ADEQ Arizona Department of Environmental Quality
Clean Air, Safe Water
Healthy Land for Everyone

TECHNICAL SUPPORT DOCUMENT

# LUST FREE PRODUCT INFORMATION SHEET

*The purpose of this document is to provide guidance for understanding Arizona Department of Environmental Quality (ADEQ) underground storage tank (UST) program requirements for the investigation, delineation, recovery, and disposition of free product associated with regulated UST releases. It 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*

**INTRODUCTION**

Releases from USTs may result in a subsurface accumulation of a phase separated liquid that is able to move into wells or excavations - this liquid is considered "free product". The majority of leaking UST (LUST) release cases involve petroleum fuels and the most common type of free product identified is "LNAPL" (light non-aqueous phase liquid) that "floats" above the water table. It is possible for LUST cases to include "DNAPL" (dense nonaqueous phase liquid) that "sinks" into the water table, however, this is less common. Free product may also be referred to as: phase separated hydrocarbons (PSH).

Under the Arizona Administrative Code (A.A.C.) R18-12-101, "free product" is defined as:
"a mobile regulated substance that is present as a nonaqueous phase liquid (e.g. liquid not dissolved in water)."

*Note: Free Product is also referred to as light nonaqueous phase liquid (LNAPL) or dense nonaqueous phase liquid (DNAPL)*

In addition, the presence of free product may indicate a confirmed release or identification of a contaminant source area. Under A.A.C. R18-12-101:

- "Release confirmation" means free product discovery, or reported laboratory analytical results of samples collected and analyzed in accordance with the sampling requirements of R18-12-280 and A.A.C. Title 9, Chapter 14, Article 6 which indicate a release of a regulated substance from the UST system.
- "Source area" means either the location of the release from an UST, the location of free product, the location of the highest soil and groundwater concentration of chemicals of concern, or the location of a soil concentration of chemicals of concern which may continue to impact groundwater or surface water.

*Note: The presence of free product is also a consideration for LUST Site Classification under A.A.C. R18-12-261.01(B)(2) and consideration of remedial response under A.A.C. R18-12-263, and sampling locations for corrective actions and UST closure.*

If free product is identified at a regulated UST facility, federal (40 CFR 280.64) and state regulations require UST owners and operators to take action to address it. The state requirements for free product investigation, removal, and reporting are detailed in A.A.C. R18-12-262.02:

**Free Product - R18-12-261.02**

1. Free product investigation. An owner or operator shall investigate for free product if site specific information indicates the potential existence for free product, and if discovered, determine its extent.
2. Free product removal. If free product is discovered, the owner or operator shall:
    a. Begin removal as soon as practicable;
    b. Remove free product in a manner minimizing the spread of contamination using recovery and disposal techniques based on site-specific hydrologic, geologic, and demographic conditions;
    c. Comply with local, state, and federal laws or regulations when treating, discharging, or disposing recovery byproducts;
    d. Use abatement of free product migration as a minimum objective for the design of the free product removal system; and
    e. Handle any flammable product in a safe and competent manner to prevent fire and explosion.
3. Forty-five day free product report. If free product is discovered, the owner or operator shall submit a status report, on a Department provided form, within 45 calendar days of free product discovery and with subsequent reports required by the Department. The status report shall contain the following information known at the time of the report:
    a. The name of the person or persons responsible for implementing the free product removal measures;
    b. The estimated quantity, type, extent and thickness of free product observed or measured in wells, boreholes, and excavations;
    c. A description of free product removal measures taken;
    d. A description of any discharge that will take place during the recovery operation and where this discharge will be located;
    e. A description of the type of treatment applied to and the effluent quality expected from any discharge;
    f. The steps that have been or are being taken to obtain necessary permits for any discharge; and
    g. The disposition of the recovered free product.

