

# Evaluating the Practicality of LNAPL Recovery

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# When is it necessary to recover LNAPL?

- ▶ Explosive vapors
- ▶ Expanding LNAPL or dissolved phase plume
- ▶ Threat to an underground utility or structure
- ▶ Surface water impact



LNAPL – light nonaqueous phase liquid  
(i.e. oil, gasoline)

# Federal Regulation

- ▶ 40 CFR 280.64 – owners and operators of USTs must remove free product to the “*maximum extent practicable*”...as determined by the implementing agency



# LNAPL Closure Requirements

Texas/Louisiana



Risk-Based Approach

New Mexico



$\leq 1/8$  inch

No "floating oil"

Oklahoma



Risk-Based

No "measurable product"

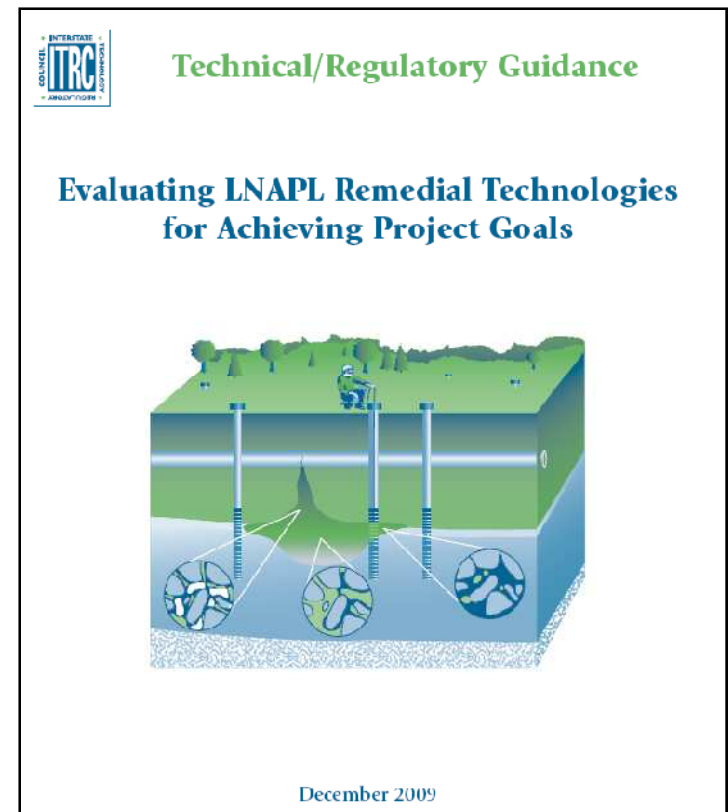
Colorado



To the extent practical

# Remedial Technology Evaluation

- ▶ ITRC Guidance provides a tool for screening remedial technologies
  - **Site setting**
  - **Geological information**
  - **LNAPL properties**
  - **LNAPL distribution**
  - **LNAPL recoverability information**
  - **LNAPL mobility and stability**
  - **Identified remedial objective**



# Remedial Alternatives

- ▶ Excavation
- ▶ Liquid recovery (single & dual phase)
- ▶ Vapor recovery
- ▶ Air sparging
- ▶ Insitu treatment (i.e. soil mixing, chemical oxidation, soil flushing)
- ▶ Natural Source Zone Depletion (i.e. MNA)

# Example Site Conditions

- ▶ Highly volatile LNAPL
- ▶ High hydraulic conductivity
- ▶ Thick vadose zone



SVE  
and/or  
Soil venting

- ▶ Crude oil in shallow subsurface
- ▶ Surface water seepage
- ▶ Low hydraulic conductivity



