Municipal Solid Waste Landfill Emission Inventory Report Guidance

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This document was prepared by the emissions inventory quality assurance team at the Arizona Department of Environmental Quality (ADEQ) to provide guidance on the best practices to use during preparation of annual emissions inventory (EI) reports for landfills. These reports are submitted to ADEQ via the Environmental Protection Agency (EPA)'s Combined Air Emissions Reporting System (CAERS). If you have any questions or suggestions about this guidance or EI preparation and reporting in general, please email EmissionInventory@azdeq.gov . For technical troubleshooting issues in CAERS, please email NodeHelpDesk@epacdx.net.

1. Types of Emissions & Associated Processes

Table 1 below includes common types of emissions found at power plants and associated CAERS Unit Type Code(s). If a type of emission in Table 1 is not applicable to your facility, then do not include that emission type in your facility's annual emission inventory. On the other hand, if your ADEQ air permit addresses any additional emissions sources not listed in Table 1, or if you are aware of any other emissions sources on-site that routinely emit more than 1 ton of regulated air pollutants per year, please include them in the report. If you are unsure how to include those emissions in the report or how to estimate them, please contact ADEQ at EmissionInventory@azdeq.gov

Table 1: Types of Emissions and Associated Processes

Type of Emission Units	CAERS Unit Type Code(s)	Description
Cover Operations	Waste Stabilization Equipment	Routine fugitives from earth-moving operations
Flares	Flare	Combustion/oxidation emissions from landfill gas controls
Generators[1]	Reciprocating IC Engine, Turbine	Internal combustion engine emissions for stationary and portable generators
Hazardous Waste	Other fugitive	Process and/or fugitive emissions from hazardous waste. Divide into more specific Unit Type Code(s) by searching in CAERS if possible.
Landfill Gas	Open Air Fugitive Source	Fugitive gases from active and inactive cells, leachate ponds, etc.
Storage[1]	Storage Tank, Storage Bin, Open Storage Pile, Open Tank or Vat	Fugitive emissions from storage piles or tanks (includes storage and dispensing of fuel)
Vehicle Dust	Other fugitive	Road (and off-road) dust entrained by haul vehicle travel

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[1] If one type of emission has multiple unit type codes that are applicable to your facility, each should be made into their own emission unit in CAERS. For example, if an IC engine and a Turbine are both present, then two units should be created. One for the IC engine and the other for the Turbine.

Working Face Fugitives	Open Air Fugitive Source	Routine fugitives from adding/rearranging/compacting fill in an active cell

2. Emission Processes and Preferred Source Classification Codes (SCC)

This section includes the preferred SCCs for each emission process found at landfills. The Environmental Protection Agency (EPA) maintains an updated list of SCCs on the following website:

https://sor-scc-api.epa.gov/sccwebservices/sccsearch/

The preferred SCCs for each emission process are listed in Table 2 and are accompanied by SCCs that have historically been used by landfills. The SCCs associated with each of the type of emissions have many options based on the type of fuel used, design capacity, etc. and other options in CAERS may be available that are more accurate for your process emissions. Please choose the most applicable SCC for each process when searching in CAERS, they might not be listed on this table due to the number of SCCs available in CAERS. For guidance searching for SCCs, review EPA's guidance document found here.

Table 2: Remapped SCCs by Emission Process

Previously Used SCCs	Preferred SCCs	Preferred SCC Descriptions
Cover Operations		
50100402	50300608	Waste Disposal > Solid Waste Disposal - Industrial > Solid Waste Landfill > Conveying of Cover Material
	50100408	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Conveying of Cover Material
	50600642	Waste Disposal > Solid Waste Disposal - Commercial > Municipal Solid Waste Landfill > Conveying of Cover Material
	50700642	Waste Disposal > Solid Waste Disposal - Institutional > Municipal Solid Waste Landfill > Conveying of Cover Material
	50300609	Waste Disposal > Solid Waste Disposal - Industrial > Solid Waste Landfill > Spreading of Daily Cover
	50100409	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Spreading of Daily Cover
	50600644	Waste Disposal > Solid Waste Disposal - Commercial > Municipal Solid Waste Landfill > Spreading of Daily Cover
	50700644	Waste Disposal > Solid Waste Disposal - Institutional > Municipal Solid Waste Landfill > Spreading of Daily Cover
Flares		
50100402	50300601	Waste Disposal > Solid Waste Disposal - Industrial > Solid Waste Landfill > Waste Gas Destruction
	50100410	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Landfill Dump: Waste Gas Destruction: Waste Gas Flares
	50200601	Waste Disposal > Solid Waste Disposal - Commercial/Institutional > Landfill Dump > Waste Gas Flares

