Introduction to the Leaking Underground Storage Tanks Exposure Evaluation Checklist, or LEEC.

Purpose

The LEEC was developed to provide a systematic approach to review available site data and establish whether points of exposure exist at an UST release site that require further investigation or further action. It was developed for use by EPA project managers for LUST sites in Indian country. It is being shared publicly as it may be useful for other implementing agency personnel and contractors.

What does the LEEC do?

The LEEC is a tool that can be used to:

- Identify and describe possible exposures at a site.
- Document the rationale for certain site decisions.
- Highlight possible data gaps, including potential data gaps before field work.
- Provide an outline of next steps for a site. Next steps might include additional data gathering, additional investigation, site ranking and prioritization, remedial action, or no further action.

Detailed instructions are included before the checklist. End notes are included after the checklist. Once completed, this checklist is a useful way to organize information about a release when communicating with interested parties.

When can I use LEEC?

Anytime! The LEEC can be helpful for organizing the approach to a new confirmed release and for identifying data needs. It can also be used to review older sites to identify what additional actions or data are needed to resolve the case.

How do I use LEEC?

To use LEEC you should have a basic understanding of petroleum release science, including LNAPL behavior, petroleum vapor intrusion and movement of dissolved phase petroleum in groundwater.

Step 1: Gather existing data.

LEEC will help you identify which missing information is critical to your case. While you should try to collect the information listed below, you can use LEEC if all you have is a map of the site and a map of the surrounding area.

- History of the release (location, time, duration, volume and petroleum substance).
- On site and nearby USTs (regulated and unregulated) and any other sources of petroleum.
- Soil and groundwater data.
- Type of building construction (basement, slab on grade, crawl space, on and offsite to assess vapor intrusion potential).
- Site and local water use – supply well locations, screen depth, municipal water supply, sole source aquifer designation.
- Local utilities.
- Topography.
- Geology.
- Local ecological information relevant to the release area.

Step 2: Evaluate exposures.

Ensure that potential ongoing exposures have been properly evaluated and any exposures mitigated as needed. Identify any ongoing sources of releases for any active facility nearby or a closed or active UST remaining on site.

Step 3: Evaluate stability.

Evaluate whether a release is likely to be stable based on age of the release or by interpreting field data such as LNAPL trends or statistical analyses of groundwater concentrations.

Step 4: Incorporate screening distances.

Evaluate whether potential points of exposure may be affected by a release using screening distances. Once these parts of LEEC are complete, your best course of action will be suggested by the responses to the checklist items. No further action may be necessary for some items. In others, data gaps will need to be filled, prompt remedial action may be required, or mitigating measures may need to be implemented.

Useful Resources

Topography, surface water and general site area

- Google maps and street view.
- USGS current topographic maps https://topobuilder.nationalmap.gov/.
- Historic USGS maps https://ngmdb.usgs.gov/topoview/.

Geology

- Geologic maps available through the United States Geological Survey at https://ngmdb.usgs.gov/ngmdb/ngmdb_home.html. Select "mapview."
- State geology websites may have useful maps and information.

Water use

- Public water supply information can be found in state annual drinking water reports; local health department private drinking water records; UST Finder.
- Sole source aquifer information can be found at https://www.epa.gov/dwssa. In addition, check state records.
- UST Finder analysis of drinking water sources nearby.

Petroleum release and site specific information (on site and nearby)

- UST Finder.
- State GIS and LUST public records.

EPA documents

- EPA LUST pages.
- EPA Threat Assessment Policy.

Interstate Technology Regulatory Council

- Petroleum vapor intrusion (PVI) guidance
- LNAPL site management: LCSM evolution, decision processes and remedial technologies.
- TPH Risk evaluation at petroleum contaminated sites.
- Effective application of guidance documents to hydrocarbon sites Hydrocarbons 101.

Leaking Underground Storage Tank Exposure Evaluation Checklist

Note to User

Once completed, this checklist should describe possible exposures at a site, the rationale for certain site decisions, possible data gaps and needs, and next steps for a site. Next steps might include additional data gathering, additional investigation, site ranking and prioritization, remedial action, or no further action. Project managers can fill out this checklist to identify potential data gaps before completing field work. The completed checklist may be useful when communicating with interested parties.

Instructions for Completing Form

Refer to the footnotes to help with the evaluation.

