

LUST SITE CHARACTERIZATION REPORT FORMAT

The purpose of this document is to assist owners and operators with ensuring that the format used and information provided meets the requirements for the Site Characterization Report (SCR). The required contents of the report are identified in Arizona Administrative Code (A.A.C.) R18-12-262(D). This document is organized to provide the user with information on the types of information that ADEQ will consider during review. It is structured to separate each regulatory requirement and reporting form section and provide:

Considerations: Common things ADEQ will be considering when reviewing each element for completeness and compliance

Recommendations: Things recommended by ADEQ but not necessarily required to be strictly adhered to that will facilitate the review of reported data and information during regulatory review

Federal and state law require Underground Storage Tank (UST) owners and operators to report releases, to conduct an investigation to determine the extent and degree of contamination, and to continue corrective actions through release case closure. The results of the investigation are required to be provided in the SCR. The SCR is considered a cornerstone of all subsequent corrective actions. This report provides a comprehensive evaluation of the actual site (and, if applicable, offsite) conditions; therefore, it is essential for determining subsequent corrective actions, including determination of site-specific corrective action standards and remedy selection, to ultimately achieve case closure.

LEAKING UST (LUST) SITE CHARACTERIZATION REPORT

A.A.C. R18-12-262(D) states:

The owner or operator shall submit a report of the information developed during the investigation required in subsection (A), in a format acceptable to the Department. The report shall be submitted within the time established in subsection (B). The report submitted under this subsection shall contain the following minimum information:

- 1. A site history summary;*
- 2. Information on bedrock, if encountered during the investigation;*
- 3. The hydrologic characteristics and uses of groundwater and surface water of the local area;*
- 4. A concise description of factors considered in determining the full extent of contamination;*
- 5. A concise summary of the results of the investigation including a conceptual site model;*
- 6. A site vicinity map, site location map and a site plan;*
- 7. A tabulation of all field screening and laboratory analytical results and water level data acquired during the investigation;*

8. *Laboratory sample analytical and associated quality assurance and quality control reports and chain-of-custody forms;*
9. *A tabulation of all wells registered with the Arizona Department of Water Resources, and other wells located within one-quarter mile of the facility property boundary;*
10. *The lithologic logs for all subsurface investigations; and*
11. *The as-built construction diagram of each well installed as part of this investigation.*

SITE CHARACTERIZATION REPORT FORMATTING REQUIREMENTS

The SCR is required to be in a format acceptable to ADEQ, and is required to include the contents detailed in A.A.C. R18-12-262(D):

Text:

- Standard first page as required by A.A.C. R18-12-264 (ADEQ form)
- Facility and site information - as determined from review of existing information and the work done to characterize the site, including subsurface conditions (soil/geology, hydrology, etc.), and site history (current & previous UST systems, substances stored throughout operational lifetime, previous site assessment and remedial investigation activities)
- Release information - including media impacted and investigated, data tables, contaminant characteristics, and corrective actions conducted
- Contaminant delineation - including sampling strategy and protocol, laboratory reports, site plans, and assessment of potential contaminant migration pathways
- Exposure concerns - including identification of known or potential human health and ecological receptors and a detailed assessment of the completeness of all human health exposure pathways
- Summary/Conclusions - including identification of any issues encountered during the investigation
- Recommendations - including identification of next actions. NOTE: the completed investigation should result in all information necessary to evaluate and propose a corrective action standard for the case per A.A.C. R18-12-262(A)(4)

Figures:

- Required figures defined in A.A.C. R18-12-262(D)(6) & R18-12-101
 - Site Vicinity Map
 - Site Location Map
 - Site Plan(s)
- Recommended figures (see additional notes on cross-sections below)
- Hydrogeologic cross-sections detailing the subsurface investigation and impacted zones, including
 - at least two sections in perpendicular orientation
 - identification of subsurface sample locations
 - clear identification of known or potential preferential contaminant migration pathways

- Soil and groundwater plume maps showing concentrations of chemicals of concern (COCs) of soil borings and monitoring wells in the figures

Tables:

- Laboratory analytical results, including corresponding Tier 1 corrective action standards and minimum groundwater protection levels (GPLs)
NOTE: corrective action standards should be specified for each CoC in each impacted medium [e.g. Soil Remediation Levels (SRLs), Aquifer Water Quality Standards (AWQS)]
- Water level data
- Wells registered with the Arizona Department of Water Resources (ADWR), and other wells located within one-quarter mile of the facility property boundary
- Field screening data