Hydraulic recovery  
and/or  
Excavation

# Remedial Alternatives





# Limiting Site Conditions

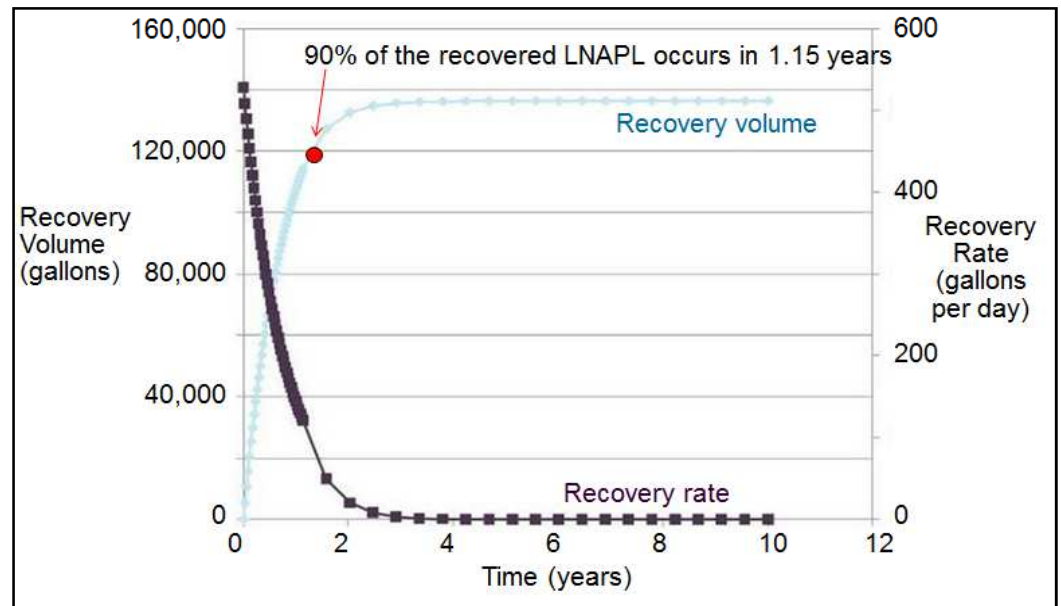
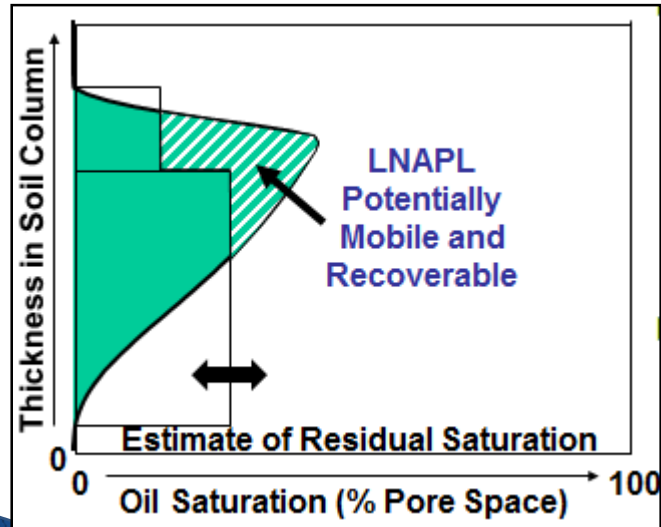
Deep contamination	Limits: Excavation, Insitu treatment
Equipment obstructions	Limits: Recovery systems, Insitu treatment
Limited radius of influence	Limits: Vapor and Hydraulic recovery systems
Low residual saturation	Limits: Vapor and Hydraulic recovery systems
Lack of vadose zone	Limits: Vapor recovery

# Reasonable Remedial Objectives

- ▶ Prevention of plume spreading
- ▶ Protection of receptors
- ▶ Reduce plume longevity
- ▶ Recovery to extent practical

# Evaluation Criteria

- ▶ Stable plume footprint
- ▶ Verifying the absence of receptors
- ▶ Recover trends
- ▶ Transmissivity