		Generators[3]		
		RICE		
N/A	20200102	Internal Combustion Engines > Industrial > Distillate Oil (Diesel) > Reciprocating		
	20300101	Internal Combustion Engines > Commercial/Institutional > Distillate Oil (Diesel) > Reciprocating		
	20200301	Internal Combustion Engines > Industrial > Gasoline > Reciprocating		
	20300301	Internal Combustion Engines > Commercial/Institutional > Gasoline > Reciprocating		
		Turbine[3]		
N/A	20200101	Internal Combustion Engines > Industrial > Distillate Oil (Diesel) > Turbine		
	20300102	Internal Combustion Engines > Commercial/Institutional > Distillate Oil (Diesel) > Turbine		
	20201701	Internal Combustion Engines > Industrial > Gasoline > Turbine		
		Hazardous Waste		
N/A	50300604	Waste Disposal > Solid Waste Disposal - Industrial > Solid Waste Landfill > Hazardous Fugitive Emissions		
	50100442	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Hazardous Fugitive Emissions		
	50600602	Waste Disposal > Solid Waste Disposal - Commercial > Municipal Solid Waste Landfill > Hazardous Fugitive Emissions		
	50700602	Waste Disposal > Solid Waste Disposal - Institutional > Municipal Solid Waste Landfill > Hazardous Fugitive Emissions		
		Landfill Gas		
N/A	50300603	Waste Disposal > Solid Waste Disposal - Industrial > Solid Waste Landfill > Fugitive Emissions		
	50100402	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Fugitive Emissions		
	50600601	Waste Disposal > Solid Waste Disposal - Commercial > Municipal Solid Waste Landfill > Fugitive Emissions		
	50700601	Waste Disposal > Solid Waste Disposal - Institutional > Municipal Solid Waste Landfill > Fugitive Emissions		
		Storage		
		Open Piles		
N/A	50300607	Waste Disposal > Solid Waste Disposal - Industrial > Solid Waste Landfill > Storage Piles		
	50100407	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Storage Piles		
	50600643	Waste Disposal > Solid Waste Disposal - Commercial > Municipal Solid Waste Landfill > Storage Piles		
	50700643	Waste Disposal > Solid Waste Disposal - Institutional > Municipal Solid Waste Landfill > Storage Piles		
		Fuel Storage		
N/A	39090003	Industrial Processes > In-process Fuel Use > Fuel Storage - Fixed Roof Tanks > Distillate Oil (No. 2): Breathing Loss		

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[3] SCCs will change based on fuel type, firing type, and heat capacity of fuel. Always select the most applicable and most detailed for your facility.

