



2021 RECAP Training Series

Webinar will begin at 9:00a

Upcoming Trainings

June 8, 2021 Webinar No. 1: Soil Sampling Best Practices – Keith Horn

July 13, 2021 Webinar No. 2: RECAP 101 Back to Basics – June Sutherlin

**August 10, 2021 Webinar No. 3: Developing an Effective Sampling Plan
– Keith Horn**

Sept. 14, 2021 Webinar No. 4: The Ins and Outs of the VRP – Jennifer Schatzle

**Oct. 12, 2021 Webinar No. 5: Common Mistakes, Misconceptions &
Compliance Issues – June Sutherlin**

Recording & PowerPoint will be available after webinar:

www.youtube.com/c/LouisianaDepartmentofEnvironmentalQuality/playlists

Course Credit / Certificates of Attendance

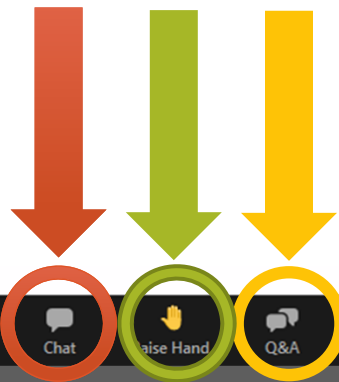
- ▶ Attend the majority of the webinar
- ▶ Answer poll questions
- ▶ LDEQ Folks: Information will be sent to Jared to apply credit
- ▶ Non-LDEQ Folks: Request Certificate



You are viewing Rebecca Otte's screen

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Chat



Raise Hand



Q&A

Leave

Poll Question No. 1:

What's your experience with RECAP?

- Brand new - just starting to learn about it
- Have limited experience/ knowledge
- Have some experience/ knowledge
- Have a good amount of experience/ knowledge

Today's Speaker

▶ Dr. June Sutherlin

RECAP 101



LDEQ's RECAP

RECAP is a consistent decision-making process for the assessment of, and the response to, environmental contamination that is based on the protection of human health and the environment.

Use of LDEQ's RECAP

- No Further Action at this time determination
 - Source as been removed or mitigated
 - Site does not pose a risk (< RECAP Standards)
 - Property remains suitable for commerce and future use
 - Financial assurance is provided when warranted
- Certification of Completion
 - Voluntary Remedial Program

Use of LDEQ's RECAP

- Corrective Action Plan approval
 - Demonstrate proposed corrective measures will be protective
 - RECAP standards will be achieved within an acceptable timeframe

- Approval of a Closure Plan for a Waste Management Unit
 - Proposed corrective measure will be protective
 - All waste, waste residues, and containment systems components removed
 - Residual COC concentrations are less than RS

*RECAP is not applicable to waste materials

Overview of LDEQ's RECAP

- Based on EPA's national health risk assessment principles/methods
- RBCA Tiered framework
 - Screening Option (SO)
 - Management Option 1 (MO-1)
 - Management Option 2 (MO-2)
 - Management Option 3 (MO-3)

Screening Option

- ▶ Soil and groundwater
 - ▶ Non-industrial and industrial/commercial land use
 - ▶ Generic; conservative default assumptions
 - ▶ Screening Standards Table 1
- SO serves as a conservative screening step to identify chemicals and media requiring further assessment

Management Option 1

- ▶ Soil and groundwater
- ▶ Non-industrial and industrial/commercial land use
- ▶ Allows for the incorporation certain site-specific data
- ▶ MO-1 RECAP Standards are in Tables 2 and 3

Management Option 2

- ▶ Soil and groundwater
- ▶ Non-industrial and industrial/commercial land use
- ▶ Allows for the incorporation of site-specific fate and transport soil properties
- ▶ Allows for the use of most current toxicity values
- ▶ MO-2 RECAP Standards are calculated by the submitter in accordance with Appendix H/spreadsheet

<https://www.deq.louisiana.gov/page/recap>

Management Option 3

- ▶ All media (soil, groundwater, sediment, biota, etc.)
- ▶ All land uses
- ▶ Allows for the assessment of complex fate and transport and exposure pathways
- ▶ Allows for the incorporation of site-specific fate and transport data and site-specific exposure data
- ▶ Allows for the use of the most current toxicity values, default exposure parameters, and risk assessment method/protocols
- ▶ Appendix H



SOIL

Soil

- ▶ **Surface soil 0-15' bgs**
 - Direct contact exposure
 - Soil leaching to groundwater
 - Potential for free product
- ▶ **Subsurface soil > 15' bgs**
 - Soil leaching to groundwater
 - Potential for free product
- ▶ Soil ≠ Sediment
- ▶ Soil ≠ Wastes (e.g., pond sludge/sediment)
- ▶ Soil ≠ Other solid media

Land Use - Soil Exposure

Why is land use important?

- ▶ Land use determines exposure potential
 - The greater the exposure potential, the lower the risk-based standard
- ▶ **Non-industrial Land Use**
 - Residential exposure
 - ↑ exposure frequency/duration; child receptor
 - Recreational, trespasser, etc
- ▶ **Industrial/Commercial Land Use**
 - Worker exposure
 - Conveyance Notice
- ▶ Land use
 - North American Industry Classification System (NAICS)
 - RECAP Section 2.9 and Appendix E

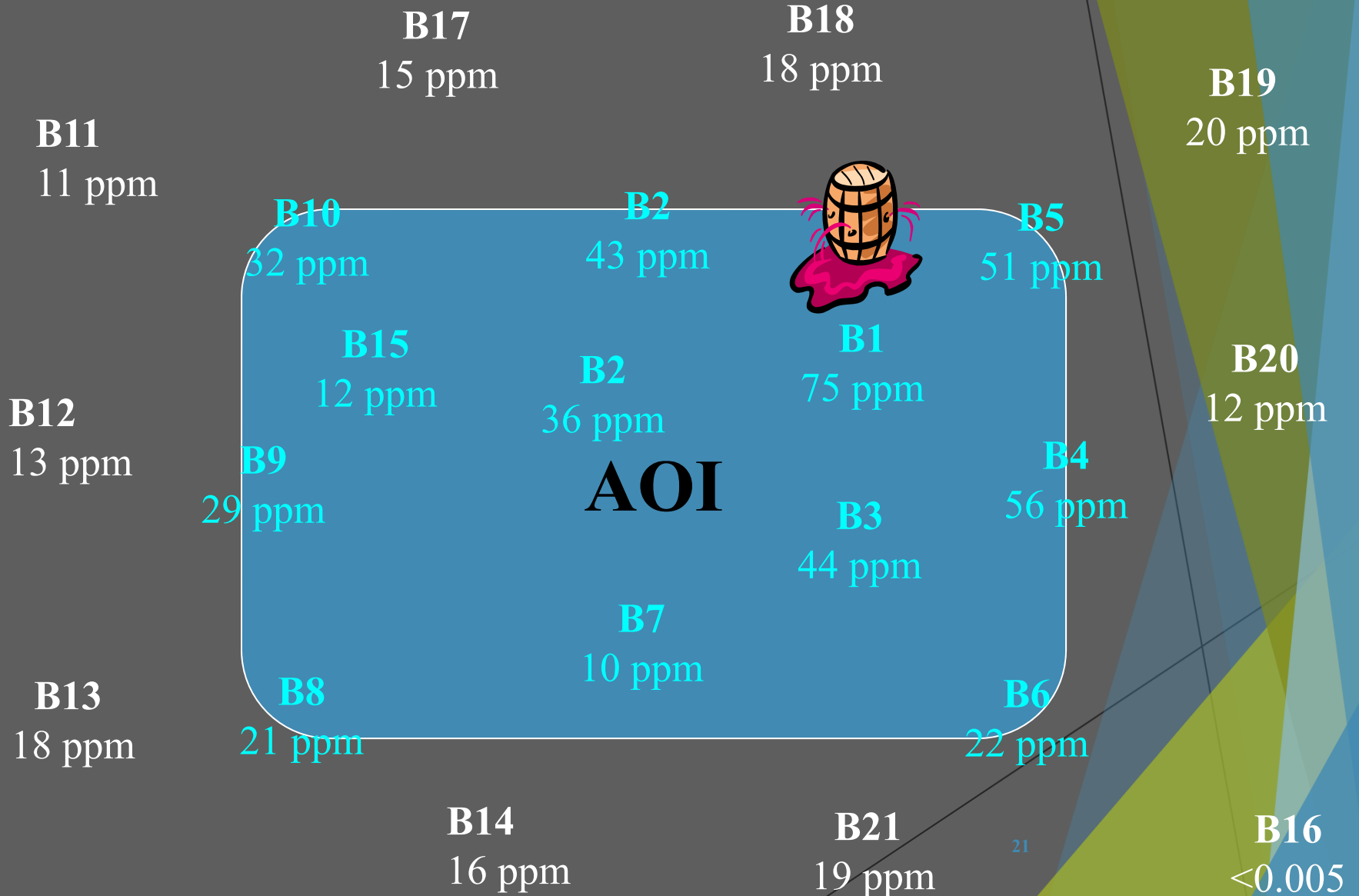
Land Use

- Current and future land use should be considered
- If land is undeveloped/future use is not known:
 - Zoning/development plans
 - Surrounding land use
 - Assume non-industrial
- ▶ **Change in land use**
 - May change exposure potential: EF/ED, exposure pathways, receptors
 - May warrant additional site evaluation, investigation, and remediation
 - Almost always changes AOI and AOIC

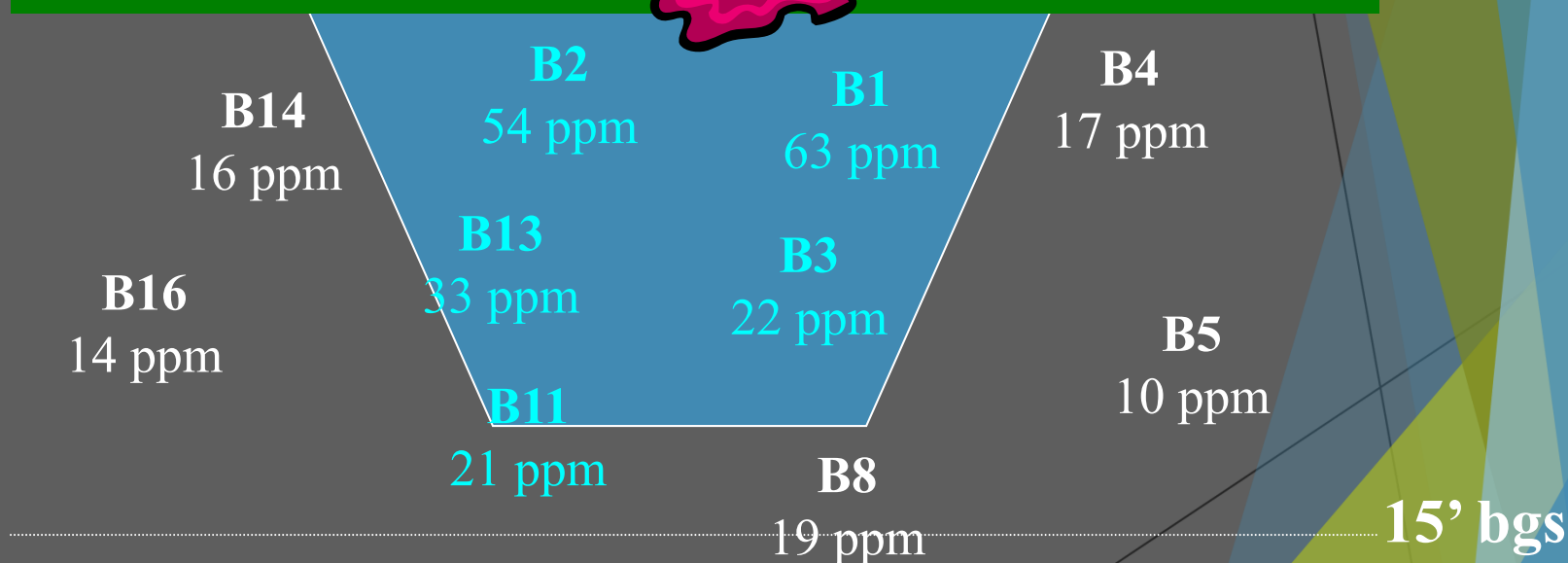
RECAP: Soil Evaluation Area of Investigation (AOI)

The **AOI** is the zone contiguous to, and including, impacted media defined vertically and horizontally by the presence of one or more constituents in concentrations that exceed the limiting standard applicable for the option being implemented.

Identification of the AOI: LRS = 20 ppm



Soil Identification of the AOI



Soil AOI Concentration (AOIC)

- ▶ *Area of investigation concentration (AOIC)* -the concentration of the COC in the environmental or biological medium to which the receptor is exposed or may be exposed in the future; and/or the concentration of the COC in an environmental medium that may serve as a source for constituent transport and/or transfer to another environmental medium.
- ▶ The purpose is to focus the RECAP assessment on the portion of the release site that is most likely to pose a potential risk to human health or the environment.
- ▶ Concept of an AOI was created to provide clear guidance on which data points should be included in the calculation of the AOI
- ▶ If a significant number of data points beyond the borders of the release site (< SS or ND) are included in the calculation of the AOIC, there will be dilution (statistically) of the areas with higher COC concentrations possibly leading to portions of the release site not being adequately remediated
- ▶ Key component of soil RECAP assessment

Area of Investigation - Why 95%UCL-AM?

- ▶ For risk assessment, the soil concentration term (AOIC) is an estimate of the arithmetic average concentration for a contaminant based on a set of sampling results
- ▶ Because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent upper confidence limit (UCL) of the arithmetic mean is used
- ▶ The 95%UCL-AM provides reasonable confidence that the true site (AOI) average will not be underestimated

AOI = “Exposure Area”
AOIC = “Exposure Concentration”

- ▶ An average concentration is used because:
 - 1) Toxicity criteria are based on lifetime average exposures; and,
 - 2) Average concentration is most representative of the concentration that would be contacted at a site (AOI) over time
- ▶ The use of an average (95%UCL-AM) concentration assumes that an exposed individual moves randomly across an exposure area (i.e., equal time is spent in different parts of the area)
- ▶ Therefore, the average concentration contacted over time equals the spatially averaged concentration over the exposure area (AOI)

For the purpose of assessing health risks under RECAP:

- ✓ AOI = exposure area
- ✓ AOIC = exposure concentration

Soil AOI Concentration (AOIC)

- ▶ **SO**: Maximum concentration obtained in the most heavily impacted area
- ▶ **MO-1, MO-2, MO-3**: 95%UCL-AM concentration
- ▶ 95%UCL-AM concentration
 - How is it calculated?
 - ✓ 95%UCL-AM: EPA ProUCL software
 - ✓ <https://www.epa.gov/land-research/proucl-software>
 - ✓ Based on all data points on or within the AOI
 - ✓ Includes ND on or within the AOI
 - ✓ Does not include data points outside the AOI

Soil AOIC 95%UCL-AM

RECAP submittal should:

- Identify the standards used to delineate the AOI
- Illustrate the boundaries of the AOI in a figure
- Include ProUCL input and output data sheets
- Identify the value used as the soil AOIC for comparison to RS

AOI and AOIC

- ▶ Assume the property as a whole is the AOI - **NO!**
- ▶ Divide the property into AOIs based on historical/former uses of the property - **NO!**
- ▶ Identify the AOI using a LSS or LRS? **YES!**
- ▶ If land use changes and the original AOI is being subdivided into smaller developments, re-evaluate the AOIC(s) based on new exposure areas; evaluate new AOICs
- ▶ If land use changes and redevelopment will result in soil removal, movement, etc consider these changes in relation to the AOI and AOIC

Poll Question No. 2:

Which of the following land use considerations are correct (select all that apply):

- Land use determines exposure potential: The greater the exposure potential, the lower the risk-based standard.
- Current and future land use should be considered.
- Change in land use may change exposure potential: EF/ED, exposure pathways, receptors and may warrant additional site evaluation, investigation, and remediation.

