0.00025	0.5	0.001	0.0001	3.5E-05	0.04	0.02	10	1	2	22	10	0.5	0.4	0.3	44000
	0.01	0.003	0.005	25	0.1	0.00025	0.00025	0.001	0.05	3.5E-05	0.02	0.05	0.5	2	0.15	1	41		0.4	2	500
	0.025	0.2	0.01	0.4	2	0.0005	0.04	0.005	0.002	0.0001	0.5	0.3	2	2	0.4	3	3	1.5	1	0.5	26000
	0.005	0.005	0.1	0.2	0.25	0.1	0.001	0.035	0.0015	0.0002	0.5	0.01	0.05	0.5	0.5	1	10	0.15	0.1	0.5	46000
	0.05	0.05	0.05	0.3	0.1	0.05	0.05	0.05	0.05	0.05	0.2	0.1	2	1	0.05	0.05	2	0.05	0.05	0.05	
	0.025	0.002	0.01	0.15	0.15	0.0005	0.0005	0.05	0.00025	0.0001	0.0005	0.002	0.4	0.5	0.15	2	2	0.5	1	0.01	32000
	0.1	0.00015	0.03	0.25	0.2	0.001	0.01	1	0.01	0.002	0.02	0.002	1.5	0.3	1.5	0.1	5		0.1	1	28000
	0.025	0.002	0.01	0.15	0.15	0.0005	0.0005	0.05	0.00025	0.0001	0.0005	0.001	0.35	0.5	2.5	0.5	1	10	12.5	0.01	1300
	0.1	0.00015	0.03	1	1	0.0005	0.003	0.03	0.002	0.0005	0.01	0.03	0.05	0.2	0.15	0.25	11	0.3	3.5	0.3	22000
	0.035	0.003	0.01	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.0003	0.02	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
	0.01	0.0005	0.005	0.05	0.05	0.00025	0.00025	0.05	0.0001	3.5E-05	0.01	0.0003	0.02	0.04	0.15	0.035	5	0.5	1	0.05	43000
	0.035	0.00025	0.01	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.007	0.008	0.05	0.1	0.15	0.1	0.1	0.5	0.1	0.01	1300
	0.13	0.00025	0.05	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.07	0.0015	0.05	0.1	0.15	2	0.1	0	0.1		
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.1	0.005	1	0.1	1.5	0.1	6	0.15	0.1	0.4	46000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.02	0.003	0.5	0.1	1.5	0.1	12	0.15	0.1	0.2	46000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.07	0.004						0.15	0.1	0.01	47000
	0.005	0.0003	0.05	0.1	0.25	0.00015	0.001	0.03	0.0015	0.0002	0.1	0.0005	0.05	0.1	0.15	0.1	1	0.15	0.1	0.01	1300
	0.3	0.0005	0.1	0.1	0.5	0.0003	0.002	0.05	0.0025	0.0005	0.5	0.0015	0.05	0.4	0.15	2	0.5	0.15	0.3	0.01	120000
	0.3	0.0003	0.05	0.05	0.1	3E-05	0.0005	0.015	0.0005	0.0001	0.1	0.005	0.05		0.15	2	0.5	3	0.4	0.01	47000
	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.05	0.0005	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.035	0.0015	0.0002	5	0.03	0.05	0.1	0.15	2	2	3	0.2	0.01	20000
	0.005	0.001	0.1	0.1	0.25	0.00015	0.004	0.035	0.0015	0.0005	0.05	0.0003	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
	0.2	0.0003	0.05	0.05	0.1	3E-05	0.0005	0.015	0.0005	0.0001	0.4	0.001	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.07	84000
	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.05	0.0005	4	0.1	0.15	0.1	20	0.15	0.1	0.2	68000
	0.1	0.002	0.05	0.05	0.25	0.00015	0.001	0.07	0.04	0.0002	0.02	0.01	0.025	0.4	1	0.5	0.5	0.5	0.5	0.04	80000
	0.2	0.0005	0.025	0.05	0.1	3E-05	0.0005	0.015	0.0005	0.0001	0.02	0.002	4	0.1	14	0.1	0.1	34	48	0.1	32000
	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.02	0.004	8	0.1	11	0.1	2	0.15	14	0.2	83000
	0.4	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.02	0.003	8	0.1	21	0.1	14	72	0.1	0.04	87000
	0.005	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.00015	0.0005	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.02	0.01	3	0.1	2	1	3	20	17	0.2	73000
	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.0015	0.0005	13	0.1	20	0.1	10	1.5	1	0.01	61000
	0.01	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.01	0.01	0	0.1	26	0.1	0	1	31	0.01	90000
	0.003	0.00015	0.025	0.03	0.1	0.0008	0.0005	0.015	0.0005	0.0001	0.007	0.003	20	0.1	30	0.1	3	0.15	31	0.01	37000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.03	0.01	2	0.1	6	0.5	12	0.15	0.1	0.01	37000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.01	0.003	0.7	0.1	1	0.5	3	0.15	34	0.01	180000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.02	0.004	0.5	0.1	0.5	0.1	0.35	0.15	7	0.01	62000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.04	0.01	3	0.1	4	3	10			0.2	62000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.01	0.004	0.5	0.1	0	3	15	6	4	0.1	44000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.0015	0.0005	1	0.1		0.1	3		0.1	0.01	39000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.00025	0.02	0.005	1	0.1	0.15	0.1	6	5	4	0.2	84000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.02	0.02	0.4	0.1	0.15	0.1	0.1	0.15	0.1	0.5	31000
	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.0015	0.0005	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.1	1300
	0.07	0.01	0.05	0.87	0.31	0.00	0.01	0.05	0.00	0.00	0.21	0.02	2.06	0.50	4.23	1.67	7.02	4.17	2.68	0.23	43827.27
	0.12	0.03	0.03	3.36	0.30	0.02	0.04	0.14	0.01	0.01	0.75	0.05	3.60	1.40	10.41	4.36	11.00	12.40	13.44	0.44	36088.81
	44	44	44	44	44	44	44	44	44	44	44	44	43	44	44	44	43	43	43	43	44
	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.71	0.63	0.63	0.71	0.71	0.68	0.71	0.71	0.63
	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01
	0.11	0.03	0.05	2.63	0.42	0.01	0.02	0.10	0.01	0.00	0.43	0.03	4.04	0.97	7.41	2.96	10.36	6.02	0.71	0.36	84823.47
	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05
	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
	0.15	0.08	0.12	2.51	0.80	0.01	0.02	0.14	0.01	0.00	0.34	0.04	7.67	1.42	11.01	4.34	16.17	10.80	14.72	0.60	*********
	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34
	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
	1.7E-03	1.8E-06	1.0E-06	2.2E-04	7.1E-05	8.1E-07	2.2E-06	1.3E-06	1.1E-06	3.0E-07	4.8E-05	3.7E-06	6.6E-04	1.3E-04	8.6E-04	3.6E-04	1.6E-03	6.6E-04	1.3E-03	8.3E-05	1.0E+01
	20																				
	230																				
	4																				
	70																				
	1533																				
	23000																				
	1.8E-07	2.2E-08	1.2E-07	2.8E-06	8.3E-07	1.1E-08	2.6E-08	1.3E-07	1.3E-06	3.5E-08	5.6E-07	4.4E-06	8.0E-06	1.5E-06	1.1E-05	4.5E-06	1.9E-05	0.0E+00	1.1E-05	1.3E-05	8.2E-07	1.2E-01
	2.2E-06	3.7E-07	2.0E-06	4.4E-05	1.4E-06	1.8E-07	4.3E-07	2.3E-06	2.1E-07	5.8E-06	8.3E-06	7.3E-07	1.3E-04	2.3E-05	1.8E-04	7.2E-05	3.2E-04	0.0E+00	1.8E-04	2.6E-04	1.0E-05	2.0E+00
	6.0E-08	3.0E-01	9.0E-03		9.0E-03	1.0E-02				7.0E-04		1.0E-02		2.0E-01	2.0E-02	1.0E-01	2.0E+00			9.0E-02		
	4.7E-04		8.0E-02			2.3E-02		2.0E-02		1.3E-02	1.7E-03	8.2E-04	8.3E-03							8.4E-02		
	1.8E-03		1.8E-01			8.1E-02		8.1E-02		8.3E-02	6.0E-02	1.8E-03	2.9E-02							2.8E-01		
	3E-10		2E-08			9E-10		1E-08		2E-10	3E-08	9E-11	2E-07							2E-07		5E-07
	5.4E-05	1.2E-06	0.000228		0.001843	1.79E-05				8.37E-06		7.29E-06		0.000122	0.000941	0.000753	0.000139		0.000941			2E-06

nex Table E Worksheet for Calculating Soil Gas Risk Maximal Exposure

	CH2CL2 UG/L	FREON 11 UG/L	1,1 DCE UG/L	1,1 DCA UG/L	1,2 DCE UG/L	CHCL3 UG/L	FREON 11	1,2 DCA UG/L	TCA UG/L	CCL4 UG/L	TCE UG/L	PCE UG/L	BENZENE UG/L	TOLUENE UG/L	CHLORO BENZENE UG/L	ETHYL BENZENE UG/L	TOTAL XYLENES UG/L	1,3/1,4 DCB UG/L	1,2 DCB UG/L	VINYL CHLORIDE UG/L	METHANE UG/L
)1	0.01	0.001	0.005	0.05	0.05	0.00023	0.001	0.001	0.0001	3.5E-05	0.001	0.0005	14	9	0.15	29	86	10	0.4	0.01	81000
)2	0.01	0.0005	0.005	0.05	0.05	0.00023	0.00023	0.001	0.0001	3.5E-05	0.005	0.004	2	2	0.15	1	14	0.5	0.4	0.01	120000
)3	0.5	0.001	0.1	0.05	2	0.00023	0.00023	0.001	0.0001	3.5E-05	0.2	0.002	0.05	0.2	0.15	0.5	0.05	0.5	0.4	2	300
)4	0.01	0.0004	0.01	0.5	0.2	0.00023	0.00023	0.001	0.0001	3.5E-05	0.005	0.002	3	0.5	0.15	5	3	0.5	0.4	0.5	43000
)5	0.01	0.1	0.005	0.5	0.1	0.00023	0.2	0.001	0.0001	3.5E-05	0.04	0.02	10	1	2	22	10	0.5	0.4	0.3	44000
)6	0.01	0.003	0.005	30	0.1	0.00023	0.00023	0.001	0.05	3.5E-05	0.02	0.05	0.5	2	0.15	1	41		0.4	2	500
)7	0.025	0.2	0.01	0.4	2	0.0023	0.04	0.005	0.002	0.0001	0.5	0.3	2	2	0.4	3	5	1.5	1	0.5	28000
)7A	0.005	0.005	0.1	0.2	0.25	0.1	0.001	0.005	0.0015	0.0002	0.5	0.01	0.05	0.5	0.5	1	10	0.15	0.1	0.5	46000
)7B	0.05	0.05	0.05	0.3	0.1	0.05	0.05	0.05	0.05	0.05	0.2	0.1	2	1	0.05	0.05	2	0.05	0.05	0.05	
)8	0.025	0.005	0.01	0.15	0.15	0.0058	0.0058	0.05	0.00025	0.0001	0.0005	0.002	0.4	0.3	0.15	2	2	0.5	1	0.01	32000
)8A	0.1	0.00015	0.03	0.25	0.2	0.001	0.01	1	0.01	0.002	0.02	0.002	1.5	0.3	1.5	0.1	5		0.1	1	28000
)9	0.025	0.005	0.01	0.15	0.15	0.0058	0.0058	0.05	0.00025	0.0001	0.0005	0.001	0.35	0.5	2.5	0.5	1	10	12.5	0.01	1300
)9A	0.1	0.00015	0.03	1	1	0.0035	0.005	0.03	0.002	0.0005	0.01	0.03	0.05	0.2	0.15	0.25	11	0.3	2.5	0.3	22000
)9B	0.035	0.005	0.01	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.0005	0.02	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
10	0.01	0.0005	0.005	0.05	0.05	0.00025	0.00025	0.05	0.0001	3.5E-05	0.01	0.0003	0.02	0.04	0.15	0.035	5	0.5	1	0.05	43000
11	0.035	0.00025	0.01	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.007	0.005	0.05	0.1	0.15	0.1	0.1	0.5	0.1	0.01	1300
12	0.15	0.00025	0.05	0.4	0.3	0.0015	0.001	0.1	0.001	0.0002	0.07	0.0015	0.05	0.1	0.15	2	0.1	0	0.1		
13	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.1	0.005	1	0.1	1.5	0.1	6	0.15	0.1	0.4	46000
14	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.02	0.003	0.5	0.1	1.5	0.1	12	0.15	0.1	0.2	46000
15	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.005	0.0015	0.0002	0.07	0.004						0.15	0.1	0.01	47000
16	0.005	0.0003	0.05	0.1	0.25	0.00015	0.001	0.03	0.0015	0.0002	0.1	0.0005	0.05	0.1	0.15	0.1	1	0.15	0.1	0.01	1300
17	0.3	0.0005	0.1	0.1	0.5	0.0023	0.005	0.05	0.0025	0.0005	0.5	0.0015	0.05	0.4	0.15	2	0.5	0.15	0.3	0.01	120000
18	0.3	0.0003	0.05	0.05	0.1	5E-05	0.0005	0.015	0.0005	0.0001	0.5	0.005	0.05		0.15	2	0.5	3	0.4	0.01	47000
19	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.05	0.0005	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
20	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.5	0.03	0.05	0.1	0.15	2	2	3	0.2	0.01	20000
21	0.005	0.001	0.1	0.1	0.25	0.00015	0.004	0.035	0.0015	0.0005	0.05	0.0005	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
22	0.2	0.0003	0.05	0.05	0.1	5E-05	0.0005	0.015	0.0005	0.0001	0.4	0.001	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.07	84000
23	0.005	0.0003	0.1	0.1	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.05	0.0005	1	0.1	0.15	0.1	20	0.15	0.1	0.2	88000
24	0.1	0.002	0.05	0.05	0.25	0.00015	0.001	0.07	0.04	0.0002	0.02	0.01	0.025	0.4	1	0.5	0.5	0.5	0.5	0.04	50000
25	0.2	0.0005	0.025	0.05	0.1	5E-05	0.0005	0.015	0.0005	0.0001	0.02	0.003	1	0.1	1.5	0.1	0.1	34	48	0.1	32000
26	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.02	0.004	0.5	0.1	1.5	0.1	2	0.15	1.5	0.2	85000
27	0.1	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.02	0.005	0.5	0.1	2.1	0.1	1.5	72	0.1	0.04	57000
28	0.005	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.00015	0.0005	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.01	1300
29	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.02	0.01	0.5	0.1	2	1	3	20	17	0.2	73000
30	0.2	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.0015	0.0005	1.5	0.1	20	0.1	10	1.5	1	0.01	61000
31	0.01	0.0003	0.05	0.05	0.25	0.00015	0.001	0.035	0.0015	0.0002	0.01	0.01	0.5	0.1	20	0.1	6	1	51	0.01	50000
32	0.003	0.00015	0.025	0.03	0.1	0.0005	0.0005	0.015	0.0005	0.0001	0.007	0.003	20	0.1	30	0.1	5	0.15	51	0.01	37000
33	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.03	0.01	2	0.1	6	0.5	12	0.15	0.1	0.01	37000
34	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.01	0.005	0.7	0.1	1	0.5	3	0.15	34	0.01	180000
35	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.02	0.004	0.5	0.1	0.5	0.1	0.35	0.15	7	0.01	62000
36	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.04	0.01	3	0.1	4	3	10			0.2	62000
37	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.01	0.004	0.5	0.1	0	3	15	0	4	0.1	44000
38	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.0015	0.0005	1	0.1		0.1	2		0.1	0.01	39000
39	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.00023	0.02	0.005	1	0.1	0.15	0.1	0	0	4	0.2	84000
40	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.02	0.02	0.4	0.1	0.15	0.1	0.1	0.15	0.1	0.5	81000
41	0.005	0.0003	0.05	0.05	0.25	0.0015	0.001	0.035	0.0015	0.0002	0.0015	0.0005	0.05	0.1	0.15	0.1	0.1	0.15	0.1	0.1	1300
(mg/m^3)	0.07	0.01	0.05	0.07	0.31	0.00	0.01	0.05	0.00	0.00	0.21	0.02	2.96	0.50	4.23	1.07	7.02	6.17	2.98	0.23	43827.27
**	0.12	0.03	0.03	0.50	0.30	0.02	0.04	0.14	0.01	0.01	0.75	0.05	3.00	1.40	10.41	4.30	11.00	12.40	13.44	0.44	36388.01
	44	44	44	44	44	44	44	44	44	44	44	44	43	44	44	43	43	43	43	43	44
3	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.71	0.83	0.83	0.71	0.71	0.40	0.71	0.71	0.83
	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01
UCL	0.11	0.02	0.05	2.63	0.42	0.01	0.32	0.10	0.01	0.00	0.43	0.03	4.04	0.97	7.41	2.96	10.36	0.02	0.71	0.36	84823.47
/sec)	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05
^2)	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
g/sec)	0.38	0.05	0.14	0.80	1.10	0.02	0.08	0.23	0.02	0.01	1.11	0.08	12.01	2.52	19.18	7.72	27.34	20.78	23.16	0.94	1.4E+05
)	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34	402.34
)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
/sec)	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
(mg/m^3)	2.5E-03	4.2E-06	1.2E-06	6.0E-04	3.9E-06	2.0E-06	9.3E-06	2.2E-05	1.9E-06	8.0E-07	8.9E-06	6.9E-06	1.1E-03	2.2E-04	1.7E-03	6.9E-04	2.4E-03	1.8E-03	2.2E-03	8.4E-05	1.3E+01
^3/day)	20																				
m/yr/yr)	230																				
yr)	25																				
kg)	70																				
(days)	9125																				
(days)	25000																				
(mg/kg dy)	1.7E-06	2.8E-07	8.7E-07	4.2E-05	6.6E-06	1.4E-07	3.7E-07	1.0E-06	1.3E-07	5.6E-08	6.0E-06	4.8E-07	7.5E-05	1.0E-05	1.2E-04	4.9E-05	1.7E-04	0.0E+00	1.3E-04	1.6E-06	3.8E-06	8.8E-01
ic (mg/kg dy)	4.8E-06	8.1E-07	2.4E-06	1.2E-04	1.8E-05	4.0E-07	1.0E-06	4.4E-06	3.7E-07	1.6E-07	1.8E-05	1.4E-06	2.1E-04	4.4E-05	3.3E-04	1.3E-04	4.7E-04	0.0E+00	3.6E-04	4.4E-04	1.0E-05	2.5E+00
(mg/kg dy)	8.0E-02	3.0E-01	9.0E-03		9.0E-03	1.0E-02				7.0E-04		1.0E-02		2.0E-01	2.0E-02	1.0E-01	2.0E+00			9.0E-02		
	4.7E-04		5.0E-02			2.3E-02		2.4E-02		1.4E-02	1.7E-03	6.2E-04	8.3E-03							8.4E-03		
mg/kg dy)^-1	1.0E-03		1.0E-01			6.1E-03		6.1E-03		8.3E-02	6.0E-03	1.0E-03	2.5E-02							2.5E-01		
R	3E-06		2E-07			1E-06		1E-07		2E-09	4E-07	9E-10	2E-06							2E-06		5E-06
	7.8E-05	2.72E-06	0.000271		0.000184	3.8E-06				0.000224		0.000135		0.000219	0.018865	0.001341	0.000237		0.004858			3E-02