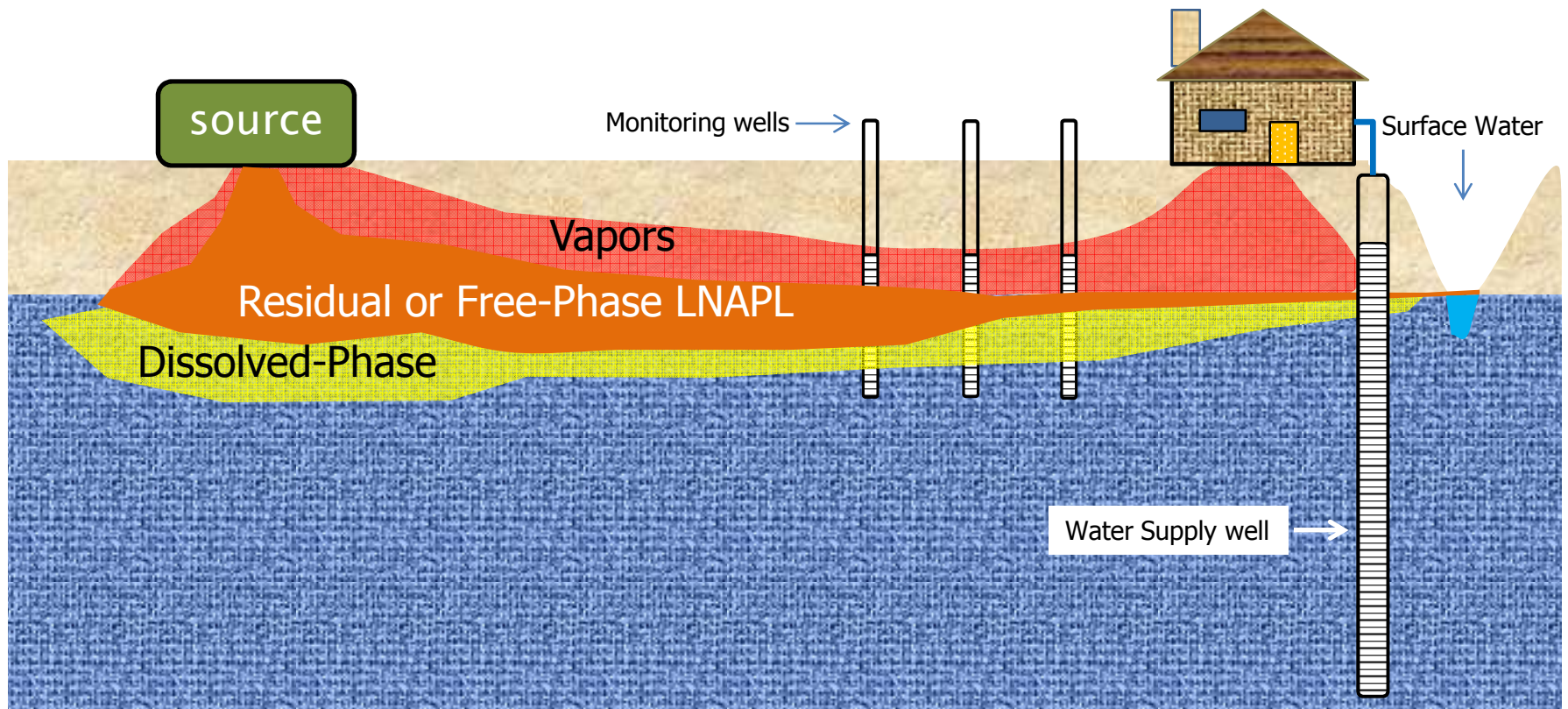


ITRC 2009 Training

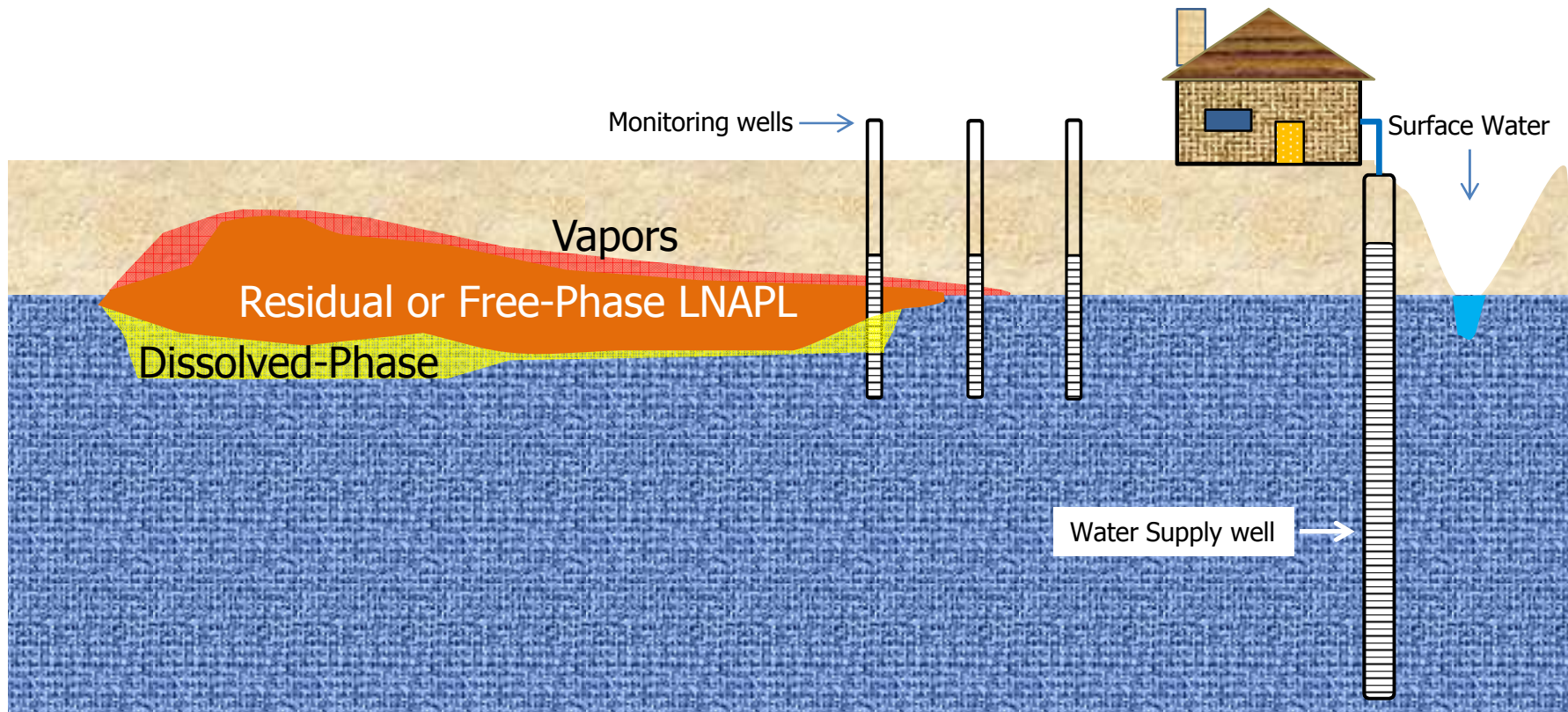
# When is it potentially unnecessary to recover LNAPL?

- ▶ Already recovered to the extent practical
- ▶ When only residual saturation exists
- ▶ No receptors at risk (vapors/water wells/surface water)
- ▶ Stable plume
- ▶ No ongoing sources
- ▶ When institutional controls are possible