## POTENTIAL IMPACTS TO HUMAN HEALTH AND ENVIRONMENT

The presence of free product may have potential adverse impacts to human health and the environment including:

- A source of vapor phase discharge of volatile constituents to the ground surface and/or confined spaces, potentially resulting in fire, explosion or inhalation hazards;
- A source of direct discharge of product and/or of dissolved-phase constituents in groundwater that may impact receptors, including drinking water resources, other wells, surface water, springs and subsurface structures including basements and utility corridors. If free product is discovered at a LUST site, the potential impacts listed above should be taken into consideration to evaluate the potential risk to human health and the environment.

The presence and potential impacts from free product should be included in the conceptual site model (CSM) and as part of the evaluation for the LUST Site Classification form (A.A.C. R-18-12-261.01).

The ADEQ Emergency Response HotLine [(602) 771-2330] and the local fire authority should be contacted immediately if conditions requiring an initial response are suspected or confirmed.

Once the initial response actions address hazards of fire, explosion, vapors or direct discharge are determined to be minimal or have been abated, the actual impact to groundwater quality should be established prior to developing a free product recovery plan.
The potential of free product posing a source of contamination to groundwater is dependent on a number of factors, including the type of product released, the volume of free product, the age of the release, plume mobility, groundwater conditions, geology and, in some cases, climate.

## FREE PRODUCT GUIDANCE

### Free Product Investigation Requirement R18-12-261.02(A)

An owner or operator shall investigate for free product if site specific information indicates the potential existence for free product, and if discovered, determine its extent.

*NOTE: The potential existence of free product may be indicated by the presence of sorbed-phased and/or dissolved-phase contaminant concentrations approaching the respective saturation point for the impacted medium. If encountered, a party should plan to further investigate for the presence of free product in that vicinity.*

**Considerations**

- Where was the free product encountered?
- Is there an immediate risk that needs to be addressed?
- What is the likely source of the free product?
- If this is an operating facility - are current site operations causing or contributing to the presence of free product?
- Are there existing conduits that need to be checked for the presence of free product?

- Are there other wells onsite that can be used to evaluate the extent of the product?
- Has there been a change in water level that may have revealed a previously submerged product source or submerged a previously unknown product source?
- Is there the potential that the free product plume may have split?

**Recommendations**
Timely investigation of free product is essential to identifying & mitigating risks, and ensuring protection of public health and the environment.

Once discovered, identification of the source of contamination and extent of impact must be investigated. This effort should also consider identification of the type and characteristics of the free product.

When free product is identified, it must be thoroughly assessed to determine the characteristics including: product type, estimated volatility, and whether it indicates a potential ongoing release that must be addressed based on testing of the existing UST system. An evaluation of the degree of free product impact requires defining the lateral and vertical extent. The free product investigation should include:

- Identifying the type, chemical and physical characteristics of the free product
- Estimating the duration and volume of release
- Evaluating probable direction of groundwater flow and free product migration
- Delineating the extent and thickness of the free product
- Assessing the free product recoverability
- Assessing potential free product removal strategies
- Assessing the known and potential impacts to receptors

**Free Product Removal Requirement R18-12-261.02(B)(1)**
If free product is discovered, the owner or operator shall: Begin removal as soon as practicable;

**Considerations**
How was the free product identified and does this influence the corrective actions to be taken? For example, was it found in;

- an existing monitoring well?
- an excavation during onsite activities?
- an adjacent surface water body?
- the utilities on or offsite?
- an adjacent building basement?
- a nearby drinking water supply well?

**Recommendations**
The report should include information on when free product removal actions were initiated. It is helpful to also include a brief description of how “as soon as practicable” was evaluated based on the discovery and impacted or potentially impacted receptors.

