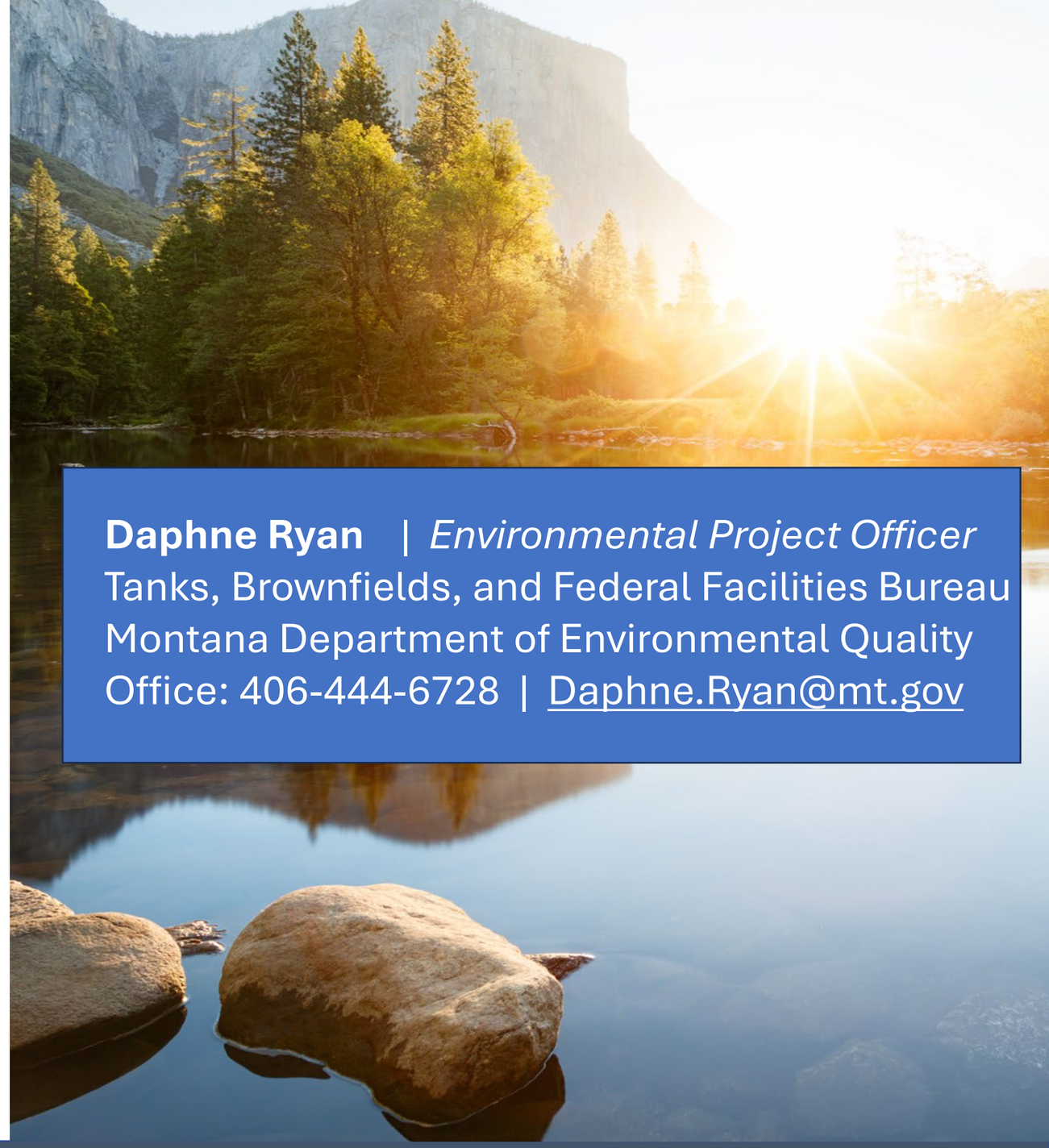
Risk-Based Corrective Action (RBCA)

Table Updates



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Tables

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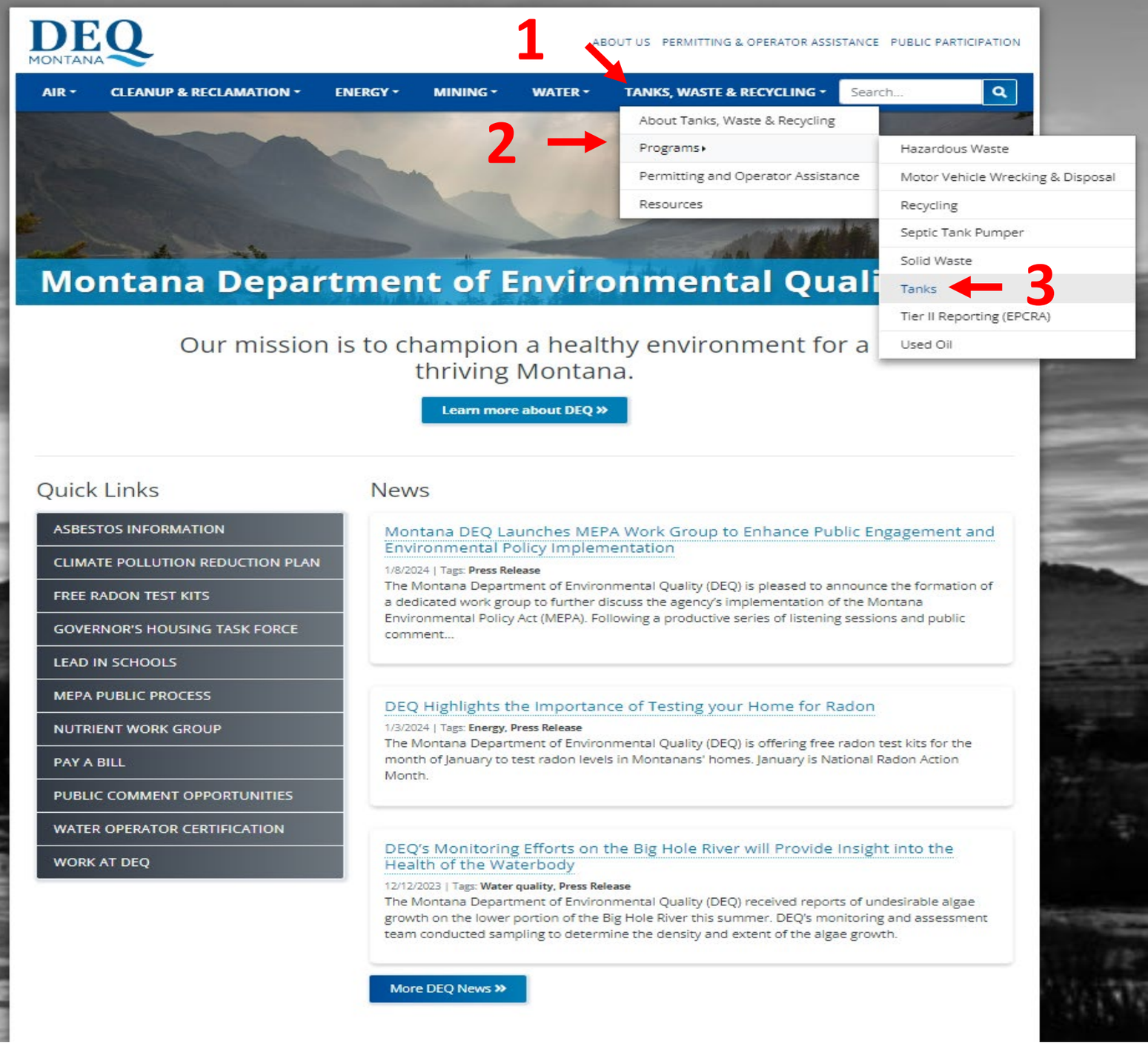
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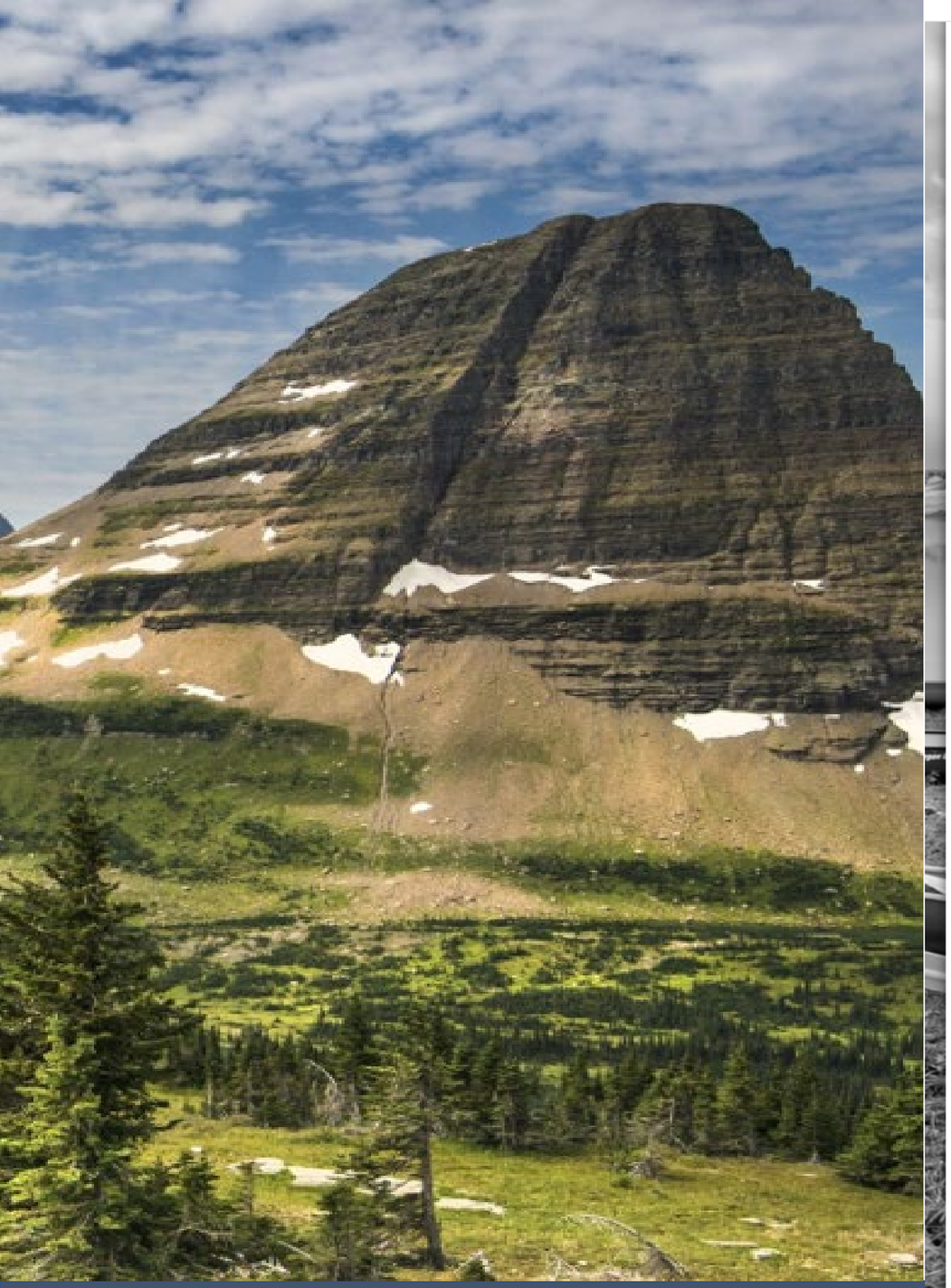
News
Montana DEQ Launches MEPA Work Group to Enhance Public Engagement and Environmental Policy Implementation
1/8/2024 | Tags: Press Release
The Montana Department of Environmental Quality (DEQ) is pleased to announce the formation of a dedicated work group to further discuss the agency's implementation of the Montana Environmental Policy Act (MEPA). Following a productive series of listening sessions and public comment...
DEQ Highlights the Importance of Testing your Home for Radon
1/3/2024 | Tags: Energy, Press Release
The Montana Department of Environmental Quality (DEQ) is offering free radon test kits for the month of January to test radon levels in Montanans' homes. January is National Radon Action Month.
DEQ's Monitoring Efforts on the Big Hole River will Provide Insight into the Health of the Waterbody
12/12/2023 | Tags: Water quality, Press Release
The Montana Department of Environmental Quality (DEQ) received reports of undesirable algae growth on the lower portion of the Big Hole River this summer. DEQ's monitoring and assessment team conducted sampling to determine the density and extent of the algae growth.
More DEQ News »



