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Identify and Overcome Regulatory Challenges in Order to Address Backlogged or Unresolved LNAPL Sites



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Interstate Technology & Regulatory Council (ITRC)



- Host organization



- Network

- State regulators
 - All 50 states, PR, DC
- Federal partners



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- ITRC Industry Affiliates Program



- Academia
- Community stakeholders

- ITRC materials available for your use

- Available from www.itrcweb.org

- Technical and regulatory guidance documents
- Online and classroom training schedule
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ITRC LNAPL History

- 2009 – 2017:
LNAPL Natural Source Zone Depletion & LNAPL Technical/Regulatory Guidance documents, 3 Part LNAPL Online Training & Classroom Training
- 2016 - 2018:
ITRC “LNAPL Update” developed
- 2018:
(LNAPL-3) LNAPL Site Management: LCSM Evolution, Decision Process, and Remedial Technologies, Revised 3 Part LNAPL Internet Based Training (IBT)

ITRC LNAPL Update Changes

- Expansion of LNAPL Key Concepts
- Development of a LNAPL Conceptual Site Model (LCSM) Section
- Emphasis on identifying SMART goals
- Additional practical knowledge Natural Source Zone Depletion (NSZD) and Transmissivity (T_n)
- New Appendix on Sheens and Fractured Rock

ITRC LNAPL Guidance



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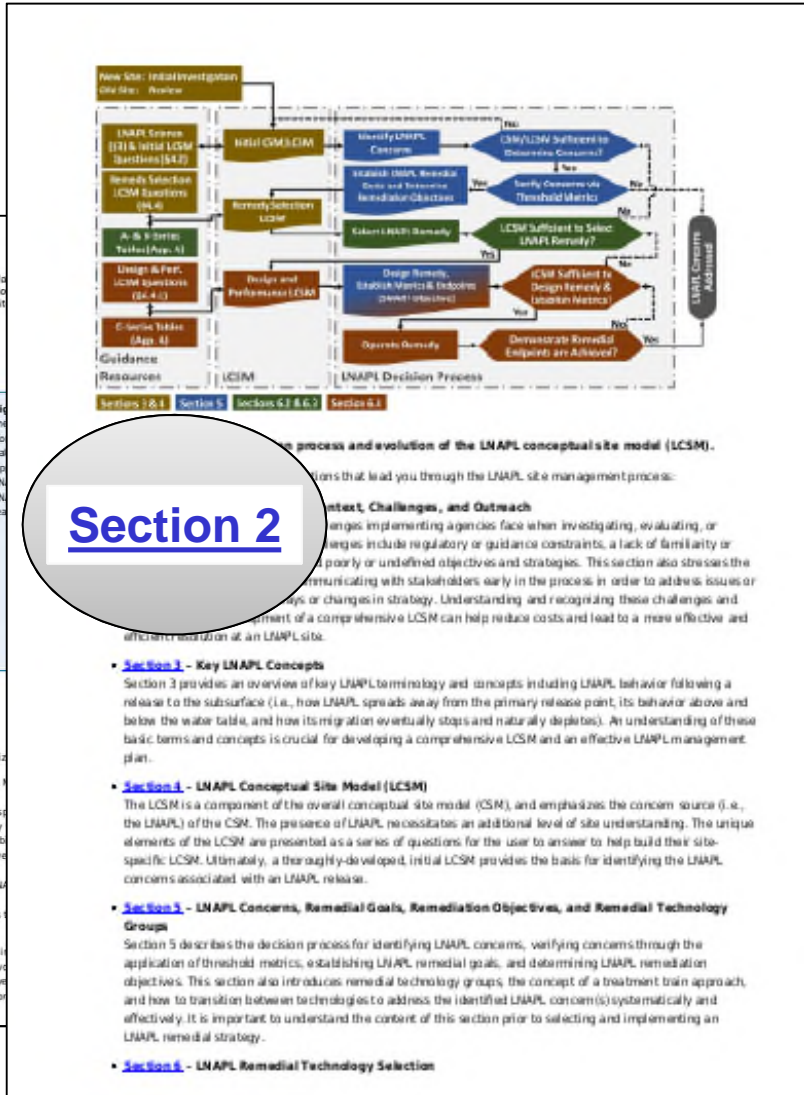
1. How to Use the Document