	39090004	Industrial Processes > In-process Fuel Use > Fuel Storage - Fixed Roof Tanks > Distillate Oil (No. 2): Working Loss
	39090011	Industrial Processes > In-process Fuel Use > Fuel Storage - Fixed Roof Tanks > Dual Fuel (Gas/Oil): Breathing Loss
	39090012	Industrial Processes > In-process Fuel Use > Fuel Storage - Fixed Roof Tanks > Dual Fuel (Gas/Oil): Working Loss
Vehicle Dust		
Unpaved Road		
N/A	50301001	Waste Disposal > Solid Waste Disposal - Industrial > Municipal Solid Waste Landfill > Unpaved Road Traffic
	50100401	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Unpaved Road Traffic
	50600603	Waste Disposal > Solid Waste Disposal - Commercial > Municipal Solid Waste Landfill > Unpaved Road Traffic
	50700603	Waste Disposal > Solid Waste Disposal - Institutional > Municipal Solid Waste Landfill > Unpaved Road Traffic
Working Face Fugitives		
N/A	50300603	Waste Disposal > Solid Waste Disposal - Industrial > Solid Waste Landfill > Fugitive Emissions
	50100402	Waste Disposal > Solid Waste Disposal - Government > Municipal Solid Waste Landfill > Fugitive Emissions
	50600601	Waste Disposal > Solid Waste Disposal - Commercial > Municipal Solid Waste Landfill > Fugitive Emissions
	50700601	Waste Disposal > Solid Waste Disposal - Institutional > Municipal Solid Waste Landfill > Fugitive Emissions

3. Acceptable Calculation Methods

This section defines the acceptable calculation methods for emissions inventory preparation. The Arizona Administrative Code R18-2-327(C)(1) requires the following order of preference for estimating emissions from any given process in the report. Valid Continuous Emissions Monitoring System (CEMS) readings or, if not available, then emission factors (EFs) derived from recent, valid on-site performance test results should be used. If recent test data is not available, it is best practice to use AP-42 fifth edition emission factors, vendor developed EFs, or manufacturer specified EFs. In the event that these three types of EFs are not available, EFs that are approved by the EPA or other reputable sources (peer-reviewed journals, etc.) should be employed to reliably estimate emissions. As a last resort, it may be acceptable to estimate emissions via models including from mass balance equations. If you are using models like LandGEM to calculate your emission factors, or using an AP-42 equation/table that is used with site specific data; select the site-specific calculation method.

Engineering judgement is not a preferred method for any emissions calculations. With that being said, supporting calculations and references should accompany **ALL** non-EPA EFs so that the calculation methodology can be easily understood and verified. Complete this by including calculation demonstrations in your required attachment on your CAERS report. Note that the calculation methods available within a given process are likely to vary by pollutant.

a. EFs with regards to Controls

For emission estimates derived using EFs, a CAERS report must note whether the EF already incorporates the impact of all applicable controls. Please be cautious as the phrasing in CAERS differs from what was used in the previous reporting platform, the State and Local Emissions Inventory System (SLEIS) reports.

> a. If the EF does not incorporate the impact of all applicable controls, please select the calculation method that identifies the EF as having "(no control efficiency used)", thus enabling the "Overall Control %" field. For example, an EF from AP-42 in this case would use "USEPA Emission Factor (no control efficiency used)" calculation method. Then enter the impact of any remaining controls in that field (or leave it blank if there are no controls operating for the given emissions). If you are unsure how to derive this percentage, please email ADEQ. Note that this option corresponds to the SLEIS EF calculation methods that included the phrase "pre-control".

> b. If the EF already incorporates all applicable control impacts, please select a calculation method that classifies the EF as "(pre-control) plus control efficiency". For example, an EF from AP-42 in this case would use "USEPA Emission Factor (pre-control) plus control efficiency" calculation method. Despite the use of the phrase "pre-control", this option corresponds to the "post-control" EF calculation method that was available in SLEIS.

If both EF types are available for a given process, then all other things (EF applicability, quality rating, etc.) being equal, ADEQ would prefer that you use option "a" and enter the Overall Control % explicitly.

b. Particulate Matter (PM) EFs

CAERS accommodates numerous PM pollutant categories, but there are 5 that ADEQ generally expects to see in the report for any process that has PM emissions: condensable PM (PM-CON), filterable PM10 (PM10-FIL), filterable PM2.5 (PM25-FIL), primary PM10 (PM10-PRI, which is the total consisting of PMCON plus PM10-FIL), and primary PM2.5 (PM25-PRI, similarly PM-CON plus PM25-FIL). Here, "PM10" denotes particles whose equivalent aerodynamic diameters are less than or equal to 10μm, and similarly "PM2.5" (sometimes encoded as "PM25") denotes the subset of those less than or equal to 2.5μm. Since PM-CON is assumed to be under 1μm, it always counts towards both PM2.5 and PM10.