For all Questions:

- Select "Yes," "No," "Unknown," or "N/A" by typing an X in the appropriate cell.
- In the last column, describe supporting evidence and the information source(s) used, such as: release report, closure report, site assessment report, boring logs, soil, groundwater, drinking water or soil vapor sample analysis data, geologic and topographic map review, regional groundwater flow, regional depth to groundwater, assessments from nearby sites, Google Earth, historic maps, PowerPoint summaries, or interviews.

For Questions 1-5:

- If all responses to Questions 1-5 are "No" or "N/A," there is no ongoing or immediate threat. Go to Question 6.
- If responses are "Yes" for Questions 1-5, remedial action likely will be required.
- If answers are "Unknown" evaluation likely will be required.

For Question 6:

- Investigation required if "Yes" or "Don't Know" is selected.
- Identify point of exposure (PoE) and describe whether exposure is possible.
- Select "N/A" if not present or "No" if PoE has been evaluated and not exposed.

For Question 7:

- Investigation, or engineering or institutional controls required if "Yes" or "Unknown" is selected and there is not sufficient information to rule out exposure (e.g., direction of groundwater flow, magnitude of release on site means off site exposure at concentrations of concern unlikely).
- Describe mitigating factors in the last column of the sub-question/sections. If uncertainty still exists, objectives for further investigation are to identify and assess whether there are any plausible pathways for future exposure from the release.

Site ID Number: Site Name:

Project Manager:

Street Address:

Latitude/Longitude:

Town: County:

State: Zip Code:

Current, Expected, and Potential Future Exposures	Yes	No	Unknown[1]	N/A	Supporting Evidence and Information Sources
1. Is a current receptor[2] exposed now through:[3]					
Drinking water *Drinking water sampled and contaminated, and/or taste and/or odor reported.*	☐	☐	☐	☐	
Indoor air *Vapor issues reported.*	☐	☐	☐	☐	
Surface water[4] *Include sheens or sediment pore water in contact with surface water.*	☐	☐	☐	☐	
Exposed surface soil *In most cases this will be surface or near surface spills on bare ground.*	☐	☐	☐	☐	
2. Is the onsite release source still there/in use? *Relates to the UST system, not residual contamination, e.g., UST removed.*	☐	☐	☐	☐	

[1] If the answer is unknown and not resolved by answering other questions on the checklist, further investigation is likely necessary.

[2] The user defines the receptors relevant to them and their stakeholders, but broadly these can be human, wildlife/other ecological, or cultural.

[3] If it is unknown whether receptors are affected, move to item 6 to evaluate the potential for an exposure based on screening distances and decide whether further investigation is necessary.

[4] Surface water includes streams, lakes, rivers, and groundwater-fed storm water and ephemeral streams. Typically, surface run off features (such as storm water retention ponds and rain-fed ephemeral streams) would not be considered here other than in the immediate aftermath of a surface spill.

Site ID Number: Site Name:

Current, Expected, and Potential Future Exposures	Yes	No	Unknown[5]	N/A	Supporting Evidence and Information Sources
3. Are there potential offsite sources? *Is an offsite source contributing to observed petroleum attributed to this site?*	☐	☐	☐	☐	
4. Is Light Non-Aqueous Phase Liquid migrating?[6] *Include information about age and estimated quantity of release, stability of groundwater plume, LNAPL thickness trends, Smear zone thickness > 5X LNAPL thickness, and LNAPL transmissivity.*	☐	☐	☐	☐	
5. Is groundwater plume migrating?[7] *Include information about age of release, estimated quantity of release, contamination of concern concentrations and trends, and plume retraction.*	☐	☐	☐	☐	
6. Are utilities at risk of exposure or of being potential preferential pathways? *Utility corridors can act as preferential pathways for LNAPL and vapors if they run through LNAPL. Describe location and depth.*	☐	☐	☐	☐	

[5] If the answer is unknown and not resolved by answering other questions on the checklist, further investigation is likely necessary.

[6] Refer to ITRC LNAPL Update, Chapter 3 "Key LNAPL Concepts and Chapter 4 "LNAPL Conceptual Site Model" for a more detailed review of appropriate data collection and the significance of the data. Two key concepts to consider are:

(1) LNAPL plumes typically stop spreading within months of the primary source being removed. If USTs were removed or emptied more than five years previously, the LNAPL plume can be assumed to be stable and not migrating,

(2) A single elevated soil concentration does not indicate significant LNAPL is present in the subsurface if nearby data are not elevated. Evaluate the data based on the history of the site, whether any measurable releases were reported and how widespread and reliable the analytical data for the site is.