Soil RECAP Standards

Soil RECAP Standards

▶ Risk-based standards

- Soil_{ni} protective of non-industrial land use
- Soil_{i} protective of industrial or commercial land use
- Soil_{es} protective of soil vapors to enclosed structure (indoor air) pathway

▶ Environmental fate and transport standards

- Soil_{GW1} soil level protective of GW1 zone
- Soil_{GW2} soil level protective of GW2 zone
- $\text{Soil}_{\text{GW3DW}}$ soil level protective of GW3 zone
- $\text{Soil}_{\text{GW3NDW}}$ soil level protective of GW3 zone

▶ Standards protective of aesthetics

- Soil_{sat} soil saturation/prevention of free product

▶ Limiting RECAP Standard

RECAP Soil Standards

▶ Quantitation limits

- If $RS < QL$, then default to QL
- QL subject to Dept approval

▶ Ceiling values

- TPH - 10,000 ppm

▶ Background levels

- State background level for arsenic in soil
- If $LRS < BG$, establish site-specific background
- Metals, dioxins, PAHs, other ubiquitous COC
- Comply with Section 2.13

Background Concentrations

Site-Specific Background samples:

- ▶ Discrete soil samples collected in the vicinity of the AOI
- ▶ Not collected in impacted areas
- ▶ Share the same basic characteristics as the medium of concern
- ▶ Must be approved by the Department
- ▶ Literature values typically unacceptable
- ▶ Some exceptions - USGS 2013 Background Study; Mielke and Wang studies - New Orleans, etc

Background Concentrations

How to calculate a site-specific background concentration?

- ▶ If ≤ 7 background data points \rightarrow calculate arithmetic average concentration to represent background
- ▶ If > 8 background data points \rightarrow calculate the arithmetic average + 1SD to represent background

Background Concentrations

How can background data be incorporated into the RECAP assessment?

- ▶ If the limiting RS < site-specific background concentration, then background concentration may be used as the LRS
- ▶ Compare to arithmetic average concentration for AOI to the site-specific background concentration
- ▶ Background concentrations applied at an AOI are subject to Dept approval
- ▶ Refer to RECAP Section 2.13 for additional guidance on site-specific background

GROUNDWATER

The background features a large, solid grey trapezoidal shape on the left side. To its right, there are several overlapping, semi-transparent geometric shapes in various shades of blue, green, and teal, creating a layered, abstract effect. The overall composition is clean and modern.

Groundwater

- ▶ Groundwater is classified based on:
 - Aquifer yield
 - Groundwater quality
 - Current and potential use
- ▶ 3 Groundwater classifications:
 - Groundwater Classification 1
 - Groundwater Classification 2
 - Groundwater Classification 3

Groundwater Classification 1

Groundwater Classification 1: public water supply

→ Yield \geq 4,800 gal/d

and

→ TDS \leq 1,000 mg/l

Class 1A: current public water supply

Class 1B: potential public water supply

Groundwater Classification 2

Groundwater Classification 2: domestic water supply

→ Yield \geq 800 gal/d but $<$ 4,800 gal/d

and

→ TDS \leq 10,000 mg/l

Class 2A: current domestic water supply

Class 2B: potential domestic water supply (TDS $<$ 1,000)

Class 2C: potential domestic water supply (TDS $>$ 1000 but \leq 10,000)

*If a public water supply well is located within one mile of the AOI property boundaries and is screened in the same stratum as the aquifer of concern or has a direct hydraulic connection, then the aquifer shall be classified as a Groundwater Classification 1 aquifer.

Groundwater Classification 3

Groundwater Classification 3:

Not a potential public or domestic water supply

→ Yield < 800 gal/d

or

→ TDS > 10,000 mg/l

*If a domestic or agricultural water supply well is located within one mile of the AOI property boundaries and is screened in the same stratum as the aquifer of concern or has a direct hydraulic connection, then the aquifer shall be classified as a Groundwater Classification 2 aquifer.

Groundwater Classification 3

- ▶ Groundwater 3 is further classified based on the designated use of the POE/downgradient surface water body
- ▶ If nearest downgradient surface water body is designated as drinking water source → GW_{3DW}
- ▶ If nearest downgradient surface water body is NOT designated as drinking water source → GW_{3NDW}
- ▶ How to determine if GW_{3DW} or GW_{3NDW} ?
 1. Determine groundwater flow direction
 2. Identify nearest downgradient surface water body (POE)
 3. Refer to LAC 33:IX §1123, Table 3 for designated use

LAC 33:IX §1123, Table 3

Table 3. Numerical Criteria and Designated Uses									
A-Primary Contact Recreation; B-Secondary Contact Recreation; C-Fish And Wildlife Propagation; L-Limited Aquatic Life and Wildlife Use; D-Drinking Water Supply; E-Oyster Propagation; F-Agriculture; G-Outstanding Natural Resource Waters									
Code	Stream Description	Designated Uses	Numerical Criteria						
			CL	SO ₄	DO	pH	BAC	°C	TDS
Atchafalaya River Basin (01)									
010101	Atchafalaya River Headwaters and Floodplain—From Old River Control Structure to Simmesport; includes Old River Diversion Channel, Lower Red River, Lower Old River	A B C	65	70	5.0	6.5-8.5	1	33	440
010201	Atchafalaya River Mainstem—From Simmesport to Whiskey Bay Pilot Channel at mile 54	A B C	65	70	5.0	6.5-8.5	1	33	440
010301	West Atchafalaya Basin Floodway—From Simmesport to Butte LaRose Bay and Henderson Lake	A B C	65	70	5.0	6.5-8.5	1	33	440
010401	East Atchafalaya Basin and Morganza Floodway South to I-10 Canal	A B C	65	70	5.0	6.5-8.5	1	33	440
010501	Lower Atchafalaya Basin Floodway—From Whiskey Bay Pilot Channel at mile 54 to US-90 bridge in Morgan City; includes Grand Lake and Six-Mile Lake	A B C D	65	70	5.0	6.5-8.5	1	33	440
010502	Intracoastal Waterway (ICWW)—Morgan City-Port Allen Route from Bayou Sorrel Lock to Morgan City	A B C D	65	70	5.0	6.5-8.5	1	33	440

GW3DW or GW3NDW?

- ▶ If the downgradient surface water body is designated as a drinking water source, the zone is a GW_{3DW}
- ▶ If the downgradient surface water body is not designated as a drinking water source, the zone is a GW_{3NDW}

Groundwater/Aquifer Use

❖ Current Use:

- LDNR Well Survey (1 mi radius/12 mo)
- 500 foot walking receptor survey

❖ Potential Use:

- sustainable yield (Aquifer Tests Appendix F)
- total dissolved solids (EPA Method 160.1; EPA Method 2540)

Groundwater Classification

Groundwater may be classified using information from another site IF:

- ▶ The site is located within 1 mile of the AOI
- ▶ The geological and hydrogeological conditions are similar
- ▶ Boring logs, well completion diagrams, hydrological and hydrogeological data (including aquifer test data and potentiometric surface maps) are available for the site
- ▶ Use of a site groundwater classification from another site is at the discretion of LDEQ and prior approval is required

Groundwater AOI, CC and POC

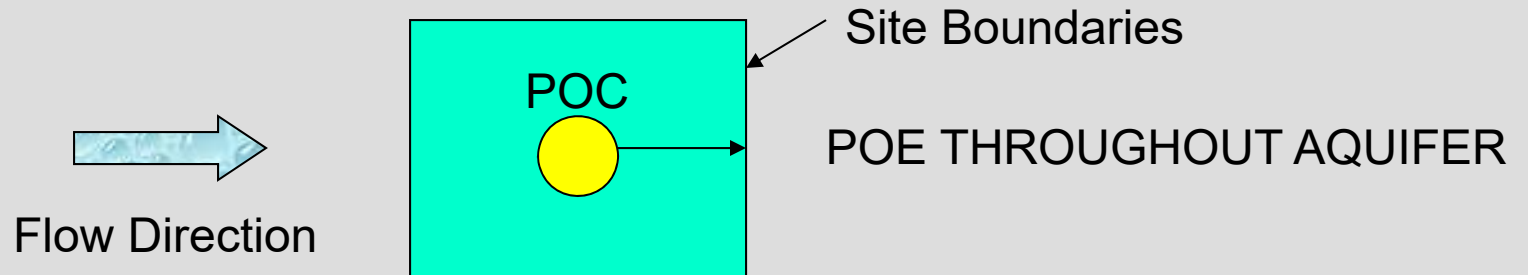
- ▶ The **groundwater AOI** = groundwater plume; delineated horizontally and vertically in same manner as the soil AOI.
- ▶ The **point of compliance (POC)** for groundwater shall be the point in the aquifer where the groundwater RS is enforced and where groundwater monitoring takes place. A sampling location positioned as near to the source as feasible without causing an adverse impact to groundwater at which reproducible and representative samples can be withdrawn shall serve as the POC.
- ▶ **Compliance concentration (CC)** - the COC concentration detected in groundwater at the point of compliance. The **CC** should be represented of the **maximum chemical concentration in groundwater**. This is concentration that is compared to the RS to determine compliance.
- ▶ The location of the **POC** is the same for all 3 groundwater ⁴⁶ classifications

Groundwater POE

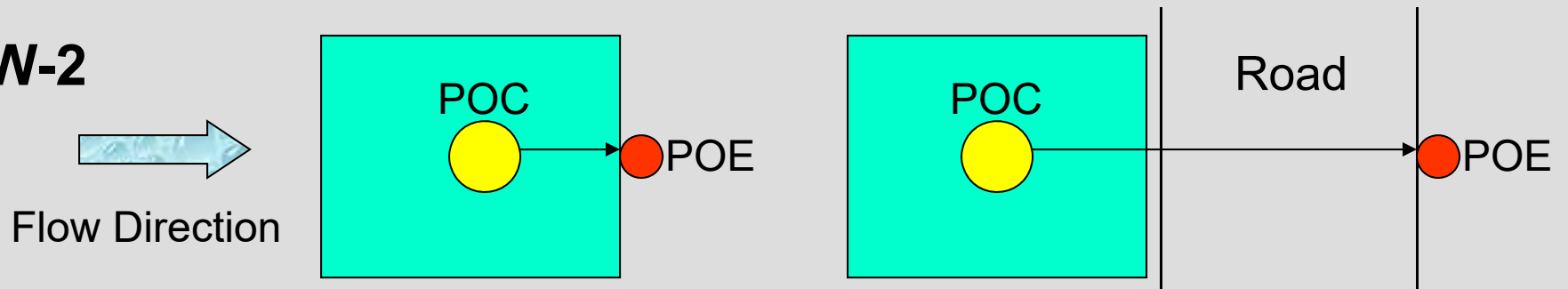
- ▶ The **point of exposure (POE)** for groundwater shall be the point in the aquifer where exposure to groundwater is occurring or may reasonably be expected to occur.
- ▶ **GW1 POE**: assumed to be **throughout the aquifer** to be protected/restored
- ▶ **GW2 POE**: assumed to be at the facility's **property boundary** (nearest to the source and/or downgradient of the source) or the nearest downgradient point off-site that could reasonably be considered for installation of a drinking water well within the aquifer to be protected/restored
- ▶ **GW3 POE**: assumed to be at the potential point of discharge to the nearest downgradient **surface water body** within the aquifer to be protected/restored.

Groundwater Point of Compliance and Point of Exposure

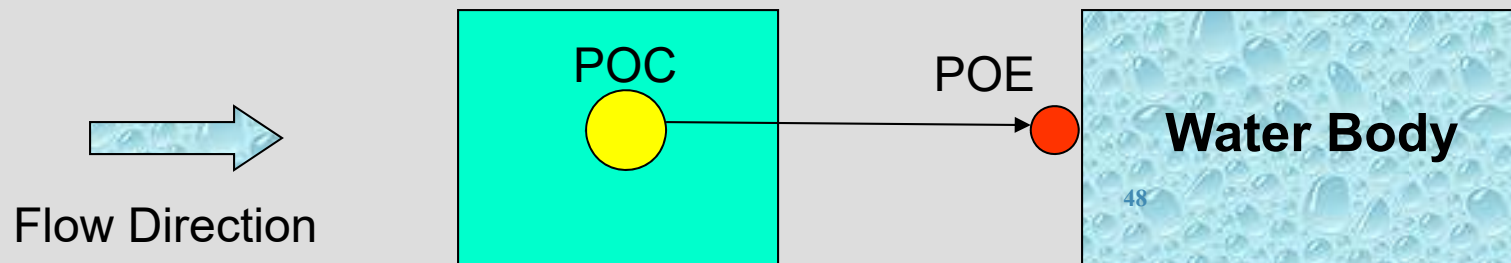
GW-1



GW-2



GW-3



Poll Question No. 3:

Groundwater is classified based on:

- Aquifer yield
- Groundwater quality
- Current and potential use
- All of the Above

Groundwater RECAP Standards

Groundwater RS

▶ Risk-based standards

- GW_1 protective of GW1 zone/drinking water source, MCL or risk-based
- GW_2 protective of GW2 zone/domestic water source, MCL or risk-based
- GW_{air} protective of groundwater vapor to ambient air
- GW_{es} protective of groundwater vapor to enclosed structure (indoor air) pathway

▶ Environmental fate and transport standards

- GW_{3DW} protective of GW3 zone/downgradient surface water body
- GW_{3NDW} protective of GW3 zone/downgradient surface water body

▶ Standard protective of aesthetics

- $Water_{sol}$ water solubility level/prevention of free product

▶ Limiting RECAP Standard

Groundwater RS

▶ Background levels

- Naturally occurring COC such as metals or other inorganics
- Comply with Section 2.13

▶ Quantitation limits

- If $RS < QL$, then default to QL
- QL subject to Dept approval

▶ Ceiling values

- TPH - 10,000 ppm

Groundwater Dilution Factors

Groundwater Dilution Factors

- ▶ Numerical estimation of the reduction in chemical concentration associated with groundwater migration
- ▶ Applicable to groundwater classifications 2 and 3
- ▶ Domenico model
- ▶ How to determine the dilution factor?
 - Determine the distance from the POC to POE
 - Determine the S_d - thickness of the groundwater plume

Estimation of S_d

S_d = Thickness of impacted groundwater within permeable zone

$S_d \neq$ Depth of groundwater below ground surface

$$S_d = 5'$$

5'

Impacted groundwater

Un-impacted groundwater

10'

15'

Estimation of S_d

S_d = Thickness of permeable zone if thickness is not known or if the zone is not impacted

$$S_d = 15'$$

10'

Un-impacted groundwater

15'

Default Domenico Dilution Factors

Appendix H

- ▶ DF2 and DF3 based on:
 - Thickness of the groundwater plume (S_d)
 - Distance from POC to POE

<u>Distance from source (feet)</u>	<u>Longitudinal DF (dimensionless)</u>			
	$S_d \leq 5$ ft	$S_d = 6-10$ ft	$S_d = 11-15$ ft	$S_d = 16-20$ ft
0 - 50	1.5	1	1	1
51 - 100	2.6	1.5	1.2	1.1
101 - 150	4.1	2.1	1.6	1.3
151 - 250	8.4	4.3	3	2.3
251 - 500	29	15	9.8	7.4
501 - 750	63	32	21	16
751 - 1000	111	57	37	28
1001 - 1250	173	86	58	43
1251 - 1500	248	124	83	62
1501 - 1750	337	169	113	84
1751 - 2000	440	220	147	110

Dilution Factors - GW2 Zone - DF2

- Applicable to GW 2 zones
- Accounts for reduction in chemical concentration as groundwater migrates from the source area to the nearest downgradient property boundary
- Applied to GW_2 and $Soil_{GW_2}$ RS

Dilution Factor- GW2 Zone

Dilution factor (DF2)

111 x ↓

GW Source
(POC)



Property boundary
(POE)