Appendices:

- Conceptual Site Model (CSM) - based on information obtained through characterization work
- Updated LUST Site Classification Form (to capture additional detail obtained since the 90-Day Report)
Note: this information will be used to assist in determining whether a Corrective Action Plan (CAP) will be requested or required
- Laboratory analytical reports including quality assurance/quality control (QA/QC) data and chain of custody forms, as required per A.A.C. R18-12-280(B)
- The lithologic logs for all soil borings and monitoring wells
- As-built construction diagram of each well installed
- Copies of permits
- If applicable, off-site access documentation to demonstrate compliance with A.R.S. § 49-1022

Note: ADEQ recommends that the owner or operator include any additional information that they determine is necessary to verify that the requirements for site characterization have been met.

Also, if the documentation required has already been submitted to ADEQ, and the owner or operator elects not to include it in this report, the SCR should clearly identify the title of the document submitted, the date it was submitted to ADEQ, and the specific location of the information within that report (page, section, figure, etc.).

GUIDANCE FOR COMPLETING THE SITE CHARACTERIZATION REPORT

Below is a discussion of each element identified in A.A.C. R18-12-262(D) that must be included in the SCR. We have included considerations, and recommendations for how to present that information in the SCR:

Requirement: A.A.C. R18-12-262(D)(1): A site history summary;

Considerations:

- What is the current site use?
- Is the site currently operating as a service station?
- What is the current use of adjacent properties?
- Were there historical UST systems and/or releases at the facility that may impact corrective actions?

Recommendations: The site history summary should include, but is not limited to:

- past and present land use of the facility;
- information on the release(s), including the nature of the release(s), the regulated substance(s) released, the estimated quantity of the release(s), and the estimated time period when the release(s) was occurring;
- events resulting in environmental impacts at the site prior to the release;
- a description of all remedial corrective actions initiated as of the time of the report.

Requirement: A.A.C. R18-12-262(D)(2): Information on bedrock, if encountered during the investigation;

Considerations:

- Is there evidence that contamination extends into or through the bedrock?
- Is the bedrock weathered or fractured?
- If bedrock is not encountered during site investigation activities, published sources may be referenced to provide information of bedrock in the area.

Recommendations: If encountered, provide a detailed discussion on the specific site and local geology, including:

- topography of the site and surrounding area;
- identification of subsurface features, if available;
- depth to bedrock;
- bedrock lithology and competency;
- description of bedrock features that affect contaminant transport (Ex: presence and orientation of preferential pathways, porosity and permeability, hydraulic conductivity, etc.);
- description of the slope of the vadose zone/bedrock interface.

Requirement: A.A.C. R18-12-262(D)(3): The hydrologic characteristics and uses of groundwater and surface water of the local area;

Considerations:

- Are there any wells or site features (e.g., septic systems, drywells, unlined irrigation laterals or canals, unlined impoundments, irrigation wells, drinking wells, etc.) that could affect the groundwater elevation/flow direction?
- What is the known or estimated depth of the shallowest groundwater elevation (and what is the date of that information)?
- Does groundwater fluctuate seasonally?
- Does information show or suggest significant water table fluctuation?
- What is the known or estimated groundwater gradient, direction(s) of flow, and velocity? Does it fluctuate; and if so, on what basis (e.g. seasonal, pumping-dependent)?
- Are there confining layers?
- Relationship of encountered groundwater to established regional aquifers?

Recommendations: Include documentation of the hydrogeologic characteristics of groundwater and surface water of the local area within 1/4 mile of either the facility boundary or the outermost extent of contamination associated with the release, whichever is the further distance, as follows:

- a description of the local known or estimated depth to groundwater and, if groundwater is threatened or impacted, the gradient, flow direction, confining layers, multiple aquifers, seasonal or historic water table fluctuation, or quality that may affect the construction or location of additional groundwater monitor wells or responses to contaminated soil, surface water or groundwater;
- a description of the local surface water including the nature and uses of any waters of the United States or any unique waters designation under Title 18, Chapter 11, Article 1, Appendix B. The nature of the surface waters must be identified as perennial, ephemeral, or intermittent, and the known or estimated local gradient and flow direction must be included.