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Tanks

Overview of Tanks Programs

Montana DEQ works closely with stakeholders to implement regulations for various aspects of above ground and underground storage tank systems, including construction, installation, and operation as well as identification and cleanup of associated leaks and funding options to support cleanup work. Use the buttons below to click through for more information on any of the programs.

Need to Report a Leak?

Call the leak reporting hotline

1-800-457-0568 (M-F 8:00-5:00)
1-406-324-4777 (After hours and holidays)

NOTE: You must report to a live person.
Leaving a message does not constitute a report.

Underground Storage Tanks

Underground Storage Tanks
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Keywords: Underground Storage Tank Permits, Licensing for Tank Professionals, Tank Operator Training, UST Owner Information

Petroleum Tank Cleanup

Petroleum Tank Cleanup
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Keywords: Petroleum Release, Petroleum Cleanup, Petroleum Investigation, Petroleum Contamination, Petroleum Remediation

Petroleum Brownfields

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Keywords: Property Owner Assistance, Petroleum Funding Eligibility, Brownfields Funding, Petroleum Release Cleanup, Abandoned Gas Station Redevelopment

Petroleum Tank Release Compensation Board

Petroleum Tank Release Compensation Board
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Keywords: Petroleum Funding, Financial Assistance, Financial Responsibility, Eligibility, Cleanup, Remediation, Remediation Assistance, Claims, Work Plan, Corrective Action Plan (CAP)

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Program Overview

The goal of the Petroleum Tank Cleanup Section is to protect human health and the environment from petroleum and hazardous substance releases from both underground and above ground storage tank systems.

- Directs and oversees reporting, investigation, cleanup, and resolution of petroleum releases.
- Is the technical resource for tank owners and operators (O/O), consultants, local government officials, and the public to help respond to questions or concerns about the cleanup of petroleum releases.
- Approves the cleanup efforts of the facility O/O, assesses the potential threat to human health and the environment and provides technical assistance with corrective action.
- Works with O/O and their identified funding source (often the PTRCB) which provides financial assistance for eligible corrective action remediation.
- Administers other funding sources:
  o Leaking Underground Storage Tank (LUST) Trust Fund Program
  o Petroleum Brownfields Program
  o Special Legislative Funding

HOTLINE for Reporting Leaks

Monday through Friday 8:00 a.m. to 5:00 p.m.
call 1-800-457-0568

After hours and holidays call 1-406-324-4777

NOTE: You must report to a live person.
Leaving a message does not constitute a report.

Save the Date

Consultants Day 2024
February 9, 2024 at Fairmont Hot Springs

GUIDANCE

Risk Based Corrective Action Guidance (RBCA)

- **Risk-Based Screening Level (RBSL) Changes**
- **Table 1**: Tier 1 Surface Soil (0-2 ft) RBSLs
- **Table 2**: Tier Subsurface Soil (>2 ft) RBSLs
- **Table 3**: Tier 1 Groundwater RBSLs and Standards
- **Table 4**: Master Table - All Potential Tier 1 RBSLs for Soil
- **Table 5**: Conceptual Site Model - Evaluation of Exposure Pathways

Remedial Investigation Guidance
Remedial Alternatives Analysis Guidance
Cleanup Guidance and **Cleanup Technologies Workbook**

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TABLE 1
TIER 1 SURFACE SOIL (0-2 ft) RBSLs (mg/kg)
(includes default RBSLs)

This table applies to contaminated surface soil from 0-2 feet below ground surface. Distance to water is from the sample depth to the water table. **For VPH compounds at UST sites, default RBSLs (bold) are used to determine if a release has occurred at a site. Default RBSLs apply to the entire soil column and always apply in the absence of adequate information. For EPH compounds, the 200 ppm EPH screen concentration is used to determine if additional analysis (fractionation) is needed.**

Distance to groundwater		< 10 fe		t to groundwater		10-20 feet to groundwater				> 20 feet to groundwater			
Chemical units (mg/kg = ppm)	E	Residential RBSL (mg/kg)	B	Commercial RBSL (mg/kg)	B	Residential RBSL (mg/kg)	B	Commercial RBSL (mg/kg)	B	Residential RBSL (mg/kg)	B	Commercial RBSL (mg/kg)	B
For Gasoline and Light Hydrocarbons me				**sured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)**									
C5-C8 Aliphatics	n	**52**	dc	220	l	52	dc	290	dc	52	dc	290	dc
C9-C12 Aliphatics	n	**77**	dc	360	dc	77	dc	360	dc	77	dc	360	dc
C9-C10 Aromatics	n	**130**	l/dc	130	l	130	dc	470	l	130	dc	720	l
MTBE	c	**0.078***	l	0.078*	l	0.16	l	0.16	l	0.25	l	0.25	l
Benzene	c	**0.07**	l	0.07	l	0.21	l	0.21	l	0.33	l	0.33	l
Toluene	n	**21**	l	21	l	65	l	65	l	100	l	100	l
Ethylbenzene	c	**6.4**	dc	26	l	6.4	dc	28	dc	6.4	dc	28	dc
Xylenes	n	**72**	dc	310	dc	72	dc	310	dc	72	dc	310	dc
Naphthalene	c	**4.3**	dc	12	l	4.3	dc	19	dc	4.3	dc	19	dc
Lead Scavengers													
1,2-Dibromoethane (EDB)	c	**0.000086***	l	0.000086*	l	0.00022*	l	0.00022*	l	0.00033*	l	0.00033*	l
1,2-Dichloroethane (DCA)	c	**0.019**	l	0.019	l	0.052	l	0.052	l	0.079	l	0.079	l
For Diesel and Heavy Hydrocarbons meas				**ured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)**									
EPH Screen, Fractionate		**200**		200		200		200		200		200	
C9-C18 Aliphatics	n	**110**	dc	540	dc	110	dc	540	dc	110	dc	540	dc
C19-C36 Aliphatics	n	**24,000**	dc	200,000	dc	24,000	dc	200,000	dc	24,000	dc	200,000	dc
C11-C22 Aromatics	n	**370**	l	370	l	490	dc	1,300	l	490	dc	2,000	l
Acenaphthene	n	**27**	l	27	l	91	l	91	l	140	l	140	l
Anthracene	n	**2,200**	dc	2,600	l	2,200	dc	8,800	l	2,200	dc	14,000	l
Benz(a)anthracene	c	**1.3**	dc	6.8	l	1.3	dc	23	l	1.3	dc	24	dc
Benzo(a)pyrene	c	**0.13****	dc	2.3	l	0.13**	dc	2.4	dc	0.13**	dc	2.4	dc
Benzo(b)fluoranthene	c	**1.3**	dc	23	l	1.3	dc	24	dc	1.3	dc	24	dc
Benzo(k)fluoranthene	c	**13**	dc	230	l	13	dc	240	dc	13	dc	240	dc
Chrysene	c	**130**	dc	690	l	130	dc	2,300	l	130	dc	2,400	dc
Dibenzo(a,h)anthracene	c	**0.13****	dc	2.4	dc	0.13**	dc	2.4	dc	0.13**	dc	2.4	dc
Fluoranthene	n	**85**	l	85	l	280	l	280	l	300	dc	440	l
Fluorene	n	**35**	l	35	l	120	l	120	l	180	l	180	l
Indeno(1,2,3-cd)pyrene	c	**1.3**	dc	24	dc	1.3	dc	24	dc	1.3	dc	24	dc
Naphthalene	c	**4.3**	dc	12	l	4.3	dc	19	dc	4.3	dc	19	dc
Pyrene	n	**83**	l	83	l	220	dc	280	l	220	dc	430	l
1-Methylnaphthalene	c	**2.1**	l	2.1	l	7.1	l	7.1	l	11	l	11	l
2-Methylnaphthalene	n	**6.9**	l	6.9	l	23	l	23	l	30	dc	35	l

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Confirmation Table

Table 1

Petroleum-Release Confirmation Risked-Based Screening Levels (RBSLs) for Soil

Laboratory analytical results that exceed the Table 1 Release Confirmation Soil RBSLs listed below confirm that a release has oc
ARM 17.56.506. These represent the most conservative Tier 1 RBSLs for Leaching to groundwater and Residential Direct Cont
including ingestion, inhalation, and dermal routes of exposure.