GW2 x DF2 =
0.005 x 111 =
0.56 mg/l

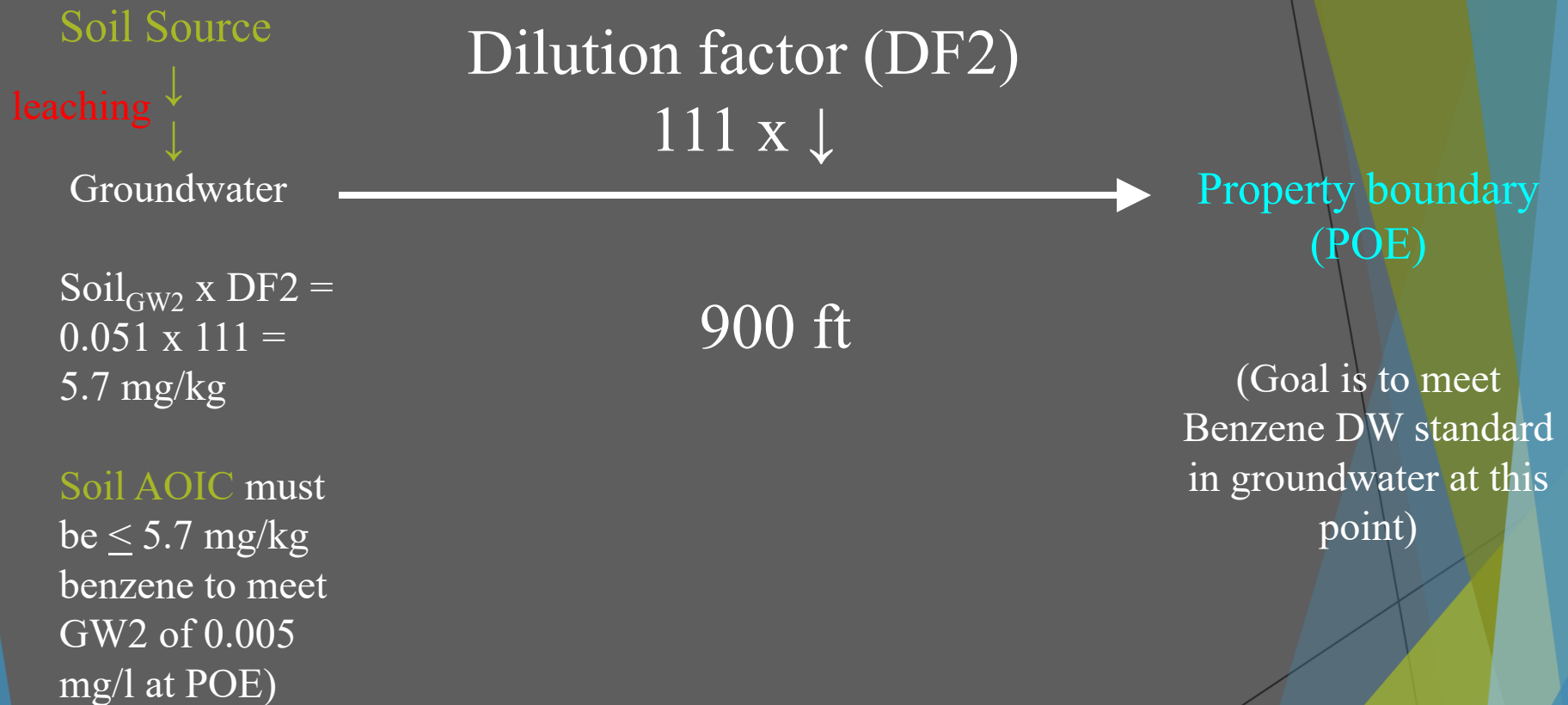
900 ft

(Must meet
DW standard at this
point)

CC at POC
must be \leq
0.56 mg/l
benzene to
meet GW2 of
0.005 mg/l at
POE)

Drinking water
standard (GW2) for
benzene is
0.005 mg/l

Dilution Factor - Soil to GW2 Zone



RECAP Section 2.17

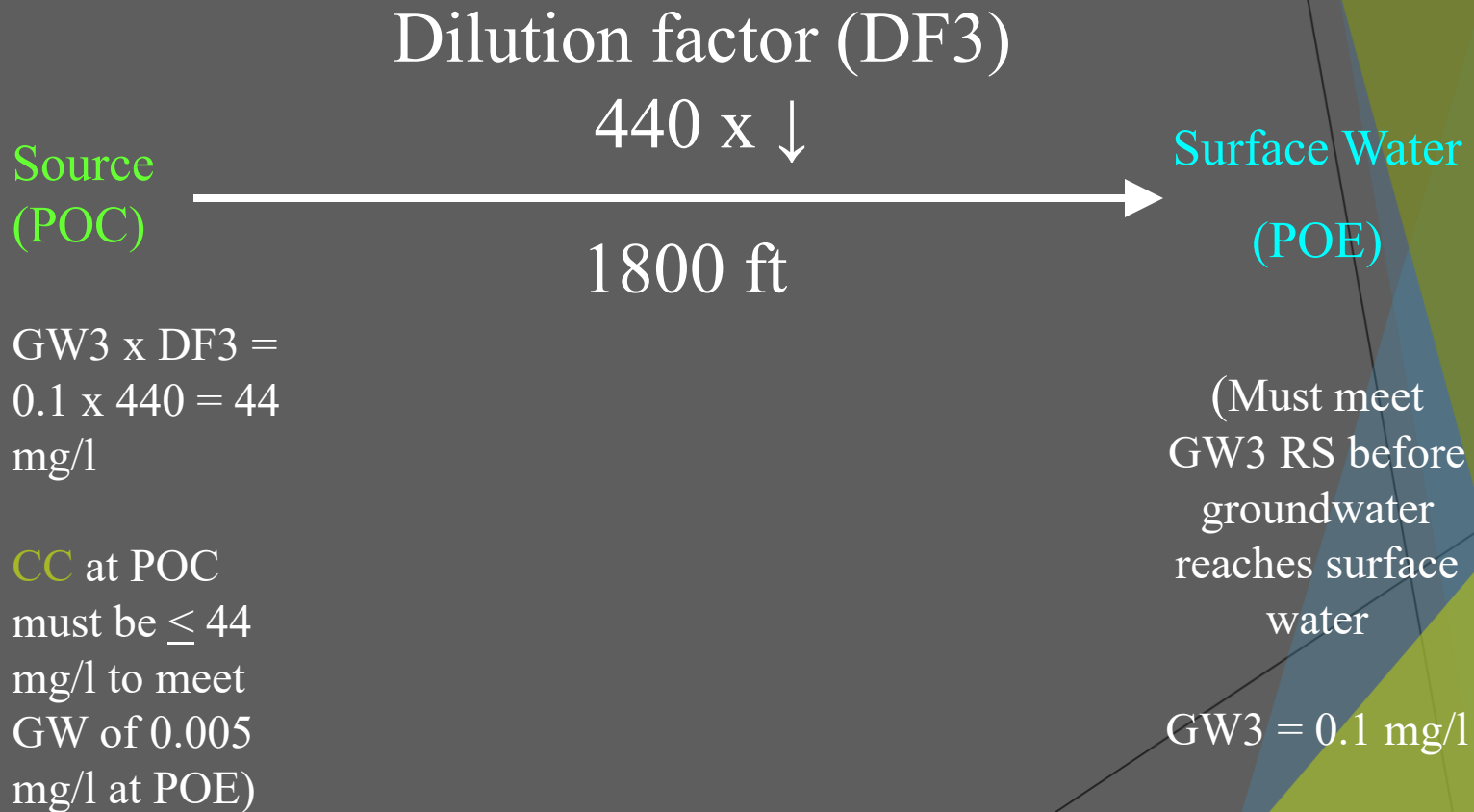
Institutional Controls for Groundwater 2

- GW2 Zone - if COC concentrations within the property boundaries $>$ GW_2 RS (without DF), then conveyance notice required
- Conveyance not needed when $Soil_{GW2}$ RS is applied

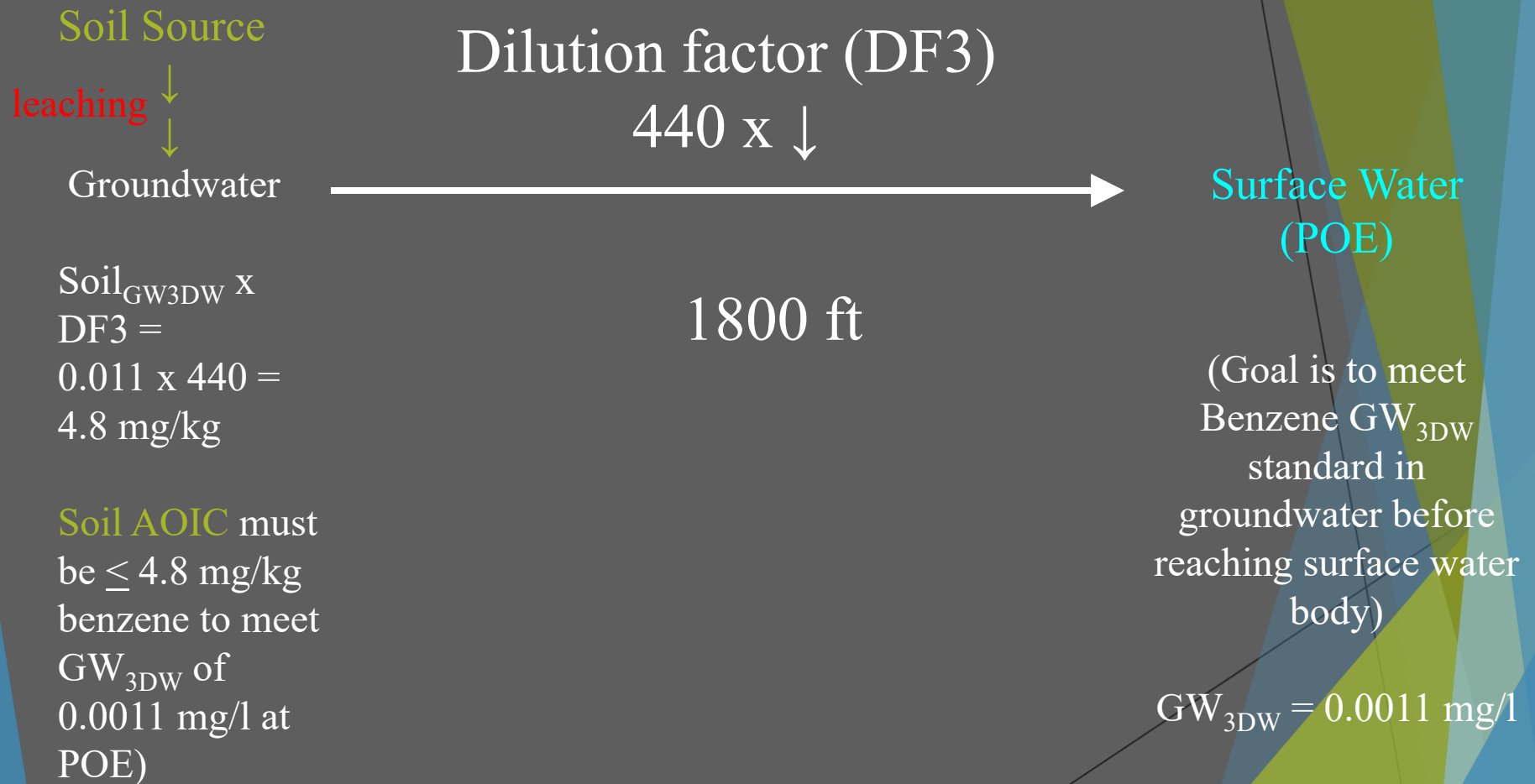
Dilution Factors - GW3 Zone - DF3

- ▶ Applicable to GW 3 zones
- ▶ Accounts for reduction in chemical concentration as groundwater migrates from the source area to the nearest downgradient surface water body
- ▶ Applied to GW_{3DW} , GW_{3NDW} , $Soil_{GW3DW}$, and $Soil_{GW3NDW}$ RS

Dilution Factors - GW 3 Zone



Dilution Factor - Soil to GW3 Zone



GW3 RS - A couple of notes ...

- ▶ The objective of the GW₃ RECAP standard is to provide protection against the migration and discharge of a COC via groundwater to a surface water body. It is not the intent of this standard to allow the discharge of a COC to surface water.
- ▶ The use of a mixing zone in the surface water body to demonstrate compliance with the GW3 is not allowed under RECAP.
- ▶ The POE is WITHIN the aquifer BEFORE groundwater reaches the surface water body.

Dilution Factors - Soil

May be applied to:

- ✓ Soil_{GW2}
- ✓ Soil_{GW3DW}
- ✓ Soil_{GW3NDW}

May **NOT** be applied to:

- × Soil_{ni}
- × Soil_i
- × Soil_{es}
- × Soil_{sat}
- × Soil_{GW1}

Dilution Factors - Groundwater

May be applied to:

- ✓ GW_2
- ✓ GW_{3DW}
- ✓ GW_{3NDW}

May **NOT** be applied to:

- × GW_1
- × GW_{air}
- × GW_{es}
- × $Water_{sol}$

Poll Question No. 4:

How to determine the dilution factor?
Check all that apply

- Pick a number out of the air
- Determine the distance from the POC to POE
- Determine the S_d - thickness of the groundwater plume

RECAP Assessments

RECAP Assessment Options

- ▶ Screening Option
- ▶ Management Option 1
- ▶ Management Option 2
- ▶ Management Option 3

SO and MO-1: Criteria for Management

In order to develop the Department-derived soil and groundwater SS and MO-1 RS, assumptions were made with regard to:

- (1) exposure potential at the AOC (receptors, exposure pathways, exposure frequency and duration, intake rates, cumulative exposures); and
- (2) site characteristics that influence constituent fate and transport (site size, soil characteristics, hydrogeological conditions, etc.).

The application of risk-based and cross-media transfer standards is protective only if the AOI shares the same (or reasonably similar) characteristics as those assumed in the development of the standards.