MEAN - Arithmatic average of samples including Sample Quantitation Limits (SQLs)

CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - CARCINOGENIC EXPOSURE X slope factor(chemical specific)

CARCINOGENIC HAZARD INDEX - (CARCINOGENIC EXPOSURE) + (reference dose(Rfd) + safety factor(10))

NON-CARCINOGENIC CDI - $\frac{\text{(MEAN Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(4 yrs))}}{\text{(body weight(70 kg) x averaging time(4 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - NON-CARCINOGENIC EXPOSURE + reference dose(Rfd)

RME - Reasonable Maximum Exposure using 95% upper confidence limit (UCL) of mean concentration

CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(70 yrs x 365 d/yr))}}$

CARCINOGENIC RISK - same as above

CARCINGOENIC HAZARD INDEX - same as above

NON-CARCINOGENIC CDI - $\frac{\text{(RME Concentration (mg/L) x ingestion rate(1 L/d) x frequency(250 d/yr) x duration(25 yrs))}}{\text{(body weight(70 kg) x averaging time(25 yrs x 365 d/yr))}}$

NON-CARCINOGENIC HAZARD QUOTIENT - same as above

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

)HS35
ft 8/95

Appendix Table D.- Worksheet for Calculating Risk and Hazard from Inhalation of Fugitive Dust, Estes Landfill Risk Assessment

	A	B	C	D	E	F	G	H	J	K	M																	
	8/30/84	8/30/84	8/30/84	8/30/84	8/31/84	8/31/84	8/30/84	8/31/84	8/31/84	8/31/84	8/30/84	Mean	n	Std Dev	95% UC	EF	ED	IR	PEF	1/PEF	BW	ATc	ATnc	SF	RfD	ELCR	HQ
Silver	0.14	0.08	0.04	0.04	0.05	0.03	0.015	0.015	0.15	0.015	0.05	0.06	3.32	0.05	0.08	250	25	20	1.4E+10	7.4E-11	70	25550	10950		5E-03		2E-10
Arsenic	3.3	3.7	2.8	2.8	4.2	4.3	2.6	3.3	3.5	2.8	2.8	3.30	3.32	0.58	3.68	250	25	20	1.4E+10	7.4E-11	70	25550	10950	1.8	3E-04	3E-11	1E-07
Barium	106	85.1	58.5	56.6	68.5	58	51.8	47.5	69.5	61.9	126	71.96	3.32	24.39	88.36	250	25	20	1.4E+10	7.4E-11	70	25550	10950		7E-02		2E-08
Beryllium	0.25	0.37	0.38	0.26	0.37	0.35	0.26	0.27	0.15	0.25	0.32	0.28	3.32	0.07	0.34	250	25	20	1.4E+10	7.4E-11	70	25550	10950	4.3	5E-03	8E-12	8E-10
Cadmium	0.8	0.32	0.18	0.17	0.1	0.1	0.06	0.17	0.42	0.08	0.06	0.22	3.32	0.22	0.37	250	25	20	1.4E+10	7.4E-11	70	25550	10950	6.3	5E-04	1E-11	9E-09
Chromium	7.1	5.3	3.7	7.8	8.7	5.7	2.6	7.4	5.1	4.3	3.4	5.65	3.32	2.16	7.10	250	25	20	1.4E+10	7.4E-11	70	25550	10950		1E+00		9E-11
Copper	258	25	16.1	15.	15.4	19.4	11.3	12	20.2	8.5	181	52.99	3.32	84.22	109.67	250	25	20	1.4E+10	7.4E-11	70	25550	10950		4E-02		4E-08
Manganese	269	255	167	18.4	218	184	154	169	200	162	217	184.06	3.32	66.18	228.31	250	25	20	1.4E+10	7.4E-11	70	25550	10950		5E-03		8E-07
Nickel	18.1	16.4	13.5	12.2	16.6	13.6	11	11.3	14.3	15.4	8.1	13.68	3.32	2.92	15.64	250	25	20	1.4E+10	7.4E-11	70	25550	10950		2E-02		8E-09
Lead	100	84	17	11.6	17	18	8.2	10	50	6.3	7.8	30.73	3.32	35.14	54.33	250	25	20	1.4E+10	7.4E-11	70	25550	10950				
Beta-BHC	0.125	0.0125	0.0025	0.012	0.0025	0.038	0.0025	0.0025	0.023	0.0025	0.0025	0.02	3.32	0.04	0.05	250	25	20	1.4E+10	7.4E-11	70	25550	10950				
4,4'-DDD	0.25	0.025	0.005	0.025	0.005	0.05	0.005	0.005	0.08	0.005	0.005	0.04	3.32	0.07	0.09	250	25	20	1.4E+10	7.4E-11	70	25550	10950	1.3	3E-04	3E-13	2E-09
4,4'-DDE	0.7	0.44	0.02	0.18	0.02	0.07	0.005	0.07	0.13	0.005	0.005	0.15	3.32	0.22	0.30	250	25	20	1.4E+10	7.4E-11	70	25550	10950	0.24		1E-13	
4,4'-DDT	0.6	0.13	0.01	0.07	0.02	0.03	0.005	0.04	0.1	0.005	0.01	0.09	3.32	0.17	0.21	250	25	20	1.4E+10	7.4E-11	70	25550	10950	0.34		5E-13	
Aroclor12	0.75	0.075	0.015	0.075	0.015	0.08	0.015	0.08	0.075	0.015	0.015	0.11	3.32	0.21	0.26	250	25	20	1.4E+10	7.4E-11	70	25550	10950	0.34	5E-04	4E-13	5E-09
Be	0.085	0.085	0.085	0.085	0.085	0.085	0.27	0.085	0.085	0.085	0.085	0.10	3.32	0.06	0.14	250	25	20	1.4E+10	7.4E-11	70	25550	10950	7.7		1E-11	
																								0.014	2E-02	1E-14	8E-11
																										7E-11	8E-07

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-15														
	Units mg/L							Units mg/L						
INORGANIC														
Lead and compounds (inorganic) (Pb)	0.0026	1.5E-06				2.5E-05		0.005«	1.7E-05				4.9E-05	
Manganese (Mn)	0.15	8.4E-05				1.5E-03	2.9E-01	0.32	1.1E-03				3.1E-03	6.3E-01
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	2«	1.1E-06	3.2E-08			2.0E-05		2«	7.0E-06	2.0E-07			2.0E-05	
cis-1,2-Dichloroethylene	850	4.8E-04				8.3E-03	8.3E-01	1100«	3.8E-03				1.1E-02	1.1E+00
Trichloroethylene (TCE)	2.6	1.5E-06	1.6E-08			2.5E-05		3.2	1.1E-05	1.2E-07			3.1E-05	
Vinyl chloride (VC)	870	4.9E-04	9.2E-04	100		8.5E-03		1700	5.9E-03	1.1E-02	100		1.7E-02	
TOTALS		- -	9E-04			- -	1.1E+00	TOTALS	- -	1E-02			- -	1.7E+00
w/o Arsenic		- -	9E-04		- -	- -	- -	w/o Arsenic	- -	1E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ater Sample

TE: EW-14

	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0074	4.1E-06	6.2E-06	28		7.2E-05	2.4E-01	0.008«	2.8E-05	4.2E-05	22		7.8E-05	2.6E-01
Boron and borates only (B)	0.56	3.1E-04				5.5E-03	6.1E-02	0.61	2.1E-03				6.0E-03	6.6E-02
Cadmium (Cd)	0.0026	1.5E-06				2.5E-05	5.1E-02	0.0035	1.2E-05				3.4E-05	6.8E-02
Lead and compounds (inorganic) (Pb)	0.0034	1.9E-06				3.3E-05		0.0056	2.0E-05				5.5E-05	
Manganese (Mn)	0.29	1.6E-04				2.8E-03	5.7E-01	0.4	1.4E-03				3.9E-03	7.8E-01
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	6.7	3.7E-06	1.1E-07			6.6E-05		20	7.0E-05	2.0E-06	1		2.0E-04	
Carbon tetrachloride (CCL4)	0.37	2.1E-07	2.7E-08			3.6E-06	5.2E-03	0.5«	1.7E-06	2.3E-07			4.9E-06	7.0E-03
Chloroform (THM) (CLFM)	0.68	3.8E-07	2.3E-09			6.7E-06	6.7E-04	1	3.5E-06	2.1E-08			9.8E-06	9.8E-04
1,2-Dichloroethane (DCA2)	0.71	4.0E-07	3.6E-08			6.9E-06		1.1	3.8E-06	3.5E-07			1.1E-05	
1,1-Dichloroethylene (DCE)	4.7	2.6E-06	1.6E-06	7		4.6E-05	5.1E-03	7	2.4E-05	1.5E-05	8		6.8E-05	7.6E-03
Dichloromethane (DCM)	1.6	8.9E-07	6.7E-09			1.6E-05	2.6E-04	2.6	9.1E-06	6.8E-08			2.5E-05	4.2E-04
Tetrachloroethylene (PCE)	1.7	9.5E-07	4.8E-08			1.7E-05	1.7E-03	2.4	8.4E-06	4.2E-07			2.3E-05	2.3E-03
Trichloroethylene (TCE)	16	8.9E-06	9.8E-08			1.6E-04		21	7.3E-05	8.1E-07			2.1E-04	
Vinyl chloride (VC)	13	7.3E-06	1.4E-05	63		1.3E-04		20	7.0E-05	1.3E-04	69		2.0E-04	
TOTALS	- -		2E-05			- -	9.3E-01	TOTALS	- -	2E-04			- -	1.2E+00
w/o Arsenic	- -		2E-05		- -	- -	- -	w/o Arsenic	- -	2E-04		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

4ADHS35

raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

ater Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
ITE: EW-PZ5														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.007«	3.9E-06	5.9E-06	4		6.8E-05	2.3E-01	0.007«	2.4E-05	3.7E-05	2		6.8E-05	2.3E-01
Boron and borates only (B)	0.91	5.1E-04				8.9E-03	9.9E-02	1.08«	3.8E-03				1.1E-02	1.2E-01
Lead and compounds (inorganic) (Pb)	0.002«	1.1E-06				2.0E-05		0.002«	7.0E-06				2.0E-05	
Manganese (Mn)	2.3	1.3E-03				2.3E-02	4.5E+00	5.4	1.9E-02				5.3E-02	1.1E+01
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	1.9	1.1E-06	3.1E-08			1.9E-05		2.6«	9.1E-06	2.6E-07			2.5E-05	
Dichloromethane (DCM)	6.8	3.8E-06	2.9E-08			6.7E-05	1.1E-03	14«	4.9E-05	3.7E-07			1.4E-04	2.3E-03
Vinyl chloride (VC)	150	8.4E-05	1.6E-04	96		1.5E-03		250	8.7E-04	1.7E-03	98		2.4E-03	
TOTALS		- -	2E-04			- -	4.8E+00	TOTALS	- -	2E-03			- -	1.1E+01
w/o Arsenic		- -	2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ıter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TE: EW-PZ3														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.018	1.0E-05	1.5E-05			1.8E-04	5.9E-01	0.023«	8.0E-05	1.2E-04			2.3E-04	7.5E-01
Manganese (Mn)	3.3	1.8E-03				3.2E-02	6.5E+00	4.4«	1.5E-02				4.3E-02	8.6E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	11	6.2E-06	1.8E-07			1.1E-04		12«	4.2E-05	1.2E-06			1.2E-04	
Chlorobenzene (monochlorobenzene) (MCB)	110	6.2E-05				1.1E-03	5.4E-02	220	7.7E-04				2.2E-03	1.1E-01
1,2-Dichlorobenzene (DCB2)	280	1.6E-04				2.7E-03	3.0E-02	630	2.2E-03				6.2E-03	6.8E-02
cis-1,2-Dichloroethylene	130	7.3E-05				1.3E-03	1.3E-01	240«	8.4E-04				2.3E-03	2.3E-01
Tetrachloroethylene (PCE)	1.1«	6.2E-07	3.1E-08			1.1E-05	1.1E-03	1.1«	3.8E-06	1.9E-07			1.1E-05	1.1E-03
Trichloroethylene (TCE)	4.4	2.5E-06	2.7E-08			4.3E-05		4.7«	1.6E-05	1.8E-07			4.6E-05	
Vinyl chloride (VC)	2900	1.6E-03	3.1E-03	100		2.8E-02		9400	3.3E-02	6.2E-02	100		9.2E-02	
TOTALS		- -	3E-03			- -	7.3E+00	TOTALS	- -	6E-02			- -	9.8E+00
w/o Arsenic		- -	3E-03		- -	- -	- -	w/o Arsenic	- -	6E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
SITE: EW-PZ1	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.008«	4.5E-06	6.7E-06			7.8E-05	2.6E-01	0.008«	2.8E-05	4.2E-05			7.8E-05	2.6E-01
Manganese (Mn)	1.3	7.3E-04				1.3E-02	2.5E+00	3.4	1.2E-02				3.3E-02	6.7E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	7.8«	4.4E-06	1.3E-07			7.6E-05		7.8«	2.7E-05	7.9E-07			7.6E-05	
1,4-Dichlorobenzene (DCB4)	40	2.2E-05	5.4E-07			3.9E-04	3.9E-03	85	3.0E-04	7.1E-06			8.3E-04	8.3E-03
1,1-Dichloroethylene (DCE)	13«	7.3E-06	4.4E-06			1.3E-04	1.4E-02	13«	4.5E-05	2.7E-05			1.3E-04	1.4E-02
cis-1,2-Dichloroethylene	4700	2.6E-03				4.6E-02	4.6E+00	8100	2.8E-02				7.9E-02	7.9E+00
Dichloromethane (DCM)	6«	3.4E-06	2.5E-08			5.9E-05	9.8E-04	6«	2.1E-05	1.6E-07			5.9E-05	9.8E-04
Tetrachloroethylene (PCE)	2«	1.1E-06	5.6E-08			2.0E-05	2.0E-03	2«	7.0E-06	3.5E-07			2.0E-05	2.0E-03
Trichloroethylene (TCE)	58	3.2E-05	3.6E-07			5.7E-04		120	4.2E-04	4.6E-06			1.2E-03	
Vinyl chloride (VC)	3800	2.1E-03	4.0E-03	100		3.7E-02		8100«	2.8E-02	5.4E-02	100		7.9E-02	
	TOTALS	- -	4E-03			- -	7.4E+00	TOTALS	- -	5E-02			- -	1.5E+01
	w/o Arsenic	- -	4E-03		- -	- -	- -	w/o Arsenic	- -	5E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-NW														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.006	3.4E-06	5.0E-06	3		5.9E-05	2.0E-01	0.0081	2.8E-05	4.2E-05	2		7.9E-05	2.6E-01
Beryllium (Be)	0.0026	1.5E-06	6.3E-06	3		2.5E-05	5.1E-03	0.003«	1.0E-05	4.5E-05	2		2.9E-05	5.9E-03
Lead and compounds (inorganic) (Pb)	0.003«	1.7E-06				2.9E-05		0.003«	1.0E-05				2.9E-05	
Manganese (Mn)	2.9	1.6E-03				2.8E-02	5.7E+00	3.1	1.1E-02				3.0E-02	6.1E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.83	4.6E-07	1.3E-08			8.1E-06		1.3	4.5E-06	1.3E-07			1.3E-05	
Chloroform (THM) (CLFM)	0.83	4.6E-07	2.8E-09			8.1E-06	8.1E-04	1.4	4.9E-06	3.0E-08			1.4E-05	1.4E-03
1,2-Dichloroethane (DCA2)	0.57«	3.2E-07	2.9E-08			5.6E-06		0.57«	2.0E-06	1.8E-07			5.6E-06	
Dichloromethane (DCM)	5.7	3.2E-06	2.4E-08			5.6E-05	9.3E-04	9.4	3.3E-05	2.5E-07			9.2E-05	1.5E-03
Di(2-ethylhexyl) Phthalate (DEHP)	26	1.5E-05	2.0E-07			2.5E-04	1.3E-02	26	9.1E-05	1.3E-06			2.5E-04	1.3E-02
Tetrachloroethylene (PCE)	0.47«	2.6E-07	1.3E-08			4.6E-06	4.6E-04	0.47«	1.6E-06	8.2E-08			4.6E-06	4.6E-04
Trichloroethylene (TCE)	0.89	5.0E-07	5.5E-09			8.7E-06		1.4	4.9E-06	5.4E-08			1.4E-05	
Vinyl chloride (VC)	170	9.5E-05	1.8E-04	94		1.7E-03		270	9.4E-04	1.8E-03	95		2.6E-03	
TOTALS	- -	- -	2E-04			- -	5.9E+00	TOTALS	- -	2E-03			- -	6.4E+00
w/o Arsenic	- -	- -	2E-04		- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