Requirement: A.A.C. R18-12-262(D)(4): A concise description of factors considered in determining the full extent of contamination;

Requirements for Delineation

Soil:

- Each CoC defined vertically and laterally to respective residential Soil Remediation Level (rSRL) [see A.A.C. R18-07-Appendix A]
- Additional samples may be necessary to provide context supporting full vertical definition has been obtained (e.g. no increasing concentration trends near/at the terminal investigation depth)

NOTE: soil characteristics provide data for necessary inputs into leaching models

Groundwater:

- All CoCs delineated vertically and laterally to respective AWQS [see A.A.C. R18-11-406]
- Groundwater monitoring wells installed upgradient, within the source area, cross-gradient, and downgradient. Monitoring network should allow for:

- Assessment of groundwater flow direction(s) and any potential fluctuating flow regimes
- Calculation of groundwater velocity
- Identification of all potential flow paths

Bedrock:

- Investigation of the vertical extent of contamination should proceed into bedrock formations with sufficient known or estimated hydraulic conductivity to transmit contaminant mass (e.g. fractures, welded conglomerates).
 - Site specific or relevant literature data may be provided to justify termination of vertical extent investigation at the bedrock interface for competent formations with no reasonable expectation for contaminant transport and storage.
- Monitoring wells must be assessed for “connectivity” to demonstrate that each well is representative of water within flow path(s)

Free Product (see definition in A.A.C. R18-12-101, including light nonaqueous phase liquid (LNAPL)):

- Characteristics of the LNAPL body(s), including:
 - Full definition of the extent of the LNAPL body
 - Saturation state(s) present characterized as residual, mobile, or migratory;
NOTE: this may be based upon transmissivity testing and recoverability assessment at multiple locations within the LNAPL body
 - LNAPL body response to fluctuations in groundwater elevation (e.g. presence of submerged source mass “smear zone”; lateral migration of mobile LNAPL due to declining groundwater elevations)
 - Composition through analysis of constituents
- If applicable, current status of free product removal activities conducted to date

NOTE: ITRC LNAPL-3 guidance document is a recommended resource for information on the characterization of LNAPL bodies and the above specified content (<https://lnapl-3.itrcweb.org/>)

Considerations:

- Does the data clearly demonstrate that contamination in each medium has been adequately characterized, both vertically and laterally?
- Is the subsurface information available adequate to identify the characteristics of contaminant transport and delineation?
- Are there any data gaps that suggest characterization is not complete?
 - If so, is it appropriate to submit the report?
 - If so and due to obstacles that could not be overcome - is justification for submission documented?

NOTE: If obstacles to characterization have been encountered that cannot be resolved with reasonable and good faith attempts, it is recommended that the

UST Owner/Operator contact ADEQ as soon as possible to discuss the situation and work to define pathways to achieve characterization to keep the case progressing.

Recommendations: Ensure that the factors relied upon to determine characterization status are identified and the rationale used to determine the full extent of contamination is provided.

These factors may include:

- selection of soil sampling locations and points;
- selection of the location and number of groundwater wells, if groundwater is encountered during the investigation;
- selection of surface water sampling locations, if surface water is encountered during the investigation;
- any differences from generally accepted industry standards that occurred during the performance of investigation activities and justification for the methodology used to complete the investigation;
- age, nature and volume of the release;
- subsurface soil and groundwater conditions;
- contaminant migration pathways;
- the evaluation of contaminant transport mechanisms and rates;
- analytical results from soil, groundwater, and soil vapor sampling;
- A.R.S. § 49-1022 considerations, i.e. if access to offsite locations could not be obtained.

In cases of potential commingling of off-site contaminant plumes, the following information for the sites contributing to the contaminant plume:

- a description of the site lithology;
- depth to groundwater;
- type and concentrations of COCs;
- description of the horizontal and vertical extent of impacted soil;
- description of the horizontal extent of impacted groundwater and/or surface water;
- description of the vertical extent of impacted groundwater;

NOTE: saturated soil samples may be collected and analyzed in support of determining terminal boring depth and/or well screening intervals. Data from saturated soil samples are not appropriate for compliance purposes against regulatory standards for soil (SRLs) or groundwater (AWQS).

- a figure depicting the location of monitor wells and the extent of the contaminant plume; and
- available free product information.

NOTE: Investigation design, including the number, type, and placement of sampling points, must be determined by the responsible party using the professional judgement of a registered environmental professional.