Therefore, the soil and groundwater SS presented in Tables 1-3 are only applicable at an AOC or AOI that meets the management criteria listed in Sections 3.1 and 4.1 of RECAP

SO and MO-1: Criteria for Management

- ▶ Non-industrial or industrial land use
- ▶ Soil and groundwater only
- ▶ Area of impacted soil \leq 0.5 acres
- ▶ Source has been removed; soil and gw are in declining conditions
- ▶ NAPL is not present
- ▶ No exposure pathways other than those addressed by SS or RS
- ▶ Groundwater is not discharging to surface water
- ▶ Refer to sections 3.1 and 4.1 for details

Screening Option

Screening Option

Screening option may be used to:

- ▶ (1) document that an AOC does not pose a threat to human health or the environment and, hence, does not require further action at this time;
- ▶ (2) identify the AOI and COC for management of the AOC under the SO; or
- ▶ (3) determine if an AOC warrants further evaluation under MO-1, MO-2, or MO-3, and if further evaluation is warranted, to identify the AOI and the COC for further assessment

Screening Option SOIL Assessment

Screening Standards- Table 1 - Soil

▶ $Soil_{SSni}$ or $Soil_{SSi}$

- $Soil_{SSni}$ = soil screening standard for non-industrial land use
- $Soil_{SSi}$ = soil screening standard for industrial land use
- risk-based values (inhalation, dermal, ingestion)
- adjusted downward to account for additivity; THQ=0.1

▶ $Soil_{SSGW}$

- protective of GW 1 zone
- applicable to all groundwater zones regardless of classification

▶ ($Soil_{sat}$)

- protection of aesthetics
- not separate SS

→ GW_{SS}

- protective of GW 1 zone
- applicable to all groundwater zones regardless of classification

Identify the Limiting Soil Screening Standard

1. Refer to Table 1 of RECAP
2. Identify the $\text{Soil}_{\text{SSni}}$ or Soil_{SSi} based on land use
3. Identify the $\text{Soil}_{\text{SSGW}}$
4. Select the lower of the two standards as the **Limiting Soil Screening Standard**

**LDEQ RECAP TABLE 1
SCREENING OPTION
SCREENING STANDARDS FOR SOIL AND GROUNDWATER**

COMPOUND	CAS #	SOIL_SSni (mg/kg)	NOTE	SOIL_SSi (mg/kg)	NOTE	SOIL_SSGW (mg/kg)	NOTE	GW_SS (mg/L)	NOTE
Acenaphthene	83-32-9	3.7E+02	N	6.1E+03	N	2.2E+02	A	3.7E-02	N
Acenaphthylene	208-96-8	3.5E+02	N	5.1E+03	N	8.8E+01	A	1.0E-01	Q
Acetone	67-64-1	1.7E+02	N	1.4E+03	N	1.5E+00	A	1.0E-01	Q
Aldrin	309-00-2	2.8E-02	C	1.3E-01	C	1.1E+01	A	1.9E-03	Q
Aniline	62-53-3	2.4E+00	N	1.7E+01	N	6.5E-02	A	1.2E-02	C
Anthracene	120-12-7	2.2E+03	N	4.8E+04	N	1.2E+02	A	4.3E-02	W
Antimony	7440-36-0	3.1E+00	N	8.2E+01	N	1.2E+01	L1	6.0E-03	MCL
Arsenic	7440-38-2	1.2E+01	D	1.2E+01	D	1.0E+02	L	1.0E-02	MCL
Barium	7440-39-3	5.5E+02	N	1.4E+04	N	2.0E+03	L	2.0E+00	MCL
Benzene	71-43-2	1.5E+00	C	3.1E+00	C	5.1E-02	A	5.0E-03	MCL
Benz(a)anthracene	56-55-3	6.2E-01	C	2.9E+00	C	3.3E+02	A	7.8E-03	Q
Benzo(a)pyrene	50-32-8	3.3E-01	Q	3.3E-01	Q	2.3E+01	A	2.0E-04	MCL
Benzo(b)fluoranthene	205-99-2	6.2E-01	C	2.9E+00	C	2.2E+02	A	4.8E-03	Q
Benzo(k)fluoranthene	207-08-9	6.2E+00	C	2.9E+01	C	1.2E+02	A	2.5E-03	Q
Beryllium	7440-41-7	1.6E+01	N	4.1E+02	N	8.0E+00	L1	4.0E-03	MCL
Biphenyl, 1,1-	92-52-4	2.3E+02	P	2.3E+02	P	1.9E+02	A	3.0E-02	N
Bis(2-chloroethyl)ether	111-44-4	3.3E-01	Q	1.1E+00	C	3.3E-01	Q	5.7E-03	Q
Bis(2-chloroisopropyl)ether	108-60-1	4.9E+00	C	1.7E+01	C	8.0E-01	Q	5.7E-03	Q
Bis(2-ethyl-hexyl)phthalate	117-81-7	3.5E+01	C	1.7E+02	C	7.9E+01	A	6.0E-03	MCL
Bromodichloromethane	75-27-4	1.8E+00	C	4.2E+00	C	9.2E-01	A	1.0E-01	MCL
Bromoform	75-25-2	4.8E+01	C	1.8E+02	C	1.8E+00	A	1.0E-01	MCL
Bromomethane	74-83-9	4.3E-01	N	3.0E+00	N	4.0E-02	A	1.0E-02	Q
Butyl benzyl phthalate	85-68-7	2.2E+02	P	2.2E+02	P	2.2E+02	P	7.3E-01	N
Cadmium	7440-43-9	3.9E+00	N	1.0E+02	N	2.0E+01	L	5.0E-03	MCL
Carbon Disulfide	75-15-0	3.6E+01	N	2.5E+02	N	1.1E+01	A	1.0E-01	N
Carbon Tetrachloride	56-23-5	1.8E-01	N	1.1E+00	C	1.1E-01	A	5.0E-03	MCL
Chlordane	57-74-9	1.6E+00	C	1.0E+01	C	1.2E+01	A	2.0E-03	MCL
Chloroaniline,p-	106-47-8	1.6E+01	N	1.7E+02	N	1.5E+00	A	2.0E-02	Q
Chlorobenzene	108-90-7	1.7E+01	N	1.2E+02	N	3.0E+00	A	1.0E-01	MCL
Chlorodibromomethane	124-48-1	2.2E+00	C	5.4E+00	C	1.0E+00	A	1.0E-01	MCL
Chloroethane (Ethylchloride)	75-00-3	4.1E+00	C	8.2E+00	C	3.5E-02	A	1.0E-02	Q
Chloroform	67-66-3	4.4E-02	N	3.0E-01	N	9.0E-01	A	1.0E-01	MCL

SO: Identification of the Soil AOI Concentration (AOIC)

Identification of AOI Concentration:

- Maximum concentration detected in soil
- Sample location within the most heavily impacted area
- Subject to department approval

SO Soil Assessment

- ▶ Compare maximum concentration detected in soil (AOIC) to LSS:
 - If $\text{max} \leq \text{LSS}$ for a chemical, then that chemical is screened out/No further evaluation is needed
 - If $\text{max} > \text{LSS}$, then the COC is evaluated further under a higher option (or remediated to LSS)
- ▶ Appendix C RECAP Form 10

SO Soil Assessment Example

XYZ Facility: release of acetone to soil

Soil data:

SB-1 80 ppm → Max → AOIC

SB-2 65 ppm

SB-3 21 ppm

SB-4 17 ppm

SB-5 1 ppm

SB-6 0.5 ppm

Identification of the Soil LSS

Industrial land use; COC is acetone

Table 1:

1. Identify the $\text{Soil}_{\text{SSI}} = 1400 \text{ mg/kg}$
2. Identify the $\text{Soil}_{\text{SSGW}} = 1.5 \text{ mg/kg}$
3. Identify the lower of Soil_{SSI} and $\text{Soil}_{\text{SSGW}} = 1.5 \text{ mg/kg}$
4. The lower value is the soil **limiting SS (LSS)**

SO Soil Assessment

- Compare **maximum soil concentration (AOIC)** to **LSS**:
 - AOIC = 80 ppm
 - LSS = 1.5 mg/kg
 - 80 mg/kg > 1.5 mg/kg
 - Acetone needs to be evaluated further under MO-1, 2, or 3 (or remediated to LSS)



Screening Option GROUNDWATER Assessment

Screening Standards- Table 1 - GW

- ▶ GW_{ss}
 - protective of GW 1 zone
 - applicable to all groundwater zones regardless of classification
- ▶ (Water_{sol})

Identification of the Groundwater Limiting Screening Standard

Table 1:

1. Identify the GW_{SS}

→ This value is the limiting groundwater SS

**LDEQ RECAP TABLE 1
SCREENING OPTION
SCREENING STANDARDS FOR SOIL AND GROUNDWATER**

COMPOUND	CAS #	SOIL_SSni (mg/kg)	NOTE	SOIL_SSi (mg/kg)	NOTE	SOIL_SSGW (mg/kg)	NOTE	GW_SS (mg/L)	NOTE
Acenaphthene	83-32-9	3.7E+02	N	6.1E+03	N	2.2E+02	A	3.7E-02	N
Acenaphthylene	208-96-8	3.5E+02	N	5.1E+03	N	8.8E+01	A	1.0E-01	Q
Acetone	67-64-1	1.7E+02	N	1.4E+03	N	1.5E+00	A	1.0E-01	Q
Aldrin	309-00-2	2.8E-02	C	1.3E-01	C	1.1E+01	A	1.9E-03	Q
Aniline	62-53-3	2.4E+00	N	1.7E+01	N	6.5E-02	A	1.2E-02	C
Anthracene	120-12-7	2.2E+03	N	4.8E+04	N	1.2E+02	A	4.3E-02	W
Antimony	7440-36-0	3.1E+00	N	8.2E+01	N	1.2E+01	L1	6.0E-03	MCL
Arsenic	7440-38-2	1.2E+01	D	1.2E+01	D	1.0E+02	L	1.0E-02	MCL
Barium	7440-39-3	5.5E+02	N	1.4E+04	N	2.0E+03	L	2.0E+00	MCL
Benzene	71-43-2	1.5E+00	C	3.1E+00	C	5.1E-02	A	5.0E-03	MCL
Benz(a)anthracene	56-55-3	6.2E-01	C	2.9E+00	C	3.3E+02	A	7.8E-03	Q
Benzo(a)pyrene	50-32-8	3.3E-01	Q	3.3E-01	Q	2.3E+01	A	2.0E-04	MCL
Benzo(b)fluoranthene	205-99-2	6.2E-01	C	2.9E+00	C	2.2E+02	A	4.8E-03	Q
Benzo(k)fluoranthene	207-08-9	6.2E+00	C	2.9E+01	C	1.2E+02	A	2.5E-03	Q
Beryllium	7440-41-7	1.6E+01	N	4.1E+02	N	8.0E+00	L1	4.0E-03	MCL
Biphenyl, 1,1-	92-52-4	2.3E+02	P	2.3E+02	P	1.9E+02	A	3.0E-02	N
Bis(2-chloroethyl)ether	111-44-4	3.3E-01	Q	1.1E+00	C	3.3E-01	Q	5.7E-03	Q
Bis(2-chloroisopropyl)ether	108-60-1	4.9E+00	C	1.7E+01	C	8.0E-01	Q	5.7E-03	Q
Bis(2-ethyl-hexyl)phthalate	117-81-7	3.5E+01	C	1.7E+02	C	7.9E+01	A	6.0E-03	MCL
Bromodichloromethane	75-27-4	1.8E+00	C	4.2E+00	C	9.2E-01	A	1.0E-01	MCL
Bromoform	75-25-2	4.8E+01	C	1.8E+02	C	1.8E+00	A	1.0E-01	MCL
Bromomethane	74-83-9	4.3E-01	N	3.0E+00	N	4.0E-02	A	1.0E-02	Q
Butyl benzyl phthalate	85-68-7	2.2E+02	P	2.2E+02	P	2.2E+02	P	7.3E-01	N
Cadmium	7440-43-9	3.9E+00	N	1.0E+02	N	2.0E+01	L	5.0E-03	MCL
Carbon Disulfide	75-15-0	3.6E+01	N	2.5E+02	N	1.1E+01	A	1.0E-01	N
Carbon Tetrachloride	56-23-5	1.8E-01	N	1.1E+00	C	1.1E-01	A	5.0E-03	MCL
Chlordane	57-74-9	1.6E+00	C	1.0E+01	C	1.2E+01	A	2.0E-03	MCL
Chloroaniline, p-	106-47-8	1.6E+01	N	1.7E+02	N	1.5E+00	A	2.0E-02	Q
Chlorobenzene	108-90-7	1.7E+01	N	1.2E+02	N	3.0E+00	A	1.0E-01	MCL
Chlorodibromomethane	124-48-1	2.2E+00	C	5.4E+00	C	1.0E+00	A	1.0E-01	MCL
Chloroethane (Ethylchloride)	75-00-3	4.1E+00	C	8.2E+00	C	3.5E-02	A	1.0E-02	Q
Chloroform	67-66-3	4.4E-02	N	3.0E-01	N	9.0E-01	A	1.0E-01	MCL

S0: Identification of the Groundwater Compliance Concentration

Compliance Concentration (CC):

- Concentration detected at the POC
- **CC** = **maximum** COC concentration in groundwater
- NOT the 95%UCL-AM concentration
- Subject to department approval

SO Groundwater Assessment

- ▶ Compare **compliance concentration (CC)** to GW_{ss} :
 - If $CC \leq GW_{ss}$ for a chemical, then the chemical is screened out/no further evaluation is needed
 - If $CC > GW_{ss}$, then the COC is evaluated further under a higher option (or remediated to GW_{ss})
- ▶ Appendix C RECAP Form 15

SO Groundwater Assessment Example

XYZ Facility: release of acetone to soil that has impacted shallow GW

GW data:

MW-1* 55 mg/l → Max → CC

MW-2 45 mg/l

MW-3 30 mg/l

MW-4 10 mg/l

MW-5 3 mg/l

MW-6 0.75 mg/l

*POC

SO Groundwater Assessment Example

Compare **compliance concentration (CC)** to GW_{SS} :

- $CC = 55 \text{ mg/l}$
- $GW_{SS} = LSS = 0.1 \text{ mg/l}$
- $55 \text{ mg/l} > 0.1 \text{ mg/l}$, therefore acetone needs to be further evaluated under a higher option (or remediated to GW_{SS})

Poll Question No. 5:

When identifying the Limiting Soil Screening Standard, after referring to Table 1 of RECAP and identifying the $\text{Soil}_{\text{SSni}}$ or Soil_{SSi} based on land use and the $\text{Soil}_{\text{SSGW}}$, you then:

- ❑ Select the highest of the two standards as the Limiting Soil Screening Standard
- ❑ Select the lower of the two standards as the Limiting Soil Screening Standard
- ❑ Pick the standard that works best with what you want to accomplish with the investigation

Management Option 1

Management Option 1 Soil Assessment

MO-1: Identification of Soil COC

COC for the MO-1 soil assessment:

- ✓ All chemicals whose max concentration in soil > limiting soil SS

MO-1 Soil RECAP Standards - Table 2

- $Soil_{ni}$ or $Soil_i$
 - $Soil_{ni}$ = soil standard for non-industrial land use
 - $Soil_i$ = soil standard for industrial land use
 - risk-based (inhalation, ingestion, dermal contact)
 - If footnoted “N” may need to consider additive noncarcinogenic health effects
 - Refer to Appendix G Table G-1 for health targets
 - If footnoted with “C” not necessary to consider additive health effects

MO-1 Soil RECAP Standards - Table 2

- Soil_{GW1} = soil standard protective of groundwater 1 zone
- $\text{Soil}_{\text{GW2}} \times \text{DF2}^*$ = soil standard protective of groundwater 2 zone
- $\text{Soil}_{\text{GW3DW}} \times \text{DF3}^*$ = soil standard protective of groundwater 3 zone that would hypothetically discharge to a surface water body classified for as a drinking water source
- $\text{Soil}_{\text{GW3NDW}} \times \text{DF3}^*$ = soil standard protective of groundwater 3 zone that would hypothetically discharge to a surface water body classified for as a non-drinking water source
- *If footnoted with “xDF”

MO-1 Dilution factors

- **DF2** = dilution factor to account for dilution of COC concentration in a groundwater 2 zone due to migration from the source (POC) to nearest downgradient property boundary (POE)
- **DF3** = dilution factor to account for dilution of COC concentration in a groundwater 3 zone due to migration from the source (POC) to nearest downgradient surface water body (POE)

MO-1 Soil RECAP Standards - Table 2

■ Soil_{sat}

- Soil_{sat} = soil saturation
- Based on protection of resource aesthetics - prevention of NAPL

■ Soil_{es}

- Standard for volatile emissions from soil to an enclosed structure
- Enclosed structure - an occupied (or potentially occupied) [i.e., one or more receptors spend a significant portion of the day (or workday) within the enclosed structure] structure on a slab foundation that has a roof and walls on all sides which prevent the free exchange of indoor air with outdoor (ambient) air.
- In general, applicable to soil ≤ 15 ft bgs (petroleum)
- Note: VI can occur from sources > 15 ft bgs (chlorinated solvents)
- In general, volatile = $\text{HLC} > 1\text{E-}05$ atm-m³/mole and $m_w < 200$ g/mole

MO-1 Soil RECAP Standards - Table 2

- Background levels
 - If MO-1 LRS for inorganic COC < BG
 - Comply with Section 2.13
- Quantitation limits
 - If MO-1 RS < QL, then default to QL
 - QL subject to Dept approval
- Ceiling values
 - TPH - 10,000 ppm

Identification of MO-1 Soil Limiting RECAP Standard - Table 2

Soil_i (Footnote N) }
Soil_{ni} (Footnote N) } Additivity
See Appendix G

Soil_{GW1}
Soil_{GW2} (Footnote x DF2) }
Soil_{GW3} (Footnote x DF3) } See Appendix H
for DF2 and DF3