In 2009, ITRC published LNAPL-1: Evaluating Natural Source Zone Depletion at Sites with LNAPL (ITRC 2009a) and LNAPL-2: Evaluating LNAPL Remedial Technologies for Achieving Project Goals (ITRC 2009a) to aid in the understanding, cleanup, and management of LNAPL at thousands of sites with varied uses and complexities. These documents have been effective in assisting implementing agencies, responsible parties, and other practitioners to identify concerns, discriminate between LNAPL composition and saturation-based goals, to screen remedial technologies efficiently, to better define metrics and endpoints for removal of LNAPL to the "maximum extent practicable," and to move sites toward an acceptable resolution and eventual case closure.

This guidance, LNAPL-3: LNAPL Site Management: LCSM Evaluation, Decision Process, and Remedial Technologies, builds upon and supersedes both previous ITRC LNAPL guidance documents in an updated, web-based format. LNAPL-1 and LNAPL-2 are still available for review; however, LNAPL-3 is inclusive of those materials with new topics presented and previous topics elaborated upon and further clarified.

- This guidance can be used for any LNAPL site regardless of size:
- develop a comprehensive LNAPL Conceptual Site Model (CSM);
 - establish appropriate LNAPL remedial goals and objectives for identified LNAPL concerns that may vary in severity and complexity;
 - inform stakeholders of the applicability and capabilities of various remedial technologies;
 - select remedial technologies that will best achieve identified LNAPL concerns and conditions;
 - describe the process for transitioning between LNAPL investigation, cleanup, and beyond; and
 - evaluate the implemented remedial technologies against the established LNAPL remedial goals and objectives.

Initial development and continued refinement of the LCSM is a key component of the LNAPL site management process. Figure 1-1 identifies the stepwise evolution of the LCSM and the tools presented within this guidance to aid in the development of the LCSM and the tools presented within this guidance to aid in the development of the LCSM and the tools presented within this guidance to aid in the development of the LCSM.



Section 2

The process and evolution of the LNAPL conceptual site model (LCSM). The process and evolution of the LNAPL conceptual site model (LCSM). The process and evolution of the LNAPL conceptual site model (LCSM).

Challenges and Outreach. Challenges implementing agencies face when investigating, evaluating, or designing remedial technologies include regulatory or guidance constraints, a lack of familiarity or understanding of LNAPL behavior, poorly or undefined objectives and strategies. This section also stresses the importance of communicating with stakeholders early in the process in order to address issues or changes in strategy. Understanding and recognizing these challenges and opportunities is critical to the development of a comprehensive LCSM that can help reduce costs and lead to a more effective and efficient resolution of an LNAPL site.

- Section 3 - Key LNAPL Concepts**
Section 3 provides an overview of key LNAPL terminology and concepts including LNAPL behavior following a release to the subsurface (i.e., how LNAPL spreads away from the primary release point, its behavior above and below the water table, and how its migration eventually stops and naturally depletes). An understanding of these basic terms and concepts is crucial for developing a comprehensive LCSM and an effective LNAPL management plan.
- Section 4 - LNAPL Conceptual Site Model (LCSM)**
The LCSM is a component of the overall conceptual site model (CSM), and emphasizes the concern source (i.e., the LNAPL) of the CSM. The presence of LNAPL necessitates an additional level of site understanding. The unique elements of the LCSM are presented as a series of questions for the user to answer to help build their site-specific LCSM. Ultimately, a thoroughly-developed, initial LCSM provides the basis for identifying the LNAPL concerns associated with an LNAPL release.
- Section 5 - LNAPL Concerns, Remedial Goals, Remediation Objectives, and Remedial Technology Groups**
Section 5 describes the decision process for identifying LNAPL concerns, verifying concerns through the application of threshold metrics, establishing LNAPL remedial goals, and determining LNAPL remediation objectives. This section also introduces remedial technology groups, the concept of a treatment train approach, and how to transition between technologies to address the identified LNAPL concern(s) systematically and effectively. It is important to understand the content of this section prior to selecting and implementing an LNAPL remedial strategy.
- Section 6 - LNAPL Remedial Technology Selection**

Additional information on LNAPL site management, including a discussion of the science and engineering of LNAPL, is provided in the appendices. The appendices provide detailed information on LNAPL site management, including a discussion of the science and engineering of LNAPL, is provided in the appendices. The appendices provide detailed information on LNAPL site management, including a discussion of the science and engineering of LNAPL, is provided in the appendices.