Water Sample

	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
SITE: EW-ETM	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.088	4.9E-05	7.4E-05	100		8.6E-04	2.9E+00	0.088	3.1E-04	4.6E-04	100		8.6E-04	2.9E+00
Lead and compounds (inorganic) (Pb)	0.016	8.9E-06				1.6E-04		0.016	5.6E-05				1.6E-04	
Manganese (Mn)	1.8	1.0E-03				1.8E-02	3.5E+00	1.8	6.3E-03				1.8E-02	3.5E+00
TOTALS		- -	7E-05			- -	6.4E+00	TOTALS	- -	5E-04			- -	6.4E+00
w/o Arsenic		- -	0E+00		- -	- -	- -	w/o Arsenic	- -	0E+00		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

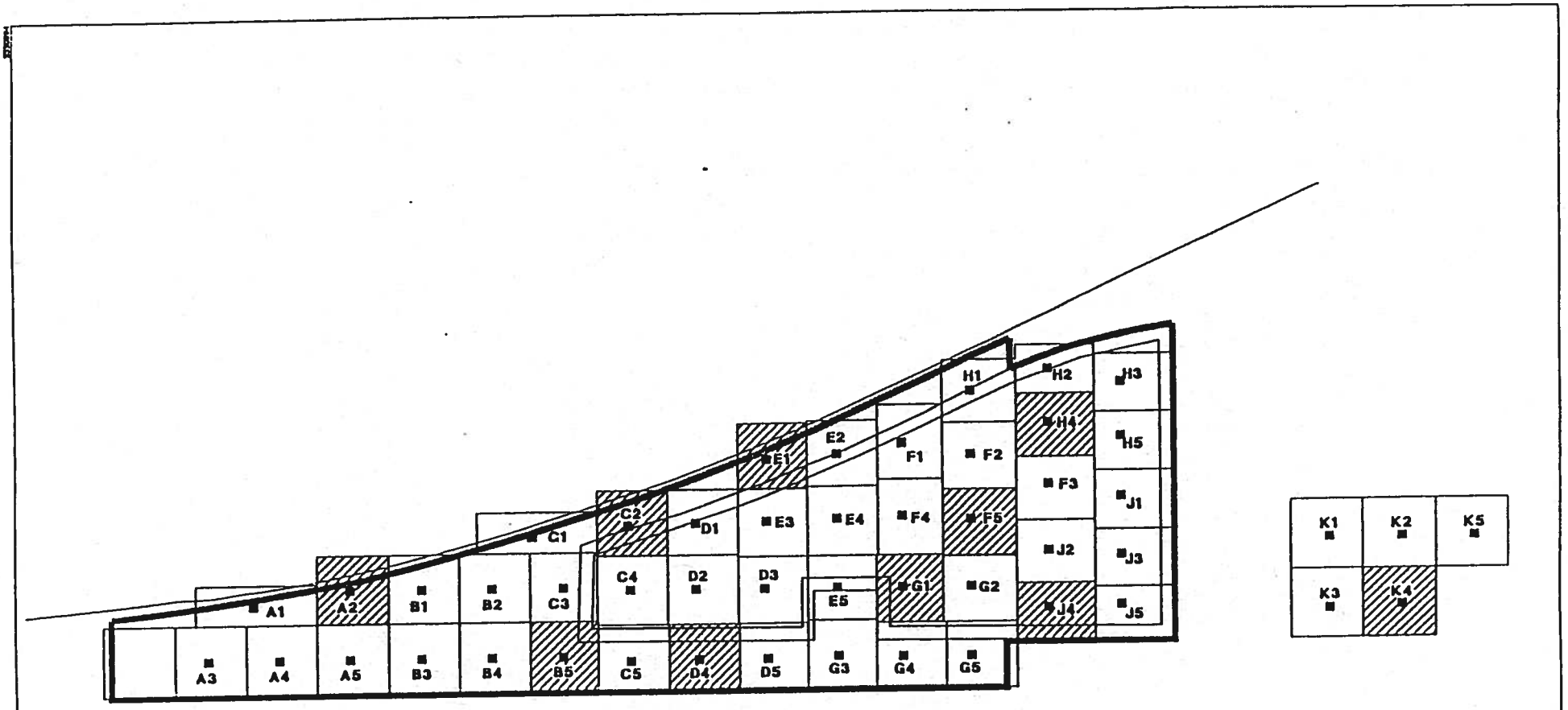
Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-18														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.015«	8.4E-06	1.3E-05	3		1.5E-04	4.9E-01	0.015«	5.2E-05	7.9E-05	1		1.5E-04	4.9E-01
Boron and borates only (B)	0.66	3.7E-04				6.5E-03	7.2E-02	0.78«	2.7E-03				7.6E-03	8.5E-02
Lead and compounds (inorganic) (Pb)	0.0073	4.1E-06				7.1E-05		0.01«	3.5E-05				9.8E-05	
Manganese (Mn)	3.4	1.9E-03				3.3E-02	6.7E+00	3.9	1.4E-02				3.8E-02	7.6E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	2.5	1.4E-06	4.1E-08			2.4E-05		3.6«	1.3E-05	3.6E-07			3.5E-05	
cis-1,2-Dichloroethylene	180	1.0E-04				1.8E-03	1.8E-01	330«	1.2E-03				3.2E-03	3.2E-01
Trichloroethylene (TCE)	1.2	6.7E-07	7.4E-09			1.2E-05		2	7.0E-06	7.7E-08			2.0E-05	
Vinyl chloride (VC)	390	2.2E-04	4.1E-04	97		3.8E-03		1100	3.8E-03	7.3E-03	99		1.1E-02	
TOTALS		- -	4E-04			- -	7.4E+00	TOTALS	- -	7E-03			- -	8.5E+00
w/o Arsenic		- -	4E-04		- -	- -	- -	w/o Arsenic	- -	7E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95



EXPLANATION

- Surface Soil Sample Location
- Area Randomly Selected for Descrete Sampling
- A3 — 1 Acre Subparcel
- Area of Relocated Refuse

Harding Lawson Associates
Engineering and
Environmental Services

DRAWN: DBS
PROJECT NUMBER: 28324-1
APPROVED:
DATE: 1/95
REVISED DATE:

SURFACE SOIL SAMPLE LOCATIONS

August, 1994
Estes Landfill
Phoenix, Arizona

FIGURE 2

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-3														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0059	3.3E-06	4.9E-06	95		5.8E-05	1.9E-01	0.007	2.4E-05	3.7E-05	96		6.8E-05	2.3E-01
Lead and compounds (inorganic) (Pb)	0.0039	2.2E-06				3.8E-05		0.0059	2.1E-05				5.8E-05	
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	0.52	2.9E-07	1.8E-08			5.1E-06	2.5E-04	0.72«	2.5E-06	1.6E-07			7.0E-06	3.5E-04
Chloroform (THM) (CLFM)	0.48	2.7E-07	1.6E-09			4.7E-06	4.7E-04	0.79«	2.8E-06	1.7E-08			7.7E-06	7.7E-04
Di(2-ethylhexyl) Phthalate (DEHP)	30	1.7E-05	2.3E-07	5		2.9E-04	1.5E-02	30	1.0E-04	1.5E-06	4		2.9E-04	1.5E-02
TOTALS		- -	5E-06			- -	2.1E-01	TOTALS	- -	4E-05			- -	2.4E-01
w/o Arsenic		- -	3E-07		- -	- -	- -	w/o Arsenic	- -	2E-06		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35
Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ater Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
TE: EW-2	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units							Units						
INORGANIC	mg/L							mg/L						
Arsenic, inorganic (As)	0.01	5.6E-06	8.4E-06	100		9.8E-05	3.3E-01	0.011«	3.8E-05	5.8E-05	100		1.1E-04	3.6E-01
Cadmium (Cd)	0.0028	1.6E-06				2.7E-05	5.5E-02	0.0035	1.2E-05				3.4E-05	6.8E-02
Lead and compounds (inorganic) (Pb)	0.0036	2.0E-06				3.5E-05		0.005«	1.7E-05				4.9E-05	
Manganese (Mn)	0.56	3.1E-04				5.5E-03	1.1E+00	0.88	3.1E-03				8.6E-03	1.7E+00
	Units							Units						
ORGANIC	ug/L							ug/L						
Dichloromethane (DCM)	4.2	2.3E-06	1.8E-08			4.1E-05	6.8E-04	7.6	2.7E-05	2.0E-07			7.4E-05	1.2E-03
	TOTALS	- -	8E-06			- -	1.5E+00	TOTALS	- -	6E-05			- -	2.2E+00
	w/o Arsenic	- -	2E-08		- -	- -	- -	w/o Arsenic	- -	2E-07		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

4ADHS35
raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-1														
	Units							Units						
INORGANIC	mg/L							mg/L						
Arsenic, inorganic (As)	0.0046	2.6E-06	3.9E-06	63		4.5E-05	1.5E-01	0.0059	2.1E-05	3.1E-05	57		5.8E-05	1.9E-01
	Units							Units						
ORGANIC	ug/L							ug/L						
Chloroform (THM) (CLFM)	0.47	2.6E-07	1.6E-09			4.6E-06	4.6E-04	0.78	2.7E-06	1.7E-08			7.6E-06	7.6E-04
1,1-Dichloroethylene (DCE)	1.5	8.4E-07	5.0E-07	8		1.5E-05	1.6E-03	2.3	8.0E-06	4.8E-06	9		2.3E-05	2.5E-03
Dichloromethane (DCM)	2.2	1.2E-06	9.2E-09			2.2E-05	3.6E-04	3.4	1.2E-05	8.9E-08			3.3E-05	5.5E-04
Tetrachloroethylene (PCE)	0.28«	1.6E-07	7.8E-09			2.7E-06	2.7E-04	0.28«	9.8E-07	4.9E-08			2.7E-06	2.7E-04
Trichloroethylene (TCE)	3.4	1.9E-06	2.1E-08			3.3E-05		5.4	1.9E-05	2.1E-07			5.3E-05	
Vinyl chloride (VC)	1.6	8.9E-07	1.7E-06	28		1.6E-05		2.8	9.8E-06	1.9E-05	34		2.7E-05	
TOTALS		- -	6E-06			- -	1.5E-01	TOTALS	- -	5E-05			- -	2.0E-01
w/o Arsenic		- -	2E-06		- -	- -	- -	w/o Arsenic	- -	2E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table 8- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ıter Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
TE: BW-WD	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0044	2.5E-06	3.7E-06	5		4.3E-05	1.4E-01	0.006	2.1E-05	3.1E-05	5		5.9E-05	2.0E-01
Manganese (Mn)	0.43	2.4E-04				4.2E-03	8.4E-01	0.48	1.7E-03				4.7E-03	9.4E-01
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.9	5.0E-07	1.5E-08			8.8E-06		1.4	4.9E-06	1.4E-07			1.4E-05	
Chloroform (THM) (CLFM)	0.7	3.9E-07	2.4E-09			6.8E-06	6.8E-04	0.71«	2.5E-06	1.5E-08			6.9E-06	6.9E-04
cis-1,2-Dichloroethylene	110	6.2E-05				1.1E-03	1.1E-01	180	6.3E-04				1.8E-03	1.8E-01
Dichloromethane (DCM)	2.2«	1.2E-06	9.2E-09			2.2E-05	3.6E-04	2.2«	7.7E-06	5.8E-08			2.2E-05	3.6E-04
Tetrachloroethylene (PCE)	0.74	4.1E-07	2.1E-08			7.2E-06	7.2E-04	0.89«	3.1E-06	1.6E-07			8.7E-06	8.7E-04
Trichloroethylene (TCE)	4.3	2.4E-06	2.6E-08			4.2E-05		5.3	1.9E-05	2.0E-07			5.2E-05	
Vinyl chloride (VC)	61	3.4E-05	6.5E-05	95		6.0E-04		97	3.4E-04	6.4E-04	95		9.5E-04	
TOTALS		- -	7E-05			- -	1.1E+00	TOTALS	- -	7E-04			- -	1.3E+00
w/o Arsenic		- -	6E-05		- -	- -	- -	w/o Arsenic	- -	6E-04		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: BW-SES														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.007	3.9E-06	5.9E-06	93		6.8E-05	2.3E-01	0.008«	2.8E-05	4.2E-05	91		7.8E-05	2.6E-01
Manganese (Mn)	0.23	1.3E-04				2.3E-03	4.5E-01	0.24«	8.4E-04				2.3E-03	4.7E-01
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.55	3.1E-07	8.9E-09			5.4E-06		1.1	3.8E-06	1.1E-07			1.1E-05	
Chloroform (THM) (CLFM)	0.25	1.4E-07	8.5E-10			2.4E-06	2.4E-04	0.28«	9.8E-07	6.0E-09			2.7E-06	2.7E-04
Chloromethane (CM)	0.94	5.3E-07	6.8E-09			9.2E-06	2.3E-03	1.7	5.9E-06	7.7E-08			1.7E-05	4.2E-03
Dichloromethane (DCM)	1.4	7.8E-07	5.9E-09			1.4E-05	2.3E-04	1.8	6.3E-06	4.7E-08			1.8E-05	2.9E-04
Tetrachloroethylene (PCE)	0.21«	1.2E-07	5.9E-09			2.1E-06	2.1E-04	0.21«	7.3E-07	3.7E-08			2.1E-06	2.1E-04
Trichloroethylene (TCE)	0.86	4.8E-07	5.3E-09			8.4E-06		1.2	4.2E-06	4.6E-08			1.2E-05	
Vinyl chloride (VC)	0.38	2.1E-07	4.0E-07	6		3.7E-06		0.59	2.1E-06	3.9E-06	8		5.8E-06	
TOTALS		- -	6E-06			- -	6.8E-01	TOTALS	- -	5E-05			- -	7.4E-01
w/o Arsenic		- -	4E-07		- -	- -	- -	w/o Arsenic	- -	4E-06		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