Chemical / Analyte / Compound	Effects - carcinogenicity	RBSL, mg/kg	Basis
For Gasoline & Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)			
MTBE	c	0.078 *	I
Benzene	c	0.07	I
Toluene	n	21	I
Ethylbenzene	c	8.4	dc
Xylenes	n	75	dc
Naphthalene	c	2.9	dc
C9-C10 Aromatics	n	100	dc
C5-C8 Aliphatics	n	78	dc
C9-C12 Aliphatics	n	89	dc
[illegible]			
1,2-Dichloroethane (DCA)	c	0.019	I
1,2-Dibromoethane (EDB)	c	0.000086 *	I
For Diesel & Heavy Hydrocarbons measured using Montana Method for Extractable Petroleum Hydrocarbons (EPH)			
**EPH Screen	n/a	200	n/a
C9-C18 Aliphatics	n	130	dc
C19-C36 Aliphatics	n	30,000	dc
C11-C22 Aromatics	n	370	I
Acenaphthene	n	27	I
Anthracene	n	2,300	dc
Benz(a)anthracene	c	1.6	dc
Benzo(a)pyrene	c	0.17	dc
Benzo(b)fluoranthene	c	1.7	dc
Benzo(k)fluoranthene	c	17	dc
Chrysene	c	170	dc
Dibenzo(a,h)anthracene	c	0.17	dc
Fluoranthene	n	85	I
Fluorene	n	35	I
Indeno(1,2,3-cd)pyrene	c	1.7	dc
Naphthalene	c	2.9	dc
Pyrene	n	83	I
1-Methylnaphthalene	c	2.1	I
2-Methylnaphthalene	n	6.9	I

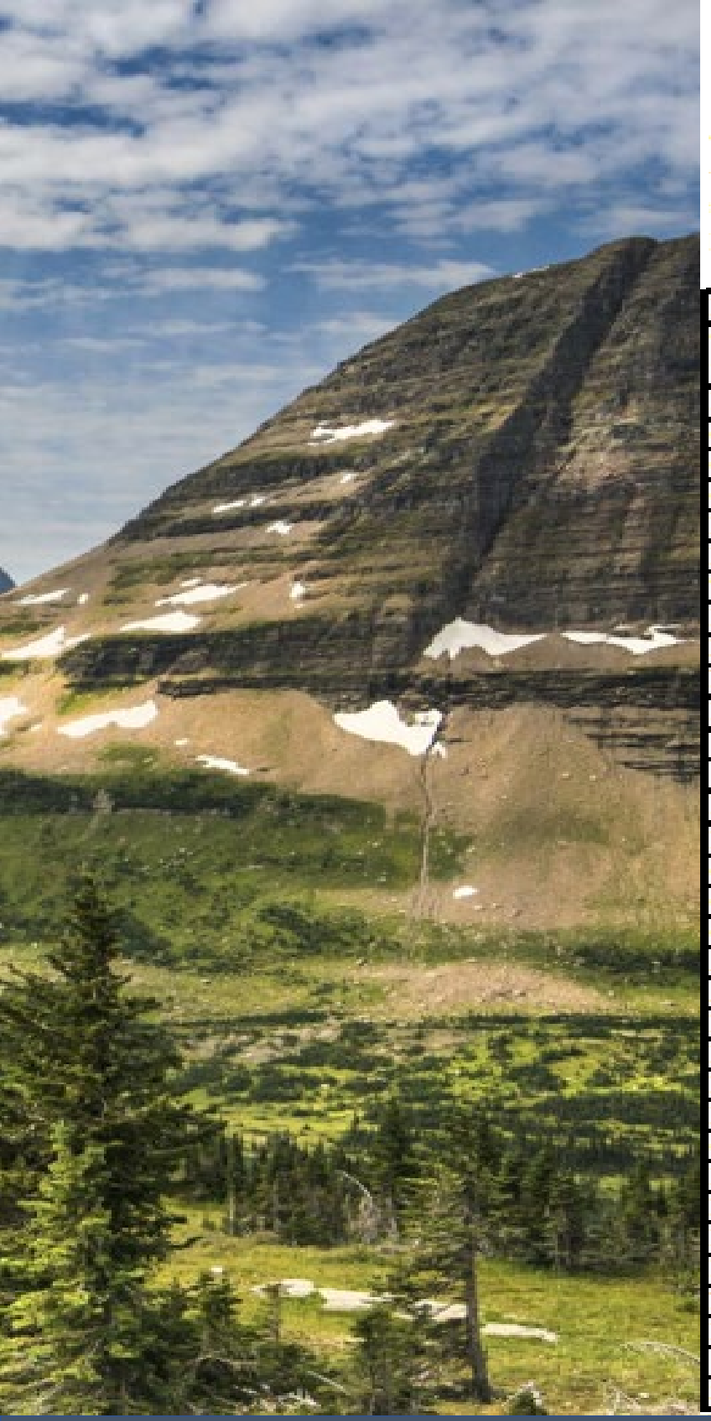

TABLE 2
TIER 1 SUBSURFACE SOIL (>2 ft) RBSLs (mg/kg)

This table applies to contaminated subsurface soil (>2 feet below the ground surface). Distance to water is from the sample depth to the water table. **For VPH compounds at UST sites, default RBSLs, provided in bold on Table 1, are used to determine if a release has occurred at a site. Default RBSLs apply to the entire soil column and always apply in the absence of adequate information. For EPH compounds the 200 ppm screen concentration is used to determine if additional analysis (fractionation) of the soil sample is needed.**

Distance to groundwater		< 10 feet to ground water		10-20 feet to ground water		> 20 feet to ground water	
Chemical units (mg/kg = ppm)	E	>2 ft Construction RBSL (mg/kg)	B	>2 ft Construction RBSL (mg/kg)	B	>2 ft Construction RBSL (mg/kg)	B
For Gasoline and Light Hydrocarbons measured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)							
C5-C8 Aliphatics	n	220	I	410	dc	410	dc
C9-C12 Aliphatics	n	640	dc	640	dc	640	dc
C9-C10 Aromatics	n	130	I	470	I	720	I
MTBE	c	0.078*	I	0.16	I	0.25	I
Benzene	c	0.07	I	0.21	I	0.33	I
Toluene	n	21	I	65	I	100	I
Ethylbenzene	c	26	I	84	I	130	I
Xylenes	n	320	I	610	dc	610	dc
Naphthalene	n	12	I	40	I	62	I
Lead Scavengers							
1,2-Dibromoethane (EDB)	c	0.000086*	I	0.00022*	I	0.00033*	I
1,2-Dichloroethane (DCA)	c	0.019	I	0.052	I	0.079	I
For Diesel and Heavy Hydrocarbons measured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)							
EPH Screen, Fractionate		200		200		200	
C9-C18 Aliphatics	n	900	dc	900	dc	900	dc
C19-C36 Aliphatics	n	200,000	dc	200,000	dc	200,000	dc
C11-C22 Aromatics	n	370	I	1,300	I	2,000	I
Acenaphthene	n	27	I	91	I	140	I
Anthracene	n	2,600	I	8,800	I	14,000	I
Benz(a)anthracene	c	6.8	I	23	I	35	I
Benzo(a)pyrene	c	2.3	I	7.5	I	12	I
Benzo(b)fluoranthene	c	23	I	76	I	120	I
Benzo(k)fluoranthene	c	230	I	750	I	1,200	I
Chrysene	c	690	I	2,300	I	3,500	I
Dibenzo(a,h)anthracene	c	7.5	I	24	I	38	I
Fluoranthene	n	85	I	280	I	440	I
Fluorene	n	35	I	120	I	180	I
Indeno(1,2,3-cd)pyrene	c	77	I	250	I	380	I
Naphthalene	n	12	I	40	I	62	I
Pyrene	n	83	I	280	I	430	I
1-Methylnaphthalene	c	2.1	I	7.1	I	11	I
2-Methylnaphthalene	n	6.9	I	23	I	35	I