**Free Product Removal Requirement R18-12-261.02(B)(2)**
Remove free product in a manner minimizing the spread of contamination using recovery and disposal techniques based on site-specific hydrologic, geologic, and demographic conditions;

**Considerations**

- How was the free product identified and does this influence the corrective actions to be taken? For example - was it found in an existing monitoring well? In an excavation during onsite activities? In an adjacent surface water body? In the utilities on or offsite? In an adjacent building basement? In a nearby drinking water supply well?
- Is recovery/removal of the free product necessary?
- Is enough known about the product and subsurface conditions to develop a recovery strategy after initial response measures have been taken?
- Is it appropriate to initiate a temporary removal method prior to designing a more complete system?
- Does the free product recovery approach meet the requirements of A.R.S. § 49-1005 and A.A.C. R18-12-262.02?
- Are there sufficient quantities available to necessitate an active recovery method?
- Has recovered free product been stored in a manner that prevents fire and safety hazards?
- Has derived waste (soil, groundwater or surface water) been properly stored and disposed?
- Has produced water been stored/disposed of in accordance with applicable environmental and safety regulations?
- Will the manner of recovery and location of discharge affect sensitive receptors?
- Has a determination been made on whether the free product is considered a hazardous waste? (This will impact disposal options)
- Have the appropriate permits for free product removal, storage, transportation, and disposal been obtained?

**Recommendations - Free Product Removal/Recovery**
If free product is still present after initial response actions, then free product removal may be required. Free product removal should be evaluated based upon site-specific conditions and the requirements of A.R.S. § 49-1005(D) and A.A.C. R18-12-261.02 including the necessity for free product removal.

Efficiency of free product removal may be affected by the soil, groundwater, and product characteristics, variability in the subsurface, aquifer hydraulic conductivity, accessibility, and the proposed method of recovery.

The information considered during the evaluation of appropriate recovery methods should include:

- Soil type
- Depth to bedrock
- Depth to groundwater
- Depth to product
- Product thickness

- Mobility (transmissivity) and product/plume migration
- Hydraulic conductivity
- Receptors (e.g. PVI, drinking water wells, sensitive receptors, surface water impacts, etc.)
- Whether data indicates that product may be submerged
- Composition of free product

The selection, design, and implementation of the method selected for free product removal must meet the requirements of A.R.S. § 49-1005(D) and A.A.C. R18-12-261.02. If it has been determined that free product recovery is necessary, the method of approach must be determined. The owner or operator is required to provide justification for the selected removal method and plans for implementation.

The method and equipment selected should prevent migration and maximize recovery based on the known or estimated quantity of product, product type, and the ability of the impacted media to yield product for recovery.

*NOTE: The department does not consider long-term hand bailing to typically be a cost-effective means of achieving free product removal. However, if long-term hand bailing is selected as the most cost- effective method of free product removal, then site-specific justification must be made to the department showing that the costs expended for the amount of free product recovered is maximized relative to other methods, while minimizing to the extent possible any further potential health and environmental impacts.*

Most commonly used methods for free product recovery include:

- Vacuum Truck
- Absorbers
- Hand Bailing
- Skimmer
- Pumping
- Vapor Extraction
- Multi-Phase Extraction
- Interceptor Trench

**<u>Free Product Removal Requirement R18-12-261.02(B)(3)</u>**
Comply with local, state, and federal laws or regulations when treating, discharging, or disposing recovery byproducts;

*Note: Recovered free product and recovery byproducts generated in the course of conducting free product removal must be properly treated, and discharged or disposed of in accordance with applicable regulations. See A.A.C. R18-12-263(F)*

**Considerations**

- Has recovered free product been stored in a manner that prevents fire and safety hazards?
- Has derived waste (soil, groundwater or surface water) been properly stored and disposed?
- Has produced water been stored/disposed of in accordance with applicable environmental and safety regulations?
- Will the manner of recovery and location of discharge affect sensitive receptors?

- Has a determination been made on whether the free product is considered a hazardous waste? (This will impact disposal options)
- Have the appropriate permits for free product removal, storage, transportation, and disposal been obtained?

**Free Product Removal Requirement R18-12-262.02(B)(4)**
Use abatement of free product migration as a minimum objective for the design of the free product removal system;

**Considerations**
- Where is the free product located?
- Has it migrated since the release?
- How far has it migrated and how quickly?
- What is known about subsurface conditions and transport mechanisms?