Although there is redundancy and overlap in these categories, you should still provide all of them, if possible, as described below. ADEQ will not double-count your emissions in the emissions billing.

Whenever EPA's AP-42 compendium of EFs provides an EF for any of these PM emissions types, it usually provides more than one. For example, AP-42 may provide PM10-PRI, PM10-FIL, and PM-CON EFs for a given type of emissions process. It may also include a note which allows you to infer some other EF values. For example, a table note might indicate that all of the PM emissions are assumed to be fine (i.e., that PM10-PRI = PM25-PRI and PM10-FIL = PM25-FIL) or coarse (i.e., that PM10-PRI = PM10-FIL and that PM25-PRI = PM25-FIL = PM-CON = 0).

Note that CAERS will <u>not</u> allow an EF value of 0, so if for example 100% of the PM10 emissions from a given process are filterable, you may omit the condensable subtotal rather than explicitly specifying a 0 estimate. Otherwise, please include all of the available PM EFs in your report.

If just a single PM EF is provided, then and only then might it be appropriate to develop your own EFs to fill in the blanks for the various subtotals, based on a speciation profile. When in doubt, email ADEQ.

4. Expected Pollutant(s)

For each of the processes at your facility, it is required to report emissions from Criteria Air Pollutants (CAPs). ADEQ asks that the facilities also report emissions from Hazardous Air Pollutants (HAPS) provided in Table 3 below, although not required.

If neither CEMS nor performance test data are available for a pollutant, please first reference EPA's *AP-42 fifth edition* to find an EF that is applicable to your facility and emission process. If the *AP-42* assumptions appear to be unsound or the necessary EF is absent, consult applicable equipment specifications. If they are not available or do not provide sufficient information to estimate EFs, EPA's WebFIRE database may then be utilized to find an appropriate EF. Unlike *AP-42*, EFs in WebFIRE can filter the search according to SCC and pollutant name. The links to all of these resources are provided below. Please note that some of the generator/vehicle dust/ storage EFs would be available in different sections of the AP-42. If your emission factor calculation method is USEPA, please select that option for each pollutant. If the system produces an error, refer back to how you actually calculated the value. Typically, the emission factors, throughputs, or SCCs that have been slightly different than what is expected, it is because of site-specific data and information. Therefore, please change the emission factor calculation method to site-specific and include the section of AP-42 you are referencing.

> **EPA's *AP-42* Solid Waste Disposal Chapter** https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-2-solid-waste-0
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> **EPA's WebFIRE:** https://cfpub.epa.gov/webfire/SearchEmissionFactor/searchpage.cfm

Reporting full groups of pollutants is preferable; however, this information will only be used for ADEQ's analysis, as well as the possibility to reduce any repeat work needed and provide a bulk upload template. Pollutants will **not** be double counted when full groups of pollutants are submitted. For example, all PM species should be reported however only PM10 Primary (Filterable + Condensable) will be billed.

a. Cover Operations

Code	Name
PM10-FIL	PM10 Filterable
PM10-PRI	PM10 Primary (Filt + Cond)
PM25-FIL	PM2.5 Filterable
PM25-PRI	PM2.5 Primary (Filt + Cond)
PM-CON	PM Condensable

b. Flares

Code	Name
100414	Ethyl Benzene
106467	1,4-Dichlorobenzene
106934	Ethylene Dibromide
107062	Ethylene Dichloride
107131	Acrylonitrile
108101	Methyl Isobutyl Ketone
108883	Toluene