ater Sample

ITE: BW-SD

	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0068	3.8E-06	5.7E-06	66		6.7E-05	2.2E-01	0.0077	2.7E-05	4.0E-05	51		7.5E-05	2.5E-01
Mercury (inorganic) (Hg)	0.0005	2.8E-07				4.9E-06	1.6E-02	0.0015	5.2E-06				1.5E-05	4.9E-02
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.57	3.2E-07	9.2E-09			5.6E-06		0.99	3.5E-06	1.0E-07			9.7E-06	
Chloroform (THM) (CLFM)	0.42	2.3E-07	1.4E-09			4.1E-06	4.1E-04	0.73	2.6E-06	1.6E-08			7.1E-06	7.1E-04
Chloromethane (CM)	1.1	6.2E-07	8.0E-09			1.1E-05	2.7E-03	1.9	6.6E-06	8.6E-08			1.9E-05	4.6E-03
cis-1,2-Dichloroethylene	20	1.1E-05				2.0E-04	2.0E-02	37	1.3E-04				3.6E-04	3.6E-02
Dichloromethane (DCM)	2	1.1E-06	8.4E-09			2.0E-05	3.3E-04	2.8«	9.8E-06	7.3E-08			2.7E-05	4.6E-04
Tetrachloroethylene (PCE)	0.52	2.9E-07	1.5E-08			5.1E-06	5.1E-04	0.91	3.2E-06	1.6E-07			8.9E-06	8.9E-04
Trichloroethylene (TCE)	2.6	1.5E-06	1.6E-08			2.5E-05		4.7	1.6E-05	1.8E-07			4.6E-05	
Vinyl chloride (VC)	2.7	1.5E-06	2.9E-06	33		2.6E-05		5.8	2.0E-05	3.9E-05	48		5.7E-05	
TOTALS		- -	9E-06			- -	2.6E-01	TOTALS	- -	8E-05			- -	3.4E-01
w/o Arsenic		- -	3E-06		- -	- -	- -	w/o Arsenic	- -	4E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-P Usage:													
O R G A N I C													
100. Trichlorotrifluoroethane (F113)	76-13-1	µg/L	0.67	1	0.69	0.66	1.6	5/ 16	31.3%	--	D	2E+05	
101. Vinyl acetate	108-05-4	µg/L						0/ 1	0.0%	--	NA	7E+03	
102. Vinyl chloride (VC)	75-01-4	µg/L	3.8	5.5	3.3	1.4	12	10/ 17	58.8%	√	A	2E-02	2E+00
103. Xylenes (total) (XYL)	1330-20-7	µg/L						0/ 16	0.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-P Usage:													
O R G A N I C													
67. Hexachlorocyclopentadiene (HCCPD)	77-47-4	µg/L						0/ 1	0.0%	--	D	5E+01	5E+01
68. Hexachloroethane	67-72-1	µg/L						0/ 1	0.0%	--	C	3E+00	
69. 2-Hexanone	591-78-6	µg/L						0/ 1	0.0%	--	NA		
70. Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
71. Isophorone	78-59-1	µg/L						0/ 1	0.0%	--	C	4E+01	
72. Methyl Ethyl Ketone (MEK)	78-93-3	µg/L						0/ 1	0.0%	--	D	4E+03	
73. Methyl isobutyl ketone	108-10-1	µg/L						0/ 1	0.0%	--	NA	6E+02	
74. 2-methylnaphthalene	91-57-6	µg/L						0/ 1	0.0%	--	ND		
75. 2-Methylphenol (o-Cresol)	95-48-7	µg/L						0/ 1	0.0%	--	C	4E+01	
76. 4-methylphenol	106-44-5	µg/L						0/ 1	0.0%	--	C	4E+01	
77. Naphthalene (PAH)	91-20-3	µg/L						0/ 1	0.0%	--	D	3E+02	
78. 2-Nitroaniline	88-74-4	µg/L						0/ 1	0.0%	--	NA	4E-01	
79. m-Nitroaniline	99-09-2	µg/L						0/ 1	0.0%	--	ND		
80. Nitrobenzene	98-95-3	µg/L						0/ 1	0.0%	--	D	4E+00	
81. p-Nitrophenol	100-02-7	µg/L						0/ 1	0.0%	--	NA		
82. 2-NITROPHENOL (UG/L)	88-75-5	µg/L						0/ 1	0.0%	--	ND		
83. n-Nitroso-di-n-propylamine	621-64-7	µg/L						0/ 1	0.0%	--	B2	5E-03	
84. n-Nitroso-diphenylamine	86-30-6	µg/L						0/ 1	0.0%	--	B2	7E+00	
85. Pentachlorophenol	87-86-5	µg/L						0/ 1	0.0%	--	B2	3E-01	1E+00
86. Phenanthrene (PAH)	85-01-8	µg/L						0/ 1	0.0%	--	D		
87. Phenol	108-95-2	µg/L						0/ 1	0.0%	--	D	4E+03	
88. Pyrene (PAH)	129-00-0	µg/L						0/ 1	0.0%	--	D	2E+02	
89. Styrene	100-42-5	µg/L						0/ 1	0.0%	--	C	1E+02	1E+02
90. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 17	0.0%	--	C	2E-01	
91. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.69	1.1	0.76	0.25	1.5	5/ 17	29.4%	✓	B2	7E-01	5E+00
92. Toluene (TOL)	108-88-3	µg/L	0.58	0.95	0.73	1.1	1.1	1/ 17	5.9%	--	D	1E+03	1E+03
93. 1,2,4-Trichlorobenzene	120-82-1	µg/L						0/ 1	0.0%	--	D	7E+01	9E+00
94. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	1.3	2	1.4	0.48	4.2	8/ 17	47.1%	--	D	6E+02	2E+02
95. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 17	0.0%	--	C	6E-01	5E+00
96. Trichloroethylene (TCE)	79-01-6	µg/L	3.8	4.9	2.3	0.33	6.7	14/ 17	82.4%	✓	B2	3E+00	5E+00
97. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.45	0.97	0.73	0.29	0.29	1/ 10	10.0%	--	D	2E+03	
98. 2,4,5-Trichlorophenol	95-95-4	µg/L						0/ 1	0.0%	--	D	7E+02	
99. 2,4,6-Trichlorophenol	88-06-2	µg/L						0/ 1	0.0%	--	B2	3E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: TW-P Usage:												
O R G A N I C												
34. Dibenzofuran	132-64-9	µg/L						0/ 1	0.0% --	D		
35. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 17	0.0% --	C	4E-01	1E+02
36. Dibutyl phthalate	84-74-2	µg/L						0/ 1	0.0% --	D	7E+02	
37. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	1.6	2.3	1.9	1.2	3.2	11/ 28	39.3% --	D	6E+02	6E+02
38. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 28	0.0% --	D	6E+02	
39. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 28	0.0% --	C	2E+00	8E+01
40. 3,3'-dichlorobenzidine	91-94-1	µg/L						0/ 1	0.0% --	B2	8E-02	
41. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.71	1.7	1.5	0.22	0.23	2/ 10	20.0% --	D	1E+03	
42. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	1.3	1.7	0.8	0.22	2.6	13/ 17	76.5% --	C	7E+01	
43. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 17	0.0% --	B2	4E-01	5E+00
44. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	1.8	2.4	1.2	1	3.8	11/ 17	64.7% --	C	6E-02	7E+00
45. 1,2-Dichloroethylene (TOTAL)		µg/L	5	7.4	2.6	2.5	10	7/ 7	100.0% --	D	7E+01	
46. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.4	12	6.1	0.69	21	10/ 10	100.0% --	D	7E+01	7E+01
47. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.4	0.91	0.71	0.27	0.27	1/ 10	10.0% --	D	1E+02	1E+02
48. Dichloromethane (DCM)	75-09-2	µg/L						0/ 17	0.0% --	B2	5E+00	5E+00
49. 2,4-Dichlorophenol	120-83-2	µg/L						0/ 1	0.0% --	D	2E+01	
50. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 16	0.0% --	B2	5E-01	5E+00
51. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 17	0.0% --	B2		
52. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 17	0.0% --	B2		
53. Diethyl phthalate	84-66-2	µg/L						0/ 1	0.0% --	D	6E+03	5E+03
54. Di(2-ethylhexyl) Phthalate (DEHP)	117-81-7	µg/L						0/ 1	0.0% --	B2	3E+00	4E+00
55. Dimethyl phthalate	131-11-3	µg/L						0/ 1	0.0% --	D	7E+04	
56. 2,4-Dimethylphenol	105-67-9	µg/L						0/ 1	0.0% --	NA	1E+02	
57. 2,4-dinitrophenol	51-28-5	µg/L						0/ 1	0.0% --	ND	1E+01	
58. 2,4-dinitrotoluene	121-14-2	µg/L						0/ 1	0.0% --	B2	5E-02	
59. 2,6-dinitrotoluene	606-20-2	µg/L						0/ 1	0.0% --	ND	7E+00	
60. Dioctylphthalate	117-84-0	µg/L						0/ 1	0.0% --	ND	1E+02	
61. Ethylbenzene (ETB)	100-41-4	µg/L	0.57	0.95	0.74	1.2	1.2	1/ 17	5.9% --	D	7E+02	7E+02
62. Ethylene dibromide (EDB)	106-93-4	µg/L						0/ 6	0.0% --	B2	4E-04	5E-02
63. Fluoranthene (PAH)	206-44-0	µg/L						0/ 1	0.0% --	D	3E+02	
64. Fluorene (PAH)	86-73-7	µg/L						0/ 1	0.0% --	D	3E+02	
65. Hexachlorobenzene	118-74-1	µg/L						0/ 1	0.0% --	B2	2E-02	1E+00
66. Hexachlorobutadiene	87-68-3	µg/L						0/ 1	0.0% --	C	5E-01	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-P Usage:													
O R G A N I C													
1. Acenaphthene (PAH)	83-32-9	µg/L						0/ 1	0.0%	--	ND	4E+02	
2. Acenaphthylene (PAH)	208-96-8	µg/L						0/ 1	0.0%	--	D	4E+02	
3. Acetone	67-64-1	µg/L						0/ 1	0.0%	--	D	7E+02	
4. Anthracene (PAH)	120-12-7	µg/L						0/ 1	0.0%	--	D	2E+03	
5. Benz[a]anthracene (PAH)	56-55-3	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
6. Benzene (BNZ)	71-43-2	µg/L						0/ 17	0.0%	--	A	1E+00	5E+00
7. Benzo[a]pyrene (PAH)	50-32-8	µg/L						0/ 1	0.0%	--	B2	5E-03	2E-01
8. Benzo[b]fluoranthene (PAH)	205-99-2	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
9. Benzo[g,h,i]perylene (PAH)	191-24-2	µg/L						0/ 1	0.0%	--	D		
10. Benzo[k]fluoranthene (PAH)	207-08-9	µg/L						0/ 1	0.0%	--	B2	3E-02	2E-01
11. Benzoic acid	65-85-0	µg/L						0/ 1	0.0%	--	D	3E+04	
12. Benzyl alcohol	100-51-6	µg/L						0/ 1	0.0%	--	ND	2E+03	
13. Bis(2-chloroethoxy)methane	111-91-1	µg/L						0/ 1	0.0%	--	D		
14. bis(2-chloroethyl) ether (BCEE)	111-44-4	µg/L						0/ 1	0.0%	--	B2	3E-02	
15. Bis(2-chloroisopropyl) ether	39638-32-9	µg/L						0/ 1	0.0%	--	ND	5E-01	
16. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.57	0.95	0.73	0.5	0.5	1/ 17	5.9%	✓	B2	6E-01	1E+02
17. p-Bromodiphenyl ether	101-55-3	µg/L						0/ 1	0.0%	--	D		
18. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 17	0.0%	--	B2	4E+00	1E+02
19. Bromomethane (BMM)	74-83-9	µg/L						0/ 17	0.0%	--	D	1E+01	
20. Butyl benzyl phthalate	85-68-7	µg/L						0/ 1	0.0%	--	C	1E+02	1E+02
21. Carbon disulfide	75-15-0	µg/L						0/ 1	0.0%	--	D	7E+02	
22. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 17	0.0%	--	B2	3E-01	5E+00
23. p-Chloroaniline	106-47-8	µg/L						0/ 1	0.0%	--	NA	3E+01	
24. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.93	1.5	1.5	0.21	8.4	11/ 32	34.4%	--	D	1E+02	1E+02
25. Chloroethane (CE)	75-00-3	µg/L						0/ 17	0.0%	--	ND		
26. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 11	0.0%	--	ND		
27. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.66	1.1	0.79	0.45	1.9	4/ 17	23.5%	✓	B2	6E+00	1E+02
28. Chloromethane (CM)	74-87-3	µg/L						0/ 17	0.0%	--	C	3E+00	
29. 4-Chloro-3-methylphenol	59-50-7	µg/L						0/ 1	0.0%	--	ND		
30. beta-Chloronaphthalene	91-58-7	µg/L						0/ 1	0.0%	--	NA	6E+02	
31. 2-Chlorophenol	95-57-8	µg/L						0/ 1	0.0%	--	D	4E+01	
32. Chrysene (PAH)	218-01-9	µg/L						0/ 1	0.0%	--	B2	3E+00	2E-01
33. Dibenz[a,h]anthracene (PAH)	53-70-3	µg/L						0/ 1	0.0%	--	B2	3E-03	2E-01

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-P Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			7.3	7.6	0.51	6.8	8.5	11/ 11	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.3	0.75	0.67	2.4	2.4	1/ 11	9.1%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.042	0.092	0.071	0.05	0.05	1/ 10	10.0%	√	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0064	0.0074	0.0015	0.006	0.0083	9/ 10	90.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L	0.072	0.091	0.025	0.047	0.051	5/ 9	55.6%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 10	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.36	0.41	0.065	0.28	0.5	9/ 9	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 10	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	48	51	3.4	41	53	11/ 11	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	170	180	16	148	203	11/ 11	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 10	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L	0.013	0.016	0.0043	0.011	0.02	4/ 10	40.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L	0.0056	0.0068	0.0016	0.01	0.01	1/ 9	11.1%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.35	0.43	0.11	0.3	0.6	6/ 9	66.7%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 9	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0049	0.0068	0.0027	0.003	0.008	5/ 10	50.0%	√	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	20	21	1.3	17	22	11/ 11	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.034	0.046	0.018	0.01	0.07	10/ 11	90.9%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 10	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 10	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	3.2	3.2	0.00000002	3.2	3.2	1/ 1	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	4	4.9	1.4	5	6	6/ 11	54.5%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 10	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	170	180	8.6	160	191	11/ 11	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	72	76	5.1	64	80	11/ 11	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 10	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	680	750	95	540	902	11/ 11	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.017	0.026	0.012	0.013	0.04	5/ 10	50.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-4 Usage:													
O R G A N I C													
34. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 15	0.0%	--	D	2E+05	
35. Vinyl chloride (VC)	75-01-4	µg/L	4.6	8.4	6.9	0.25	20	8/ 15	53.3%	✓	A	2E-02	2E+00
36. Xylenes (total) (XYL)	1330-20-7	µg/L	0.84	1.5	0.96	3.6	3.6	1/ 10	10.0%	--	D	1E+04	1E+04

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-4 Usage:													
O R G A N I C													
1. Acetone	67-64-1	µg/L						0/ 3	0.0%	--	D	7E+02	
2. Benzene (BNZ)	71-43-2	µg/L						0/ 15	0.0%	--	A	1E+00	5E+00
3. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L	0.25	0.42	0.31	0.33	1.3	2/ 15	13.3%	√	B2	6E-01	1E+02
4. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 15	0.0%	--	B2	4E+00	1E+02
5. Bromomethane (BMM)	74-83-9	µg/L						0/ 15	0.0%	--	D	1E+01	
6. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 15	0.0%	--	B2	3E-01	5E+00
7. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	0.68	1.1	0.94	0.38	3.5	7/ 27	25.9%	--	D	1E+02	1E+02
8. Chloroethane (CE)	75-00-3	µg/L	0.29	0.48	0.36	0.2	0.2	1/ 15	6.7%	--	ND		
9. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 15	0.0%	--	ND		
10. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.66	1.5	1.6	0.4	6.5	3/ 15	20.0%	√	B2	6E+00	1E+02
11. Chloromethane (CM)	74-87-3	µg/L						0/ 15	0.0%	--	C	3E+00	
12. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 15	0.0%	--	C	4E-01	1E+02
13. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	1.8	2.8	2.5	1	12	8/ 25	32.0%	--	D	6E+02	6E+02
14. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 26	0.0%	--	D	6E+02	
15. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L	0.67	0.84	0.42	1.1	2.4	2/ 26	7.7%	--	C	2E+00	8E+01
16. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.33	0.53	0.36	0.4	0.55	2/ 15	13.3%	--	D	1E+03	
17. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	0.45	0.8	0.64	0.63	2.6	3/ 15	20.0%	--	C	7E+01	
18. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L						0/ 15	0.0%	--	B2	4E-01	5E+00
19. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	0.22	0.33	0.2	0.69	0.69	1/ 15	6.7%	--	C	6E-02	7E+00
20. cis-1,2-Dichloroethylene	156-59-2	µg/L	3.3	6.1	5.1	1.1	14	6/ 15	40.0%	--	D	7E+01	7E+01
21. trans-1,2-Dichloroethylene	156-60-5	µg/L	0.24	0.38	0.26	0.99	0.99	1/ 15	6.7%	--	D	1E+02	1E+02
22. Dichloromethane (DCM)	75-09-2	µg/L						0/ 15	0.0%	--	B2	5E+00	5E+00
23. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 15	0.0%	--	B2	5E-01	5E+00
24. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 15	0.0%	--	B2		
25. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 15	0.0%	--	B2		
26. Ethylbenzene (ETB)	100-41-4	µg/L	0.34	0.46	0.22	1.1	1.1	1/ 15	6.7%	--	D	7E+02	7E+02
27. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 15	0.0%	--	C	2E-01	
28. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.19	0.28	0.16	0.3	0.3	1/ 15	6.7%	√	B2	7E-01	5E+00
29. Toluene (TOL)	108-88-3	µg/L	0.37	0.46	0.16	0.51	0.76	3/ 15	20.0%	--	D	1E+03	1E+03
30. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L						0/ 15	0.0%	--	D	6E+02	2E+02
31. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 15	0.0%	--	C	6E-01	5E+00
32. Trichloroethylene (TCE)	79-01-6	µg/L	0.34	0.67	0.6	2.5	2.5	1/ 15	6.7%	√	B2	3E+00	5E+00
33. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	0.41	0.67	0.47	1.6	1.6	1/ 15	6.7%	--	D	2E+03	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-4 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			6.9	7.3	0.23	6.6	7.2	4/ 4	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	0.36	0.88	0.33	0.9	0.9	1/ 4	25.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L						0/ 4	0.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.0076	0.015	0.0047	0.005	0.008	2/ 4	50.0%	✓	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 4	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 4	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.38	0.64	0.16	0.1	0.5	4/ 4	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 4	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	49	63	8.69999999	35	59	4/ 4	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	140	170	19	110	160	4/ 4	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 4	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 4	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 4	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L	0.31	0.48	0.11	0.5	0.5	1/ 4	25.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 4	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L	0.0045	0.01	0.0035	0.005	0.005	1/ 4	25.0%	✓	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	24	26	1.6	21	25	4/ 4	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.3	0.95	0.41	0.01	1	4/ 4	100.0%	✓	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 4	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 4	0.0%	--	D	1E-01	1E-01
20. Nitrate/Nitrite (total)		mg/L	0.41	0.41		0.41	0.41	1/ 1	100.0%	--	D	1E+01	1E+01
21. Potassium (K)	7440-09-7	mg/L	6.5	7.9	0.87	6	8	4/ 4	100.0%	--	ND		
22. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
23. Silver (Ag)	7440-22-4	mg/L						0/ 4	0.0%	--	D	4E-02	5E-02
24. Sodium (Na)	7440-23-5	mg/L	130	180	35	78	170	4/ 4	100.0%	--	ND		
25. Sulfate (SO4)	14808-79-8	mg/L	62	80	11	43	71	4/ 4	100.0%	--	D	4E+02	
26. Thallium (Tl)	7440-28-0	mg/L						0/ 4	0.0%	--	ND	5E-04	
27. Total Dissolved Solids (TDS)		mg/L	550	700	97	400	650	4/ 4	100.0%	--	ND		
28. Zinc and compounds (Zn)	7440-66-6	mg/L	0.11	0.21	0.059	0.04	0.18	4/ 4	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %	WoE	HBGL	MCL
Water Sample												
Sample Site: TW-2 Usage:												
O R G A N I C												
1. Benzene (BNZ)	71-43-2	µg/L						0/ 1	0.0% --	A	1E+00	5E+00
2. Bromodichloromethane (THM) (BDCM)	75-27-4	µg/L						0/ 1	0.0% --	B2	6E-01	1E+02
3. Bromoform (THM) (BRFM)	75-25-2	µg/L						0/ 1	0.0% --	B2	4E+00	1E+02
4. Bromomethane (CMBr)	74-83-9	µg/L						0/ 1	0.0% --	D	1E+01	
5. Carbon tetrachloride (CCL4)	56-23-5	µg/L						0/ 1	0.0% --	B2	3E-01	5E+00
6. Chlorobenzene (monochlorobenzene) (MCB)	108-90-7	µg/L	1.3	2.6	0.15	1.1	1.4	2/ 2	100.0% --	D	1E+02	1E+02
7. Chloroethane (CE)	75-00-3	µg/L						0/ 1	0.0% --	ND		
8. 2-Chloroethylvinyl ether (CEVE)	110-75-8	µg/L						0/ 1	0.0% --	ND		
9. Chloroform (THM) (CLFM)	67-66-3	µg/L	0.49	0.49		0.49	0.49	1/ 1	100.0% ✓	B2	6E+00	1E+02
10. Chloromethane (CLM)	74-87-3	µg/L						0/ 1	0.0% --	C	3E+00	
11. Dibromochloromethane (THM) (DBCM)	124-48-1	µg/L						0/ 1	0.0% --	C	4E-01	1E+02
12. 1,2-Dichlorobenzene (DCB2)	95-50-1	µg/L	2.7	2.7		2.7	2.7	1/ 1	100.0% --	D	6E+02	6E+02
13. 1,3-Dichlorobenzene (DCB3)	541-73-1	µg/L						0/ 1	0.0% --	D	6E+02	
14. 1,4-Dichlorobenzene (DCB4)	106-46-7	µg/L						0/ 1	0.0% --	C	2E+00	8E+01
15. Dichlorodifluoromethane (DCDFM)	75-71-8	µg/L	0.93	0.93		0.93	0.93	1/ 1	100.0% --	D	1E+03	
16. 1,1-Dichloroethane (DCA)	75-34-3	µg/L	9.8	9.8	0.00000008	9.8	9.8	1/ 1	100.0% --	C	7E+01	
17. 1,2-Dichloroethane (DCA2)	107-06-2	µg/L	1.5	1.5		1.5	1.5	1/ 1	100.0% ✓	B2	4E-01	5E+00
18. 1,1-Dichloroethylene (DCE)	75-35-4	µg/L	7.1	7.1	0.00000004	7.1	7.1	1/ 1	100.0% ✓	C	6E-02	7E+00
19. cis-1,2-Dichloroethylene	156-59-2	µg/L	7.5	7.5		7.5	7.5	1/ 1	100.0% --	D	7E+01	7E+01
20. trans-1,2-Dichloroethylene	156-60-5	µg/L						0/ 1	0.0% --	D	1E+02	1E+02
21. Dichloromethane (DCM)	75-09-2	µg/L						0/ 1	0.0% --	B2	5E+00	5E+00
22. 1,2-Dichloropropane (DCP2)	78-87-5	µg/L						0/ 1	0.0% --	B2	5E-01	5E+00
23. cis-1,3-Dichloropropene (cDCP3)	10061-01-5	µg/L						0/ 1	0.0% --	B2		
24. trans-1,3-Dichloropropene (tDCP3)	10061-02-6	µg/L						0/ 1	0.0% --	B2		
25. Ethylbenzene (ETB)	100-41-4	µg/L						0/ 1	0.0% --	D	7E+02	7E+02
26. 1,1,2,2-Tetrachloroethane (TET)	79-34-5	µg/L						0/ 1	0.0% --	C	2E-01	
27. Tetrachloroethylene (PCE)	127-18-4	µg/L	0.48	0.48		0.48	0.48	1/ 1	100.0% ✓	B2	7E-01	5E+00
28. Toluene (TOL)	108-88-3	µg/L						0/ 1	0.0% --	D	1E+03	1E+03
29. 1,1,1-Trichloroethane (TCA)	71-55-6	µg/L	2	2		2	2	1/ 1	100.0% --	D	6E+02	2E+02
30. 1,1,2-Trichloroethane (TCA2)	79-00-5	µg/L						0/ 1	0.0% --	C	6E-01	5E+00
31. Trichloroethylene (TCE)	79-01-6	µg/L	11	11		11	11	1/ 1	100.0% ✓	B2	3E+00	5E+00
32. Trichlorofluoromethane (TCFM)	75-69-4	µg/L	1.2	1.2		1.2	1.2	1/ 1	100.0% --	D	2E+03	
33. Trichlorotrifluoroethane (F113)	76-13-1	µg/L						0/ 1	0.0% --	D	2E+05	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94AD8535
8/95