Soil_{sat} } Applicable to liquids

+/- Soil_{es}

Limiting RS = lower of applicable standards

LDEQ RECAP TABLE 2 MANAGEMENT OPTION 1 STANDARDS FOR SOIL

COMPOUND	CAS #	SOILni	NOTE	SOILi	NOTE	SOILGW1	NOTE	SOILGW2	NOTE	SOILGW3DW	NOTE	SOILGW3NDW	NOTE	SOILsat	SOILesni*	SOILesi*
Acenaphthene	83-32-9	3.7E+03	N	6.1E+04	N	2.2E+02	A	2.2E+02	X DF 2	2.5E+02	X DF3	3.2E+02	X DF 3	NA	7.3E+04	2.5E+05
Acenaphthylene	208-96-8	3.5E+03	N	5.1E+04	N	8.8E+01	A	8.8E+01	X DF 2	1.4E+02	X DF3	1.9E+02	X DF 3	NA	3.8E+04	1.3E+05
Acetone	67-64-1	1.7E+03	N	1.4E+04	N	1.5E+00	A	1.5E+00	X DF 2	8.5E+00	X DF3	1.8E+02	X DF 3	1.3E+05	6.6E+02	2.3E+03
Aldrin	309-00-2	2.8E-02	C	1.3E-01	C	1.1E+01	A	1.1E+01	F	1.1E+01	H	1.1E+01	H	NA		
Aniline	62-53-3	2.4E+01	N	1.7E+02	N	6.5E-02	A	6.5E-02	X DF 2	3.2E-02	X DF3	4.4E-01	X DF 3	1.0E+04		
Anthracene	120-12-7	2.2E+04	N	4.8E+05	N	1.2E+02	A	1.2E+02	X DF 2	1.2E+02	X DF3	1.2E+02	X DF 3	NA	1.0E+06	1.0E+06
Antimony	7440-36-0	3.1E+01	N	8.2E+02	N	1.2E+01	L1	1.2E+01	L1	1.2E+01	L1	1.2E+01	L1	NA		
Arsenic	7440-38-2	1.2E+01	D	1.2E+01	D	1.0E+02	L	1.0E+02	L	1.0E+02	L	1.0E+02	L	NA		
Barium	7440-39-3	5.5E+03	N	1.4E+05	N	2.0E+03	L	2.0E+03	L	2.0E+03	L	2.0E+03	L	NA		
Benzene	71-43-2	1.5E+00	C	3.1E+00	C	5.1E-02	A	5.1E-02	X DF 2	1.1E-02	X DF3	1.3E-01	X DF 3	9.0E+02	1.0E+00	2.5E+00
Benz(a)anthracene	56-55-3	6.2E-01	C	2.9E+00	C	3.3E+02	A	3.9E+00	X DF 2	1.6E-02	X DF3	1.6E-02	X DF 3	NA		
Benzo(a)pyrene	50-32-8	3.3E-01	Q	3.3E-01	Q	2.3E+01	A	2.3E+01	X DF 2	2.3E+01	X DF3	2.3E+01	X DF 3	NA		
Benzo(b)fluoranthene	205-99-2	6.2E-01	C	2.9E+00	C	2.2E+02	A	1.3E+01	X DF 2	1.3E+01	G	1.3E+01	G	NA		
Benzo(k)fluoranthene	207-08-9	6.2E+00	C	2.9E+01	C	1.2E+02	A	1.2E+02	X DF 2	1.2E+02	G	1.2E+02	G	NA		
Beryllium	7440-41-7	1.6E+02	N	4.1E+03	N	8.0E+00	L1	8.0E+00	L1	8.0E+00	L1	8.0E+00	L1	NA		
Biphenyl, 1,1-	92-52-4	2.9E+03	N	4.4E+04	N	1.9E+02	A	1.9E+02	X DF 2	1.4E+02	X DF3	1.7E+02	X DF 3	2.3E+02	4.6E+03	1.1E+04
Bis(2-chloroethyl)ether	111-44-4	3.3E-01	Q	1.1E+00	C	3.3E-01	Q	6.6E-02	F	3.3E-01	Q	2.4E-03	X DF 3	9.8E+03	7.6E+00	1.9E+01
Bis(2-chloroisopropyl)ether	108-60-1	4.9E+00	C	1.7E+01	C	8.0E-01	Q	2.7E-03	X DF 2	3.1E-03	X DF3	8.2E-03	X DF 3	8.4E+02	1.0E+00	5.5E+00
Bis(2-ethylhexyl)phthalate	117-81-7	3.5E+01	C	1.7E+02	C	7.9E+01	A	7.9E+01	X DF 2	7.9E+01	X DF3	7.9E+01	X DF 3	2.2E+02		
Bromodichloromethane	75-27-4	1.8E+00	C	4.2E+00	C	9.2E-01	A	9.2E-01	X DF 2	9.2E-01	G	3.0E-02	X DF 3	3.1E+03	8.2E-02	4.3E-01
Bromoform	75-25-2	4.8E+01	C	1.8E+02	C	1.8E+00	A	1.8E+00	X DF 2	6.9E-02	X DF3	6.1E-01	X DF 3	2.7E+03	1.4E+01	7.4E+01
Bromomethane	74-83-9	4.3E+00	N	3.0E+01	N	4.0E-02	A	3.5E-02	X DF 2	1.8E-01	X DF3	2.1E+00	X DF 3	3.0E+03	1.9E-01	6.4E-01
Butyl benzyl phthalate	85-68-7	1.2E+04	N	1.7E+05	N	4.4E+03	A	4.4E+03	X DF 2	1.5E+03	X DF3	1.7E+03	X DF 3	2.2E+02		

Management Option 1

Soil AOIC:

- 95% UCL-AM concentration
- Max concentration
 - ✓ If < 95%UCL-AM concentration
 - ✓ If data set too small to calculate 95%UCL-AM

Management Option 1 Soil Assessment

MO-1 Soil Assessment

Compare the soil **AOIC** to the **MO-1 limiting soil RS**:

- If $AOIC \leq$ limiting RS for a COC, then no further evaluation of COC needed for soil
- If $AOIC >$ limiting RS for a COC, then further evaluation of the COC is needed under a higher option (or remediate to MO-1 LRS)

Appendix C RECAP Forms 11 and 12

MO-1 Soil Assessment Example

- ABC Facility had a release of toluene to soil
- Uppermost groundwater zone is classified as a GW_3 aquifer
- Thickness of the groundwater plume is 5 ft ($S_d = 5$ ft)
- Distance from source (POC) to nearest downgradient surface water body (POE) is 1200 ft
- Surface water body has a drinking water designation (GW_{3DW})

MO-1 Soil Assessment Example

For MO-1, soil AOIC is the lower of the 95%UCL-AM and Max concentration

- ▶ 95%UCL-AM concentration = 294 mg/kg
- ▶ Max concentration = 530 mg/kg
- ▶ AOIC = 294 mg/kg

MO-1 Soil Assessment Example

MO-1 Soil **Limiting RECAP Standard:**

Table 2: $Soil_i = 4800 \text{ mg/kg}$

$Soil_{GW3DW} = 120 \times \text{DF3 of } 173 = 20,760 \text{ mg/kg}$

$Soil_{sat} = 520 \text{ mg/kg}$

COC	$Soil_i$	$Soil_{GW3DW} \times \text{DF3}$	$Soil_{sat}$	LRS
Toluene	4800	$120 \times 173 = 20,760$	520	520

Limiting RS (LRS) = 520 mg/kg (lower of the 3 RS)

*Refer to MO-1 DF Table for DF3 (Appendix H)

MO-1 Soil Assessment Example

Compare the AOIC to the LRS:

- Toluene AOIC = 294 mg/kg
- MO-1 Soil LRS = 520 mg/kg
- 294 mg/kg < 520 mg/kg
- NFA-ATT for toluene in soil

COC	LRS	AOIC	Further assessment?
Toluene	520	294	No

Soil to Groundwater Pathway SPLP Data

- SPLP data should be representative of most heavily impacted soil (max concentration)
- Compare the SPLP results to the GW RS (Table 3) multiplied by the DF(s):
 - /// GW 1 Zone: $GW_1 \times DF_{\text{Summers}}$
 - /// GW 2 Zone: $GW_2 \times DF_{\text{Summers}} \times DF2$
 - /// GW 3 Zone: $GW_3 \times DF_{\text{Summers}} \times DF3$
 - /// Default DF_{Summers} is 20
 - /// DF2 and DF3 are site-specific

Soil to Groundwater Pathway SPLP Data

- /// If SPLP results \leq GW RS, then soil to gw pathway does not require further assessment
- /// If SPLP results $>$ GW RS, then delineate area of concern
- /// SPLP vs TCLP
- /// SPLP vs LRS
- /// SPLP evaluation replaces the Soilgw

MO-1 Soil to Groundwater Pathway: SPLP Example

- XXX Facility had a release of chlorodibromomethane to soil
- Uppermost groundwater zone is classified as GW_3 aquifer
- Surface water body has a non-drinking water designation (GW_{3NDW})
- Thickness of the first groundwater zone is 4 ft ($S_d = 4$ ft)
- Distance from POC to nearest downgradient surface water body is 1760 ft
 - $DF3 = 440$
- **SPLP test results: 16 mg/l**

MO-1 Soil to Groundwater Pathway: SPLP Example

Compare SPLP results to $GW_{3NDW} \times DF_{Summers} \times DF3$:

- $5E-03\text{mg/l} \times 20 \times 440 = 44 \text{ mg/l}$
- 44 mg/l is SPLP value protective of groundwater
- **SPLP test results = 16 mg/l**
- $16 \text{ mg/l} < 44 \text{ mg/l}$
- Soil to groundwater pathway does not require further assessment for this COC

Poll Question No. 6:

Which of the following is true regarding using SPLP Data to evaluate the Soil to Groundwater Pathway (select all that apply):

- SPLP data should be representative of least impacted soil (minimum concentration)
- If SPLP results $<$ GW RS, then soil to groundwater pathway does not require further assessment
- If SPLP results $>$ GW RS, then delineate area of concern
- SPLP evaluation replaces the Soil_{gw}

MO-1

Groundwater Assessment

MO-1: Identification Groundwater COC

COC for the MO-1 groundwater assessment:

- ✓ All chemicals whose max concentration in groundwater $> GW_{SS}$

MO-1 Groundwater RS - Table 3

■ GW_1

- GW 1 zone
- MCL or risk-based (drinking water, inhalation of volatiles)
- Footnote “N” (noncarcinogen) - may need to adjust for additivity
- NO DF

■ GW_2

- GW 2 zone
- MCL or Risk-based (drinking water, inhalation of volatiles)
- Footnote “N” (noncarcinogen) - may need to adjust for additivity
- DF2 (source to property boundary)

MO-1 Groundwater RS - Table 3

- GW_{3DW} and GW_{3NDW}
 - GW 3 zone
 - Prevents discharge of COC to surface water via groundwater migration
 - DF3 (source to SW)
- $Water_{sol}$
 - GW 1, 2, and 3
 - Aesthetics - prevention of free product

MO-1 Groundwater RS - Table 3

- GW_{air}
 - standard for emissions from shallow groundwater to ambient air

- GW_{es}
 - Standard for volatile emissions from groundwater to an enclosed structure

 - Enclosed structure - an occupied (or potentially occupied) [i.e., one or more receptors spend a significant portion of the day (or workday) within the enclosed structure] structure on a slab foundation that has a roof and walls on all sides which prevent the free exchange of indoor air with outdoor (ambient) air.

 - In general, applicable to soil ≤ 15 ft bgs (petroleum)

 - Note: VI can occur from sources > 15 ft bgs (chlorinated solvents)

 - In general, volatile = $HLC > 1E-05$ atm-m³/mole and $mw < 200$ g/mole

MO-1 Groundwater RS

- Quantitation limits
- Background levels
- If $GW_3 \times DF3 < GW_2$, then use GW_2

Identification of MO-1 Groundwater Limiting RS

Table 3

GW_1 } Footnote N: Additivity - refer to Appendix G

GW_2 } Footnote N: Additivity - refer to Appendix G
Footnote X DF2

GW_3 (Footnote x DF3)

S (Water_{sol})

+/- GW_{air} (Footnote N)

+/- GW_{es} (Footnote N)

Limiting groundwater RS = lowest of RS

**LDEQ RECAP TABLE 3
MANAGEMENT OPTION 1, 2, AND 3
STANDARDS FOR GROUNDWATER**

COMPOUND	CAS #	GW 1	NOTE	GW 2	NOTE	GW 3 DW	NOTE	GW 3 NDW	NOTE	S	Gwesi*	Gwesi*	Gwairni*	Gwairi*
Acenaphthene	83-32-9	3.7E-01	N	3.7E-01	X DF 2	4.3E-01	X DF 3	5.4E-01	X DF 3	4.2E+00	2.8E+03	9.6E+03	1.7E+05	2.4E+05
Acenaphthylene	208-96-8	3.7E-01	N	3.7E-01	X DF 2	5.6E-01	X DF 3	7.7E-01	X DF 3	1.6E+01	3.6E+03	1.2E+04	2.1E+05	3.0E+05
Acetone	67-64-1	6.1E-01	N	6.1E-01	X DF 2	3.3E+00	X DF 3	7.2E+01	X DF 3	1.0E+06	5.8E+03	2.0E+04	3.5E+05	4.8E+05
Aldrin	309-00-2	1.9E-03	Q	1.9E-03	F	1.9E-03	G	1.9E-03	G	1.8E-01				
Aniline	62-53-3	1.2E-02	C	1.2E-02	X DF 2	5.7E-03	X DF 3	8.0E-02	X DF 3	3.6E+04				
Anthracene	120-12-7	1.8E+00	N	1.8E+00	X DF 2	1.1E-01	X DF 3	1.1E-01	X DF 3	4.3E-02	3.7E+04	1.3E+05	1.0E+06	1.0E+06
Antimony	7440-36-0	6.0E-03	MCL	6.0E-03	X DF 2	6.0E-03	X DF 3	2.6E-01	X DF 3	NA				
Arsenic	7440-38-2	1.0E-02	MCL	1.0E-02	X DF 2	5.0E-02	X DF 3	5.0E-02	X DF 3	NA				
Barium	7440-39-3	2.0E+00	MCL	2.0E+00	X DF 2	2.0E+00	X DF 3	4.5E+01	X DF 3	NA				
Benzene	71-43-2	5.0E-03	MCL	5.0E-03	X DF 2	1.1E-03	X DF 3	1.3E-02	X DF 3	1.8E+03	2.9E+00	7.2E+00	3.9E+02	3.9E+02
Benz(a)anthracene	56-55-3	7.8E-03	Q	9.1E-05	X DF 2	3.8E-07	X DF 3	3.8E-07	X DF 3	9.4E-03				
Benzo(a)pyrene	50-32-8	2.0E-04	MCL	2.0E-04	X DF 2	2.0E-04	X DF 3	2.0E-04	X DF 3	1.6E-03				
Benzo(b)fluoranthene	205-99-2	4.8E-03	Q	9.1E-05	X DF 2	9.1E-05	H	9.1E-05	H	1.5E-03				
Benzo(k)fluoranthene	207-08-9	2.5E-03	Q	9.1E-04	X DF 2	9.1E-04	H	9.1E-04	H	8.0E-04				
Beryllium	7440-41-7	4.0E-03	MCL	4.0E-03	X DF 2	4.0E-03	X DF 3	3.0E-01	X DF 3	NA				
Biphenyl, 1,1-	92-52-4	3.0E-01	N	3.0E-01	X DF 2	2.3E-01	X DF 3	2.7E-01	X DF 3	7.5E+00	1.7E+02	4.2E+02	1.1E+04	1.1E+04
Bis(2-chloroethyl)ether	111-44-4	5.7E-03	Q	5.7E-03	F	2.8E-05	X DF 3	2.1E-04	X DF 3	1.7E+04	1.5E+01	3.7E+01	8.8E+02	8.8E+02
Bis(2-chloroisopropyl)ether	108-60-1	5.7E-03	Q	2.7E-04	X DF 2	3.1E-04	X DF 3	8.3E-04	X DF 3	1.7E+03	2.4E+00	1.3E+01	1.4E+02	3.1E+02
Bis(2-ethylhexyl)phthalate	117-81-7	6.0E-03	MCL	6.0E-03	X DF 2	6.0E-03	X DF 3	6.0E-03	X DF 3	3.4E-01				
Bromodichloromethane	75-27-4	1.0E-01	MCL	1.0E-01	X DF 2	1.0E-01	H	3.3E-03	X DF 3	6.7E+03	2.1E-01	1.1E+00	1.4E+01	3.0E+01
Bromoform	75-25-2	1.0E-01	MCL	1.0E-01	X DF 2	3.9E-03	X DF 3	3.5E-02	X DF 3	3.1E+03	1.8E+01	9.5E+01	1.1E+03	2.3E+03
Bromomethane	74-83-9	1.0E-02	Q	8.7E-03	X DF 2	4.5E-02	X DF 3	5.3E-01	X DF 3	1.5E+04	1.3E+00	4.5E+00	1.5E+02	2.1E+02
Butyl benzyl phthalate	85-68-7	7.3E+00	N	7.3E+00	X DF 2	9.1E-01	X DF 3	1.0E+00	X DF 3	2.7E+00				
Cadmium	7440-43-9	5.0E-03	MCL	5.0E-03	X DF 2	1.0E-02	X DF 3	1.0E-02	X DF 3	NA				
Carbon Disulfide	75-15-0	1.0E+00	N	1.0E+00	X DF 2	2.8E+00	X DF 3	1.5E+01	X DF 3	1.2E+03	5.3E+00	1.3E+01	1.3E+03	1.3E+03
Carbon Tetrachloride	56-23-5	5.0E-03	MCL	5.0E-03	X DF 2	2.2E-04	X DF 3	1.2E-03	X DF 3	7.9E+02	6.1E-01	1.5E+00	1.4E+02	1.4E+02
Chlordane	57-74-9	2.0E-03	MCL	2.0E-03	X DF 2	2.0E-03	H	2.0E-03	H	5.6E-02				
Chloroaniline, p-	106-47-8	1.5E-01	N	1.5E-01	X DF 2	1.2E-01	X DF 3	6.7E-01	X DF 3	5.3E+03				
Chlorobenzene	108-90-7	1.0E-01	MCL	1.0E-01	X DF 2	1.0E-01	X DF 3	7.1E-01	X DF 3	4.7E+02	4.4E+02	1.1E+03	4.9E+04	4.9E+04
Chlorodibromomethane	124-48-1	1.0E-01	MCL	1.0E-01	X DF 2	3.9E-04	X DF 3	5.1E-03	X DF 3	2.6E+03	4.5E-01	2.4E+00	2.8E+01	5.9E+01
Chloroethane (Ethylchloride)	75-00-3	1.0E-02	Q	3.8E-03	X DF 2	1.3E+01	X DF 3	1.2E+02	X DF 3	5.7E+03	5.1E+03	1.3E+04	1.1E+06	1.1E+06
Chloroform	67-66-3	1.0E-01	MCL	1.0E-01	X DF 2	5.3E-03	X DF 3	7.0E-02	X DF 3	7.9E+03	1.3E+00	3.1E+00	1.5E+02	1.5E+02
Chloromethane	74-87-3	1.0E-02	Q	1.5E-03	X DF 2	2.5E-03	X DF 3	3.7E-02	X DF 3	5.3E+03	9.0E+00	2.2E+01	1.9E+03	1.9E+03