[7] As with LNAPL, petroleum dissolved phase plumes typically stabilize within a few years of a release being stopped as biodegradation balances the spread of petroleum contaminants from the source area. Changing groundwater elevations, pumping regimes (such as nearby quarries or new drinking or agricultural water supply wells) may "destabilize" previously stable plumes. Dissolved phase migrating in fractured bedrock areas or areas with discrete high conductivity features (such as buried gravel-filled alluvial channels) may create discrete, long plumes. When evaluating the potential for dissolved phase plumes away from a release site, the geology needs to be understood, but this may be achieved using published information and does not always need site-specific borehole data.

Site ID Number: Site Name:

Current, Expected, and Potential Future Exposures	Yes	No	Unknown	N/A	Supporting Evidence and Information Sources
7. Are there points of exposure within typical screening distances that need to be evaluated?[8] For instance:	☐	☐	☐	☐	
Drinking water wells on site or on neighboring properties? *Is aquifer of the drinking water well connected to the shallow, contaminated groundwater?*	☐	☐	☐	☐	
A "sole source" aquifer[9] beneath the site? *Heightened caution required when releases may affect sole source aquifers.*	☐	☐	☐	☐	
Surface water within 200 feet or connected to the mobile LNAPL area of the release site by utilities? *How deep are storm drains relative to contamination and groundwater? Can they act as a pathway to surface water?*	☐	☐	☐	☐	

[8] Establish potential points of exposure at all sites before deciding what further work is needed. Once points of exposure are known, establish potential pathways using published information, data from the site itself, and data from nearby sites likely to be in similar geologic or topographic settings. This allows development of an initial conceptual site model. The CSM provides a framework to establish data gaps that prevent a full assessment of potential future exposure being made and guides further data gathering.

[9] "Sole source" aquifers are defined by EPA as:

- The aquifer supplies at least 50 percent of the drinking water for its service area.
- There are no reasonably available alternative drinking water sources should the aquifer become contaminated.

If a sole source aquifer is present at a site, consider a more conservative approach than if underlying aquifers are unusable or when other drinking water sources are readily available (e.g., either municipal water or surface water). Appropriate tools need to be used to ensure sufficient data are available to estimate the extent of the plume above drinking water standards and predict areas where future drinking water wells might be affected. Once that information is available, use the screening criteria in the checklist to evaluate potential exposures in that sole source aquifer.

Site ID Number: Site Name:

Current, Expected, and Potential Future Exposures	Yes	No	Unknown	N/A	Supporting Evidence and Information Sources
Existing buildings within a 30' Petroleum Vapor Intrusion lateral screening distance from vapor source? *A "source" of vapors is LNAPL, dissolved phase groundwater or residual soil contamination (e.g., Total Petroleum Hydrocarbons >250mg/kg, benzene>10mg/kg).*[10]	☐	☐	☐	☐	
Existing buildings within the vertical PVI screening distances[11] **or buildings connected to utilities that run through LNAPL?** *Vertical screening distance of 6' from dissolved phase contamination or 15' from LNAPL.*	☐	☐	☐	☐	

[10] Refer to EPA PVI Guide, Table 3, page 52. Note MI EGLE Volume IV Executive Summary Vapor Intrusion Assessment Process *"As a result, unacceptable risks from PVI are generally only observed where: 1) non-aqueous phase liquid (NAPL) is near or entering a structure; 2) NAPL has entered a utility that is connected to a structure; or 3) groundwater above the volatilization to indoor air criteria (VIAC) is entering a structure."* While criteria (e.g., VISL) exist for deciding whether particular groundwater concentrations pose potential VI risks, no such criteria exist for soil. Judgement calls based on the contaminant volatility, age, and concentration may allow you to screen out VI from soil only. But in many cases, a soil gas sample (passive or active) may be the most definitive decision making tool for VI where soil with petroleum is detected within the screening distance.

[11] Refer to EPA PVI Guide, Table 3, page 52. Six feet to dissolved phase or low level soil, 15 feet to LNAPL or residual LNAPL.