# When it might be necessary to recover LNAPL...



# When it might not be necessary to recover LNAPL...

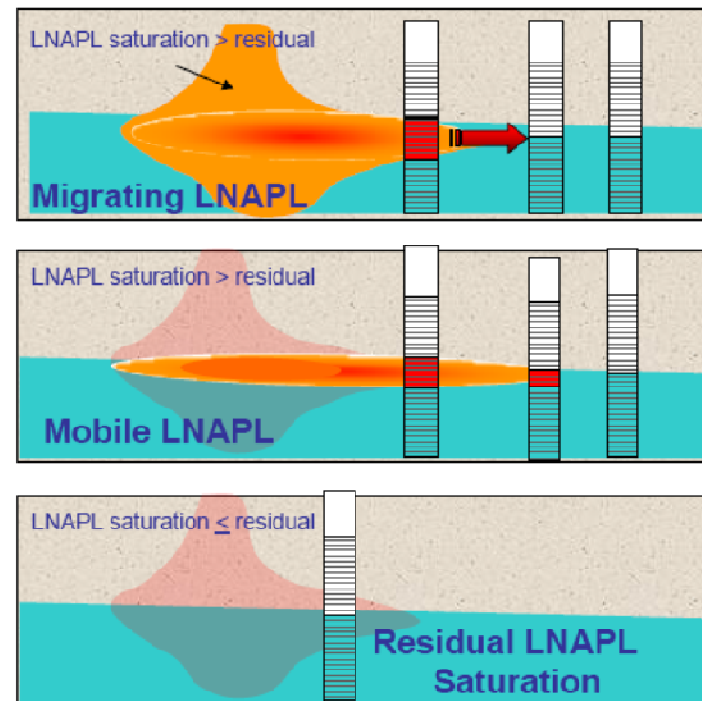


# Thoughts from EPA

- ▶ Applicability of potential remedial technologies depends on site-specific hydrogeologic characteristics, nature and distribution of contaminants, **and remedial objectives**.
- ▶ Technologies for removal of mobile LNAPL exist and may be applicable at **some sites**.
- ▶ Subsurface restoration to precontamination conditions may require removal of **virtually all LNAPL** and much of the contamination sorbed to aquifer material. Technological limitations to complete LNAPL removal may exist at many **sites**. (EPA Ground Water Issue - EPA/540/S-95/500, 1995)

# Important Considerations

- ▶ No LNAPL source = No LNAPL spread (ITRC 2009)
- ▶ Most remedial technologies leave residual product in place (except excavation)



ITRC – Remedial Technologies Evaluation 2009

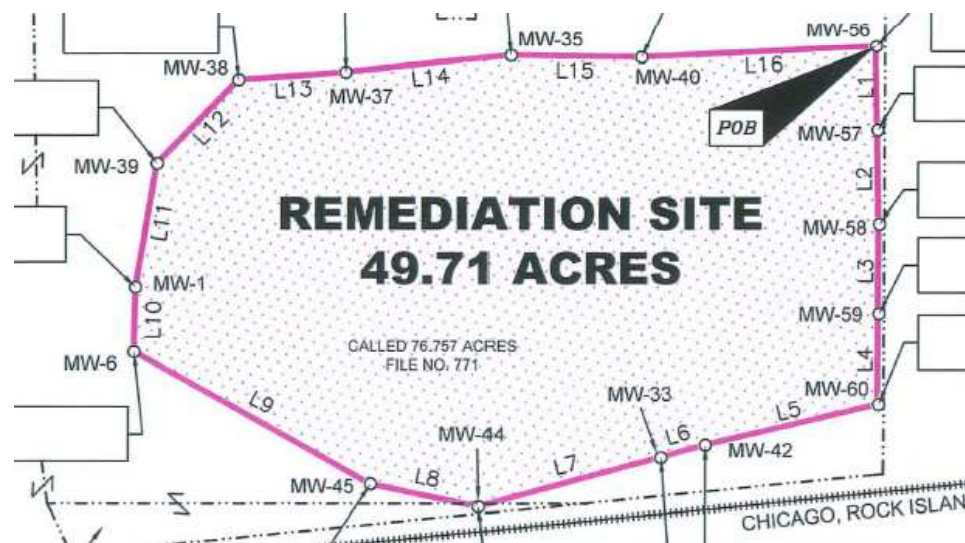


# Important Considerations

- ▶ Dissolved hydrocarbon plume growth is typically restricted by natural attenuation
- ▶ Deed restriction can prohibit water well use (i.e. institutional control)



Dilution, Sorption,  
Volatilization, Microbial  
degradation



# Conclusions

- ▶ Site-specific conditions influence options
- ▶ Regulations provide structure and options
- ▶ Receptors can be protected by LNAPL removal or LNAPL control
- ▶ Implementation of institutional controls is frequently necessary

**It may or may not be necessary to remove LNAPL to protect receptors.**

# QUESTIONS?

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