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What is LNAPL?

Light **N**on-**A**queous **P**hase **L**iquid

Less dense than water.
Do not mix with water.

Gasoline, Diesel, Motor Oil,
and similar materials are
examples of LNAPL.



What is a LCSM?

The **LNAPL Conceptual Site Model** is the collection of information that incorporates key attributes of the LNAPL body with site setting and hydrogeology to support site assessment and corrective action decision-making. The **LCSM** integrates information and considerations specific to the LNAPL body relating to the risks of the contaminant source, exposure pathways, and receptors. The content of the **LCSM** will typically evolve over time as different phases of the corrective action process require different information.

EPA Backlog Study

- Why do UST releases need to be cleaned up?
To restore and protect
- How many UST releases are there?
540,000+ confirmed / 473,000+ cleaned
- Are all UST sites equally dangerous or costly to clean?
Vary considerably / some involve years and cost millions / others minor and restore quickly and less cost
- Are there ways to control the cost of these potentially expensive cleanups?
EPA encourages use of expedited assessment and alternative cleanup technologies with risk-based decision-making

The screenshot shows the EPA website page for 'Cleaning Up Underground Storage Tank (UST) Releases'. The page includes a navigation menu with 'Environmental Topics', 'Laws & Regulations', and 'About EPA'. The main content area features a sidebar with links to 'USTs Home', 'Learn About USTs', 'Meeting UST Requirements', 'Preventing and Detecting Releases', 'Cleaning Up Releases', 'Laws & Regulations', 'UST Program in Indian Country', 'Emerging Fuels and USTs', 'Frequent Questions', and 'UST A - Z Subject Index'. The main text explains that EPA works with state, territorial, tribal, and industry partners to clean up releases from USTs, which can contaminate soil, groundwater, surface water, or indoor air. It lists several key questions addressed on the page, such as 'Why do UST releases need to be cleaned up?', 'How many UST releases are there?', and 'Are all contaminated UST sites equally dangerous or costly to clean up?'. A 'Resources' box on the right lists links to 'UST Tool/Kit Card', 'UST Performance Measures', 'Federal UST Regulations', 'EPA Office of Research and Development', and 'EPA Office of Enforcement'. The page also includes a 'CONTACT US' section and a 'Top of Page' link.

Presentation Objective

- Discuss actions that State regulators and practitioners can take to identify perceived or actual regulatory challenges or impediments that may be hindering the development of a thorough and comprehensive LNAPL Conceptual Site Model (LCSM)
- To recognize and address the challenges that can lead to defensible, technically appropriate, and cost effective risk management decisions for all involved stakeholders

LNAPL Regulatory Challenges

- Both the 2008 and 2017 surveys indicated that implementing agencies face regulatory challenges when managing, evaluating, or remediating LNAPL sites.
- Implementing agency may assume that any selected removal strategy will be long and costly.
- Assumption could have a detrimental impact on the assessment and remediation decision.
- Cost-effective or risk-appropriate decision, consistent within the regulatory constraints, may be made if there is sufficient or increased understanding of the site and LNAPL concerns.