Site ID Number: Site Name:

8. Underlying geology and screening distances. *Before evaluating the potential exposure over larger screening distances in section 9, assess the likely underlying soil and rock types. The screening distances below are conservative in most soil types but if the site overlies fractured bedrock or may have preferential pathways, such as alluvial gravel channels, then consider whether even more conservative distances are appropriate.*

Soil Type	***Discussion***
Sand ☐	
Gravel ☐	
Clay ☐	
Fractured Bedrock ☐	
Other ☐	

Current, Expected, and Potential Future Exposures	**Yes**	**No**	**Unknown**	**N/A**	**Supporting Evidence and Information Sources**
9. Are there current or reasonably anticipated[12] points of exposure within conservative screening distances?[13] For instance:	☐	☐	☐	☐	
Drinking water wells within a quarter mile? *This potential exposure could be resolved by fate and transport modeling or institutional controls that restrict future drinking water wells within a quarter mile unless specifically evaluated for potential exposure.*	☐	☐	☐	☐	

[12] "Reasonably anticipated" means there is a reuse plan, or future use could be inferred from existing land use or zoning. For example, if the area is industrial, it would not be reasonably anticipated that a residential building with a basement would be built on the site unless the area has residential redevelopment as an established long term plan.

[13] Plume studies from across the U.S. and Europe show that almost all dissolved phase petroleum plumes (where the boundary of the plume is defined as a drinking water standard) from LUSTs are less than a quarter mile in length and most are less than 300 feet. In some circumstances, such as with fractured bedrock or karst geological features, or where the release is not a typical LUST (e.g., a pipeline release, a release from a bulk storage facility UST) plume lengths may be longer and need more in-depth study to assess whether points of exposure beyond a quarter of a mile may exist.

Site ID Number: Site Name:

Current, Expected, and Potential Future Exposures	Yes	No	Unknown	N/A	Supporting Evidence and Information Sources
Surface water within a quarter mile? *This potential exposure could be resolved by investigation or by fate and transport modeling for potential exposure.*	☐	☐	☐	☐	
Future building within Vapor Intrusion screening distances of LNAPL or contaminated groundwater? *This potential exposure could be resolved by institutional control requiring future buildings to have vapor mitigation.*	☐	☐	☐	☐	
Construction worker exposure to contaminated soil/water during maintenance of utility lines in contact with residual or mobile LNAPL?[14] *This potential exposure could be resolved by a soil and groundwater management plan.*	☐	☐	☐	☐	
Construction worker exposure to contaminated soil/water during predicted future development? *A predicted future development might be the local county land use plan for the area or might be an approved redevelopment. This potential exposure could be resolved by a soil and groundwater management plan.*	☐	☐	☐	☐	

[14] Construction worker health and safety is primarily governed by the Occupational Safety and Health Administration. Typical Level D personal protective equipment will be adequate for most construction activities outside of LNAPL areas. A soil management and construction, and health and safety plan that includes appropriate construction precautions and describes how to manage excavation dewatering should be established as part of post-closure documentation when contamination is left in place.

Site ID Number: Site Name:

Conclusions and Next Steps	Rationale and Details
No Further Action based on stable LNAPL and dissolved phase groundwater plume, and no current or reasonably anticipated future exposure to receptors. *Assessment of future exposure should be based on typical land use in the area, local land use plans or site-specific planning approvals. Site specific institutional or engineering controls may be appropriate at some sites with residual contamination.* **Further investigation. What is the objective? What additional data might change your decision or reduce uncertainty in relation to potential future exposures? What is the simplest way to obtain that data?** *For example, the depth to suspected LNAPL at a building within the PVI screening distance may not be known. A High Resolution Site Characterization (e.g., Optical Image Profiler or Laser-Induced Fluorescence investigation) would provide that data with one day of work without needing to install monitoring wells or conduct long term groundwater monitoring. Alternatively, a near slab passive sampler might verify whether soil vapor of concern is present at the foundation depth without needing to verify the presence or depth of LNAPL.* **Remedial Action.** *If there is an ongoing exposure, take action now.* *If migrating LNAPL or a migrating dissolved plume exists or is suspected, then more in-depth investigation and, potentially, corrective action mitigation measures will be necessary.*	
Communication Activities/Plan: Do Tribes, stakeholders and EPA agree regarding No Further Action or objectives of further investigation?	