MO-1: Id of the GW Compliance Concentration

Compliance Concentration:

- Concentration detected at the POC
- Maximum concentration
- **NOT** 95%UCL-AM concentration

Management Option 1 Groundwater Assessment

Compare the compliance concentration to the groundwater LRS:

- If $CC \leq LRS$ for a COC, then no further assessment for the COC
 - If $CC > LRS$, then proceed to a higher option or remediate to MO-1 LRS
- ▶ Appendix C RECAP Form 16

MO-1 GW 1 Assessment Example

JXJ Facility had a release of benzene to a GW 1 zone located 50 ft bgs; $S_d = 5$ ft; distance to property boundary is 1400 ft; distance to SW is 3200 ft; SW is classified as NDW source.

Groundwater data:

MW-1(POC)	0.06 mg/l (CC)
MW-2	0.002 mg/l
MW-3	0.05 mg/l
MW-4	0.04 mg/l
MW-5	0.01 mg/l

MO-1 GW 1 Assessment Example

Identification of the LRS for GW 1 zone:

- ❖ $GW_1 = 5E-03 \text{ mg/l}$
- ❖ $Water_{sol} = 1800 \text{ mg/l}$

LRS = $5E-03 \text{ mg/l}$

Compare CC to LRS:

- ❖ $0.06 \text{ mg/l} > 5E-03 \text{ mg/l}$ so need to remediate gw

Note: POE - throughout aquifer

MO-1 GW 2 Assessment Example

JXJ Facility had a release of benzene to a GW 2 zone located 30 ft bgs; $S_d = 10$ ft; distance to property boundary is 1400 ft; distance to SW is 3200 ft; SW is classified as non-DW source.

Groundwater data:

MW-1 (POC)	0.6 mg/l (CC)
MW-2	0.3 mg/l
MW-3	0.28 mg/l
MW-4	0.4 mg/l
MW-5	0.12 mg/l

MO-1 GW 2 Assessment Example

Identification of the LRS for GW 2 zone:

- ❖ $\text{GW}_2 = 5\text{E-}03 \text{ mg/l} \times \text{DF2 of } 124 = 0.62 \text{ mg/l}$
- ❖ $\text{Water}_{\text{sol}} = 1800 \text{ mg/l}$

MO-1 GW LRS = 0.62 mg/l

Compare CC to LRS:

- ❖ $0.6 \text{ mg/l} < 0.62 \text{ mg/l}$ so NFA-ATT/conveyance notice

Note: POE - nearest downgradient property boundary

MO-1 GW 3 Assessment Example

JXJ Facility had a release of benzene to a GW 3 zone located 10 ft bgs; $S_d = 5$ ft; distance to property boundary is 1400 ft; distance to SW is 3200 ft; SW is classified as non-DW source.

Groundwater data:

MW-1 (POC)	61 mg/l (CC)
MW-2	29 mg/l
MW-3	53 mg/l
MW-4	41 mg/l
MW-5	37 mg/l

MO-1 GW 3 Assessment Example

Identification of the LRS for GW3 zone:

- ❖ $GW_{3NDW} = 1.3E-02 \text{ mg/l} \times \text{DF3 of } 440 = 5.7 \text{ mg/l}$
- ❖ $\text{Water}_{sol} = 1800 \text{ mg/l}$
- ❖ $GW_{air} = 390 \text{ mg/l}$

MO-1 GW LRS = 5.7 mg/l

Compare CC to LRS:

- ❖ $61 \text{ mg/l} > 5.7 \text{ mg/l}$ so need to evaluate under MO-2 or MO-3

Note: POE - nearest downgradient surface water body

Chemicals not listed in Tables 1, 2, and 3

- ▶ If a chemical is not listed in Tables 1, 2 and 3, SS and RS should be derived in accordance with Appendix H
- ▶ Appendix H spreadsheet
<https://www.deq.louisiana.gov/page/recap>
- ▶ All contaminants are regulated under RECAP
- ▶ Analyte list should include all chemicals known or suspected to be present at the AOI based on current or past land use (including breakdown products of potential concern).
- ▶ No “RECAP VOCs”, “RECAP metals”, etc

Management Option 2

Management Option 2

- Soil and groundwater
- Industrial and non-industrial land use
- Same RS as MO-1 but NO lookup table
 - Soil_{ni}-PEF and Soil_i-PEF
- Soil RS are developed using site-specific geotechnical data in accordance with Appendix H
- The most current toxicity values should be used
- GW RS from Table 3 with site-specific DF
- Soil and groundwater assessments follow same steps as MO-1 assessments

MO-2 Site-specific EF&T data

Examples of site-specific data that may be used under MO-2:

- Source size
- Fraction of organic carbon
- Soil particle density
- Water-filled soil porosity
- Dry soil bulk density

Geophysical Parameters

Fraction of organic carbon (f_{oc})

- Soil sample should be collected from an area of non-impacted soil that is representative of the soil conditions within the AOI
- Method of analysis
 - ✓ Heat loss on ignition (ATSM D2974)
→ $foc = \text{organic matter (\%)} / 174$
 - ✓ Total Organic Carbon (SW846 Method 9060 modified)
→ $foc = \text{TOC (mg/kg)} / 10^6$

Geophysical Parameters

- ▶ **Geochemical parameters** should be collected from an appropriate location
 - Area not affected by the release
 - Lithological unit that is most representative of impacted soil interval at the AOI
- ▶ **Site-specific data** should be entered in the Appendix H spreadsheet for the calculation of MO-2 RS
 - Soil properties & Q/C tab

MO-2: Appendix H Spreadsheet

Where to input geophysical data

→ Soil Properties & QC tab

Soil properties		Management Option 2				
Revision Date: 08/04/2003						
Run date:	11/9/2015					
****calculation inputs****						
1.7g/cm3		pb = dry soil bulk density				
0.358491Lpore/Lsoil		n = total soil porosity				
0.21Lwater/Lsoil		nw = water-filled soil porosity				
0.148491Lair/Lsoil		na = air-filled soil porosity				
2.65g/cm3		ps = soil particle density				
0.006g/g		foc = fractional organic carbon in soil				
148(ft) = L		L = length of the source at the water table				
148(ft) = W		W = width of impacted area perpendicular to flow direction of aquifer				
0.5Acres		AOI site area - input into Q/C equation below				
76.30616g/m2-s		per kg/m3 Q/C = inverse of mean concentration at center of square source				
Q/C Table						
site size	148*148	209*209	295*295	467*467	660*660	1143*1143
site size	0.5 acre	1 acre	2 acre	5 acre	10 acre	30 acre
Q/C value	76.3062	67.4304	59.872	51.4648	46.1707	39.2329

Fraction of organic carbon (f_{oc})

Example: Benzene, site-specific $f_{oc} = 0.02$

Spreadsheet, soil properties and Q/C tab, replace default 0.006 with 0.02, then open tab for each RS to get site-specific value

mg/kg	Soil _{ni}	Soil _i	Soil _{GW1} Soil _{GW2}	Soil _{GW3D} W	Soil _{GW3NDW}	Soil _{sat}	Soil _{esn} i	Soil _{esi}
Default	0.79	1.6	0.011	0.0023	0.027	900	1.0	2.5
Site-specific	1.3	2.6	0.029	0.0063	0.071	2400	2.7	6.7

Site-Specific MO-2 RECAP Evaluation for Typical UST Sites Appendix I

Underground Storage Tanks

- MO-2 assessment for typical UST
- 16 Category Tables for RS
- Categories are defined by fraction of organic carbon and areal extent of source area
- Appendix I

Appendix I Site Categorization

Source Length (L) in feet

148	Category 1	Category 5	Category 9	Category 13
100	Category 2	Category 6	Category 10	Category 14
65	Category 3	Category 7	Category 11	Category 15
30	Category 4	Category 8	Category 12	Category 16
	0.006	0.01	0.02	0.03

Fractional Organic Carbon (foc)

Poll Question No. 7:

Examples of site-specific data that may be used under MO-2 include:

- Source size
- Fraction of organic carbon
- Soil particle density
- Water-filled soil porosity
- Dry soil bulk density
- All of the above

Management Option 3

Management Option 3 Assessment

- Site-Specific MO-3 RECAP Standards (no look up table)
- Site-specific EF&T data
- Site-specific exposure data
- Most current toxicity values
- All media (sediment, biota, etc)
- May involved sophisticated modeling
- Often complex assessments
- Requires workplan

RECAP

Miscellaneous Topics

Site Investigation

- ▶ Appendix B Site Investigation Requirements
- ▶ Section 2.3 Site Investigation Requirements
- ▶ Section 2.4 Data QA/QC Requirements
- ▶ Section 2.5 Data Evaluation and Data Usability
- ▶ Appendix F Aquifer Tests

Sampling Workplans

Join LDEQ Environmental Senior Scientist Keith Horn on **August 10, 2021 from 9:00 to 11:30 am** for a webinar on how to develop an effective sampling plan for a RECAP investigation

Register: https://deqlouisiana.zoom.us/webinar/register/WN_SL-HHEUZTbGvinL3c5qEqw

Additivity

Noncarcinogenic Health Effects

Additivity - why is it important?

Reference dose (RfD) and Reference concentration (RfC)

- ▶ noncarcinogenic toxicity value
- ▶ defines “protective or acceptable” exposure level (the daily exposure level that is likely to be without an appreciable risk of adverse health effects during a lifetime)
- ▶ based on the protection of most sensitive health effect
- ▶ Concept of threshold

Hazard quotient = Exposure/RfD

- ▶ When Hazard Quotient = 1, exposure = RfD and RfC
- ▶ Target Hazard Quotient = 1 is used for the calculation of SS and RS
- ▶ Therefore, a risk-based SS or RS represents a protective level of a COC in soil or groundwater

Example

Soil_{ni} for 1,1-biphenyl is 2900 mg/kg

→ 2900 mg/kg of 1,1-biphenyl in soil is protective of kidney effects associated with exposure to soil in a residential setting

Additivity - why is it important?

But, what if 1,1-biphenyl, pyrene, 1,2,4,5-tetrachlorobenzene, and fluoranthene were present in residential soil at concentrations that met the MO-1 Soil_{ni}?
Would exposure levels be acceptable?

Do these COC have the same health targets? Yes, kidney

COC	Soil _{ni} (mg/kg)	AOIC (mg/kg)	Exposure = RfD (Hazard Quotient = 1)
1,1,-biphenyl	2900	2900	1
Pyrene	2300	2300	1
1,2,4,5-tetrachlorobenzene	12	12	1
fluoranthene	2200	2200	1
Total HQ for kidney			4

Soil_{ni} adjusted for additivity to the kidney:

COC	Soil _{ni} (mg/kg) Adjusted	AOIC (mg/kg)	Exposure = RfD (Hazard Quotient = 1)
1,1,-biphenyl	$2900/4 = 725$	725	1/4
Pyrene	$2300/4 = 575$	575	1/4
1,2,4,5-tetrachlorobenzene	$12/4 = 3$	3	1/4
fluoranthene	$2200/4 = 550$	550	1/4
Total HQ for kidney			1

Which RS require adjustment?