Appendix Table A- Summary for all chemicals in groundwater by site,
Estes Landfill Risk Assessment

Chemical Name	CASRN	Units	Mean	95% UCL	Deviation	Lowest	Highest	Detects	Det %		WoE	HBGL	MCL
Water Sample													
Sample Site: TW-2 Usage:													
ORGANIC/INORGANIC : NOT SPECIFIED													
1. pH			6.7	6.7		6.7	6.7	1/ 1	100.0%	--	ND		
I N O R G A N I C													
1. Ammonia (NH3)	7664-41-7	mg/L	1.3	1.3		1.3	1.3	1/ 1	100.0%	--	D	7E+00	
2. Antimony (Sb)	7440-36-0	mg/L	0.006	0.006		0.006	0.006	1/ 1	100.0%	--	D	3E-03	1E-02
3. Arsenic, inorganic (As)	7440-38-2	mg/L	0.006	0.006		0.006	0.006	1/ 1	100.0%	√	A	2E-05	5E-02
4. Barium (Ba)	7440-39-3	mg/L						0/ 1	0.0%	--	D	5E-01	2E+00
5. Beryllium (Be)	7440-41-7	mg/L						0/ 1	0.0%	--	B2	8E-06	1E-03
6. Boron and borates only (B)	7440-42-8	mg/L	0.6	0.6		0.6	0.6	1/ 1	100.0%	--	D	6E-01	
7. Cadmium (Cd)	7440-43-9	mg/L						0/ 1	0.0%	--	B1	4E-03	5E-03
8. Calcium (Ca)	7440-70-2	mg/L	60	60		60	60	1/ 1	100.0%	--	ND		
9. Chloride (Cl)-		mg/L	180	180		180	180	1/ 1	100.0%	--	ND		
10. Chromium(III)	16065-83-1	mg/L						0/ 1	0.0%	--	NA	7E+00	1E-01
11. Copper (Cu)	7440-50-8	mg/L						0/ 1	0.0%	--	D	3E-01	
12. Cyanide (Cn)	57-12-5	mg/L						0/ 1	0.0%	--	D	1E-01	2E-01
13. Fluoride (F)	7782-41-4	mg/L						0/ 1	0.0%	--	D	4E-01	4E+00
14. Iron (Fe)	7439-89-6	mg/L						0/ 1	0.0%	--	ND		
15. Lead and compounds (inorganic) (Pb)	7439-92-1	mg/L						0/ 1	0.0%	--	B2	5E-03	
16. Magnesium (Mg)	7439-95-4	mg/L	25	25		25	25	1/ 1	100.0%	--	ND		
17. Manganese (Mn)	7439-96-5	mg/L	0.18	0.18		0.18	0.18	1/ 1	100.0%	√	D	4E-02	
18. Mercury (inorganic) (Hg)	7439-97-6	mg/L						0/ 1	0.0%	--	D	2E-03	2E-03
19. Nickel, soluble salts (Ni)	7440-02-0	mg/L						0/ 1	0.0%	--	D	1E-01	1E-01
20. Potassium (K)	7440-09-7	mg/L	5	5		5	5	1/ 1	100.0%	--	ND		
21. Selenium and compounds (Se)	7782-49-2	mg/L						0/ 1	0.0%	--	D	4E-02	5E-02
22. Silver (Ag)	7440-22-4	mg/L						0/ 1	0.0%	--	D	4E-02	5E-02
23. Sodium (Na)	7440-23-5	mg/L	200	200		200	200	1/ 1	100.0%	--	ND		
24. Sulfate (SO4)	14808-79-8	mg/L	70	70		70	70	1/ 1	100.0%	--	D	4E+02	
25. Thallium (Tl)	7440-28-0	mg/L						0/ 1	0.0%	--	ND	5E-04	
26. Total Dissolved Solids (TDS)		mg/L	710	710		710	710	1/ 1	100.0%	--	ND		
27. Zinc and compounds (Zn)	7440-66-6	mg/L	0.06	0.06		0.06	0.06	1/ 1	100.0%	--	D	2E+00	

-- Chemical removed from risk analysis because there were no positive detections in the data set or the highest detected value was less than the HBGL or was less than the MCL and the WoE is not "A", "B1" or "B2".

94ADHS35
8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Water Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
SITE: EW-13														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.0071	4.0E-06	6.0E-06	94		6.9E-05	2.3E-01	0.012«	4.2E-05	6.3E-05	95		1.2E-04	3.9E-01
Cadmium (Cd)	0.0062	3.5E-06				6.1E-05	1.2E-01	0.013	4.5E-05				1.3E-04	2.5E-01
Lead and compounds (inorganic) (Pb)	0.0029	1.6E-06				2.8E-05		0.0067	2.3E-05				6.6E-05	
Manganese (Mn)	0.048	2.7E-05				4.7E-04	9.4E-02	0.1«	3.5E-04				9.8E-04	2.0E-01
	Units ug/L							Units ug/L						
ORGANIC														
Bromodichloromethane (THM) (BDCM)	1.5	8.4E-07	5.2E-08	1		1.5E-05	7.3E-04	3	1.0E-05	6.5E-07	1		2.9E-05	1.5E-03
Chloroform (THM) (CLFM)	3.9	2.2E-06	1.3E-08			3.8E-05	3.8E-03	7	2.4E-05	1.5E-07			6.8E-05	6.8E-03
1,2-Dichloroethane (DCA2)	0.28	1.6E-07	1.4E-08			2.7E-06		0.45	1.6E-06	1.4E-07			4.4E-06	
Tetrachloroethylene (PCE)	0.48	2.7E-07	1.3E-08			4.7E-06	4.7E-04	0.6«	2.1E-06	1.0E-07			5.9E-06	5.9E-04
Trichloroethylene (TCE)	44	2.5E-05	2.7E-07	4		4.3E-04		54	1.9E-04	2.1E-06	3		5.3E-04	
TOTALS		- -	6E-06			- -	4.5E-01	TOTALS	- -	7E-05			- -	8.5E-01
w/o Arsenic		- -	4E-07		- -	- -	- -	w/o Arsenic	- -	3E-06		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

:er Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
'E: EW-12	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
'NORGANIC	Units mg/L							Units mg/L						
Arsenic, inorganic (As)	0.0081	4.5E-06	6.8E-06	98		7.9E-05	2.6E-01	0.011	3.8E-05	5.8E-05	98		1.1E-04	3.6E-01
Lead and compounds (inorganic) (Pb)	0.0071	4.0E-06				6.9E-05		0.0096	3.4E-05				9.4E-05	
RGANIC	Units ug/L							Units ug/L						
Chloroform (THM) (CLFM)	0.85	4.8E-07	2.9E-09			8.3E-06	8.3E-04	1.2	4.2E-06	2.6E-08			1.2E-05	1.2E-03
,2-Dichloroethane (DCA2)	0.3«	1.7E-07	1.5E-08			2.9E-06		0.3«	1.0E-06	9.5E-08			2.9E-06	
etrachloroethylene (PCE)	0.8	4.5E-07	2.2E-08			7.8E-06	7.8E-04	1.3	4.5E-06	2.3E-07			1.3E-05	1.3E-03
richloroethylene (TCE)	12	6.7E-06	7.4E-08	1		1.2E-04		17	5.9E-05	6.5E-07	1		1.7E-04	
TOTALS w/o Arsenic		- -	7E-06 1E-07		- -	- -	2.7E-01 - -	TOTALS w/o Arsenic	- -	6E-05 1E-06		- -	- -	3.6E-01 - -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
ADHS35
aft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
EW-W														
	Units mg/L							Units mg/L						
RGANIC														
onia (NH3)	4.7	2.6E-03				4.6E-02	4.6E-02	6.4	2.2E-02				6.3E-02	6.3E-02
enic, inorganic (As)	0.038	2.1E-05	3.2E-05	8		3.7E-04	1.2E+00	0.042	1.5E-04	2.2E-04	6		4.1E-04	1.4E+00
yllium (Be)	0.0026	1.5E-06	6.3E-06	2		2.5E-05	5.1E-03	0.003«	1.0E-05	4.5E-05	1		2.9E-05	5.9E-03
on and borates only (B)	0.59	3.3E-04				5.8E-03	6.4E-02	0.68	2.4E-03				6.7E-03	7.4E-02
d and compounds (inorganic) (Pb)	0.003	1.7E-06				2.9E-05		0.0049	1.7E-05				4.8E-05	
ganese (Mn)	3	1.7E-03				2.9E-02	5.9E+00	3.2	1.1E-02				3.1E-02	6.3E+00
	Units ug/L							Units ug/L						
ANIC														
ızene (BNZ)	1	5.6E-07	1.6E-08			9.8E-06		1.5	5.2E-06	1.5E-07			1.5E-05	
oroform (THM) (CLFM)	0.62«	3.5E-07	2.1E-09			6.1E-06	6.1E-04	0.62«	2.2E-06	1.3E-08			6.1E-06	6.1E-04
-Dichloroethane (DCA2)	1.2	6.7E-07	6.1E-08			1.2E-05		2	7.0E-06	6.4E-07			2.0E-05	
-1,2-Dichloroethylene	58	3.2E-05				5.7E-04	5.7E-02	110	3.8E-04				1.1E-03	1.1E-01
hloromethane (DCM)	7.6	4.2E-06	3.2E-08			7.4E-05	1.2E-03	11	3.8E-05	2.9E-07			1.1E-04	1.8E-03
2-ethylhexyl) Phthalate (DEHP)	87	4.9E-05	6.8E-07			8.5E-04	4.3E-02	87	3.0E-04	4.3E-06			8.5E-04	4.3E-02
,2,2-Tetrachloroethane (TET)	1.3	7.3E-07	1.5E-07			1.3E-05		2.2	7.7E-06	1.5E-06			2.2E-05	
chloroethylene (TCE)	1.3	7.3E-07	8.0E-09			1.3E-05		1.9	6.6E-06	7.3E-08			1.9E-05	
yl chloride (VC)	340	1.9E-04	3.6E-04	90		3.3E-03		490	1.7E-03	3.3E-03	92		4.8E-03	
TOTALS		- -	4E-04			- -	7.3E+00	TOTALS	- -	4E-03			- -	7.9E+00
w/o Arsenic		- -	4E-04		- -	- -	- -	w/o Arsenic	- -	3E-03		- -	- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
: Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
.DHS35
ıft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ater Sample

ITE: EW-WTM

	AVERAGE EXPOSURE (MEAN)							REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC			CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.042	2.3E-05	3.5E-05	100		4.1E-04	1.4E+00	0.042	1.5E-04	2.2E-04	100		4.1E-04	1.4E+00
Manganese (Mn)	3.16«	1.8E-03				3.1E-02	6.2E+00	3.16«	1.1E-02				3.1E-02	6.2E+00
TOTALS		- -	4E-05			- -	7.6E+00	TOTALS	- -	2E-04			- -	7.6E+00
w/o Arsenic		- -	0E+00		- -	- -	- -	w/o Arsenic	- -	0E+00		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
		CARCINOGENIC			NON-CARCINOGENIC			CARCINOGENIC			NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TE: EW-RW1														
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	3.4	1.9E-03				3.3E-02	3.3E-02	6.7	2.3E-02				6.6E-02	6.6E-02
Arsenic, inorganic (As)	0.067	3.7E-05	5.6E-05	3		6.6E-04	2.2E+00	0.12	4.2E-04	6.3E-04	2		1.2E-03	3.9E+00
Boron and borates only (B)	0.59	3.3E-04				5.8E-03	6.4E-02	0.81	2.8E-03				7.9E-03	8.8E-02
Lead and compounds (inorganic) (Pb)	0.0048	2.7E-06				4.7E-05		0.0091	3.2E-05				8.9E-05	
Manganese (Mn)	4.7	2.6E-03				4.6E-02	9.2E+00	7.9	2.8E-02				7.7E-02	1.5E+01
Nickel, soluble salts (Ni)	0.17	9.5E-05				1.7E-03	8.3E-02	0.36	1.3E-03				3.5E-03	1.8E-01
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	6.8«	3.8E-06	1.1E-07			6.7E-05		6.8«	2.4E-05	6.9E-07			6.7E-05	
Chlorobenzene (monochlorobenzene) (MCB)	84	4.7E-05				8.2E-04	4.1E-02	140«	4.9E-04				1.4E-03	6.8E-02
1,2-Dichlorobenzene (DCB2)	350	2.0E-04				3.4E-03	3.8E-02	600	2.1E-03				5.9E-03	6.5E-02
cis-1,2-Dichloroethylene	4500	2.5E-03				4.4E-02	4.4E+00	8700	3.0E-02				8.5E-02	8.5E+00
Tetrachloroethylene (PCE)	0.86«	4.8E-07	2.4E-08			8.4E-06	8.4E-04	0.86«	3.0E-06	1.5E-07			8.4E-06	8.4E-04
Trichloroethylene (TCE)	28	1.6E-05	1.7E-07			2.7E-04		42«	1.5E-04	1.6E-06			4.1E-04	
Vinyl chloride (VC)	1800	1.0E-03	1.9E-03	97		1.8E-02		3700	1.3E-02	2.5E-02	97		3.6E-02	
TOTALS		- -	2E-03			- -	1.6E+01	TOTALS	- -	3E-02			- -	2.8E+01
w/o Arsenic		- -	2E-03		- -	- -	- -	w/o Arsenic	- -	2E-02		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
TE: EW-RW2														
	Units mg/L							Units mg/L						
INORGANIC														
Arsenic, inorganic (As)	0.038	2.1E-05	3.2E-05	11		3.7E-04	1.2E+00	0.044«	1.5E-04	2.3E-04	8		4.3E-04	1.4E+00
Lead and compounds (inorganic) (Pb)	0.0035	2.0E-06				3.4E-05		0.005«	1.7E-05				4.9E-05	
Manganese (Mn)	2.7	1.5E-03				2.6E-02	5.3E+00	3.3«	1.2E-02				3.2E-02	6.5E+00
	Units ug/L							Units ug/L						
ORGANIC														
cis-1,2-Dichloroethylene	150	8.4E-05				1.5E-03	1.5E-01	310«	1.1E-03				3.0E-03	3.0E-01
Trichloroethylene (TCE)	0.49«	2.7E-07	3.0E-09			4.8E-06		0.49«	1.7E-06	1.9E-08			4.8E-06	
Vinyl chloride (VC)	250	1.4E-04	2.7E-04	89		2.4E-03		420«	1.5E-03	2.8E-03	92		4.1E-03	
TOTALS		- -	3E-04			- -	6.7E+00	TOTALS	- -	3E-03			- -	8.2E+00
w/o Arsenic		- -	3E-04		- -	- -	- -	w/o Arsenic	- -	3E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