LNAPL Regulatory Challenges

Themes encountered in LNAPL survey

- Lack of Familiarity and Understanding of LNAPL Subsurface Behavior
- Undefined Strategies or Objective-Based LNAPL Characterization
- Lack of Familiarity with Nontraditional LNAPL Characterization Methods
- Establishing Appropriate Remedial Goals and Determining Remediation Objectives
- Differentiating Between Residual, Mobile, and Migrating LNAPL
- Transitioning between Technologies

Lack of Familiarity and Understanding of LNAPL Subsurface Behavior



The 2017 updated LNAPL survey responses indicated that:

- Over half of the regulatory staff had less than 10 years of experience dealing with LNAPL sites.
- The majority of the responses indicated no formal internal LNAPL training.
- 2,000+ participants have attended classroom training. 17,000+ have participated in IBT.
- 77% indicated that their program uses the 2009 LNAPL guidance
- 20% indicated that there have been changes/updates in their program since original ITRC guidance.

Undefined Strategies or Objective-Based LNAPL Characterization



- Standard practice has been to include general remediation objectives in the CSM.
- These objectives / strategies may be defined by regulatory or guidance procedures utilized by the implementing agencies.
- 2008 - Risk-based approaches to define LNAPL remediation objectives were not considered by many
- 2017 - 31 programs define when active recovery of LNAPL is no longer required, only half of the respondents indicated that their specific programs define when a site with remaining LNAPL can be issued a no further action/case closure/site completion letter.

Undefined Strategies or Objective-Based LNAPL Characterization

- Many commented that site goals and objectives were selected on a *case-by-case* basis. Flexibility? Unresolved or inadequately defined?
- Need to develop/select SMART remediation objectives
 - **S**pecific
 - **M**easurable
 - **A**ttainable
 - **R**elevant
 - **T**imely
- 2011 ITRC Integrated DNAPL Site Strategy guidance

Lack of Familiarity with Nontraditional LNAPL Characterization Methods



- Regulators are accustomed to traditional investigative methods (e.g., borings and monitoring wells)
- Some methods are incorporated into state regulations or reimbursement criteria
- Surveys indicated that new methods were not proposed by the consultant/owner
- Survey indicated that when non-traditional methods were used, not always “successful”

Lack of Familiarity with Nontraditional LNAPL Characterization Methods



- This may be inexperience with the case managers or an insufficient LCSM.
- The use of non-traditional methods can provide useful, higher resolution information that provides an improved understanding of LNAPL distribution.
- Discussion of non-traditional methods or tools can be found in 2015 ITRC Integrated DNAPL Site Characterization and Tools Selection guidance
- Upcoming ITRC Advanced Site Characterization Tools guidance will be available in 2020.

Establishing Appropriate Goals and Determining Remediation Objectives



- Promotes consistency and allows the regulated community to understand what is expected or required for LNAPL investigations.
- Most decisions regarding remedial goals and remediation objectives are driven by thickness and contaminant concentrations.
- The 2017 regulator survey responses indicated that:
 - 24 state programs define MEP
 - 19 programs use total petroleum hydrocarbon (TPH) toxicity / screening values as an indicator of LNAPL
 - 23 programs evaluate individual constituents for analytical compliance.

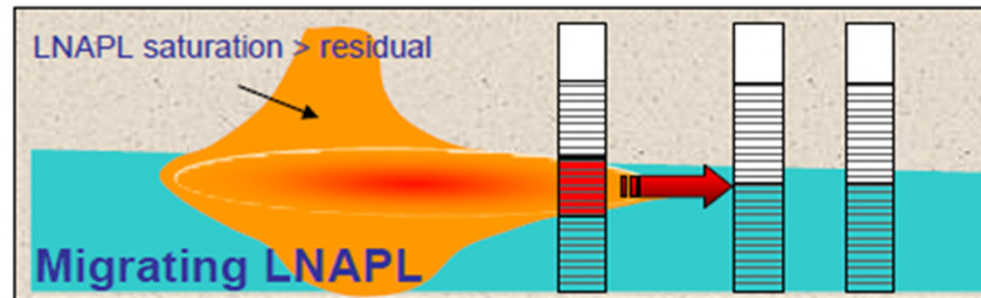
Establishing Appropriate Goals and Determining Remediation Objectives