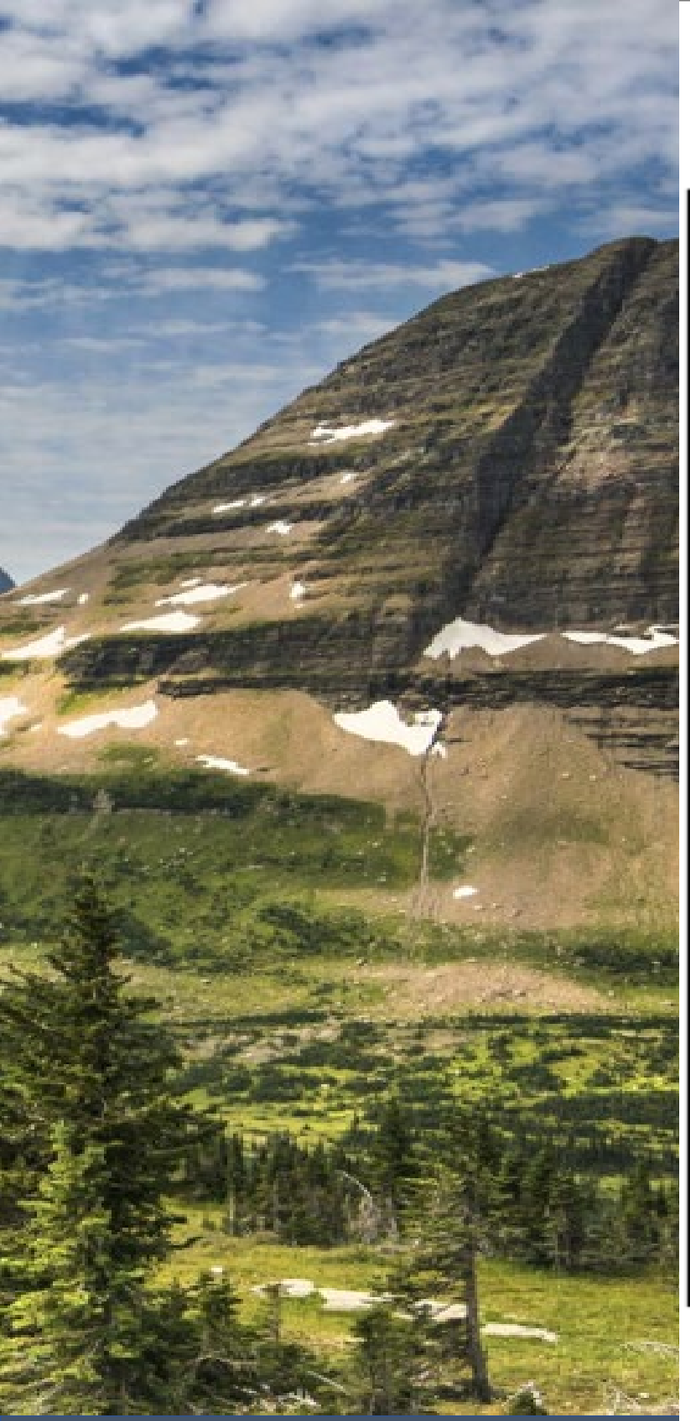

TABLE 4 - MASTER TABLE
ALL POTENTIAL TIER 1 RBSLs FOR SOIL (mg/kg)
Leaching RBSLs are based on the distance from the bottom of the contamination to the groundwater.

Chemical	Leaching 0-10 feet	Leaching 10-20 feet	Leaching >20 feet	Direct Contact Residential	Direct Contact Commercial*	Direct Contact Construction
For Gasoline and Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)						
C5-C8 Aliphatics	220	770	1,200	52	290	410
C9-C12 Aliphatics	11,000	40,000	60,000	77	360	640
C9-C10 Aromatics	130	470	720	130	1,000	1,000
MTBE	0.078	0.16	0.25	52	230	8,900
Benzene	0.07	0.21	0.33	1.3	5.7	240
Toluene	21	65	100	610	5,500	5,500
Ethylbenzene	26	84	130	6.4	28	1,300
Xylenes	320	1,000	1,600	72	310	610
Naphthalene**	12	40	62	4.3[c]	19[c]	140[n]
Lead Scavengers						
1,2-Dibromoethane (EDB)	0.000086	0.00022	0.00033	0.04	0.18	7.8
1,2-Dichloroethane (DCA)	0.019	0.052	0.079	0.52	2.3	110
For Diesel and Heavy Hydrocarbons measured using the Montana Method for Extractable Petroleum Hydrocarbons (EPH)						
C9-C18 Aliphatics	53,000	170,000	270,000	110	540	900
C19-C36 Aliphatics	Considered Immobile			24,000	200,000	200,000
C11-C22 Aromatics	370	1,300	2,000	490	3,900	3,900
Acenaphthene	27	91	140	450	3,800	3,800
Anthracene	2,600	8,800	14,000	2,200	19,000	19,000
Benz(a)anthracene	6.8	23	35	1.3	24	390
Benzo(a)pyrene	2.3	7.5	12	0.13	2.4	39
Benzo(b)fluoranthene	23	76	120	1.3	24	390
Benzo(k)fluoranthene	230	750	1,200	13	240	3,900
Chrysene	690	2,300	3,500	130	2400	39,000
Dibenzo(a,h)anthracene	7.5	24	38	0.13	2.4	39
Fluoranthene	85	280	440	300	2,500	2,500
Fluorene	35	120	180	300	2,500	2,500
Indeno(1,2,3-cd)pyrene	77	250	380	1.3	24	390
Naphthalene**	12	40	62	4.3[c]	19[c]	140[n]
Pyrene	83	280	430	220	1,900	1,900
1-Methylnaphthalene	2.1	7.1	11	20	81	1,400
2-Methylnaphthalene	6.9	23	35	30	250	250

* = Construction workers are exposed to both surface and subsurface soil. The lower of construction or commercial RBSLs are provided here.

** = Naphthalene has both carcinogenic ([c]) and non-carcinogenic effects ([n]). For residential and commerial receptors the carcinogenic RBSLs are lower. For construction workers the non-carcinogenic RBSL are lower. Please use the appropriate adjustment for Tier 2 analysis (see Section 5.2).

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Table 2: Tier 1 RBSLs

All Potential Tier 1 Risked-Based Screening Levels (RBSLs) for Soil, mg/kg

Leaching RBSLs: require vertical distance (feet) from base of petroleum-contaminated soil sample to groundwater.

Direct Contact RBSLs: require depth below ground surface (feet bgs) to petroleum-contaminated soil sample.

Chemical / Analyte / Compound	Leaching RBSLs, mg/kg Distance (feet) from Soil Sample to Groundwater			Direct Contact RBSLs, mg/kg Carcinogenic Effects, Receptors, and Depth Intervals			
	0-10 feet	10-20 feet	>20 feet	carcinogenic / non-carcinogenic	Residential 0 - 2 feet bgs	Commercial 0 - 2 feet bgs	Construction 0 - 10 feet bgs
For Gasoline & Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)							
MTBE	0.078	0.16	0.25	c	67	310	9,100
Benzene	[illegible]	[illegible]	[illegible]	c/n	1.7 [c]	7.6 [c]	190 [n]
Toluene	21	65	100	n	630	6,300	14,000
Ethylbenzene	26	84	130	c	8.4	38	1,200
Xylenes	320	1,000	1,600	n	75	330	1,900
Naphthalene	[illegible]	[illegible]	[illegible]	c/n	2.9 [c]	13 [c]	120 [n]
C9-C10 Aromatics	130	470	720	n	100	570	6,900
C5-C8 Aliphatics	220	770	1,200	n	78	390	14,000
C9-C12 Aliphatics	11,000	40,000	60,000	n	89	410	630
Lead Scavengers							
1,2-Dichloroethane (DCA)	0.019	0.052	0.079	c	0.67	3.0	100
1,2-Dibromoethane (EDB)	0.000086	0.00022	0.00033	c	0.05	0.24	7.3
For Diesel & Heavy Hydrocarbons measured using Montana Method for Extractable Petroleum Hydrocarbons (EPH)							
C9-C18 Aliphatics	53,000	170,000	270,000	n	130	620	970
C19-C36 Aliphatics	Considered Immobile			n	30,000	470,000	2,100,000
C11-C22 Aromatics	370	1,300	2,000	n	540	6,200	24,000
Acenaphthene	27	91	140	n	470	6,000	10,000
Anthracene	2,600	8,800	14,000	n	2,300	30,000	50,000
Benz(a)anthracene	6.8	23	35	c	1.6	31	390
Benzo(a)pyrene	2.3	7.5	12	c/n	0.17 [c]	3.1 [c]	15 [n]
Benzo(b)fluoranthene	23	76	120	c	1.7	31	390
Benzo(k)fluoranthene	230	750	1,200	c	17	310	3,900
Chrysene	690	2,300	3,500	c	170	3,100	39,000
Dibenzo(a,h)anthracene	7.5	24	38	c	0.17	3.1	39
Fluoranthene	85	280	440	n	310	4,000	5,000
Fluorene	35	120	180	n	310	4,000	20,000
Indeno(1,2,3-cd)pyrene	77	250	380	c	1.7	31	390
Naphthalene	12	40	62	c/n	2.9 [c]	13 [c]	120 [n]
Pyrene	83	280	430	n	230	3,000	15,000
1-Methylnaphthalene	2.1	7.1	11	c	25	110	1,400
2-Methylnaphthalene	6.9	23	35	n	31	400	200

TABLE 3
TIER 1 GROUNDWATER RBSLs AND STANDARDS

This table applies to groundwater and consists of DEQ-7 Human Health Standards (HHSs; DEQ 2012), where available. For compounds without DEQ-7 HHSs, DEQ has developed RBSLs and included them in the table. For EPH compounds, a total extractable hydrocarbon (TEH) concentration of 1,000 µg/L is used to determine if additional analysis (fractionation) is needed. Surface water impacts require a minimum of a Tier 2 evaluation.

Chemical	Effect	Basis	Groundwater Standard or RBSL (µg/l)
For Gasoline and Light Hydrocarbons measured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)			
C5-C8 Aliphatics [(b)]	n	rb	650
C9-C12 Aliphatics[(b)]	n	rb	1,400
C9-C10 Aromatics[(b)]	n	rb	1,100
MTBE	n	hhs	30
Benzene	c	hhs	5
Toluene	n	hhs	1,000
Ethylbenzene	n	hhs	700
Xylenes	n	hhs	10,000
Naphthalene	c	hhs	100
Lead Scavengers			
Ethylene dibromide (EDB)	c	hhs	0.017
1,2-Dichloroethane (DCA)	c	hhs	4
For Diesel and Heavy Hydrocarbons measured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)			
EPH / TEH Screen fractionation required[(a)]			1,000
C9-C18 Aliphatics[(b)]	n	rb	1,400
C19-C36 Aliphatics	n	bu	1,000
C11-C22 Aromatics[(b)]	n	rb	1,100
Acenaphthene	n	hhs	70
Anthracene	n	hhs	2,100
Benz(a)anthracene	c	hhs	0.5
Benzo(a)pyrene	c	hhs	0.05*
Benzo(b)fluoranthene	c	hhs	0.5
Benzo(k)fluoranthene	c	hhs	5
Chrysene	c	hhs	50
Dibenzo(a,h)anthracene	c	hhs	0.05*
Fluoranthene	n	hhs	20
Fluorene	n	hhs	50
Indeno(1,2,3-cd)pyrene	c	hhs	0.5
Naphthalene	c	hhs	100
Pyrene	n	hhs	20
1-Methylnaphthalene	c	rsl	11
2-Methylnaphthalene	n	rsl	36

Groundwater Table

Table 3

Groundwater Standards and Risked-Based Screening Levels (RBSLs)

Table applies to groundwater and consists of current DEQ-7 Human Health Standards, where available. For compounds without DEQ-7 standards, the risk-based screening levels (RBSLs) have been developed using EPA's RSL equations and information found in Appendix D. For EPH compounds, a total extractable hydrocarbon (TEH) concentration of 1,000 µg/L is used to determine if fractionation is needed. For surface water, see Appendix D.