4ADHS35

raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and
non-cancer hazard quotients by sampling site,
Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
EW-PZ5														
	Units mg/L							Units mg/L						
RGANIC														
enic, inorganic (As)	0.007«	3.9E-06	5.9E-06	4		6.8E-05	2.3E-01	0.007«	2.4E-05	3.7E-05	2		6.8E-05	2.3E-01
on and borates only (B)	0.91	5.1E-04				8.9E-03	9.9E-02	1.08«	3.8E-03				1.1E-02	1.2E-01
d and compounds (inorganic) (Pb)	0.002«	1.1E-06				2.0E-05		0.002«	7.0E-06				2.0E-05	
ganese (Mn)	2.3	1.3E-03				2.3E-02	4.5E+00	5.4	1.9E-02				5.3E-02	1.1E+01
	Units ug/L							Units ug/L						
ANIC														
zene (BNZ)	1.9	1.1E-06	3.1E-08			1.9E-05		2.6«	9.1E-06	2.6E-07			2.5E-05	
chloromethane (DCM)	6.8	3.8E-06	2.9E-08			6.7E-05	1.1E-03	14«	4.9E-05	3.7E-07			1.4E-04	2.3E-03
yl chloride (VC)	150	8.4E-05	1.6E-04	96		1.5E-03		250	8.7E-04	1.7E-03	98		2.4E-03	
TOTALS	- -	2E-04				- -	4.8E+00	TOTALS	- -	2E-03			- -	1.1E+01
w/o Arsenic	- -	2E-04			- -	- -	- -	w/o Arsenic	- -	2E-03		- -	- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.
DHS35
ft 8/95

Appendix Table 8- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample

TE: EW-PZ6

	MEAN Concen.	AVERAGE EXPOSURE (MEAN) CARCINOGENIC CDI**	RISK	%	HZD INDX	NON-CARCINOGENIC CDI**	HZD QTNT	95% UCL Concen.	REASONABLE MAXIMUM EXPOSURE (RME) CARCINOGENIC CDI**	RISK	%	HZD INDX	NON-CARCINOGENIC CDI**	HZD QTNT
	Units mg/L							Units mg/L						
INORGANIC														
Ammonia (NH3)	7	3.9E-03				6.8E-02	6.8E-02	7.96«	2.8E-02				7.8E-02	7.8E-02
Arsenic, inorganic (As)	0.025	1.4E-05	2.1E-05	3		2.4E-04	8.2E-01	0.033	1.2E-04	1.7E-04	3		3.2E-04	1.1E+00
Boron and borates only (B)	0.79	4.4E-04				7.7E-03	8.6E-02	0.83«	2.9E-03				8.1E-03	9.0E-02
Manganese (Mn)	3	1.7E-03				2.9E-02	5.9E+00	3.9«	1.4E-02				3.8E-02	7.6E+00
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	5.1«	2.9E-06	8.3E-08			5.0E-05		5.1«	1.8E-05	5.2E-07			5.0E-05	
Dichloromethane (DCM)	6«	3.4E-06	2.5E-08			5.9E-05	9.8E-04	6«	2.1E-05	1.6E-07			5.9E-05	9.8E-04
Vinyl chloride (VC)	720	4.0E-04	7.6E-04	97		7.0E-03		860«	3.0E-03	5.7E-03	97		8.4E-03	
TOTALS		- -	8E-04			- -	6.8E+00	TOTALS	- -	6E-03			- -	8.9E+00
w/o Arsenic		- -	8E-04		- -	- -	- -	w/o Arsenic	- -	6E-03		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table 8- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
EW-PZ3														
	Units mg/L							Units mg/L						
RGANIC														
enic, inorganic (As)	0.018	1.0E-05	1.5E-05			1.8E-04	5.9E-01	0.023«	8.0E-05	1.2E-04			2.3E-04	7.5E-01
ganese (Mn)	3.3	1.8E-03				3.2E-02	6.5E+00	4.4«	1.5E-02				4.3E-02	8.6E+00
	Units ug/L							Units ug/L						
ANIC														
zene (BNZ)	11	6.2E-06	1.8E-07			1.1E-04		12«	4.2E-05	1.2E-06			1.2E-04	
orobenzene (monochlorobenzene) (MCB)	110	6.2E-05				1.1E-03	5.4E-02	220	7.7E-04				2.2E-03	1.1E-01
-Dichlorobenzene (DCB2)	280	1.6E-04				2.7E-03	3.0E-02	630	2.2E-03				6.2E-03	6.8E-02
-1,2-Dichloroethylene	130	7.3E-05				1.3E-03	1.3E-01	240«	8.4E-04				2.3E-03	2.3E-01
rachloroethylene (PCE)	1.1«	6.2E-07	3.1E-08			1.1E-05	1.1E-03	1.1«	3.8E-06	1.9E-07			1.1E-05	1.1E-03
chloroethylene (TCE)	4.4	2.5E-06	2.7E-08			4.3E-05		4.7«	1.6E-05	1.8E-07			4.6E-05	
yl chloride (VC)	2900	1.6E-03	3.1E-03	100		2.8E-02		9400	3.3E-02	6.2E-02	100		9.2E-02	
TOTALS	- -		3E-03			- -	7.3E+00	TOTALS	- -		6E-02		- -	9.8E+00
w/o Arsenic	- -		3E-03		- -	- -	- -	w/o Arsenic	- -		6E-02	- -	- -	- -

One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day
Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

DHS35
ft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

er Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
E: EW-PZ4														
	Units mg/L							Units mg/L						
NORGANIC														
mmonia (NH3)	8.4	4.7E-03				8.2E-02	8.2E-02	9.9	3.5E-02				9.7E-02	9.7E-02
rsenic, inorganic (As)	0.014«	7.8E-06	1.2E-05	100		1.4E-04	4.6E-01	0.014«	4.9E-05	7.3E-05	100		1.4E-04	4.6E-01
arium (Ba)	2.5	1.4E-03				2.4E-02	3.5E-01	2.8«	9.8E-03				2.7E-02	3.9E-01
ead and compounds (inorganic) (Pb)	0.003«	1.7E-06				2.9E-05		0.003«	1.0E-05				2.9E-05	
anganese (Mn)	3.5	2.0E-03				3.4E-02	6.8E+00	4«	1.4E-02				3.9E-02	7.8E+00
	TOTALS	- -	1E-05			- -	7.7E+00	TOTALS	- -	7E-05			- -	8.8E+00
	w/o Arsenic	- -	0E+00		- -	- -	- -	w/o Arsenic	- -	0E+00		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

4ADHS35

raft 8/95

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ter Sample	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
IE: SB-3	Units ug/L							Units ug/L						
ORGANIC														
Carbon tetrachloride (CCL4)	9.1	5.1E-06	6.6E-07	19		8.9E-05	1.3E-01	9.1	3.2E-05	4.1E-06	19		8.9E-05	1.3E-01
Chloroform (THM) (CLFM)	3	1.7E-06	1.0E-08			2.9E-05	2.9E-03	3	1.0E-05	6.4E-08			2.9E-05	2.9E-03
1,1-Dichloroethylene (DCE)	8.3	4.6E-06	2.8E-06	80		8.1E-05	9.0E-03	8.3	2.9E-05	1.7E-05	80		8.1E-05	9.0E-03
Trichloroethylene (TCE)	1.2	6.7E-07	7.4E-09			1.2E-05		1.2	4.2E-06	4.6E-08			1.2E-05	
	TOTALS	- -	3E-06			- -	1.4E-01	TOTALS	- -	2E-05			- -	1.4E-01
	w/o Arsenic	- -	3E-06		- -	- -	- -	w/o Arsenic	- -	2E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

Appendix Table B- Worksheet for calculating CDIs, ELCR, and non-cancer hazard quotients by sampling site, Estes Landfill Risk Assessment

ıter Sample

TE: SB-4

	AVERAGE EXPOSURE (MEAN)						REASONABLE MAXIMUM EXPOSURE (RME)					
	CARCINOGENIC				NON-CARCINOGENIC		CARCINOGENIC				NON-CARCINOGENIC	
	MEAN Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT	95% UCL Concen.	CDI**	RISK	%	HZD INDX	CDI**	HZD QTNT
	Units ug/L							Units ug/L						
ORGANIC														
Benzene (BNZ)	0.39	2.2E-07	6.3E-09			3.8E-06		0.56	2.0E-06	5.7E-08			5.5E-06	
Bromodichloromethane (THM) (BDCM)	0.28	1.6E-07	9.7E-09			2.7E-06	1.4E-04	0.43	1.5E-06	9.3E-08			4.2E-06	2.1E-04
Chloroform (THM) (CLFM)	1.2	6.7E-07	4.1E-09			1.2E-05	1.2E-03	1.3	4.5E-06	2.8E-08			1.3E-05	1.3E-03
1,2-Dichloroethane (DCA2)	0.24	1.3E-07	1.2E-08	1		2.3E-06		0.35	1.2E-06	1.1E-07	1		3.4E-06	
1,1-Dichloroethylene (DCE)	4.6	2.6E-06	1.5E-06	64		4.5E-05	5.0E-03	5.7	2.0E-05	1.2E-05	54		5.6E-05	6.2E-03
Dichloromethane (DCM)	1.1	6.2E-07	4.6E-09			1.1E-05	1.8E-04	1.4	4.9E-06	3.7E-08			1.4E-05	2.3E-04
1,2-Dichloropropane (DCP2)	0.22	1.2E-07	8.4E-09			2.2E-06		0.3«	1.0E-06	7.1E-08			2.9E-06	
Tetrachloroethylene (PCE)	2.7	1.5E-06	7.5E-08	3		2.6E-05	2.6E-03	3.9	1.4E-05	6.8E-07	3		3.8E-05	3.8E-03
Trichloroethylene (TCE)	22	1.2E-05	1.4E-07	6		2.2E-04		26	9.1E-05	1.0E-06	5		2.5E-04	
Vinyl chloride (VC)	0.58	3.2E-07	6.2E-07	26		5.7E-06		1.2	4.2E-06	8.0E-06	36		1.2E-05	
TOTALS		- -	2E-06			- -	9.1E-03	TOTALS	- -	2E-05			- -	1.2E-02
w/o Arsenic		- -	2E-06		- -	- -	- -	w/o Arsenic	- -	2E-05		- -	- -	- -

* One-half of the reported detection limit or sample quantitation limit was used in calculations for the mean and 95% UCL. ** Units equal mg/kg-day

« Highest detected concentration was used because the Mean or 95% UCL exceeded the highest detected concentration.

94ADHS35

Draft 8/95

HOW DID THE GROUNDWATER AROUND THE LANDFILL BECOME CONTAMINATED?

Groundwater in the vicinity of the Landfill ranges between thirty and sixty feet below land surface, and generally flows in a westerly direction. During extended periods of water flow in the Salt River, groundwater flows in a more southwesterly direction.

It is believed that when the Landfill was operated, industrial liquid wastes were disposed of in pits. These wastes probably seeped downward and came in contact with the groundwater moving under the site. Seepage may have been increased as a result of flood waters entering the Landfill from the Salt River. Tests conducted in 1981 and 1982 indicated that groundwater in the area of the Landfill was contaminated with several compounds, including, but not limited to vinyl chloride and 1,2-dichloroethene.

HOW DOES THE CONTAMINATED GROUNDWATER AFFECT PEOPLE LIVING IN THE AREA?

The nearest homes appear to be located at least one-quarter of a mile away from the Landfill. Contamination beneath the Landfill does not impact or threaten any municipal drinking water wells. The closest City water supply well is located approximately seven miles northwest of the Landfill, well away from the contamination. The closest known private drinking water supply well is located approximately one and one-half miles north, northwest of the Landfill. Both wells are outside of the area of impact from the Landfill.

Although known area wells have been inventoried through searches of public records, the possibility remains that unregistered private wells exist in the area for irrigation or drinking water use. Please call the ADEQ contact listed below if you are aware of any such wells.

WHAT ARE THE CHEMICALS OF CONCERN IN GROUNDWATER?

The primary chemicals of concern at the Landfill are volatile organic compounds or VOCs. VOCs are thought to be present because of the past disposal of solvents used in various industries. In particular, two compounds, vinyl chloride and cis-1,2-dichloroethene (cis-1,2-DCE), are present in groundwater beneath the Landfill at levels that exceed safe drinking water standards. These two compounds are thought to be present because of the decomposition of a more common solvent, trichloroethene (TCE). On occasion, TCE has also been detected in the groundwater.

WHAT STUDIES HAVE BEEN DONE?

In 1987, the City voluntarily conducted an initial groundwater quality investigation to evaluate the magnitude and extent of groundwater contamination. In addition, a Technical Task Committee was formed to oversee and coordinate activities. The Technical Task Committee consisted of representatives from ADEQ, the Arizona Department of Water Resources (ADWR) and the City (Bank One began participating in 1993). Activities included installing new monitor wells, groundwater sampling, file searches and aerial photo reviews. These investigations confirmed the presence of contamination above state safe drinking water standards in the groundwater under the Landfill, and that a possible source area for the contamination was located in the southeast corner of the Landfill.

In September, 1990, a second investigation was initiated. Activities included installing additional monitor wells, conducting groundwater sampling, monitoring groundwater levels, soil gas studies, aquifer testing, and groundwater treatment studies. The results of the second investigation confirmed the existence of a former liquid disposal pit near the southeast corner of the site. This pit appeared to be the major source of the groundwater contamination.

In the fall of 1991, a third investigation was approved by ADEQ. These investigations were and are being conducted to better define the extent of the contamination and determine how fast the contamination is moving. Information from the investigation will be used to develop a remedy for the groundwater contamination in the area.

WHAT IS BEING DONE TO FIX THE PROBLEM?

ADEQ is working with the City and Bank One to develop remedial alternatives that can respond to the groundwater contamination. Because groundwater under the Landfill is affected by the Salt River, the site is technically complex. A system to pump and treat contaminated groundwater is under study; however, preliminary evaluation of this system suggests that it might be only partially effective during extended periods of water flow in the Salt River. Data collected from the newest monitor wells show contamination at the site may be deeper than previously thou...

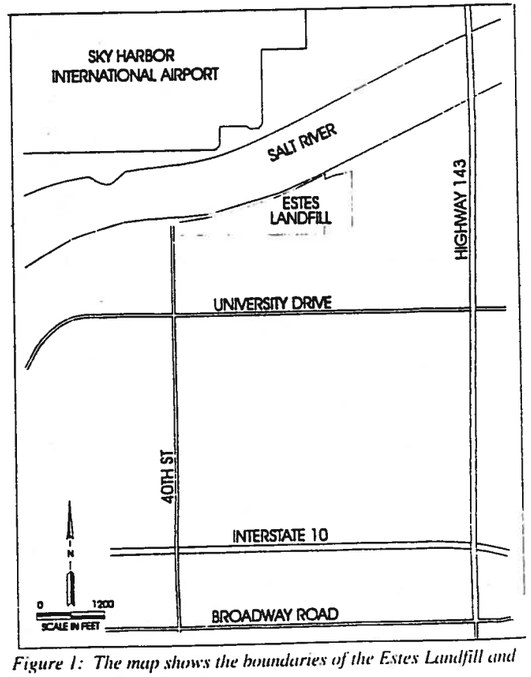


Figure 1: The map shows the boundaries of the Estes Landfill and its proximity to the Salt River

Additional data are being collected and information reviewed to assist in designing a remedial action plan. Prior to implementing a remedial action plan, community members will have an opportunity to submit comments. Remedial activities may begin as early as 1997.

WHAT IS THE STATE SUPERFUND (WQARF) PROGRAM?

The Water Quality Assurance Revolving Fund (WQARF) is Arizona's version of the federal Superfund environmental cleanup program. WQARF was created by the state legislature under the Environmental Quality Act of 1986. Under the act, WQARF was established to help clean up areas contaminated with hazardous substances in Arizona. Funding is provided by fees and other resources authorized by the legislature. WQARF finances cleanups when private cleanup money cannot be found or responsible parties have not been identified.