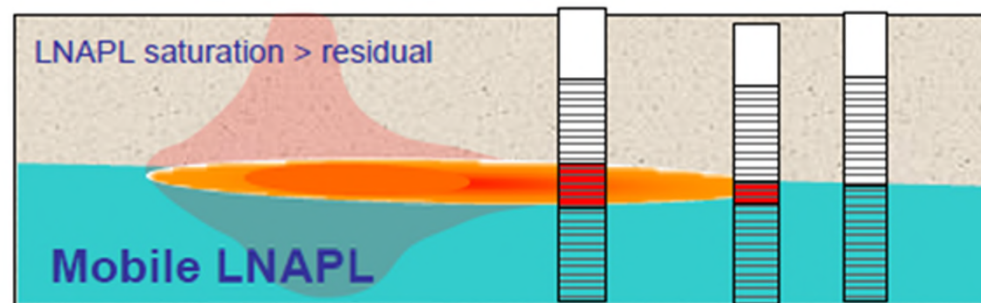
- Thickness or concentration may not provide a basis for defining the point when cleanup objective is achieved
- Can be improved by considering contaminant mass discharge and mass flux. These estimates can help understand the role or influence of natural attenuation and the risks to receptors
- The estimates can also help prioritize which sites need further characterization and remediation
- A discussion of mass discharge and flux can be found in the April 2010 ITRC Use and Measurement of Mass Flux and Mass Discharge guidance (ITRC 2010)

Differentiating Between Residual, Mobile, and Migrating LNAPL

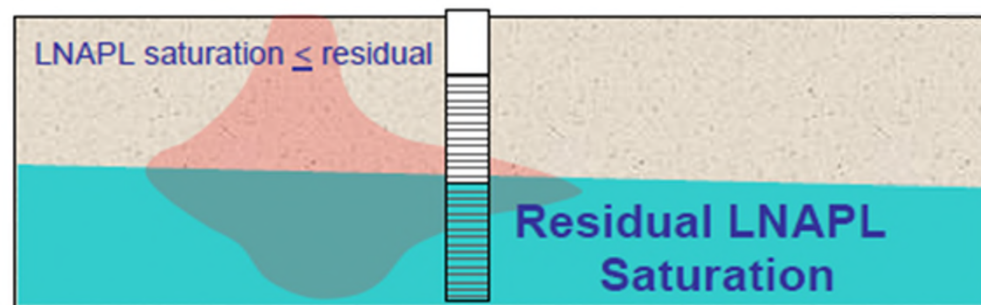
Migrating



Mobile



Residual



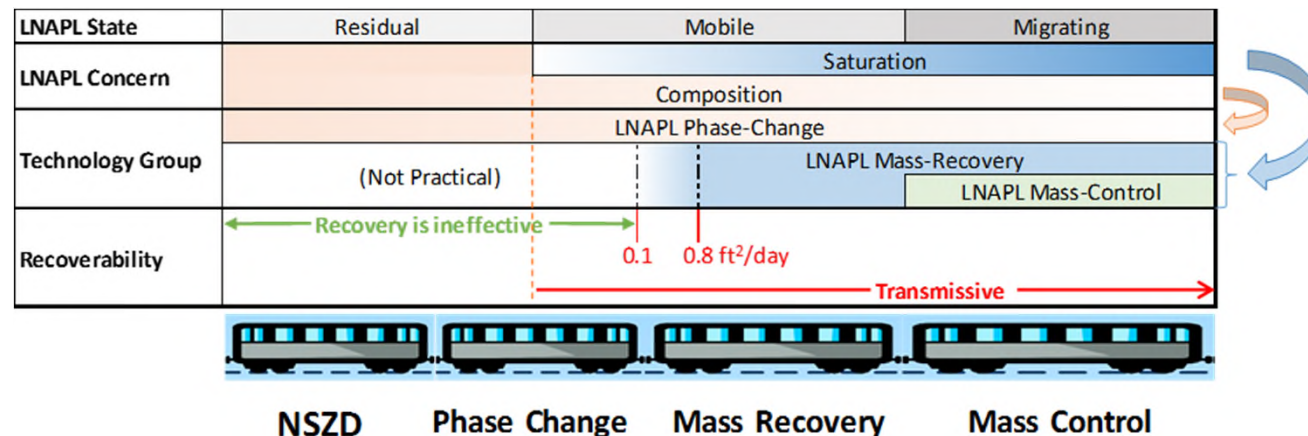
Differentiating Between Residual, Mobile, and Migrating LNAPL



- The 2017 survey indicated that only 13 programs have defined these terms
- To establish appropriate cleanup objectives, it is important to understand the differences between residual, mobile, and migrating LNAPL
- New ITRC LNAPL Guidance discusses the differences and provides tools (e.g., LNAPL transmissivity) and suggestions in understanding the importance of establishing realistic and achievable objectives.