**Recommendations**
Consistent with recent updates from USEPA regarding 40 CFR 280.64, ADEQ considers the objective of A.R.S. § 49-1005 with respect to free product and A.A.C. R18-12-261.02 to be removal of free product to prevent migration. “Mobile” and “residual” LNAPL are distinct from “migrating” LNAPL in that they do not spread laterally and do not increase the LNAPL footprint into unimpacted areas. All forms of LNAPL are subject to assessment and characterization; however, based upon this corrective action goal, abatement of mobile and residual LNAPL is not required to meet the regulatory requirement to prevent free product migration.

*NOTE: See the resources listed at the end of this document for additional information.*

**Free Product Removal Requirement R18-12-261.02(B)(5)**
Handle any flammable product in a safe and competent manner to prevent fire and explosion.

**Considerations**
- Are the actions taken ensuring that any potential risks for fire and explosion have been addressed?

**Recommendations**
Ensure that early response actions adequately assess the type of product and its potential risk factors. This may involve conducting laboratory analyses and investigation of the characteristic properties of detected compounds.

*NOTE: Questions or concerns regarding safe storage and handling procedures should be directed to the local fire authority.*

**Free Product Reporting Requirement R18-12-261.02(C)**

Forty-Five Day Free Product Report - If free product is discovered, the owner or operator shall submit a status report, on a Department provided form, within 45 calendar days of free product discovery and with subsequent reports required by the Department. The status report shall contain the following information known at the time of the report:

- The name of the person or persons responsible for implementing the free product removal measures;
- The estimated quantity, type, extent and thickness of free product observed or measured in wells, boreholes, and excavations;
- A description of free product removal measures taken;
- A description of any discharge that will take place during the recovery operation and where this discharge will be located;
- A description of the type of treatment applied to and the effluent quality expected from any discharge;
- The steps that have been or are being taken to obtain necessary permits for any discharge; and
- The disposition of the recovered free product.

*NOTE: There are two separate forms available online for this reporting requirement:*

- *Initial 45-Day Free Product Report From* - for use in the initial free product reporting
- *Subsequent 45-Day Free Product Report Form* - for use in all further required free product reporting
- Forms are located online in the Underground Storage Tank Corrective Action forms at https://azdeq.gov/forms

**Considerations**

- Is the appropriate form being used for reporting?
- Is the site plan clear and legible?
- Is the information provided complete and accurate?
- Has the site conceptual site model (CSM) been updated with free product information?
- Has the LUST Site Classification Form been updated and provided to ADEQ?
- Is additional information helpful in understanding the actions taken to date and proposed future actions?

**Recommendations**

A.A.C. R18-12-261.02(C)(1): The name of the person or persons responsible for implementing the free product removal measures.

Ensure that the report form and the information on the document submittal form are consistent. The person responsible is the corrective action lead - typically this is the UST owner or operator. An environmental consultant is not equivalent to the responsible party.

A.A.C. R18-12-261.02(C)(2): The estimated quantity, type, extent and thickness of free product observed or measured in wells, boreholes, and excavations. Ensure that the information provided is complete and accurate:

- Quantity: The estimated quantity, if not known from a specific event, must be estimated based on information available at the time work is conducted.
- Product Type: If the free product appears to be a mixture of different product types, identify all applicable types.
    - Unleaded Gasoline
    - Premium Unleaded Gasoline
    - Leaded Gasoline
    - Diesel
    - Kerosene
    - Used Oil/Waste Oil
    - New Oil
    - Aviation Gasoline
    - Jet Fuel
    - Other _____
    - Hazardous Substance - If the product is a hazardous substance, it is important to identify the substance
- Type(s) of Saturation State: The known or estimated saturation states present within the free product (or LNAPL) body. *NOTE: a single LNAPL body may contain multiple saturation states in different locations. Also, migratory LNAPL is most commonly associated with recent releases where the time since release has not been sufficient to dissipate the LNAPL head pressure.*
    - Residual (LNAPL body does not redistribute vertically or laterally in response to groundwater elevation changes or installation of new wells)
    - Mobile (LNAPL body areas are not expanding laterally, but may move into newly installed wells or be vertically redistributed due to groundwater elevation fluctuations)
    - Migratory (LNAPL body is expanding laterally into previously unimpacted saturated soil pores due to LNAPL head pressure and gradient exceeding native resistive forces)