The WQARF program is similar to the federal Superfund program or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which was created by Congress in 1980. Working with the U.S. Environmental Protection Agency, ADEQ currently oversees cleanup at 68 federal and state Superfund sites in Arizona.

WHERE CAN I GET MORE INFORMATION?

Much of the technical information collected from the investigations has been summarized in two reports. Copies of these Groundwater Quality Investigation reports as well as other documents related to this site are available for review at ADEQ. Please contact the WQARF File Coordinator for an appointment.

Julie Jones, WQARF File Coordinator
ADEQ
3033 North Central Avenue
Phoenix, Arizona 85012
Phone: (602) 207-4190 or
1-800-234-5677 ext. 4190
8a.m. to 5p.m. - Monday thru Friday

Both Groundwater Quality Investigation Reports and other information about the Estes Landfill is also available for review at the following locations: Central Library, Ocotillo Branch Library and the City of Phoenix Office of Environmental Programs.

If you have specific questions that are not addressed in the information repositories, you can contact the ADEQ project manager:

Ed Pond, Project Manager
Remedial Projects Section
Arizona Department of Environmental Quality
3033 North Central Avenue, #619
Phoenix, Arizona 85012
(602) 207-4575

HOW CAN I GET INVOLVED?

ADEQ, the City, and Bank One are preparing a Community Involvement Plan for the Site. The plan will outline ways for ADEQ, the City, and Bank One to further inform and involve the community in decisions and activities regarding the Estes Landfill project. Public outreach activities may include community interviews, additional fact sheets and briefings, workshops and/or public meetings. ADEQ, the City, and Bank One are very interested in hearing your concerns and answering your questions about the site. To help answer your questions, we are asking that you complete and return the mailing list coupon below. Your input will help us develop a mailing list of interested persons; let us know your main concerns; tell us if you have any information about companies that may have used the Estes Landfill (also referred to as the 40th Street Landfill) and provide us with any additional information on private wells, nearby residences, or interested neighborhood groups.

MAILING LIST COUPON - ESTES LANDFILL

Please add me to the mailing list

Name _____
Address _____
_____
Phone # _____
□ Organization/Affiliation _____
_____
□ My main concerns are (attached sheets as needed): _____
_____
□ I would like to receive information on: _____
_____
□ I have additional information on dumping at the Estes Landfill or private water supply wells and wish to be contacted by a state or city representative. (If you wish to report anonymously, please call Ed Pond, ADEQ Project Manager, at 207-4575.)

Return to: Ed Pond, ADEQ, 3033 North Central Avenue, Phoenix, AZ 85012

Community Involvement Plan

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY January 1997

Estes Landfill - State Superfund Site
Phoenix, AZ

This Community Involvement Plan for the Estes Landfill was prepared by the City of Phoenix and ENSR Consulting and Engineering with guidance from the Remedial Projects Section of the Arizona Department of Environmental Quality.

City of Phoenix

OFR96-31 ADEQ Document Number
1614-001-002 City of Phoenix Document Number

1614-001-002 City of Phoenix Document Number

OFR96-31 ADEQ Document Number

COMMUNITY INVOLVEMENT PLAN
ESTES LANDFILL STATE SUPERFUND SITE
PHOENIX, ARIZONA

Prepared by

CITY OF PHOENIX

Phoenix, Arizona

and

ENSR CONSULTING AND ENGINEERING

Fort Collins, Colorado

with guidance from the Remedial Projects Section of the

Arizona Department of Environmental Quality

January 1997

CONTENTS

1.0 OVERVIEW OF COMMUNITY INVOLVEMENT PLAN 1-1

2.0 SITE SUMMARY 2-1
- 2.1 Physical Description 2-1
- 2.2 History of the Site 2-1
- 2.3 Site Study Activities 2-3
- 2.4 Draft Risk Assessment 2-5

3.0 COMMUNITY BACKGROUND 3-1
- 3.1 Community Profile 3-1

4.0 CHRONOLOGY OF COMMUNITY INVOLVEMENT 4-1

5.0 KEY COMMUNITY ISSUES 5-1
- 5.1 Economic 5-1
- 5.2 Redevelopment 5-2
- 5.3 Bradley Landfill 5-2
- 5.4 Technical 5-2
- 5.5 Site-Specific 5-2

6.0 INFORMATION NEEDS 6-1

7.0 OBJECTIVES AND HIGHLIGHTS OF THE COMMUNITY INVOLVEMENT PLAN 7-1
- 7.1 Community Involvement Objectives 7-1
- 7.2 Plan Highlights 7-1

8.0 COMMUNICATION TECHNIQUES AND TIMING 8-1
- 8.1 Communication Techniques 8-1
- 8.2 Maintenance of the Site Mailing List 8-1
- 8.3 Preparation and Distribution of Fact Sheets 8-1
- 8.4 Maintenance of the Information Repository 8-1
- 8.5 Requests for Information 8-2
- 8.6 Public Comment Period on RI/FS and Proposed Plan 8-2
- 8.7 Public Meetings 8-2
- 8.8 News Releases/News Media Activities 8-2
- 8.9 Responsiveness Summary 8-2
- 8.10 Community Interviews 8-3

8.11 Timing of Activities 8-3
8.12 Briefings for Local Officials 8-3

LIST OF TABLES

8-1 Proposed Schedule of Community Involvement Activities for Estes Landfill State Superfund Site 8-4

LIST OF FIGURES

2-1 Estes Landfill Map 2-2

1.0 OVERVIEW OF COMMUNITY INVOLVEMENT PLAN

This Community Involvement Plan describes the process to respond to issues of community concern regarding the Estes Landfill State Superfund Site in Phoenix, Arizona and outlines community involvement activities to be conducted during the Site Remedial Investigation and Feasibility Study (RI\FS) process.

This plan has been developed in accordance with the 1990 National Contingency Plan and the 1992 U.S. Environmental Protection Agency Community Relations Handbook. The plan provides the basis for two-way communication designed not only to keep citizens informed about site progress, but also to give them opportunity to provide input into site decisions.

This Community Involvement Plan has been prepared to assist the Arizona Department of Environmental Quality (ADEQ), the City of Phoenix (the City), and Bank One Arizona, N.A. (Bank One) in maintaining a community involvement program tailored to the needs of the community in the vicinity of the Estes site. Community involvement activities are being conducted to educate the community and enlist the community's involvement in site activities.

The plan includes the following sections:

- Site Description;
- Community Background;
- Plan Highlights;
- Techniques and Timing; and
- Appendices.
  - A - Information Repository Location
  - B - Community Interview Script
  - C - Glossary of Terms

The plan's information is based primarily on interviews of community leaders, business owners, and elected officials conducted in Phoenix in September 1995. The interviews were conducted by environmental program managers and community relations staff representing ADEQ, the City, and ENSR Consulting and Engineering. The interviews provided information to the interviewees on the site, solicited opinions and concerns, and asked how ADEQ and the City can involve and inform the public.

2.0 SITE SUMMARY

2.1 Physical Description

The Estes Landfill is located south of the Salt River between 40th and 45th Streets in Phoenix (See Figure 2-1). The landfill now occupies approximately 40 acres in an area that is mostly new commercial development and older industrial properties. The landfill is bounded by 40th Street on the west, the Salt River on the north, the Waste Management Regional Waste Transfer Station and the Bradley Landfill on the south and vacant land to the east. The Bradley Landfill is still in operation. Like the adjacent Bradley Landfill, at times the Estes Landfill was also known as the 40th Street Landfill.

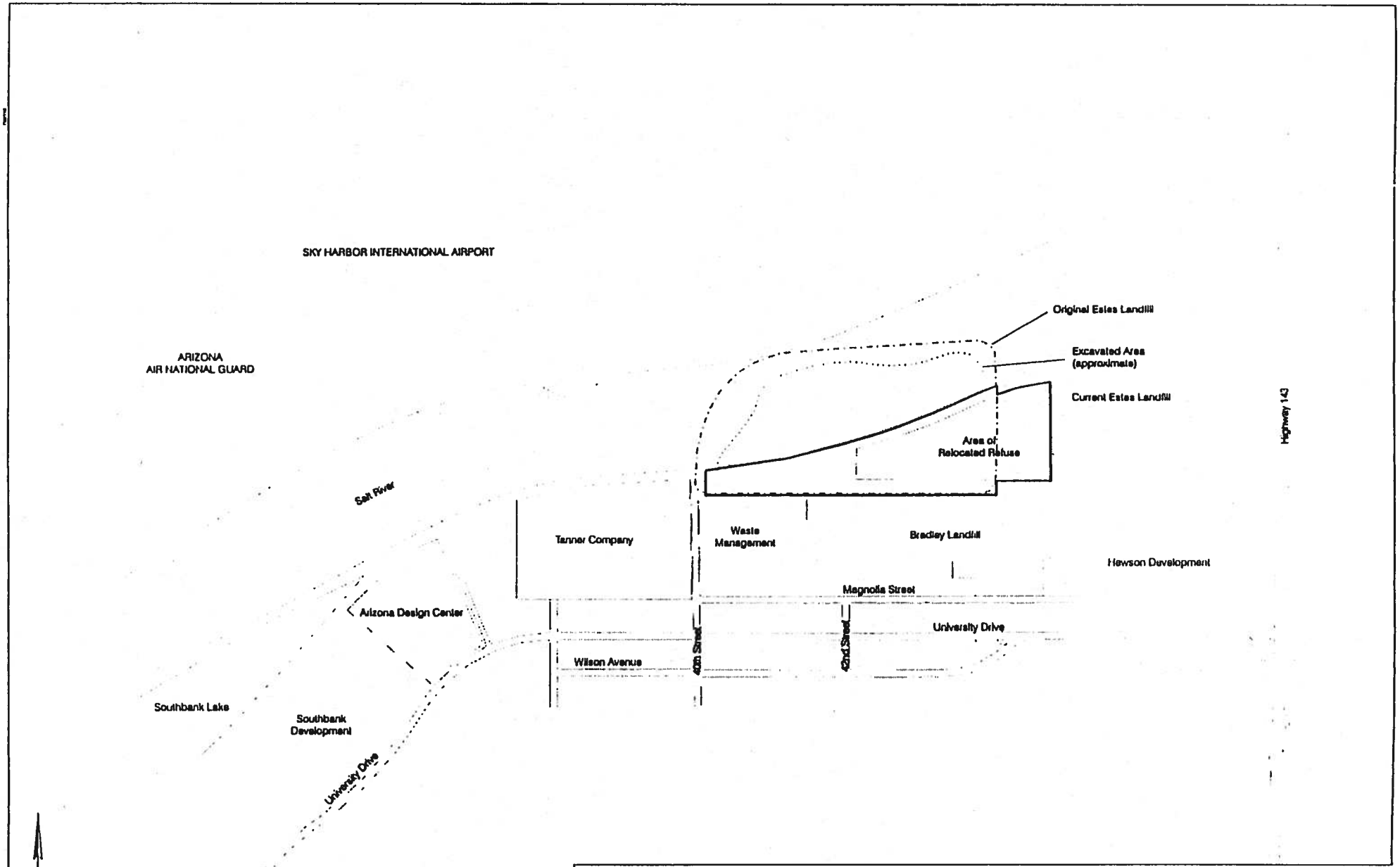
2.2 History of the Site

The Estes Landfill was operated by Garbage Service Co., Inc. from the early 1950s until 1972, when it was permanently closed. The landfill was used by commercial trash haulers, septic tank effluent haulers, and other users.

In 1978, 1979, and 1980 flooding along the Salt River caused substantial damage to several properties along the river including the south runway of the Phoenix Sky Harbor International Airport and large portions of the landfill. As a result of the flooding, the City, in conjunction with several state and federal agencies, developed a program of river channelization and bank stabilization to protect public and private property in that portion of the river from future flood events. To implement this program, several properties in the area were condemned by the City. One such property was the Estes Landfill, which was acquired in 1982 by the City from Valley National Bank of Arizona (now Bank One Arizona, N.A.), which held title as trustee for the estate of Calvin Estes.

After the City acquired the property, a portion of the landfill was relocated to accommodate flood control levees and the improved river channel. During the relocation, the Arizona Department of Health Services (ADHS: the predecessor to ADEQ), and the City tested the materials to be moved. Some of the materials were classified as hazardous waste under the federal hazardous waste law, the Resource Conservation and Recovery Act (RCRA). These wastes were sent to a hazardous waste disposal site in California. Nonhazardous wastes were relocated on top and to the east of the previous fill area.

In 1993, the City and Bank One (as successor to Valley National Bank of Arizona) settled a court case brought by the City, and agreed to work together on future investigations and remedial activities. Under the agreement, the City and Bank One will jointly fund and manage the project with ADEQ's oversight. The City and Bank One may also seek funding from other parties who were responsible for the original disposal of hazardous substances into the landfill.



Harding Lawson Associates
Engineering and
Environmental Services

Site Map
Estes Landfill
Phoenix, Arizona

FIGURE
2-1

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
DBS	ds-1		1/97	

Between 1980 and 1982, groundwater contamination by volatile organic compounds (VOCs) was discovered in two industrial supply wells located near the Estes Landfill. VOCs are thought to be present because of the past disposal of industrial solvent waste in the landfill. Under direction from ADEQ, the City installed four monitoring wells in 1982 to assess the presence of VOCs in the groundwater. Samples collected from these wells between 1982 and 1984 indicated vinyl chloride as the predominant contaminant in the groundwater beneath the landfill. Cis-1,2-dichloroethene is also present in the groundwater. Vinyl chloride and cis-1,2-dichloroethene are believed to be breakdown products of trichloroethene (TCE), which was a commonly used industrial solvent during the time of the landfill's operation.

Groundwater in the vicinity of the landfill ranges between 30 and 60 feet below land surface, and generally flows in a westerly direction. During extended periods of water flow in the Salt River, groundwater flows in a more southerly direction.

Because the site was a suspected source of groundwater contamination, the site was designated in 1989 as part of ADEQ's East Lake Park/East Washington Water Quality Assurance Revolving Fund (WQARF) Study Area. The Estes Landfill is now listed as a WQARF priority site. WQARF was created by the state legislature under the Environmental Water Quality Act of 1986. Under the act, WQARF was established to address areas contaminated with hazardous substances in Arizona. WQARF is similar to the federal Superfund program or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which was created by Congress in 1980 to address hazardous substance sites.

2.3 Site Study Activities

Under state and federal laws, certain current and past owners and operators of the landfill, companies which disposed of waste at the site, and companies which transported waste to the site, can be held responsible for contamination. Although the City never operated the landfill the City has been voluntarily conducting studies at the site since 1986. In 1987, the City began conducting an initial groundwater quality investigation to evaluate the magnitude and extent of groundwater contamination. In addition, a Technical Committee (TC) task force was formed to oversee and coordinate activities. The task force consisted of representatives from ADEQ, the Arizona Department of Water Resources (ADWR), and the City. The task force was charged with planning a groundwater quality investigation in 1986 after ADHS released a Site Inspection Report identifying monitoring wells impacted by groundwater contamination near the Estes and Bradley Landfills.

The Phase I groundwater quality investigation activities, which began in 1987, included:

- Six groundwater monitor wells installed and sampled;
- Historical aerial photo and records review;

- Draft Phase I groundwater quality investigation report submitted to ADEQ in 1990.

This investigation confirmed the presence of groundwater contamination under the landfill, and that a possible source area for the contamination was in the southeast corner of the original landfill.

The Phase II groundwater investigation began in 1990. The major investigation activities included:

- Eight monitor wells installed and tested;
- Groundwater sampling;
- Tests conducted to evaluate different groundwater treatment technologies;
- Initial soil gas studies and an exploratory boring;
- Conduct of a long-term aquifer test; and
- A draft Phase II groundwater quality investigation report submitted to ADEQ in 1992.

The investigation results confirmed the existence of a former liquid disposal pit near the site's original southeast corner. This appeared to be the major source of the groundwater contamination.

The Phase III investigation began in 1991. Major activities included:

- Feasibility study of a pilot groundwater pump and treat system;
- Additional studies to evaluate other remedial options including:
  - Additional soil gas studies;
  - Installing discrete monitor well clusters and conducting aquifer tests;
  - Geophysical surveys;
  - Updated well inventory.

The pump and treat system evaluation has indicated that the system would not be effective during flows in the Salt River due to the landfill's complex hydrogeology. Therefore, the City has concentrated its efforts on studying more feasible remedial alternatives to address groundwater contamination.

Throughout the project the City has inventoried nearby water supply wells through searches of public records. The nearest registered domestic water well is approximately 1.5 miles away and is not in the path of contaminated groundwater flow. The area's drinking water is provided by the City, and no known drinking water wells are impacted by the landfill.

2.4 Draft Risk Assessment

ADHS completed a Draft Risk Assessment in August 1995. The purpose of the assessment was to evaluate potential health risks that may result from contaminants at the landfill. ADHS staff evaluated potential exposure from soil gas, fugitive dust, and water. The nearest home is located about one-quarter mile south of the landfill. Contamination beneath the landfill does not impact or threaten any municipal drinking water wells. As previously mentioned, the closest known private drinking water supply well is located approximately one and one-half miles north, northwest of the landfill. The closest City water supply well is located approximately seven miles northwest of the landfill, well away from the contamination. Both wells are outside of the area of impact from the landfill.

The Draft Risk Assessment supports the following conclusions:

- Because there is no exposure through registered private domestic wells, there are no known current public health risks from contaminants in groundwater;
- Soil gas concentrations measured at the landfill are low and present at most a negligible on-site health risk; off-site soil gas concentrations were below detectable levels;
- Surface soil, which could blow off the landfill as fugitive dust, poses, at most, a negligible health risk; and
- Because of the commercial land use in the area, it is unlikely that private wells would be installed and used for drinking water. The City does not use groundwater in the area for its water supply.