- ▶ Only **risk-based RS** are adjusted to account for potential additive effects
 - ✓ Soil_{ni} , Soil_{i} , Soil_{es}
 - ✓ GW_{1} , GW_{2} , GW_{es} , GW_{air}
 - ✗ Soil_{GW} , Soil_{sat} , GW_{3} , $\text{Water}_{\text{sol}}$, background levels, quantitation limits, MCLs, ceiling values are **NOT** adjusted
 - ✗ Screening Standards Table 1 (THQ = 0.1)

Additivity - Noncarcinogens

- ▶ Identification of critical effect/target organs
 - ✓ Target organ/system listed as the basis for the RfD and RfC
 - MO-1: RECAP Appendix G Table G-1
 - MO-2 and MO-3: IRIS, PPRTV, HEAST, etc
- ▶ COC are grouped by target
- ▶ RS are adjusted based on number of COC with same target

TABLE G-1
Critical Effects and Target Organs/Systems

CONSTITUENT	CAS #	CRITICAL EFFECT(S)/TARGET ORGAN(S) ²
Acenaphthene	83-32-9	Liver toxicity
Acetone	67-64-1	Liver effects (increased weight); Kidney toxicity
Aldrin	309-00-2	Liver toxicity
Aniline	62-53-3	Spleen toxicity
Anthracene	120-12-7	No observed effects
Antimony	7440-36-0	Decreased longevity; Decreased blood glucose; Altered blood cholesterol levels
Arsenic	7440-38-2	Skin effects (hyperpigmentation and keratosis); Vascular effects
Barium	7440-39-3	Kidney effects (increased weight)
Benzene	71-43-2	Bone marrow toxicity (lymphocytopenia) ³
Benz(a)anthracene	56-55-3	NA ⁴
Benzo(a)pyrene	50-32-8	NA
Benzo(b)fluoranthene	205-99-2	NA
Benzo(k)fluoranthene	207-08-9	NA
Beryllium	7440-41-7	Gastrointestinal effects (erosion and inflammatory lesions); Beryllium sensitization; Respiratory system (chronic beryllium disease - chronic inflammatory lung disease)
Biphenyl, 1,1-	92-52-4	Kidney toxicity
Bis(2-chloroethyl)ether	111-44-4	NA
Bis(2-chloroisopropyl)ether	108-60-1	Hematological system effects (red blood cell toxicity/destruction and decreased hemoglobin)
Bis(2-ethyl-hexyl)phthalate	117-81-7	Liver effects (increased weight)
Bromodichloromethane	75-27-4	Kidney effects (cytomegaly)
Bromoform	75-25-2	Liver effects
Bromomethane	74-83-9	Gastrointestinal effects (epithelial hyperplasia of stomach); Nasal cavity effects (degeneration and proliferative lesions of the olfactory epithelium)
Butyl benzyl phthalate	85-68-7	Liver effects (increased weight); CNS effects (increased brain weight)
Cadmium	7440-43-9	Kidney effects (proteinuria)
Carbon Disulfide	75-15-0	Fetal toxicity (malformations); Peripheral nervous system dysfunction

MO-1 Additivity Example

Acetone, cadmium, chlorobenzene and 1,1-DCE are present in residential soil; all have MO-1 Soil_{ni} based on noncarcinogenic effects

Step 1- Identify health effect targets (App G Table G-1):

- ❖ Acetone: **liver**, **kidney**
- ❖ Cadmium: **kidney**
- ❖ Chlorobenzene: **liver**
- ❖ 1,1-DCE: **liver**

MO-1 Additivity Example

Step 2 - Summarize by targets:

(3) Liver: acetone, chlorobenzene, 1,1-DCE

(2) Kidney: acetone, cadmium

- ✓ Acetone Soil_{ni} needs to be divided by 3 (liver)
- ✓ Chlorobenzene Soil_{ni} needs to be divided by 3 (liver)
- ✓ 1-1, DCE Soil_{ni} needs to be divided by 3 (liver)
- ✓ Cadmium Soil_{ni} needs to be divided by 2 (kidney)

MO-1 Additivity Example

Step 3 - Adjust Soil_{ni} to account for additivity:

	<u>Table 2 Soil_{ni}</u>	<u>Adjusted Soil_{ni}</u>
Acetone	1700	$1700/3 = 570$
Cadmium	39	$39/2 = 20$
Chlorobenzene	170	$170/3 = 57$
1,1,-DCE	130	$130/3 = 43$

Additivity

Modification of risk-based MO-2 and MO-3 RS:

- » equal apportionment of RS or THQ
or
- » site-specific apportionment of RS or THQ

Additivity Example:

Equal Apportionment:

<u>COC</u>	<u>Target</u>	<u>THQ</u>	<u>Soil_{ni}</u>	<u>Apportioning THI</u>		<u>Adjusted Soil_{ni}</u>
barium	Kidney	1.0	5500	0.33	(5500 ÷ 3)	1833 mg/kg
toluene	Kidney	1.0	680	0.33	(680 ÷ 3)	226 mg/kg
biphenyl	kidney	1.0	2900	0.33	(2900 ÷ 3)	966 mg/kg
Total HI		3.0 ↑		1.0	√	

Site-Specific Apportionment:

<u>COC</u>	<u>Target</u>	<u>THQ</u>	<u>Soil_{ni}</u>	<u>Apportioning THI</u>		<u>Adjusted RS</u>
barium	Kidney	1.0	5500	0.1		550 mg/kg
toluene	Kidney	1.0	680	0.8		544 mg/kg
biphenyl	kidney	1.0	2900	0.1		290 mg/kg
Total HI		3.0 ↑		1.0	√	

Additivity Example cont'd

COC	Soil _{ni} - Equal apportionment	AOIC	Soil _{ni} - Site-specific apportionment	AOIC
barium	1833	410 ✓	550	410 ✓
toluene	226	500 ↑	544	500 ✓
biphenyl	966	220 ✓	290	220 ✓

Additivity: GW_1 and GW_2

- Include all Noncarcinogenic COC when identifying targets
- If no current exposure:
 - ⚡ Adjust GW_1 or GW_2 RS based on NC effects
 - ⚡ Do not adjust GW_1 or GW_2 RS based on MCL
- If exposure is occurring:
 - ⚡ Adjust GW_1 or GW_2 RS based on NC effects
 - ⚡ For GW_1 or GW_2 RS based on MCL:
 1. Calculate GW_1 or GW_2 RS for NC effects (Appendix H)
 2. Adjust RS to account for additivity

▶ Appendix G

Additivity Enclosed Structure Example

Soil: Toluene (liver, kidney, CNS)

Ethylbenzene (liver, kidney, fetal)

Hexachloroethane (kidney)

GW: Chlorobenzene (liver)

Fluoranthene (kidney, liver, hematological system)

Hexachloroethane (kidney)

Additivity Enclosed Structure Example

What is the exposure medium?

- Indoor Air

What are the COC for indoor air?

- Volatile COC (HLC > 1E-05 atm-m³/mol and mw < 200 g/mol)
 - ✓ Toluene (liver, kidney, CNS)
 - ✓ Ethylbenzene (liver, kidney, fetal)
 - ✓ Chlorobenzene (liver)

Based on additive effects to the liver:

- Divide the Soil_{es} and GW_{es} for toluene, ethylbenzene, and chlorobenzene by 3

Additivity - Carcinogens

- ▶ SS and RS are based on a target risk level of 10^{-6}
- ▶ Exposure to multiple COC typically results in a cumulative risk within the 10^{-4} to 10^{-6} risk range
- ▶ Therefore, not necessary to modify the standards to account for exposure to multiple carcinogens or multiple impacted media

Toxicity Values

Hierarchy of sources

- ▶ Tier 1: EPA's Integrated Risk Information System (IRIS)
 - <https://www.epa.gov/iris>
- ▶ Tier 2: EPA's Provisional Peer-Reviewed Toxicity Values (PPRTV)
 - <https://www.epa.gov/pprtv>
- ▶ Tier 3: EPA and non-EPA sources (ATSDR, California EPA, HEAST, etc)

Use of revised toxicity values under RECAP 2003:

- ▶ Cannot recalculate SS or MO-1 RS using revised toxicity values
- ▶ MO-2 RS - use most current toxicity values
- ▶ MO-3 RS - use most current toxicity values

Toxicity Values Use in Appendix H Spreadsheet

- ▶ Enter toxicity values in SF & RfD tab of spreadsheet
- ▶ Reference concentration (RfC) mg/m^3
 - Convert to units of $\text{mg}/\text{kg}/\text{day}$ by multiplying the RfC by $20 \text{ m}^3/\text{day}$ and dividing by 70 kg before entering the value in spreadsheet
- ▶ Inhalation unit risk (IUR) risk $(\text{ug}/\text{m}^3)^{-1}$
 - Convert to units of risk $(\text{mg}/\text{kg}/\text{day})^{-1}$ by multiplying by 70 kg , dividing by $20 \text{ m}^3/\text{day}$, and multiplying by $1000 \text{ ug}/\text{mg}$ before entering the value in spreadsheet

Poll Question No. 8:

True or False:

Only risk-based RS are adjusted to account for potential additive effects.

Appendix D

Total Petroleum Hydrocarbons

TPH Fraction and Indicator Method

Petroleum hydrocarbon releases are assessed based on the identification and quantitation of indicator compounds and hydrocarbon fractions

COC for Petroleum Releases

Table D-1 Page D-TPH-5

Total Petroleum Hydrocarbons

- TPH Fraction and Indicator Compound Approach
- **Indicator compounds** may include:
 - BTEX
 - PAHs
 - Metals
 - Additives

Hydrocarbon Fractions

Table D-1 Page D-TPH-5

- Dependent on type of release
- Hydrocarbon fractions include:

Aliphatics

$C_{>6} - C_8$

$C_{>8} - C_{10}$

$C_{>10} - C_{12}$

$C_{>12} - C_{16}$

$C_{>16} - C_{35}$

$C_{>35}$

Aromatics

$C_{>8} - C_{10}$

$C_{>10} - C_{12}$

$C_{>12} - C_{16}$

$C_{>16} - C_{21}$

$C_{>21} - C_{35}$

$C_{>35}$

TPH Mixtures

TPH-G, TPH-D, and TPH-O

- TPH-GRO = $C_6 - C_{10}$
- TPH- DRO = $C_{10} - C_{28}$
- TPH-ORO = $C_{>28}$
- Other mixtures

TPH - Table D-1

- ▶ Table D-1 Identifies COC for various types of releases
- ▶ If the type of release is not in Table D-1 contact LDEQ for COC

Table D-1

Indicator Compound	gasoline	jet fuel ² (JP-8)	kerosene	Diesel, light fuel oils	heavy fuel oils	crude oil	highly refined base oils (hydraulic fluid) ³	used motor oil, lubricating oil	unknown
Benzene	X								X
Toluene	X								X
Ethylbenzene	X								X
Xylene	X								X
Acenaphthene				X	X	X		X	X
Acenaphthylene				X	X	X		X	X
Anthracene				X	X	X		X	X
Benzo(a)pyrene				X	X	X		X	X
Chrysene				X	X	X		X	X
Dibenz(a,h)anthracene				X	X	X		X	X
Indeno(1,2,3-cd)pyrene				X	X	X		X	X
Benzo(k)fluoranthene				X	X	X		X	X
Benzo(b)fluoranthene				X	X	X		X	X
Benzo(a)anthracene				X	X	X		X	X
Fluoranthene				X	X	X		X	X
Fluorene				X	X	X		X	X
Naphthalene				X	X	X		X	X
2-Methylnaphthalene				X	X	X		X	X
Phenanthrene				X	X	X		X	X
Pyrene				X	X	X		X	X
Lead (inorganic)	X ⁴								X ⁴
Metals								X	
Methyl tertbutyl ether	X ⁴								X ⁴
Methyl ethyl ketone	X ⁴								X ⁴
Methyl isobutyl ketone	X ⁴								X ⁴
Aliphatics C ₆ - C ₈	X ⁵	X	X ⁷			X ⁶			X ⁶
Aliphatics C ₈ - C ₁₀	X ⁵	X	X ⁷			X ⁶			X ⁶
Aliphatics C ₁₀ - C ₁₂		X	X ⁷	X ⁸		X ⁶			X ⁶
Aliphatics C ₁₂ - C ₁₆		X	X ⁷	X ⁸		X ⁶	X ⁹		X ⁶
Aliphatics C ₁₆ - C ₃₅		X		X ⁸	X ⁹	X ⁶	X ⁶	X ¹⁰	X ⁶
Aromatics C ₈ - C ₁₀	X ⁵	X	X ⁷			X ⁶			X ⁶
Aromatics C ₁₀ - C ₁₂		X	X ⁷	X ⁸		X ⁶			X ⁶
Aromatics C ₁₂ - C ₁₆		X	X ⁷	X ⁸		X ⁶	X ⁶		X ⁶
Aromatics C ₁₆ - C ₂₁		X		X ⁸	X ⁹	X ⁶	X ⁶		X ⁶
Aromatics C ₂₁ - C ₃₅		X			X ⁹	X ⁶	X ⁶	X ¹⁰	X ⁶
TPH-GRO C ₆ - C ₁₀	X ¹¹	X ⁶	X ¹¹			X ¹¹			X ⁶
TPH-DRO C ₁₀ - C ₂₈ ¹²		X ⁶	X ¹³	X ¹³	X ¹³	X ¹³	X ¹³		X ⁶
TPH-ORO C ₂₈ ¹²		X ⁶			X ¹⁴	X ¹⁴	X ¹⁴	X ¹⁴	X ⁶

How were the RS for TPH-GRO, DRO, and ORO derived?

Example: Soil_{ni} for TPH-DRO (C₁₀ - C₂₈)

Aliphatics C _{>8} -C ₁₀	1200
Aliphatics C _{>10} -C ₁₂	2300
Aliphatics C _{>12} -C ₁₆	3700
Aliphatics C _{>16} -C ₃₅	10,000
Aromatics C _{>8} -C ₁₀	650
Aromatics C _{>10} -C ₁₂	1200
Aromatics C _{>12} -C ₁₆	1800
Aromatics C _{>16} -C ₂₁	1500
Aromatics C _{>21} -C ₃₅	1800

TPH

- TPH Analytical methods

- TPH - 8015B, Texas 1005
- Fractions - Texas 1006, MDEP VPH/EPH
- PAH - 8310 or 8270
- $C_{>35}$
- Fractionation data supersedes 8015 mixture data

TPH

- Table D-2 P/C Properties of fractions
- Table D-3 RfD and target organs/critical effects
 - TPHCWG; not in IRIS
- Table D-4 Critical effects/targets for all petroleum COC
- Aesthetic cap of 10,000 ppm

Additivity: TPH

■ Additivity - TPH RS based on 10,000 cap

- ⚡ Do not adjust 10,000 cap
 - ⚡ Identify risk-based value in Appendix H worksheets
 - ⚡ Adjust risk-based RS to account for additive effects
 - ⚡ If adjusted risk-based RS < 10,000, use risk-based RS
 - ⚡ If adjusted risk-based RS > 10,000, use 10,000 cap
-
- ⚡ Example: Table 2 Soil_i for Aliphatics C₁₂₋₁₆ is 10,000 mg/kg; The risk-based Soil_i from Appendix H is 38,000 mg/kg. Adjust 38,000 for additivity. If the adjusted value is \geq than 10,000, then the Soil_i is still 10,000 mg/kg. If the adjusted value is less than 10,000 mg/kg, then the Soil_i is the adjusted risk-based value.