Requirement: A.A.C. R18-12-262(D)(6): A site vicinity map, site location map and a site plan;

From A.A.C. R18-12-101:

“Site vicinity map” means: *a representation by means of signs and symbols on a planar surface, at an established scale, of the natural and artificial physical features, used in the exposure assessment, that occur within at least 500 feet of the facility boundaries, with the direction of orientation indicated.*

“Site location map” means: *a representation by means of signs and symbols on a planar surface, at an established scale, of the streets, wells, and general use of the land for properties within at least one-quarter mile of the facility boundaries, with the direction of orientation indicated.*

“Site plan” means: *a representation by means of signs and symbols on a planar surface, at an established scale, of the physical features (natural, artificial, or both) of the facility and surrounding area necessary to meet the requirements under which the site plan is prepared, with the direction of orientation indicated.*

Considerations:

- Are figures legible?
- Is the scale included and accurate?
- Is there a North arrow?
- Does the site location map include identification of surface features, or topographic conditions that may impact corrective actions at the site?
- Are multiple site plans needed to clearly identify significant information including extent of soil contamination and groundwater contamination (are separate figures needed to show extent of different chemicals of concern or does a contaminant plume vary with depth or seasonality)?

Recommendations: When preparing these figures, ensure that they convey the appropriate information. It may be necessary to have multiple figures to ensure clarity in communication.

The site vicinity and site location maps should include:

- Property boundaries of the facility where the release(s) occurred;
- Named and unnamed streets, roads, alleys and other thoroughfares;
- General land use of properties and locations of any schools, day care centers, hospitals, nursing homes, other potentially sensitive receptor populations, and, if applicable, identification of other LUST sites;
- Wells discovered or installed during the investigation.
 - Each well should be identified by any assigned ADWR number, and for wells without an assigned ADWR number, the number assigned by the owner or operator;

- Wells installed during the investigation should be surveyed by a land surveyor with active registration in good standing with AZ BTR and the survey information reported
- True well locations should be listed and identified in all figures;
- If it true well location cannot be determined, cadastral locations may be used but must include appropriate designation and justification
- Any surface water bodies, including flow direction; and
- Groundwater flow direction(s)

The site plan or plans are more detailed and in many cases, multiple site plans are required when groundwater contamination is involved. The number of these figures should be determined based on what is necessary to maintain clarity of messaging. These figures should include:

- Property boundaries of the facility and other properties;
- Named and unnamed streets, roads, alleys and other thoroughfares;
- Any buildings, structures, or above ground storage tanks on the facility;
- Type and extent of on-site ground-surface cover, indicated as asphalt, concrete, soil, or another specific type of cover;
- The location of the UST system
- Known above or below ground utility corridors, sewer systems, irrigation canals, and drainage channels within and adjacent to the area investigated;
- Sample locations
- Land use of properties that are impacted by the release(s);
- Structures surrounding the facility
- Full lateral extent of soil contamination, boreholes and other sample collection locations, including the sampling locations used during any UST closure activities related to the release(s);
- Wells discovered or installed during the investigation. Each well should be identified by any assigned ADWR number, and for wells without an assigned ADWR number, the number assigned by the owner or operator;
- If groundwater has been impacted, threatened, or investigated;
 - Groundwater monitor wells, documented full lateral extent of groundwater contamination, and seasonal and historic directions of groundwater flow and hydraulic gradients, if groundwater has been impacted, threatened, or investigated.
 - Isoconcentration contours for target chemicals of concern (e.g. benzene, MtBE, 1,2-DCA, etc.), minimally including the respective delineation standard (e.g. AWQS)
 - Groundwater elevation contours and seasonal and historic directions of groundwater flow and hydraulic gradients.
- If surface water has been impacted - identify surface water bodies with sample collection locations, documented full lateral extent of surface water contamination and the flow direction.

Requirement: A.A.C. R18-12-262(D)(7): A tabulation of all field screening and laboratory analytical results and water level data acquired during the investigation;

Considerations:

- Were the appropriate laboratory analyses conducted? – see https://static.azdeq.gov/ust/analytical_data.pdf
- Have any equipment issues been identified?
- Are analytical reports complete?
- If there are data quality issues, is that data still useful?

Recommendations: Ensure that information/data included in table format is legible, and that footnotes are clear and understandable. A tabulation of field screening results acquired during the investigation that includes the following:

- sample identification number;
- sample location;
- sample media;
- sample collection depth;
- date and time each sample was collected;
- field screening method;
- screening results.