Transitioning between Technologies

- Multiple technologies or “treatment trains” may be necessary in order to effectively control, recover, or conduct a phase change of the LNAPL mass.
- Important to recognize and address this “transition” from one technology or strategy to the next in order to address the LNAPL and the identified risks and concerns effectively.



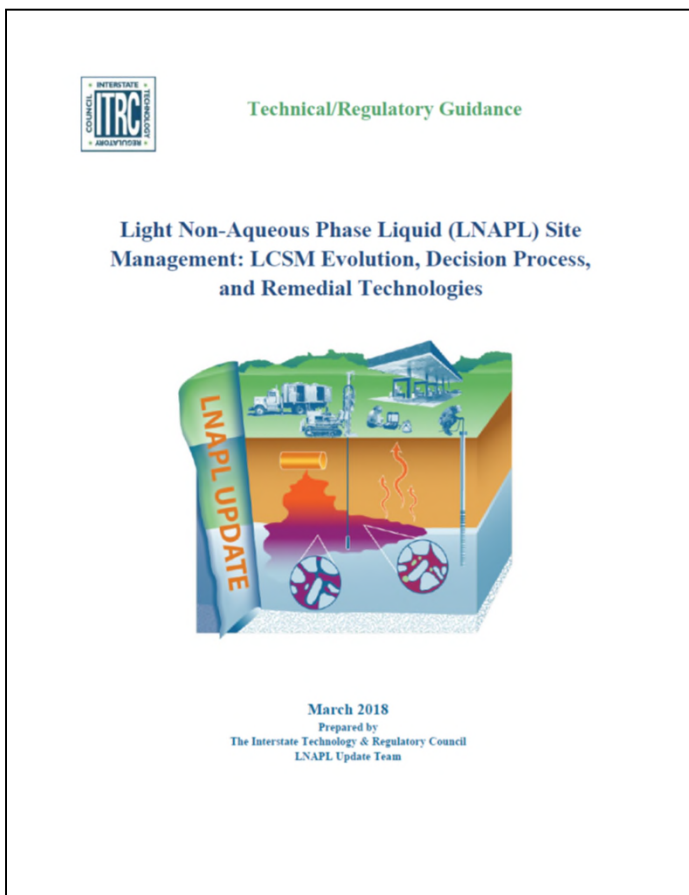
Transitioning between Technologies

- This should include the transition from an active technology driven strategy to the next, and perhaps final, less active strategy.
- May include identification and measurement of Natural Source Zone Depletion (NSZD) rates, moving the site into Monitored Natural Attenuation (MNA), establishing institutional controls, or even approving case closure.
- Can promote consistent remedial progress and navigation through the regulatory process as the site moves through investigation, cleanup, and beyond.

Transitioning between Technologies

- Allows identification of relevant permits, technical reviews, and approvals that may be required as the site transitions from one technology to the next.
- Describing the transition process and metrics can provide financial efficiencies and assist with the budgeting process.
- Identifying relevant objectives and concerns during transitions promotes understanding and support from stakeholders.
- New ITRC LNAPL Guidance discusses treatment trains and transitioning.

Questions? Comments? Complaints?



Upcoming Online Training:

Connecting the Science to Managing LNAPL Sites – 3-Part Series

- October 30 - Part 1: Understanding LNAPL Behavior in the Subsurface
- November 6 - Part 2: LNAPL Conceptual Site Models and the LNAPL Decision Process
- November 13 - Part 3: Using LNAPL Science, the LCSM, and LNAPL Goals to Select an LNAPL Remedial Technology

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