Additivity: TPH Fractions

- Aliphatics $C_{>6}-C_8$
- Aliphatics $C_{>8}-C_{16}$ ($C_{>8}-C_{10}$, $C_{>10}-C_{12}$, $C_{>12}-C_{16}$)
- Aliphatics $C_{>16}-C_{35}$
- Aromatics $C_{>8}-C_{16}$ ($C_{>8}-C_{10}$, $C_{>10}-C_{12}$, $C_{>12}-C_{16}$)
- Aromatics $C_{>16}-C_{35}$

Additivity: TPH Fractions Example

- Soil: ethylbenzene, aliphatics $C_{>8}-C_{10}$, $C_{>10}-C_{12}$, $C_{>12}-C_{16}$
- Id of targets:
 - ethylbenzene: liver, kidney, developmental
 - aliphatics $C_{>8}-C_{10}$: liver, hematological system
 - aliphatics $C_{>10}-C_{12}$: liver, hematological system
 - aliphatics $C_{>12}-C_{16}$: liver, hematological system
- Additivity - Liver: ethylbenzene and aliphatics $C_{>8}-C_{16}$
- Adjustment factor: 2 NOT 4

$C_{>8}-C_{16}$

Additivity: TPH Fractions Example 1 (cont'd)

- Adjustment of MO-1 Soil_{ni}:

ethylbenzene: $1600/2 = 800$ mg/kg

aliphatics C_{>8}-C₁₀: $1200/2 = 600$ mg/kg

aliphatics C_{>10}-C₁₂: $2300/2 = 1150$ mg/kg

aliphatics C_{>12}-C₁₆: $3700/2 = 1850$ mg/kg

TPH

Additivity Example 2

Gasoline release to non-industrial soil

Table D-1: BTEX, aliphatics $C_{>6}-C_8$, $C_{>8}-C_{10}$, aromatics $C_{>8}-C_{10}$

MO-1 Additivity Example: Soil Gasoline Release

<u>COC</u>	<u>MO-1 Soil_{ni}</u>	<u>Target Organ/Effect</u>
benzene	Carcinogen	---
ethylbenzene	1600	liver, kidney, develop.
toluene	680	liver, kid., CNS, nas.epi.
xylene	180	↑activity, ↓bw, ↑mort.
aliphatics C ₆₋₈	12,000*	kidney
aliphatics C ₈₋₁₀	1200	liver, hematol. sys.
aromatics C ₈₋₁₀	650	↓bw

*risk-based value

MO-1 Additivity Example: Soil Gasoline Release

Summarize by target organ:

- (3) liver: ethylbenzene, toluene, aliphatics C8-10
- (3) kidney: ethylbenzene, toluene, aliphatics C6-8
- (1) developmental: ethylbenzene
- (1) CNS: toluene
- (1) nasal epithelium: toluene
- (1) hyperactivity: xylene
- (2) ↓bw: xylene, aromatics C8-10
- (1) ↑mortality: xylene
- (1) hematological system: aliphatics C8-10

MO-1 Additivity Example: Soil Gasoline Release

COC

benzene

ethylbenzene

toluene

xylene

aliphatics C₆₋₈

aliphatics C₈₋₁₀

aromatics C₈₋₁₀

Adjusted MO-1 Soil_{ni}

Carcinogen

1600 ÷ 3 = 533 (liver)

680 ÷ 3 = 227 (liver)

180 ÷ 2 = 90 (↓bw)

12,000 ÷ 3 = 4000 (kidney)

1200 ÷ 3 = 400 (liver)

650 ÷ 2 = 325 (↓bw)

MO-1 Additivity Example: Soil Gasoline Release

Identification of the limiting soil RS:

<u>COC</u>	<u>Soil_{ni}</u>	<u>Soil_{GWDW}</u> *	<u>Soil_{sat}</u>
benzene	1.5	4.8	900
ethylbenzene	533	29,040	230
toluene	227	52,800	520
xylene	90	79,200	150
aliphatics C ₆₋₈	4,000	10,000	NA
aliphatics C ₈₋₁₀	400	10,000	NA
aromatics C ₈₋₁₀	325	10,000	NA

*based on a DF3 of 440

Poll Question No. 9:

Take a break or keep going?

- Take a 5 minute break
- Keep going
- Doesn't matter to me

Appendix D
Non-Traditional Parameters
TEQ: Dioxins and PCBs
PCBs

Non-Traditional Parameters

- Chlorides, sulfates, pH, etc.
- Evaluation highly dependent on professional judgement
- MO-2 or MO-3
- Protection of health, ecological receptors, livestock, crops, and vegetation
- Prevent migration and cross-media transfer
- Protect beneficial uses of medium/aesthetics
- Protect structures
- Consider solubility, soil saturation
- Odor and taste thresholds
- Visual considerations

Total TEQ Equivalent Concentration (Dioxins and Furans)

- ▶ Dioxin Toxicity Equivalency Factors (TEF) represent the toxicity of each dioxin and furan congener relative to 2,3,7,8-TCDD

- ▶ Total TEQ concentration is calculated for each sample result

$$\text{TEQ} = \sum (C_i \times \text{TEF}_i)$$

C_i = individual dioxin and furan congener concentration in environmental media

TEF_i = toxicity equivalence factor

Sum of the TEFs x dioxin and furan congener concentrations = TEQ concentration

TEQ concentration is compared to the 2,3,7,8-TCDD RS

- ▶ TCDD RS (Carcinogenic vs noncarcinogenic)
- ▶ EPA and LDEQ: 2005 WHO TEF (https://rais.ornl.gov/documents/dioxin_tef.pdf)
- ▶ Laboratory generated TEQs are often based on International TEFs (I-TEF)
- ▶ WHO-TEF \neq I-TEF

RECAP Submittal Requirements

- Include all requirements listed in RECAP
 - /// SO - Page 83
 - /// MO-1 - Page 89
 - /// MO-2 - Page 97
 - /// MO-3 - Page 108
 - /// Appendix I Assessment - I-21
- Include all information, data, etc to allow the reviewer to be able to reproduce all calculations, verify all assumptions, conclusions, etc.
- Appendix C - RECAP Forms

Total TEQ Equivalent Concentration (PCBs)

- ▶ 209 PCB congeners total
- ▶ 12 PCB dioxin-like congeners (DLC) (WHO 12)
- ▶ Toxicity Equivalency Factors (TEF) represent the toxicity of dioxin-like PCB congener relative to 2,3,7,8-TCDD
- ▶ Total TEQ concentration is calculated for each sample result

$$\text{TEQ} = \sum (C_i \times \text{TEF}_i)$$

C_i = individual dioxin-like PCB congener concentration in environmental media

TEF_i = toxicity equivalence factor

Sum of the TEFs x dioxin and furan congener concentrations = TEQ concentration

TEQ concentration is compared to the 2,3,7,8-TCDD RS

Example TEQ calculation for residential soil:

Analytical results of dioxins, furans and PCB congeners in a soil sample:

Congener	Concentration (ppt)
1,2,3,7,8-PeCDD	10
2,3,4,7,8-PeCDF	30
PCB 126	20

Congener	TEF
1,2,3,7,8-PeCDD	1
2,3,4,7,8-PeCDF	0.5
PCB 126	0.1

Congener	Calculation of TEQ for each congener
1,2,3,7,8-PeCDD	10 ppt x 1 = 10 ppt TEQ
2,3,4,7,8-PeCDF	30 ppt x 0.5 = 15 ppt TEQ
PCB 126	20 ppt x 0.1 = 2 ppt TEQ

Total TEQ:

$$10 \text{ ppt} + 15 \text{ ppt} + 2 \text{ ppt} = 27 \text{ ppt}$$

Compare TEQ concentration of 27 ppt to the residential soil screening level for 2,3,7,8-TCDD of 50 ppt.

PCBs

- ▶ Congener data vs Aroclor data
 - An Aroclor is a mixture of PCB congeners
 - Aroclor 1260: 12 - 12 carbons and 60 = 60% chlorination
 - Due to weathering, the composition of the mixture changes over time
 - Analytical method for Aroclors is based on pattern recognition, therefore, Aroclor data is nonspecific and may underestimate amount of PCB present due to weathering
 - Congener data is very specific, better assessment of presence and toxicity
 - Congener data much more expensive than Aroclor data
 - Compromise: analyze for WHO 12 PCB DLC (risk drivers)
 - Media - soil, sediment, fish, GW1, etc.
 - Discuss with LDEQ prior to site investigation

Vapor Intrusion Pathway

- ▶ Soil gas sampling
- ▶ Sub-slab sampling
- ▶ Indoor air sampling
- ▶ Internal agency guidance/policy
- ▶ Sampling protocols and data interpretation - discuss with LDEQ prior to initiating investigation

Vapor Intrusion Pathway - Chlorinated Solvents

RECAP states:

- ▶ In general, the Soil_{es} and GW_{es} are applicable to soil and groundwater present at a depth less than or equal to 15 ft bgs that are impacted with volatile constituents and located beneath an enclosed structure.
- ▶ The need to evaluate the vapor intrusion pathway for soil and/or groundwater present at a depth greater than 15 ft bgs shall be determined by the Department based on site-specific conditions (COC present, nature of the release, subsurface characteristics, etc.) and the level of concern associated with the potential migration of volatile emissions from soil and/or groundwater to an enclosed structure.
- ▶ Chlorinated Solvents: The VI pathway can be complete for chlorinated solvents (TCE, PCE, DCE, VC) with source depths greater than 15 ft bgs

Resampling Dos and Don'ts

- ▶ Resampling data replaces existing data when:
 - ❖ A RS for a TPH mixture is exceeded and TPH fractionation data are obtained for that location
 - ❖ Soil has been removed or moved and existing data are no longer representative
 - ❖ Existing data are not valid or are questionable based on QA/QC data or other technical factor (e.g. matrix interference, elevated SQL, etc)
 - ❖ Existing data is very old and likely not representative of current site conditions, i.e., benzene in shallow groundwater and available data is 15 years old
 - ❖ Other valid technical or analytical reason
- ▶ Otherwise, new data supplements not replaces existing data

RECAP : Phase II Assessments

- ▶ Data are generally screened under the SO - data for each sampling location are compared to the LSS
- ▶ Generally, site investigation/available data are inadequate to conduct a MO-1 RECAP assessment
 - ❖ Available site information does not meet requirements for higher tiers of assessment (e.g., MO-1 requires groundwater classification, groundwater flow direction, delineation of AOI, etc)
 - ❖ There can be exceptions
- ▶ If a COC is not listed in Table 1, SS must be calculated for the COC using the spreadsheet; EPA Screening Levels may not be used
- ▶ The area addressed by the Phase II assessment should meet criteria for management under the SO
- ▶ The SO submittal requirements should be met where appropriate or information is available
- ▶ If none of the COC exceed the Limiting Standard → No Further Interest
- ▶ An NFI letter only addresses the SAMPLING LOCATIONS not the property

No Further Interest vs No Further Action

NFI

- ▶ Limited dataset (e.g., Phase II)
- ▶ Applicable only to specific locations where the data was collected - **not the entire property**
- ▶ LSS or LRS applied to individual data points (not 95%UCL-AM)
- ▶ All detected concentrations must be \leq LSS
- ▶ Compliance with industrial RS requires conveyance notice on data locations not the entire property

NFA-ATT

- ▶ Assessment (and if warranted remediation) complies with RECAP
- ▶ Applicable to an AOI - **not the entire property**
- ▶ $AOIC/CC \leq$ Limiting SS, MO-1, MO-2 or MO-3 RS
- ▶ Compliance with industrial RS requires conveyance notice for AOI not the entire property

NFA-ATT Clarifications

- ▶ Compliance with non-industrial standards within an AOI does not imply unrestricted/unlimited land/property use
- ▶ AOI = Exposure Area; Therefore, if future land use involves the division of a closed AOI into smaller parcels, then re-evaluation of exposure concentrations for newly defined areas is required.
- ▶ If land use changes from industrial to nonindustrial the Department shall be notified within 30 days and the AOI shall be re-evaluated

Non-Detect Analytical Results

- ▶ For COC that are not detected, RECAP requires that the Sample Quantitation Limit (also referred to as the Reporting Limit) be less than the LSS or LRS prior to eliminating the COC from further assessment
 - ✓ Page 29: In the RECAP submittal, non-detected results shall be reported as less than the numerical value of the SQL (e.g., < 5 ug/l) and a comparison of the SQL to the limiting SS or RS shall be presented for all constituents reported as not detected to demonstrate that the SQL are less than or equal to the limiting SS or RS prior to eliminating a COC from further assessment.
- ▶ Elevated Reporting Limits is an analytical issue that should be resolved early in the process - determine why it is occurring and if possible correct the issue
- ▶ Identify data gaps

Non-Detect Analytical Results

- ▶ Nondetected COC should not be included in the RECAP assessment - do not use the RL as the AOIC
- ▶ Nondetected COC should not be included in conveyance notice
- ▶ When calculating 95%UCL-AM using ProUCL, enter the full RL not $\frac{1}{2}$ RL

Mutagens

Acrylamide, benzidine, Cr⁺⁶, chloroprene, 1,2-dibromo-3-chloropropane, ethylene oxide, 3-methylcholanthrene, methylene chloride, 4,4'-methylene-bis(2-chloroaniline), N-nitroso-N-ethylurea, N-nitroso-N-methylurea, N-nitrosodiethylamine, N-nitrosodimethylamine, cPAH, TCE, 1,2,3-trichloropropane, urethane, vinyl chloride

- ▶ Carcinogens that cause a change in the DNA of a cell are referred to as mutagens
 - ▶ DNA changes may cause certain diseases, such as cancer
 - ▶ Increased susceptibility to mutagens during early-life
 - ▶ In the absence of chemical-specific data to evaluate differences in susceptibility, age-dependent adjustment factors (ADAFs) should be applied
 - ▶ The *Supplemental Guidance* establishes ADAFs for three specific age groups
 - ❖ 10X risk for birth to <2 yr
 - ❖ 3X risk for 2 yr to <16 yr
 - ❖ 1X risk for 16-70 yr
- Nonindustrial RS for mutagens cannot be calculated using :DEQ spreadsheet; calculate under MO-3 using current EPA protocols - request LDEQ tox assistance

Conveyance Notice

A conveyance notification shall be required under the following site conditions:

- ▶ A conveyance notification shall be placed on all properties having residual constituent concentrations in soil that are greater than the acceptable exposure concentration defined for non-industrial (residential) land use [i.e., constituent concentrations greater than the $Soil_{ni}$ (or $Soil_{esni}$ if applicable)].
 - Note: If land use at the AOI is industrial and the limiting soil RS applied at the AOI is a non-risk-based RS ($Soil_{GW}$, $Soil_{sat}$, quantitation limit, or background level) that is lower than the $Soil_{ni}$, then a conveyance notification shall not be required.
- ▶ A Groundwater 2 Zone shall be required to have a conveyance notification on that portion of the plume within property boundaries that contains a residual constituent concentration that exceeds the GW_2 RS (without the application of a dilution and attenuation factor).

Conveyance Notice

Only include in conveyance notice:

- ✓ COC in surface soil > Soil_{ni}
- ✓ COC in groundwater 2 zone on property > GW_1

Do not include in conveyance notice:

- ✗ Exceedances of Soil_{GW} or Soil_{sat}
- ✗ Exceedances of GW_3 RS
- ✗ Not detected COC with elevated RLs

Conveyance Notice form

CN Summary Tables

Surface soil:

For the **highest RECAP option completed**, list the COC, AOIC, NFA BOD LRS, and the Soil_{ni} used to identify the portion(s) of the property addressed in the notice:

COC	Soil _{ni} (mg/kg)	AOIC (mg/kg)	Basis of AOIC (UCL or Max)	NFA BOD LRS (mg/kg)	Basis of BOD LRS
Example COC	33	45	UCL	37	Soil _{GW3DW}

Summary Tables

Groundwater:

For the highest RECAP option completed, list the COC, CC at the POC, and the GW_1 used to identify the portion(s) of the property addressed in the notice.

COC	CC (mg/l)	GW_1 (mg/l)	NFA BOD LRS (mg/l)	Basis of BOD LRS
Example COC	9	0.05	$0.05 \times 248 = 12$	$GW_2 \times DF2$
Example COC	0.5	0.011	0.6	Water _{sol}

Conveyance Notice

Attach:

- 1) a scaled site plan illustrating the area(s) of the property where the AOIC for one or more COC is greater than the Soil_{ni} and/or GW_1
- 2) a table listing the COC concentrations remaining at each sampling location;
- 3) the legal description of the property; Note: The legal description used in the notice must be the exact description contained within previous conveyance documents, and which defines the property or properties in a legal sense. This legal description must be obtained from the civil records of the Parish where the site is located; and
- 4) a draft copy of the conveyance notice; the current notice format may be obtained from the LDEQ.

Conveyance Notice

- ! Notice should be reviewed and approved by the team leader **before** the notice is filed!
- ! A number of notices have been filed by RP or Consultant that were incorrect which required that additional notices be filed on the property
- ! The conveyance notice should not be written/filed until the RECAP and all associated site activities have been completed and approved by the Department
- ! Inform the RP and consultant

Poll Question No. 10:

After this training, I feel (check all that apply):

- More confident in my RECAP knowledge
- Less confident in my RECAP knowledge
- About the same in my RECAP knowledge
- Invigorated
- Exhausted

Questions?



Upcoming Trainings

August 10, 2021 Webinar No. 3:
Developing an Effective Sampling Plan - Keith Horn

Sept. 14, 2021 Webinar No. 4:
The Ins and Outs of the VRP - Jennifer Schatzle

Oct. 12, 2021 Webinar No. 5:
Common Mistakes, Misconceptions & Compliance Issues
June Sutherlin

Email Rebecca.Otte@LA.gov for registration Links

Recording & PowerPoints available on LDEQ YouTube Channel

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