Chemical / Analyte / Compound	Effects - carcinogenicity	Basis	Groundwater Standard or RBSL, µg/L
For Gasoline and Light Hydrocarbons measured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)			
MTBE	n	DEQ-7	30
Benzene	c	DEQ-7	5
Toluene	n	DEQ-7	1,000
Ethylbenzene	n	DEQ-7	700
Xylenes	n	DEQ-7	10,000
Naphthalene	c	DEQ-7	100
C9-C10 Aromatics	n	rbsl	1,100
C5-C8 Aliphatics	n	rbsl	650
C9-C12 Aliphatics	n	rbsl	2,700
Lead Scavengers			
1,2-Dichloroethane (DCA)	c	DEQ-7	4
Ethylene dibromide (EDB)	c	DEQ-7	0.017
For Diesel and Heavy Hydrocarbons measured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)			
EPH / TEH Screen fractionation required[a]			1,000
C9-C18 Aliphatics	n	rbsl	2,700
C19-C36 Aliphatics	n	rbsl/bu	96,000/bu
C11-C22 Aromatics	n	rbsl	1,100
Acenaphthene	n	DEQ-7	70
Anthracene	n	DEQ-7	2,100
Benz(a)anthracene	c	DEQ-7	0.5
Benzo(a)pyrene	c	DEQ-7	0.05*
Benzo(b)fluoranthene	c	DEQ-7	0.5
Benzo(k)fluoranthene	c	DEQ-7	5
Chrysene	c	DEQ-7	50
Dibenzo(a,h)anthracene	c	DEQ-7	0.05*
Fluoranthene	n	DEQ-7	20
Fluorene	n	DEQ-7	50
Indeno(1,2,3-cd)pyrene	c	DEQ-7	0.5
Naphthalene	c	DEQ-7	100
Pyrene	n	DEQ-7	20
1-Methylnaphthalene	c	rsl	11
2-Methylnaphthalene	n	rsl	36

Notes: (a) = An exceedance of the 1,000 µg/l EPH/TEH screen value indicates only that fractionation is required. If none of the fractions exceed, EPH/TEH does not need to be identified as a COPC exceeding RBSLs.

Effect: n = non-carcinogenic RBSLs and DEQ-7 standards are based on a hazard quotient of 1.

c = carcinogenic DEQ-7 standards are based on a cancer risk $1X10^{-5}$.

bu = beneficial use ceiling - if taste/odor or any other parameters that render a water harmful, detrimental or injurious to the beneficial uses for that water are violated, the site cannot be closed

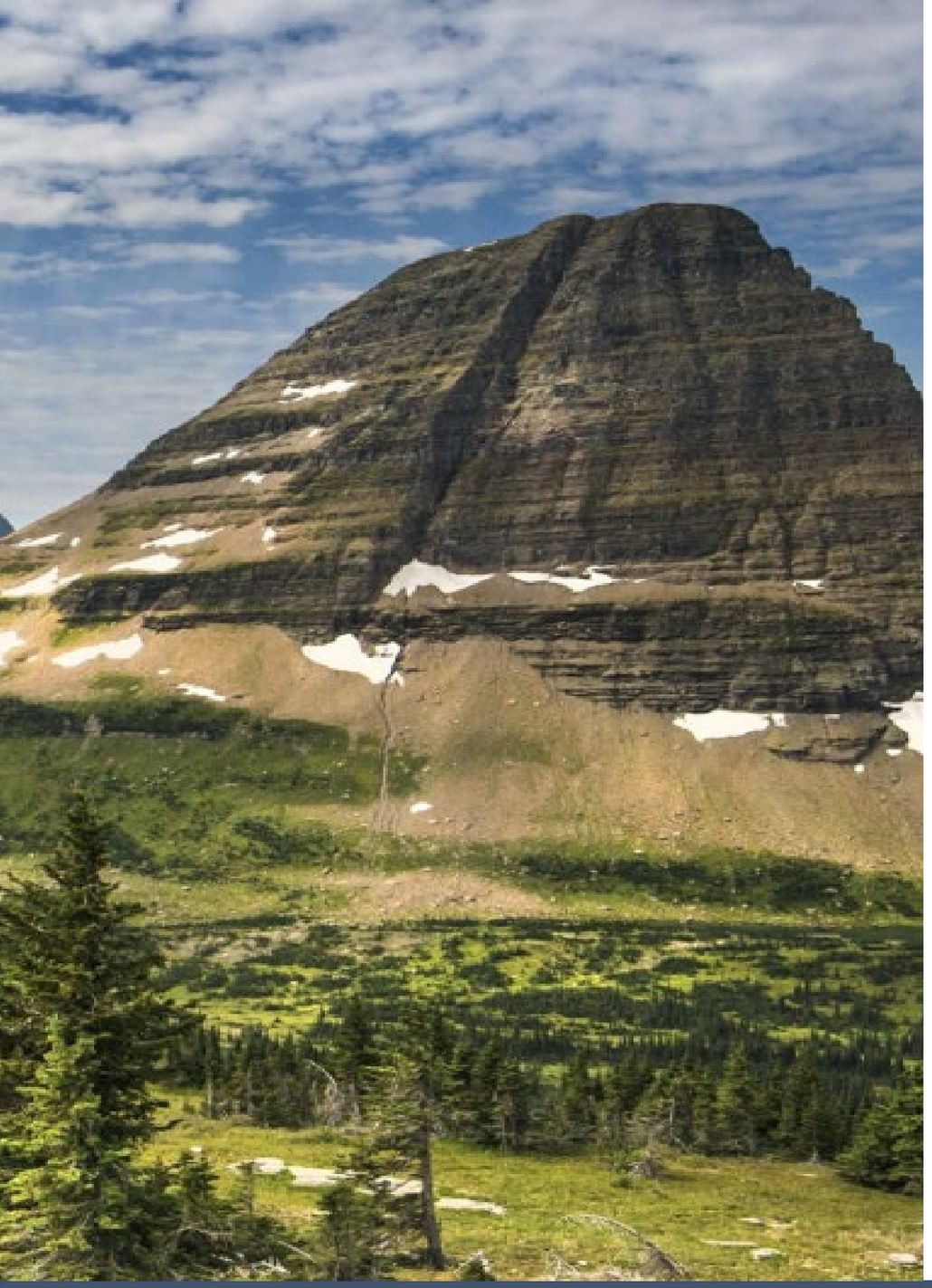

Table 4
Lookup Tables

Calculated Tier 2 Direct Contact Soil RBSLs

3 Tables – A, B, C

Site-Specific Tier 2 RBSLs for Direct-Contact Soil

- Calculated from Tier 1 RBSLs (Table 2)
- Two separate calculations
  - One for carcinogenic analytes
  - One for non-carcinogenic analytes

Table 2: Tier 1 Soil RBSLs

All Potential Tier 1 Risked-Based Screening Levels (RBSLs) for Soil, mg/kg

Leaching RBSLs: require vertical distance (feet) from base of petroleum-contaminated soil sample to groundwater.

Direct Contact RBSLs: require depth below ground surface (feet bgs) to petroleum-contaminated soil sample.

Chemical / Analyte / Compound	Leaching RBSLs, mg/kg Distance (feet) from Soil Sample to Groundwater			Direct Contact RBSLs, mg/kg Carcinogenic Effects, Receptors, and Depth Intervals			
	0-10 feet	10-20 feet	>20 feet	carcinogenic / non-carcinogenic	Residential 0 - 2 feet bgs	Commercial 0 - 2 feet bgs	Construction 0 - 10 feet bgs
For Gasoline & Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)							
MTBE	0.078	0.16	0.25	c	67	310	9,100
Benzene	0.07	0.21	0.33	c/n	1.7 [c]	7.6 [c]	190 [n]
Toluene	21	65	100	n	630	6,300	14,000
Ethylbenzene	26	84	130	c	8.4	38	1,200
Xylenes	320	1,000	1,600	n	75	330	1,900
Naphthalene	12	40	62	c/n	2.9 [c]	13 [c]	120 [n]
C9-C10 Aromatics	130	470	720	n	100	570	6,900
C5-C8 Aliphatics	220	770	1,200	n	78	390	14,000
C9-C12 Aliphatics	11,000	40,000	60,000	n	89	410	630
Lead Scavengers							
1,2-Dichloroethane (DCA)	0.019	0.052	0.079	c	0.67	3.0	100
1,2-Dibromoethane (EDB)	0.000086	0.00022	0.00033	c	0.05	0.24	7.3
For Diesel & Heavy Hydrocarbons measured using Montana Method for Extractable Petroleum Hydrocarbons (EPH)							
C9-C18 Aliphatics	53,000	170,000	270,000	n	130	620	970
C19-C36 Aliphatics	Considered Immobile			n	30,000	470,000	2,100,000
C11-C22 Aromatics	370	1,300	2,000	n	540	6,200	24,000
Acenaphthene	27	91	140	n	470	6,000	10,000
Anthracene	2,600	8,800	14,000	n	2,300	30,000	50,000
Benz(a)anthracene	6.8	23	35	c	1.6	31	390
Benzo(a)pyrene	2.3	7.5	12	c/n	0.17 [c]	3.1 [c]	15 [n]
Benzo(b)fluoranthene	23	76	120	c	1.7	31	390
Benzo(k)fluoranthene	230	750	1,200	c	17	310	3,900
Chrysene	690	2,300	3,500	c	170	3,100	39,000
Dibenzo(a,h)anthracene	7.5	24	38	c	0.17	3.1	39
Fluoranthene	85	280	440	n	310	4,000	5,000
Fluorene	35	120	180	n	310	4,000	20,000
Indeno(1,2,3-cd)pyrene	77	250	380	c	1.7	31	390
Naphthalene	12	40	62	c/n	2.9 [c]	13 [c]	120 [n]
Pyrene	83	280	430	n	230	3,000	15,000
1-Methylnaphthalene	2.1	7.1	11	c	25	110	1,400
2-Methylnaphthalene	6.9	23	35	n	31	400	200