Note: any issues encountered should be identified

A tabulation of field screening and laboratory analytical results acquired during the investigation that includes the following:

- sample identification number;
- sample location;
- sample media;
- sample collection depth;
- date and time each sample was collected;
- analytical results identifying the analytical method, units of measure;

Note: any data issues should be identified

- Tier 1 corrective action standards should be included for each impacted medium (e.g. SRLs, GPLs, AWQS).

A tabulation of water level data acquired in investigating the full extent of contamination that includes the following:

- groundwater monitor well site identification number and ADWR registration number;
- date of measurement;
- elevation above mean sea level, or other established benchmark, of top of casing, water level, and, if present, free product level;
- depth to water and, if present, free product and thickness of free product.

Note: any issues encountered should be identified

A narrative description should be provided to document the validity and usability for any data resulting from collection, handling, and/or analysis issues.

Requirement: A.A.C. R18-12-262(D)(8): Laboratory sample analytical and associated quality assurance and quality control reports and chain-of-custody forms;

Considerations:

- Is this a final or draft laboratory report?
- Are there data issues that may impact the validity of the samples?
- Is the chain of custody consistent with the analyses in the report?
- Were holding times met?
- Were samples delivered to the laboratory at the appropriate temperature?

Recommendations:

- include complete copies of laboratory reports and chain-of-custody forms supporting the tabulation described in A.A.C. R18-12-262(D)(7), and supporting laboratory documents that report analytical quality assurance and quality evaluations and identification of anomalies;
- provide documentation demonstrating compliance with A.A.C. R18-12-280, including all sample collection, handling, and analysis procedures, and specific documentation of any deviations;
- provide a narrative description on the validity and use of any data subject to QA/QC qualifiers noted in the analytical case summary (Ex: contaminated blanks).

NOTE: Ensure that the laboratory report has been fully reviewed by the laboratory (and consultant) for any data issues, and that any issues identified are clearly communicated.

Requirement: A.A.C. R18-12-262(D)(9): A tabulation of all wells registered with the Arizona Department of Water Resources, and other wells located within one-quarter mile of the facility property boundary;

Considerations:

- Make note of which wells are down-gradient of the subject site and the screened depths of those wells
- Consider running the UST Locator report available at <https://adeq.maps.arcgis.com/apps/webappviewer/index.html?id=b8be559447ee4e588ca57f3d15bcd43f>

Recommendations:

- thoroughly evaluate the location of wells, understanding that in some cases, not all wells being used in the area may be registered with the Arizona Department of Water Resources (ADWR);
- the tabulation should include: the ADWR registered well registration number, water use category(s) and classification (exempt vs. non-exempt), screened interval, reported water level, and drill date, if recorded;

- for wells that are identified that are not registered with ADWR, clearly identify the address and location of the well, use, and if known, water level, installation date, and last used date.

Requirement: A.A.C. R18-12-262(D)(10): The lithologic logs for all subsurface investigations;

Considerations:

- Are the logs complete?
- Are descriptions consistent between logs?
- If there were advancement issues, was the correct drill rig utilized?

Recommendations: Provide the lithologic logs developed for each borehole, excavation, monitor well, and sample collection location installed to investigate the full extent of contamination.

Logs should include the following information:

- the identification number assigned to the subsurface penetration;
- date and method of the subsurface penetration;
- depth of penetration;
- depth and description of lithologies encountered see Appendix E);
- depth of each sample collected including sample identification number;
- field screening results of each sample collected;
- other information describing subsurface lithology.

Requirement: A.A.C. R18-12-262(D)(11): The as-built construction diagram of each well installed as part of this investigation.

Considerations:

- Are the construction diagrams complete?
- Are they consistent with ADWR records?
- Are the well designations consistent with those on the site plan(s)?

Recommendations: Ensure that the as-built construction diagram of each well installed to investigate the full extent of contamination contains the following:

- the unique identification number assigned to the well;
- date of installation;
- total depth and diameter of hole;
- casing material, diameter, and screened interval -screen size and type;
- intervals for the annular fill materials described as sand, grout, or another specified material;
- seal material and thickness;
- surface completion information;
- identification of the surveyed fixed reference point used to determine the elevation in relation to sea level, or other established benchmark, of the well head and the determined elevation of the well head for groundwater monitor wells.

Note: It is recommended to include copies of original elevation survey information