108907	Chlorobenzene
110543	Hexane
127184	Tetrachloroethylene
1330207	Xylenes (Mixed Isomers)
463581	Carbonyl Sulfide
56235	Carbon Tetrachloride
67663	Chloroform
71432	Benzene
71556	Methyl Chloroform
7439976	Mercury
74873	Methyl Chloride
75003	Ethyl Chloride
75014	Vinyl Chloride
75092	Methylene Chloride
75150	Carbon Disulfide
75343	Ethylidene Dichloride
75354	Vinylidene Chloride
7647010	Hydrochloric Acid
7783064	Hydrogen Sulfide
78875	Propylene Dichloride
78933	Methyl Ethyl Ketone
79016	Trichloroethylene
79345	1,1,2,2-Tetrachloroethane
CO	Carbon Monoxide
N2O	Nitrous Oxide
NMOC	Nonmethane Organic Compounds from MSW Landfill
NOX	Nitrogen Oxides
PM10-FIL	PM10 Filterable
PM10-PRI	PM10 Primary (Filt + Cond)
PM25-FIL	PM2.5 Filterable
PM25-PRI	PM2.5 Primary (Filt + Cond)
PM-CON	PM Condensable
SO2	Sulfur Dioxide
VOC	Volatile Organic Compounds

c. Generators

Code	Name
106990	1,3-Butadiene
107028	Acrolein

108883	Toluene
115071	Propylene
1330207	Xylene (Mixed Isomers)
50000	Formaldehyde
71432	Benzene
75070	Acetaldehyde
91203	Naphthalene
CO	Carbon Monoxide
N2O	Nitrous Oxide
NO2	Nitrogen Dioxide
NOX	Nitrogen Oxides
PM10-FIL	PM10 Filterable
PM10-PRI	PM10 Primary (Filt + Cond)
PM25-FIL	PM2.5 Filterable
PM25-PRI	PM2.5 Primary (Filt + Cond)
PM-CON	PM Condensable
SO2	Sulfur Dioxide
VOC	Volatile Organic Compounds

d. Hazardous Waste

Code	Name
100414	Ethyl Benzene
100425	Styrene
106467	1,4-Dichlorobenzene
106934	Ethylene Dibromide
107062	Ethylene Dichloride
108054	Vinyl Acetate
108883	Toluene
108907	Chlorobenzene
120821	1,2,4-Trichlorobenzene
127184	Tetrachloroethylene
1330207	Xylenes (Mixed Isomers)
540590	1,2-Dichloroethylene
542756	1,3-Dichloropropene
56235	Carbon Tetrachloride
67663	Chloroform
71432	Benzene
74873	Methyl Chloride
74964	Bromoethane
75003	Ethyl Chloride
75014	Vinyl Chloride
75092	Methylene Chloride
75150	Carbon Disulfide
75252	Bromoform
75343	Ethylidene Dichloride

75354	Vinylidene Chloride
78875	Propylene Dichloride
78933	Methyl Ethyl Ketone
79005	1,1,2-Trichloroethane
79016	Trichloroethylene
79345	1,1,2,2-Tetrachloroethane
87683	Hexachlorobutadiene
91203	Naphthalene
96128	1,2-Dibromo-3-Chloropropane
98828	Cumene
VOC	Volatile Organic Compounds

e. Landfill Gas

Code	Name
100414	Ethyl Benzene
100425	Styrene
106467	1,4-Dichlorobenzene
106934	Ethylene Dibromide
106978	Butane
107062	Ethylene Dichloride
107131	Acrylonitrile
108101	Methyl Isobutyl Ketone
108883	Toluene
108907	Chlorobenzene
109660	Pentane
110543	Hexane
127184	Tetrachloroethylene
1330207	Xylenes (Mixed Isomers)
2199691	Dichlorobenzene,1,4-,D4
463581	Carbonyl Sulfide
540590	1,2-Dichloroethylene
56235	Carbon Tetrachloride
64175	Ethyl Alcohol
670630	Isopropyl Alcohol
67641	Acetone
67663	Chloroform
68475592	Alkane Blend
71432	Benzene
71556	Methyl Chloroform
74384	Propane
7439976	Mercury
74839	Methyl Bromide
74873	Methyl Chloride
74931	Methyl Mercaptan
749868	Propane
75003	Ethyl Chloride
75014	Vinyl Chloride