Table 4a: Calculated Tier 2 Soil RBSLs Direct Contact Residential

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Table 4a

Calculated Tier 2* Soil RBSLs: Direct Contact Residential Receptor 0 - 2 feet bgs

Effects c: carcinogenic n: non-carcinogenic	Tier 1 Soil RBSLs, mg/kg Direct Contact Residential Receptor		Calculated Tier 2 RBSLs for Surface Soil Exceedances of Tier 1 RBSLs, mg/kg											
			Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Non-Carcinogenic Analytes >Tier 1 RBSLs)						*Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Carcinogenic Analytes >Tier 1 RBSLs)*					
			Number of Non-Carcinogenic Analytes >Tier 1 RBSLs						Number of Carcinogenic Analytes >Tier 1 RBSLs					
	Chemical / Analyte / Compound	0 - 2 feet bgs	1	2	3	4	5	6	1	2	3	4	5	6
	For Gasoline & Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)													
c	MTBE	**67**	---	---	---	---	---	---	670	335	223	168	134	112
c	Benzene	**1.7**	---	---	---	---	---	---	17	8.5	5.7	4.3	3.4	2.8
n	Toluene	**630**	6,300	3,150	2,100	1,575	1,260	1,050	---	---	---	---	---	---
c	Ethylbenzene	**8.4**	---	---	---	---	---	---	84	42	28	21	16.8	14
n	Xylenes	**75**	750	375	250	188	150	125	---	---	---	---	---	---
c	Naphthalene	**2.9**	---	---	---	---	---	---	29	15	9.7	7.3	5.8	4.8
n	C9-C10 Aromatics	**60**	600	300	200	150	120	100	---	---	---	---	---	---
n	C5-C8 Aliphatics	**90**	900	450	300	225	180	150	---	---	---	---	---	---
n	C9-C12 Aliphatics	**160**	1,600	800	533	400	320	267	---	---	---	---	---	---
	Lead Scavengers													
c	1,2-Dichloroethane (DCA)	**0.67**	---	---	---	---	---	---	6.7	3.4	2.23	1.68	1.34	1.12
c	1,2-Dibromoethane (EDB)	**0.05**	---	---	---	---	---	---	0.5	0.3	0.17	0.13	0.10	0.08
	For Diesel & Heavy Hydrocarbons measured using Montana Method for Extractable Petroleum Hydrocarbons (EPH)													
n	C9-C18 Aliphatics	**230**	2,300	1,150	767	575	460	383	---	---	---	---	---	---
n	C19-C36 Aliphatics	**25,000**	250,000	125,000	83,333	62,500	50,000	41,667	---	---	---	---	---	---
n	C11-C22 Aromatics	**540**	5,400	2,700	1,800	1,350	1,080	900	---	---	---	---	---	---
n	Acenaphthene	**470**	4,700	2,350	1,567	1,175	940	783	---	---	---	---	---	---
n	Anthracene	**2,300**	23,000	11,500	7,667	5,750	4,600	3,833	---	---	---	---	---	---
c	Benz(a)anthracene	**1.6**	---	---	---	---	---	---	16	8.0	5.3	4.0	3.2	2.7
c	Benzo(a)pyrene	**0.17**	---	---	---	---	---	---	1.7	0.85	0.57	0.43	0.34	0.28
c	Benzo(b)fluoranthene	**1.7**	---	---	---	---	---	---	17	8.5	5.7	4.3	3.4	2.8
c	Benzo(k)fluoranthene	**17**	---	---	---	---	---	---	170	85	57	43	34	28
c	Chrysene	**170**	---	---	---	---	---	---	1,700	850	567	425	340	283
c	Dibenzo(a,h)anthracene	**0.17**	---	---	---	---	---	---	1.7	0.85	0.57	0.43	0.34	0.28
n	Fluoranthene	**310**	3,100	1,550	1,033	775	620	517	---	---	---	---	---	---
n	Fluorene	**310**	3,100	1,550	1,033	775	620	517	---	---	---	---	---	---
c	Indeno(1,2,3-cd)pyrene	**1.7**	---	---	---	---	---	---	17	8.5	5.7	4.3	3.4	2.8
c	Naphthalene	**2.9**	---	---	---	---	---	---	29	15	9.7	7.3	5.8	4.8
n	Pyrene	**230**	2,300	1,150	767	575	460	383	---	---	---	---	---	---
c	1-Methylnaphthalene	**25**	---	---	---	---	---	---	250	125	83.3	62.5	50	41.7
n	2-Methylnaphthalene	**31**	310	155	103	78	62	52	---	---	---	---	---	---

*Refer to RBCA Guidance Section 4.0 for details on the Tier 2 Evaluation Process and calculation of Tier 2 RBSLs

Table 4b: Calculated Tier 2 Soil RBSLs Direct Contact Commercial

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Table 4b

Calculated Tier 2* Soil RBSLs: Direct Contact Commercial Receptor 0 - 2 feet bgs

Effects c: carcinogenic n: non-carcinogenic	Tier 1 Soil RBSLs, mg/kg Direct Contact Commercial Receptor		Calculated Tier 2 RBSLs for Surface Soil Exceedances of Tier 1 RBSLs, mg/kg											
			Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Non-Carcinogenic Analytes >Tier 1 RBSLs)						*Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Carcinogenic Analytes >Tier 1 RBSLs)*					
	Chemical / Analyte / Compound	0 - 2 feet bgs	Number of Non-Carcinogenic Analytes >Tier 1 RBSLs						Number of Carcinogenic Analytes >Tier 1 RBSLs					
			1	2	3	4	5	6	1	2	3	4	5	6
	For Gasoline & Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)													
c	MTBE	**310**	---	---	---	---	---	---	3,100	1,550	1,033	775	620	517
c	Benzene	**7.6**	---	---	---	---	---	---	76	38	25	19	15.2	12.7
n	Toluene	**6,300**	63,000	31,500	21,000	15,750	12,600	10,500	---	---	---	---	---	---
c	Ethylbenzene	**38**	---	---	---	---	---	---	380	190	127	95	76	63
n	Xylenes	**330**	3,300	1,650	1,100	825	660	550	---	---	---	---	---	---
c	Naphthalene	**13**	---	---	---	---	---	---	130	65	43	33	26	22
n	C9-C10 Aromatics	**300**	3,000	1,500	1,000	750	600	500	---	---	---	---	---	---
n	C5-C8 Aliphatics	**450**	4,500	2,250	1,500	1,125	900	750	---	---	---	---	---	---
n	C9-C12 Aliphatics	**800**	8,000	4,000	2,667	2,000	1,600	1,333	---	---	---	---	---	---
	Lead Scavengers													
c	1,2-Dichloroethane (DCA)	**3**	---	---	---	---	---	---	30	15	10	7.5	6	5
c	1,2-Dibromoethane (EDB)	**0.24**	---	---	---	---	---	---	2.4	1.2	0.80	0.60	0.48	0.40
	For Diesel & Heavy Hydrocarbons measured using Montana Method for Extractable Petroleum Hydrocarbons (EPH)													
n	C9-C18 Aliphatics	**1,200**	12,000	6,000	4,000	3,000	2,400	2,000	---	---	---	---	---	---
n	C19-C36 Aliphatics	**330,000**	3,300,000	1,650,000	1,100,000	825,000	660,000	550,000	---	---	---	---	---	---
n	C11-C22 Aromatics	**6,200**	62,000	31,000	20,667	15,500	12,400	10,333	---	---	---	---	---	---
n	Acenaphthene	**6,000**	60,000	30,000	20,000	15,000	12,000	10,000	---	---	---	---	---	---
n	Anthracene	**30,000**	300,000	150,000	100,000	75,000	60,000	50,000	---	---	---	---	---	---
c	Benz(a)anthracene	**31**	---	---	---	---	---	---	310	155	103	78	62	52
c	Benzo(a)pyrene	**3.1**	---	---	---	---	---	---	31	15.5	10.3	7.8	6.2	5.2
c	Benzo(b)fluoranthene	**31**	---	---	---	---	---	---	310	155	103	78	62	52
c	Benzo(k)fluoranthene	**310**	---	---	---	---	---	---	3,100	1,550	1,033	775	620	517
c	Chrysene	**3,100**	---	---	---	---	---	---	31,000	15,500	10,333	7,750	6,200	5,167
c	Dibenzo(a,h)anthracene	**3.1**	---	---	---	---	---	---	31	15.5	10.3	7.8	6.2	5.2
n	Fluoranthene	**4,000**	40,000	20,000	13,333	10,000	8,000	6,667	---	---	---	---	---	---
n	Fluorene	**4,000**	40,000	20,000	13,333	10,000	8,000	6,667	---	---	---	---	---	---
c	Indeno(1,2,3-cd)pyrene	**31**	---	---	---	---	---	---	310	155	103	78	62	52
c	Naphthalene	**13**	---	---	---	---	---	---	130	65.0	43	33	26	22
n	Pyrene	**3,000**	30,000	15,000	10,000	7,500	6,000	5,000	---	---	---	---	---	---
c	1-Methylnaphthalene	**110**	---	---	---	---	---	---	1,100	550.0	367	275	220	183
n	2-Methylnaphthalene	**400**	4,000	2,000	1,333	1,000	800	667	---	---	---	---	---	---

*Refer to RBCA Guidance Section 4.0 for details on the Tier 2 Evaluation Process and calculation of Tier 2 RBSLs

Table 4c: Calculated Tier 2 Soil RBSLs Direct Contact Construction

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Table 4c

Calculated Tier 2* Soil RBSLs: Direct Contact Construction Receptor 0 - 10 feet bgs