3.0 COMMUNITY BACKGROUND

3.1 Community Profile

The current community is a mixture of new commercial development and older industrial properties. From the 1930s into the early 1960s, there were homes and small farms south of the landfill on University Drive and 40th Street. The residences were on large parcels of land (about an acre or more). The farms specialized in poultry and produce.

In the early 1960s, commercial and light industrial businesses began replacing the residences. Some homeowners also began operating businesses on their properties and moved their families to other parts of Phoenix. By the early 1970s, the area consisted of commercial and light industrial businesses with a few residential properties. Today, the area is almost exclusively commercial and industrial.

4.0 CHRONOLOGY OF COMMUNITY INVOLVEMENT

The site has been the subject of public involvement dating back to 1980, when the Arizona Department of Health Services (ADHS) discovered contaminated groundwater downgradient of the Landfill. The City and other relevant authorities have conducted community outreach activities that include:

- The 1982 partial site relocation was discussed at City Council meetings and the Arizona Legislature;
- The site was discussed at public meetings of the Phoenix Environmental Quality Commission and multiple public meetings of the Phoenix City Council's Environment and Natural Resources Subcommittee. City Environmental Programs staff have briefed the City Council on site study progress, legal activities, and contracting processes periodically in 1981, 1982, and between 1986 and the present;
- Various reports regarding the Landfill were prepared and submitted to the public files by relevant agencies, including a 1986 ADHS report on the Estes and adjacent Bradley Landfills;
- Copies of all technical reports, including quarterly status reports and proposed technical tasks, have been submitted to ADEQ for review and submission into public files;
- An information repository was established at the Ocotillo Library in 1990, and it contains various technical documents about the investigation activities. Information on the Estes Landfill is also available in the Government Publications Section of the Central Library;
- The City published ads during the weeks of July 21 through August 4, 1991 in the *Arizona Republic, Tribune Newspapers, El Sol de Arizona,* and the *Arizona Informant*, requesting information regarding dumping at the Estes and Bradley Landfills;
- The City created an informational mailing list in 1993;
- The City and ADEQ prepared and mailed an informational fact sheet about the site in February 1995 to 117 interested parties. In addition, a door-to-door distribution in the vicinity of the site was completed. This mailing generated two responses for more information about the site;
- Representatives of the City and ADEQ conducted interviews with 20 community members and local officials in September 1995.

5.0 KEY COMMUNITY ISSUES

Community interviews to identify potential issues and information needs on the Estes Landfill were conducted in September 1995. During the interview process, the interviewees were briefed about the site and related activities, including the ADHS's draft risk assessment. Although the interviews represent a sample of the community, an effort was made to include a broad spectrum of community representatives. The information presented in this section summarizes the key issues and information needs identified during the interviews. (See Appendix B for the Community Interview Script). The interviews indicated much variation in the level of existing knowledge about the site. Most people commended the City for conducting the interviews and appreciated the opportunity to be briefed on the site.

The following general categories of issues which were identified during the interviews, are discussed in the rest of this chapter.

- Economic;
- Redevelopment;
- Bradley Landfill;
- Technical;
- Site-specific.

5.1 Economic

Several participants asked about potential remedial costs. Most interview participants agreed in principle that the site should be addressed, but several questioned the potential cost and asked if the City had the funding. Several interviewees stressed that the costs of clean up should be weighed against the net benefit. One interviewee said the remediation should be cost-effective and have a purpose, and that the City should not be cleaning up "just to clean up." One interviewee encouraged the City to keep looking for other responsible parties in order to share the remediation cost.

5.2 Redevelopment

Some interviewees said they hoped the landfill area would be redeveloped after it was remediated. Two persons envisioned businesses and hotels in the area, and others hoped that remediation efforts would provide job opportunities. Two people were concerned that homes might be built in the area, and that prospective buyers should be notified of the presence of the landfill. Two other people indicated that the landfill should be considered in the Rio Salado redevelopment plans.

5.3 Bradley Landfill

Several participants expressed concern about the Bradley Landfill. One participant was concerned about the Bradley landfill's appearance and its visibility from State Route 153. Another expressed concern about the appearance of both landfills and the fact that they "will be the gateway to Tempe and Phoenix." Another participant said that the Bradley and Estes Landfills needed to be addressed together, and that the Bradley Landfill needs more regulatory attention.

5.4 Technical

A brief technical overview of the site was provided to participants. All participants appeared to understand that the site is complex, and that groundwater technical activities are complicated by the proximity of the site to the Salt River. Participants also seemed to acknowledge that pumping and treating groundwater as a remedial option may not be viable because flows in the river can overwhelm pumpage. At least three participants expressed interest in and support for bioremediation as a potential remedial option. One other participant commented that if the City waited 50 years, the landfill may clean itself up, thereby, negating the need for expensive technology.

5.5 Site-Specific

The participants were briefed on the draft Risk Assessment prepared by the ADHS for the Estes Landfill. During several interviews, ADEQ mentioned its concerns about the potential migration of contaminated groundwater.

When asked about site impacts, participants felt that nearby business, property owners, and developers would be most affected by the site. They felt potential buyers could be concerned about buying property near a contaminated area.

Most participants were satisfied with the City's pace at the site and proposed activities schedule. One participant commended the City for its aggressive pace. However, some thought the City should take action soon, because the longer the contamination continues, the more negative community perception could become.

6.0 INFORMATION NEEDS

Most people interviewed had similar suggestions for meeting their information needs. The majority of interviewees identified distribution of fact sheets as the most effective method of obtaining information. The majority stated the information should be in non-technical terms and wanted to be notified of significant events. All participants appreciated the personal interviews, commended the City and ADEQ for their efforts, and requested to be put on the mailing list.

The use of workshops and public meetings were also identified as appropriate ways to keep the community informed, when the City has significant information to share. One participant said the meetings should focus on the positive and be outcome-based. Representatives of Palmdale Elementary School offered the school auditorium as a possible meeting location and to send meeting notices home with students to their parents.

One participant suggested the City work with the Arizona Republic and the New Times to get news coverage.

7.0 OBJECTIVES AND HIGHLIGHTS OF THE COMMUNITY INVOLVEMENT PLAN

7.1 Community Involvement Objectives

The community involvement plan provides a framework to facilitate ongoing dialogue with the surrounding community, provide information regarding site activities, and promote communication among the regulating agencies, the general public and the responsible parties.

Frequent and direct interaction with interested community members and the timely distribution of information are of primary importance. Emphasis will be placed on an educational effort to promote understanding about site activities to those interested. A variety of techniques are defined to provide informational opportunities to various groups at appropriate levels of detail.

7.2 Plan Highlights

The Estes Landfill Community Involvement Plan includes the following elements:

- Maintenance of the site mailing list;
- Preparation and distribution of informational bilingual fact sheets at critical project milestones;
- Maintenance of the information repository;
- Public meetings/workshops at key appropriate project milestones;
- Assistance with responding to information requests from the general public; and
- Briefing of public officials.

The communication methods listed above address the issues and information needs identified during the community interview process. The overall approach is to provide information to the public regarding site activities in a timely fashion and at the appropriate level of detail. The potential for misinterpretation of technical data can be reduced by briefing interested parties when findings become available. Individual information needs will be addressed throughout the program, and timely responses to information requests will be provided.

8.0 COMMUNICATION TECHNIQUES AND TIMING

8.1 Communication Techniques

This section describes the activities to be included in the community involvement plan for the Estes Landfill site and the planned timing of the activities.

8.2 Maintenance of the Site Mailing List

A site mailing list was developed in 1993 and is computerized for use in distributing mailings and meeting notifications. The list is comprised of property owners in the vicinity of the site, interested groups and associations, interested individuals, elected officials, and local, and state agencies. The list will be updated as new names and addresses are submitted to the City. The list will be maintained in data base format for ease of access. The list has been updated based on the interviews.

8.3 Preparation and Distribution of Fact Sheets

As a means of providing information on the site status, project updates or fact sheets will be prepared in Spanish and English and distributed as needed. The fact sheets will be distributed after submittal of the remedial investigation, feasibility study, and proposal plan to ADEQ. Fact sheets will be prepared with ADEQ's review and approval.

A bilingual fact sheet was produced and distributed in Spring 1995. It provides an overview of the site and information on the site's history, past investigation activities, and public participation opportunities. Fact sheets will be distributed to those on the mailing list, supplied to the information repository, and provided as door-hangers to local businesses in the vicinity of the landfill.

8.4 Maintenance of the Information Repository

In 1990, an information repository was established at the Ocotillo Public Library. The location is listed in Appendix A. The repository houses pertinent site documents, allowing for convenient access and review of site information by the interested public. The repository's technical reports will be updated as new information is available.

8.5 Requests for Information

The City will provide assistance to the ADEQ in responding to requests for information or materials on an as-needed basis.

8.6 Public Comment Period on RI/FS and Proposed Plan

A minimum 30-day public comment period must be held to allow citizens to express their opinions on the proposed alternative for remedial action at the Estes Landfill. Community input should be encouraged by informing citizens that their opinions will be considered in the ultimate decision on remedial design and action. A public notice will be placed in the local newspapers announcing the availability of the documents and the comment period. Information about the public comment period will also be included in the fact sheet, which will be published in Spanish and English.

8.7 Public Meetings

A public meeting will be held during the public comment period to provide an opportunity for the City and ADEQ to answer citizen questions and discuss the recommended remedial action. The meeting could be held at one of the following locations: Palmdale Elementary School; Ocotillo Public Library; the River of Life Tabernacle; South Mountain Community College; and Phoenix College. The meetings will be publicized in the fact sheet and in the local newspapers.

8.8 News Releases/News Media Activities

News releases will be prepared and distributed to area news media (newspaper, radio, and television) when program milestones are reached.

8.9 Responsiveness Summary

This document will summarize public concerns and issues raised during the public comment period on the proposed plan. The summary will be compiled and distributed by ADEQ and include ADEQ's responses to the comments. The summary will be sent to individuals requesting a copy of the summary, potentially responsible parties, and individuals who submit comments.

8.10 Community Interviews

Twenty interviews were conducted in September 1995. The interviews were conducted by environmental managers and community relations staff representing ADEQ, the City, and ENSR. Additional interviews may be conducted if community concerns change.

8.11 Timing of Activities

The community involvement plan will be implemented for the duration of site activities. The timing of community activities will be related to the remedial action milestones.

8.12 Briefings for Local Officials

Briefings have been conducted by the City since 1987. Briefings are recommended at any point during the remedial investigation, feasibility study, and remedial action. Briefings would also helpful if unexpected events or delays occur at the site.

Table 8-1 illustrates a proposed milestone schedule for implementation of the Community Involvement Plan.

Table 8-1

Proposed Schedule of Community Involvement Activities for Estes Landfill State Superfund Site

Activities	Status
Information Repository	The repository was established in 1990. The repository's technical reports will be updated as new information is available.
Site Mailing List	The mailing list was created in 1993 and will be updated as new names and addresses are submitted to the City.
Community Interviews	20 interviews were conducted in September 1995. Additional interviews may be conducted if community concerns change.
Fact Sheets	A bilingual fact sheet was distributed in Spring 1995 Other bilingual fact sheets will be prepared and distributed after the remedial investigation, the feasibility study, and the proposed plan have been provided to ADEQ.
Public Meetings	A public meeting should be held before the remedial action plan is adopted.
Briefings for Local Officials	Briefings have been conducted by the City since 1987. Briefings are recommended at any point during the remedial investigation, feasibility study, and remedial action. Briefings would also help if unexpected events or displays occur at the site.
Response to Information Requests	The City will respond to information requests from citizens and officials on an ongoing basis.
Public Comment Period	A minimum 30-day public comment period will be held when the remedial investigation, feasibility study and proposed plan are released to the public. The comment period can be extended at least 30 days upon timely request. A bilingual public notice will be placed in local newspapers announcing the availability of the documents and the comment period.
Responsiveness Summary	The summary will be prepared following the public comment period. This document is a summary of written or oral comments made by the public about the proposed remedial plan and RI/FS and the agency responses to those comments.
News Releases/News Media	News releases will be prepared and distributed to area news media (newspaper, radio, and television) when program milestones are reached.

Arizona Department of Environmental Quality

THE ESTES LANDFILL STATE SUPERFUND SITE

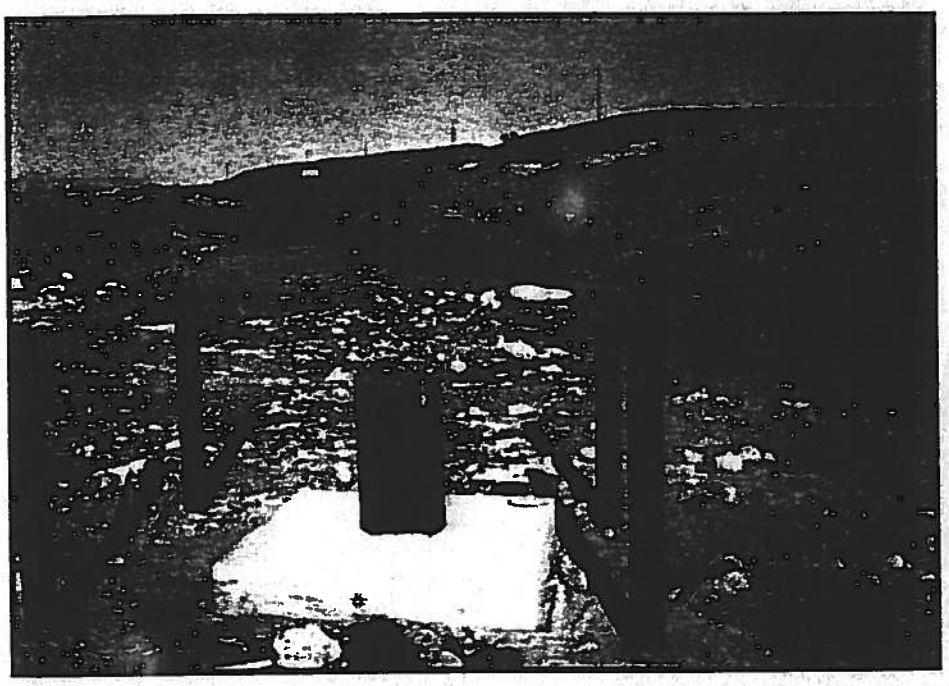
Spring '95

Este documento se puede obtener en español llamando a Superfund Hotline al 207-4360

AN UPDATE ON THE ESTES LANDFILL STATE SUPERFUND SITE

Studies of environmental conditions at the Estes Landfill are being conducted under the supervision of the Arizona Department of Environmental Quality (ADEQ) by the City of Phoenix (the City) and Bank One Arizona, N.A. (Bank One). The groundwater under the Estes Landfill is contaminated, but the City does not use this groundwater to supply its drinking water. The drinking water served by the City to area residents is provided from other water sources and meets all applicable federal and state safe drinking water requirements. Efforts are continuing to locate those responsible for the industrial waste that was disposed of in the Estes Landfill.

This Fact Sheet provides information on the Estes Landfill's history, ongoing studies and future plans, and also describes how to participate and obtain more information.



This photograph was taken after completion of monitor well EW-9. The well is located in the Salt River Channel and is surrounded by steel protective posts. The relocated portion of the Estes Landfill is visible in the background (see below for details).

SITE HISTORY

The Estes Landfill, hereafter referred to as the Landfill, is located south of the Salt River between 40th and 45th Streets in Phoenix, Arizona (see Figure 1). The Landfill now occupies about 40 acres in an area that is mostly new commercial development and older industrial properties. The site is bounded by the Salt River on the North, 40th Street on the West, the Waste Management regional transfer station and the Bradley Landfill on the south, and vacant land to the east. The Bradley Landfill is still in operation. Both Landfills may also have been known as the 40th Street Landfill.

The Landfill was privately owned and operated from the early 1950's until 1972, when it was permanently closed. The City is the current owner of the Landfill.

In 1978, 1979, and 1980, flooding along the Salt River caused substantial damage to several properties along the river, including the south runway of the Phoenix Sky Harbor International Airport, and large portions of the Landfill. As a result of the flooding, the state and the City developed a program of river channelization and bank stabilization to protect public and private property in that stretch of the river from future flood events. To implement this program, several properties in the area were condemned by the City. One such property was the Landfill, which was acquired by the City from the Valley National Bank of Arizona (now Bank One Arizona, N.A.) in 1982.

After the City acquired the property, a portion of the Landfill was relocated to accommodate flood control levees and the improved river channel. During the relocation, the Arizona Department of Health Services (ADHS), ADEQ's predecessor, and the City tested the materials to be moved. Some of the materials were classified as hazardous waste and sent to a hazardous waste disposal site in California. Nonhazardous wastes were relocated on top of what is now the site.

In 1993, the City and Bank One (as trustee and successor to Valley National Bank of Arizona) settled a court case brought by the City and agreed to work together on future investigations and cleanup. Under the agreement, the City and Bank One will jointly fund and manage the project with ADEQ's oversight. The City and Bank One may also seek funding from other parties who were responsible for the original disposal of hazardous materials into the Landfill.

OFFICIAL NOTICE
STATE OF ARIZONA

If you have a well in your backyard or somewhere else on your property, or know of a private well in the area of the groundwater pollution and you suspect that it is not registered with the Department of Water Resources, please call 207-4360. You may leave a message in English or Spanish. Someone will call you back as soon as possible.

Public Affairs
Arizona Department of Environmental Quality
3033 North Central Avenue
Phoenix, Arizona 85012