75081	Ethanethiol
75092	Methylene Chloride
75150	Carbon Disulfide
75183	Methyl Sulfide
75252	Bromoform
75274	Bromodichloromethane
75343	Ethylidene Dichloride
75354	Vinylidene Chloride
7783064	Hydrogen Sulfide
78875	Propylene Dichloride
78933	Methyl Ethyl Ketone
79005	1,1,2-Trichloroethane
79016	Trichloroethylene
79345	1,1,2,2-Tetrachloroethane
CFC	Chlorofluorocarbons
CO	Carbon Monoxide
NMOC	Nonmethane Organic Compounds from MSW Landfill
VOC	Volatile Organic Compounds

f. Storage

Code	Name
Toluene	108883
Propylene	110543
Benzene	71432
o-Xylene	95476
PM10-FIL	PM10 Filterable
PM10-PRI	PM10 Primary (Filt + Cond)
PM25-FIL	PM2.5 Filterable
PM25-PRI	PM2.5 Primary (Filt + Cond)
Volatile Organic Compounds	VOC

g. Vehicle Dust

Code	Name
PM10-FIL	PM10 Filterable
PM10-PRI	PM10 Primary (Filt + Cond)
PM25-FIL	PM2.5 Filterable
PM25-PRI	PM2.5 Primary (Filt + Cond)
PM-CON	PM Condensable

h. Working Face Fugitives

Code	Name
100414	Ethyl Benzene
106467	1,4-Dichlorobenzene

106934	Ethylene Dibromide
107062	Ethylene Dichloride
107131	Acrylonitrile
108101	Methyl Isobutyl Ketone
108883	Toluene
108907	Chlorobenzene
110543	Hexane
127184	Tetrachloroethylene
1330207	Xylenes (Mixed Isomers)
463581	Carbonyl Sulfide
56235	Carbon Tetrachloride
67663	Chloroform
71432	Benzene
71556	Methyl Chloroform
7439976	Mercury
74873	Methyl Chloride
75003	Ethyl Chloride
75014	Vinyl Chloride
75092	Methylene Chloride
75150	Carbon Disulfide
75343	Ethylidene Dichloride
75354	Vinylidene Chloride
7647010	Hydrochloric Acid
7783064	Hydrogen Sulfide
78875	Propylene Dichloride
78933	Methyl Ethyl Ketone
79016	Trichloroethylene
79345	1,1,2,2-Tetrachloroethane
NMOC	Nonmethane Organic Compounds from MSW Landfill
VOC	Volatile Organic Compounds

5. Frequently Asked Questions (FAQs)

1. **What calculation code should be used when deriving an EF from a parametric equation found in EPA's AP-42?**
   A: It is preferred to label EFs derived from parametric equations in AP-42 using the code for as a site-specific EF as long as the variables are using site-specific data.

2. **Is it okay to calculate PM-CON and PM-FIL as a subset of PM-PRI because PM-CON EFs are not available?**
   A: Since AP-42 provides EFs for condensable, filterable, and primary PM, it is best practice to use the EPA approved EFs. However, if you have stack test data, use that instead of AP-42 EFs. If AP-42 does not have an EF for condensable, it is likely that the process does not emit condensable PM.

3. **If the calculation methods used in the previous year's annual emission inventory do not match those of the permit application, which is the more appropriate calculation method to use?**
   A: Use the calculation method that is most representative of the current state at the facility. If you are ever unsure of which calculation method to use or are having trouble reproducing emissions estimates with the original calculation method, always reach out to ADEQ for guidance.

4. **Who should I reach out to for help with my facility's emissions inventory?**
   A: Please direct your questions to EmissionInventory@azdeq.gov. Inventory preparers are always encouraged to contact ADEQ for questions and assistance with their emissions inventory.

5. **How much reference information should I attached to my CAERS report?**
   A: In order to ensure a timely quality assurance review and approval of your report you should attach any referenced items including stack test results, calculation workbooks, etc. Please also reference the Supporting documentation in a CAERS report on our emission inventory (https://azdeq.gov/emissions-inventories).