Effects c: carcinogenic n: non-carcinogenic	Tier 1 Soil RBSLs, mg/kg Direct Contact Construction Receptor		Calculated Tier 2 RBSLs for Subsurface Soil Exceedances of Tier 1 RBSLs, mg/kg											
			Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Non-Carcinogenic Analytes >Tier 1 RBSLs)						*Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Carcinogenic Analytes >Tier 1 RBSLs)*					
	Chemical / Analyte / Compound	0 - 10 feet bgs	Number of Non-Carcinogenic Analytes >Tier 1 RBSLs						Number of Carcinogenic Analytes >Tier 1 RBSLs					
			1	2	3	4	5	6	1	2	3	4	5	6
	For Gasoline & Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)													
c	MTBE	**9,100**	---	---	---	---	---	---	91,000	45,500	30,333	22,750	18,200	15,167
n	Benzene	**190**	1,900	950	633	475	380	317	---	---	---	---	---	---
n	Toluene	**14,000**	140,000	70,000	46,667	35,000	28,000	23,333	---	---	---	---	---	---
c	Ethylbenzene	**1,200**	---	---	---	---	---	---	12,000	6,000	4,000	3,000	2,400	2,000
n	Xylenes	**1,900**	19,000	9,500	6,333	4,750	3,800	3,167	---	---	---	---	---	---
n	Naphthalene	**120**	1,200	600	400	300	240	200	---	---	---	---	---	---
n	C9-C10 Aromatics	**4,000**	40,000	20,000	13,333	10,000	8,000	6,667	---	---	---	---	---	---
n	C5-C8 Aliphatics	**2,000**	20,000	10,000	6,667	5,000	4,000	3,333	---	---	---	---	---	---
n	C9-C12 Aliphatics	**3,000**	30,000	15,000	10,000	7,500	6,000	5,000	---	---	---	---	---	---
	Lead Scavengers													
c	1,2-Dichloroethane (DCA)	**100**	---	---	---	---	---	---	1,000	500	333	250	200	167
c	1,2-Dibromoethane (EDB)	**7.3**	---	---	---	---	---	---	73	37	24	18.3	14.6	12.2
	For Diesel & Heavy Hydrocarbons measured using Montana Method for Extractable Petroleum Hydrocarbons (EPH)													
n	C9-C18 Aliphatics	**4,600**	46,000	23,000	15,333	11,500	9,200	7,667	---	---	---	---	---	---
n	C19-C36 Aliphatics	**1,600,000**	16,000,000	8,000,000	5,333,333	4,000,000	3,200,000	2,666,667	---	---	---	---	---	---
n	C11-C22 Aromatics	**33,000**	330,000	165,000	110,000	82,500	66,000	55,000	---	---	---	---	---	---
n	Acenaphthene	**10,000**	100,000	50,000	33,333	25,000	20,000	16,667	---	---	---	---	---	---
n	Anthracene	**50,000**	500,000	250,000	166,667	125,000	100,000	83,333	---	---	---	---	---	---
c	Benz(a)anthracene	**390**	---	---	---	---	---	---	3,900	1,950	1,300	975	780	650
n	Benzo(a)pyrene	**15**	150	75	50	38	30	25	---	---	---	---	---	---
c	Benzo(b)fluoranthene	**390**	---	---	---	---	---	---	3,900	1,950	1,300	975	780	650
c	Benzo(k)fluoranthene	**3,900**	---	---	---	---	---	---	39,000	19,500	13,000	9,750	7,800	6,500
c	Chrysene	**39,000**	---	---	---	---	---	---	390,000	195,000	130,000	97,500	78,000	65,000
c	Dibenzo(a,h)anthracene	**39**	---	---	---	---	---	---	390	195	130	98	78	65
n	Fluoranthene	**5,000**	50,000	25,000	16,667	12,500	10,000	8,333	---	---	---	---	---	---
n	Fluorene	**40**	400	200	133	100	80	67	---	---	---	---	---	---
c	Indeno(1,2,3-cd)pyrene	**390**	---	---	---	---	---	---	3,900	1,950	1,300	975	780	650
n	Naphthalene	**120**	1,200	600	400	300	240	200	---	---	---	---	---	---
n	Pyrene	**15,000**	150,000	75,000	50,000	37,500	30,000	25,000	---	---	---	---	---	---
c	1-Methylnaphthalene	**1,400**	---	---	---	---	---	---	14,000	7,000	4,667	3,500	2,800	2,333
n	2-Methylnaphthalene	**200**	2,000	1,000	667	500	400	333	---	---	---	---	---	---

*Refer to RBCA Guidance Section 4.0 for details on the Tier 2 Evaluation Process and calculation of Tier 2 RBSLs

New Equation

Tier 1 RBSL X 10/ # Non-Carcinogenic Analytes>Tier 1 RBSLs

=

Tier 2 RBSL

How To Calculate Tier 2 RBSL

1. **<u>Determine</u> number** of Noncarcinogenic analytes that exceed their respective RBSLs = (# exceedances)

2. For each Noncarcinogenic analyte, **<u>lookup</u> Tier 1 RBSL** in RBCA Table 2 = Tier 1 RBSL

3. **<u>Multiply</u>** Tier 1 RBSL **by 10** = (RBSL x 10)

4. **<u>Divide</u>** Tier 1 RBSL x 10 by **# exceedances** = **<u>Tier 2 RBSL</u>**

Example

Sample Information and Field Data		Volatile Petroleum Hydrocarbons (VPH) compounds, mg/kg									
Sample ID	Sample Depth, ft bgs	MTBE	Benzene	Toluene	Ethyl-benzene	Xylenes	Naphthalene	C9-C10 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	TPH
Carcinogenic(C)/Non-Carcinogenic (N)			N	N	C	N	N	N	N	N	
DEQ Tier 1 RBSLs[1], Leaching 0-10		0.078	0.07	21	26	320	12	130	220	11,000	NSL
DEQ Tier 1 RBSLs[1], Direct Contact		9,100	190	14,000	1,200	1900	120	6,900	14000	630	NSL
SB-1	4		255	32	14	851	220	<10	<10	<10	
SB-2	4		130	18	8	15	64	-	-	-	

3 Non-Carcinogenic analytes exceed Tier 1 RBSL

Tier 2 RBSL Calculation

Benzene RBSL = 190 mg/kg

Number of NC exceedances = 3

190 X 10 / 3 = 633

Tier 2 RBSL = 633 mg/kg

Tier 2 RBSL Calculation

Xylene RBSL = 1900 mg/kg

Number of NC exceedances = 3

1900 X 10 / 3 = 6,333

Tier 2 RBSL = 6,333 mg/kg

Tier 2 RBSL Calculation

Naphthalene RBSL = 120 mg/kg

Number of NC exceedances = 3

120 X 10 / 3 = 400

Tier 2 RBSL = 400 mg/kg

Calculated Tier 2 RBSLs

$$\text{Benzene} : \frac{(190)(10)}{3} = 633$$

$$\text{Xylenes} : \frac{(1900)(10)}{3} = 6{,}333$$

$$\text{Naphthalene} : \frac{(120)(10)}{3} = 400$$

Table 4c

Calculated Tier 2* Soil RBSLs: Direct Contact Construction Receptor 0 - 10 feet bgs

Effects c: carcinogenic n: non-carcinogenic	Tier 1 Soil RBSLs, mg/kg Direct Contact Construction Receptor: Chemical / Analyte / Compound	0 - 10 feet bgs	Calculated Tier 2 RBSLs for Subsurface Soil Exceedances of Tier 1 RBSLs, mg/kg: Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Non-Carcinogenic Analytes >Tier 1 RBSLs) — Number of Non-Carcinogenic Analytes >Tier 1 RBSLs: 1	2	3	4	5	6	Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Carcinogenic Analytes >Tier 1 RBSLs) — Number of Carcinogenic Analytes >Tier 1 RBSLs: 1	2	3	4	5	6
	For Gasoline & Light Hydrocarbons measure		**using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)**															
c	MTBE	**9,100**	---	---	---	---	---	---	91,000	45,500	30,333	22,750	18,200	15,167
n	Benzene	**190**	1,900	950	633	475	380	317	---	---	---	---	---	---
n	Toluene	**14,000**	140,000	70,000	46,667	35,000	28,000	23,333	---	---	---	---	---	---
c	Ethylbenzene	**1,200**	---	---	---	---	---	---	12,000	6,000	4,000	3,000	2,400	2,000
n	Xylenes	**1,900**	19,000	9,500	6,333	4,750	3,800	3,167	---	---	---	---	---	---
n	Naphthalene	**120**	1,200	600	400	300	240	200	---	---	---	---	---	---
n	C9-C10 Aromatics	**4,000**	40,000	20,000	13,333	10,000	8,000	6,667	---	---	---	---	---	---
n	C5-C8 Aliphatics	**2,000**	20,000	10,000	6,667	5,000	4,000	3,333	---	---	---	---	---	---
n	C9-C12 Aliphatics	**3,000**	30,000	15,000	10,000	7,500	6,000	5,000	---	---	---	---	---	---
	Lead Scavengers													
c	1,2-Dichloroethane (DCA)	**100**	---	---	---	---	---	---	1,000	500	333	250	200	167
c	1,2-Dibromoethane (EDB)	**7.3**	---	---	---	---	---	---	73	37	24	18.3	14.6	12.2
	For Diesel & Heavy Hydrocarbons measured		**sing Montana Method for Extractable Petroleum Hydrocarbons (EPH)**											
n	C9-C18 Aliphatics	**4,600**	46,000	23,000	15,333	11,500	9,200	7,667	---	---	---	---	---	---
n	C19-C36 Aliphatics	**1,600,000**	16,000,000	8,000,000	5,333,333	4,000,000	3,200,000	2,666,667	---	---	---	---	---	---
n	C11-C22 Aromatics	**33,000**	330,000	165,000	110,000	82,500	66,000	55,000	---	---	---	---	---	---
n	Acenaphthene	**10,000**	100,000	50,000	33,333	25,000	20,000	16,667	---	---	---	---	---	---
n	Anthracene	**50,000**	500,000	250,000	166,667	125,000	100,000	83,333	---	---	---	---	---	---
c	Benz(a)anthracene	**390**	---	---	---	---	---	---	3,900	1,950	1,300	975	780	650
n	Benzo(a)pyrene	**15**	150	75	50	38	30	25	---	---	---	---	---	---
c	Benzo(b)fluoranthene	**390**	---	---	---	---	---	---	3,900	1,950	1,300	975	780	650
c	Benzo(k)fluoranthene	**3,900**	---	---	---	---	---	---	39,000	19,500	13,000	9,750	7,800	6,500
c	Chrysene	**39,000**	---	---	---	---	---	---	390,000	195,000	130,000	97,500	78,000	65,000
c	Dibenzo(a,h)anthracene	**39**	---	---	---	---	---	---	390	195	130	98	78	65
n	Fluoranthene	**5,000**	50,000	25,000	16,667	12,500	10,000	8,333	---	---	---	---	---	---
n	Fluorene	**40**	400	200	133	100	80	67	---	---	---	---	---	---
c	Indeno(1,2,3-cd)pyrene	**390**	---	---	---	---	---	---	3,900	1,950	1,300	975	780	650
n	Naphthalene	**120**	1,200	600	400	300	240	200	---	---	---	---	---	---
n	Pyrene	**15,000**	150,000	75,000	50,000	37,500	30,000	25,000	---	---	---	---	---	---
c	1-Methylnaphthalene	**1,400**	---	---	---	---	---	---	14,000	7,000	4,667	3,500	2,800	2,333
n	2-Methylnaphthalene	**200**	2,000	1,000	667	500	400	333	---	---	---	---	---	---