*NOTE: See discussion of LNAPL states of saturation and characteristics in the ITRC LNAPL-3 guidance for additional information (https://lnapl-3.itrcweb.org/)*

Extent and thickness of free product observed or measured in wells, boreholes, and excavations: The corrective action investigation should allow for estimating the lateral and vertical extent (thickness) of the free product.

- Documentation of the lateral extent should be shown on a site plan. The site plan must include required details as identified in the free product report form. Note: If the full extent has not been determined, hatched lines should be used where the extent has been inferred
- Free product thickness may vary in different wells and boreholes, or across an excavation. Thickness measurements should be provided in a tabular format and should identify the equipment used for taking the measurements.

*Note: it is helpful to include details in the summary of how and where the free product was identified.*

A.A.C. R18-12-261.02(C)(3): A description of free product removal measures taken:

- Describe actions taken to prevent the further release of free product (i.e. removal of product from a leaking tank, repair or removal of the tank, etc.)
- Describe actions taken to prevent further migration of free product and free product removal, including removal of saturated soils acting as a source for the product

Information provided should identify each method of free product removal conducted including the date initiated, the length of time implemented, and, if applicable, the wells used.

**A.A.C. R18-12-261.02(C)(4):** A description of any discharge that will take place during the recovery operation and where this discharge will be located: In most cases, recovered product is stored in aboveground containment, appropriately labeled, and transported offsite.

If product recovery efforts produce a discharge of contaminated material, this must be handled in accordance with all applicable requirements and sufficient detail should be included in the report to clearly describe both the discharge and the location (e.g., sanitary sewer, storm sewer, on-site infiltration, surface water) where discharge will take place and the final receiving entity/body (e.g., publicly owned treatment works or utility authority, name of surface water body). It is recommended that a site plan be provided to identify the area of the discharge.

*Note: local jurisdictions and fire departments should be contacted as applicable.*

**A.A.C. R18-12-261.02(C)(5):** A description of the type of treatment applied to and the effluent quality expected from any discharge: Any discharge must be handled in accordance with applicable requirements and any treatment must be documented within the free product report. The anticipated impact of the treatment on effluent quality are also required to be included. Information should be provided in a clear and concise format, either in text or a table. It is recommended that associated treatment related sampling results, if available, are also included.

**A.A.C. R18-12-261.02(C)(6):** The steps that have been or are being taken to obtain necessary permits for any discharge: This section should identify the evaluation used to determine all permitting required, and the progress of permitting efforts. Information should be provided in a clear and concise format, either in text or a table. Provide copies of permits with the free product report.

*Note: Discharge must happen in accordance with permits.*

**A.A.C. R18-12-261.02(C)(7):** The disposition of the recovered free product: This section should describe the method of disposal and the amount disposed.

Provide copies of transportation and disposal documentation (manifests) with the free product report.

The following documents are also required to be submitted to ADEQ and should be attached to the Free Product Report:

- A.A.C. R18-12-261.01 - Current LUST Site Classification Form
- A.A.C. R18-12-264 - Document Submittal Form ("Standard First Page")

ADEQ also recommends that owners or operators include any additional information that they believe is significant for the evaluation of free product response, investigation, recovery, and disposition actions.

**RECOMMENDED RESOURCES**

- How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites: A Guide for State Regulators. (EPA 510-R-96-001). September 1996.
- UST Technical Compendium: Release Investigation, Confirmation, and Corrective Action [Updates]. (USEPA OUST).
- Light Non-Aqueous Phase Liquid (LNAPL) Site Management: LCSM Evolution, Decision Process, and Remedial Technologies (LNAPL-3). ITRC, 2018.
- ADEQ Arizona UST Locator 2.0 Mapping Resource