*Refer to RBCA Guidance Section 4.0 for details on the Tier 2 Evaluation Process and calculation of Tier 2 RBSLs

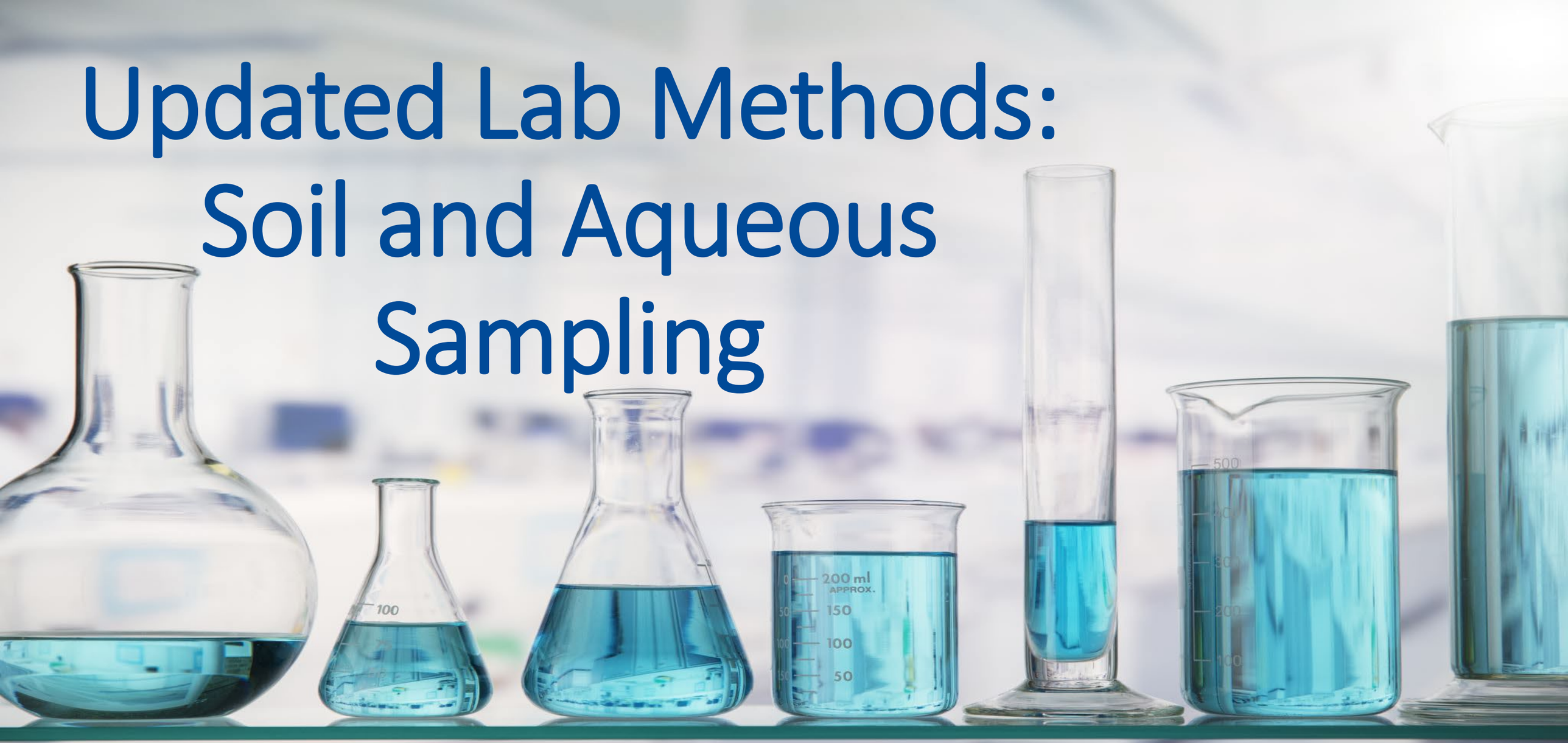
Table 4c

Calculated Tier 2* Soil RBSLs: Direct Contact | Construction Receptor | 0 - 10 feet bgs

Effects (c: carcinogenic, n: non-carcinogenic)	Tier 1 Soil RBSLs, mg/kg — Direct Contact — Construction Receptor: Chemical / Analyte / Compound	0 - 10 feet bgs	Calculated Tier 2 RBSLs for Subsurface Soil Exceedances of Tier 1 RBSLs, mg/kg — *Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Non-Carcinogenic Analytes >Tier 1 RBSLs)*: Number of Non-Carcinogenic Analytes >Tier 1 RBSLs: 1	2	3	*Tier 2 RBSL = Tier 1 RBSL X 10 / (number of Carcinogenic Analytes >Tier 1 RBSLs)*: Number of Carcinogenic Analytes >Tier 1 RBSLs: 1	2	3
	For Gasoline & Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)							
c	MTBE	**9,100**	---	---	---	91,000	45,500	30,333
n	Benzene	~~**190**~~	~~1,900~~	~~950~~	633	---	---	---
n	Toluene	**14,000**	140,000	70,000	46,667	---	---	---
c	Ethylbenzene	**1,200**	---	---	---	12,000	6,000	4,000
n	Xylenes	~~**1,900**~~	~~19,000~~	~~9,500~~	6,333	---	---	---
n	Naphthalene	~~**120**~~	~~1,200~~	~~600~~	400	---	---	---
n	C9-C10 Aromatics	**4,000**	40,000	20,000	13,333	---	---	---
n	C5-C8 Aliphatics	**2,000**	20,000	10,000	6,667	---	---	---
n	C9-C12 Aliphatics	**3,000**	30,000	15,000	10,000	---	---	---
	Lead Scavengers							
c	1,2-Dichloroethane (DCA)	**100**	---	---	---	1,000	500	333
c	1,2-Dibromoethane (EDB)	**7.3**	---	---	---	73	37	24
	For Diesel & Heavy Hydrocarbons measured using Montana Method for Extractable Petroleum Hydrocarbons (EPH)							
n	C9-C18 Aliphatics	**4,600**	46,000	23,000	15,333	---	---	---
n	C19-C36 Aliphatics	**1,600,000**	16,000,000	8,000,000	5,333,333	---	---	---
n	C11-C22 Aromatics	**33,000**	330,000	165,000	110,000	---	---	---

*Refer to RBCA Guidance Section 4.0 for details on the Tier 2 Evaluation Process and calculation of Tier 2 RBSLs

Updated Lab Methods: Soil and Aqueous Sampling



DEQ MONTANA

Table A: Soil Samples

Parameter	Analytical Method	Sample Container/ Preservation	Holding Time
Soil Samples			
VPH	Montana Method VPH	60 mL or 40 mL VOA vials or 4 oz wide mouth jar. Collect at least 10 g of soil, cool to 4 ±2° C. Must be preserved at the lab in methanol within 48 hours of collection. or Methanol preservation in the field.1 mL methanol for every g soil, +/- 25%; lab can provide appropriate vials with methanol for easy collection; cool to 4 ±2° C. If preserving with methanol in the field, a sample containing no methanol must also be submitted for determining moisture percentage.	28 Days to analysis from collection. If collecting in the field without methanol, lab preservation in methanol w/in 48 hours and 28 days to analysis from collection.
EPH Screen	Montana Method EPH	4-oz wide-mouth amber glass jar, cool to 4±2° C	Extracted within 14 days of collection. Analyzed within 40 days of extraction.
EPH Fractionation with or without PAH's	Montana Method EPH (PAHs: 8270))	One 4-oz glass jar, cool to (4 ± 2) °C	Following EPH Screen 14-day to extraction, 40 days to analysis.
VOCs/Oxygenates/ 1,2 DCA/lead scavengers EDB	EPA Method 8260 /SW-846-5035A	One 4-oz. glass jar, cool to (4 ± 2) °C Preserve in methanol in field or at lab within 48 hours of collection.	48 hours to lab extraction. 14-day hold time from collection MeOH preservation: 14 days to extraction and analysis from collection.
RCRA Metals plus zinc (Except Hg) Mercury (Hg)	EPA Method 6010 or 6020 EPA Method 7471 B	One 4-oz. plastic or glass jar, no preservation One 4-oz. plastic or glass jar, no preservation	6 months 28 days
% Moisture- required for all soil samples	USDA Handbook 60 method 26 (or equivalent)		

Table A - Soil Sampling and Preservation Protocol
Alternate approved versions of the methods are allowed.

60 mL or 40 mL VOA vials or 4 oz wide mouth jar. Collect at least 10 g of soil, cool to 4 ±2° C. Must be preserved at the lab in methanol within 48 hours of collection.

or

Methanol preservation in the field.
1 mL methanol for every g soil, +/- 25%; lab can provide appropriate vials with methanol for easy collection; cool to 4 ±2° C.

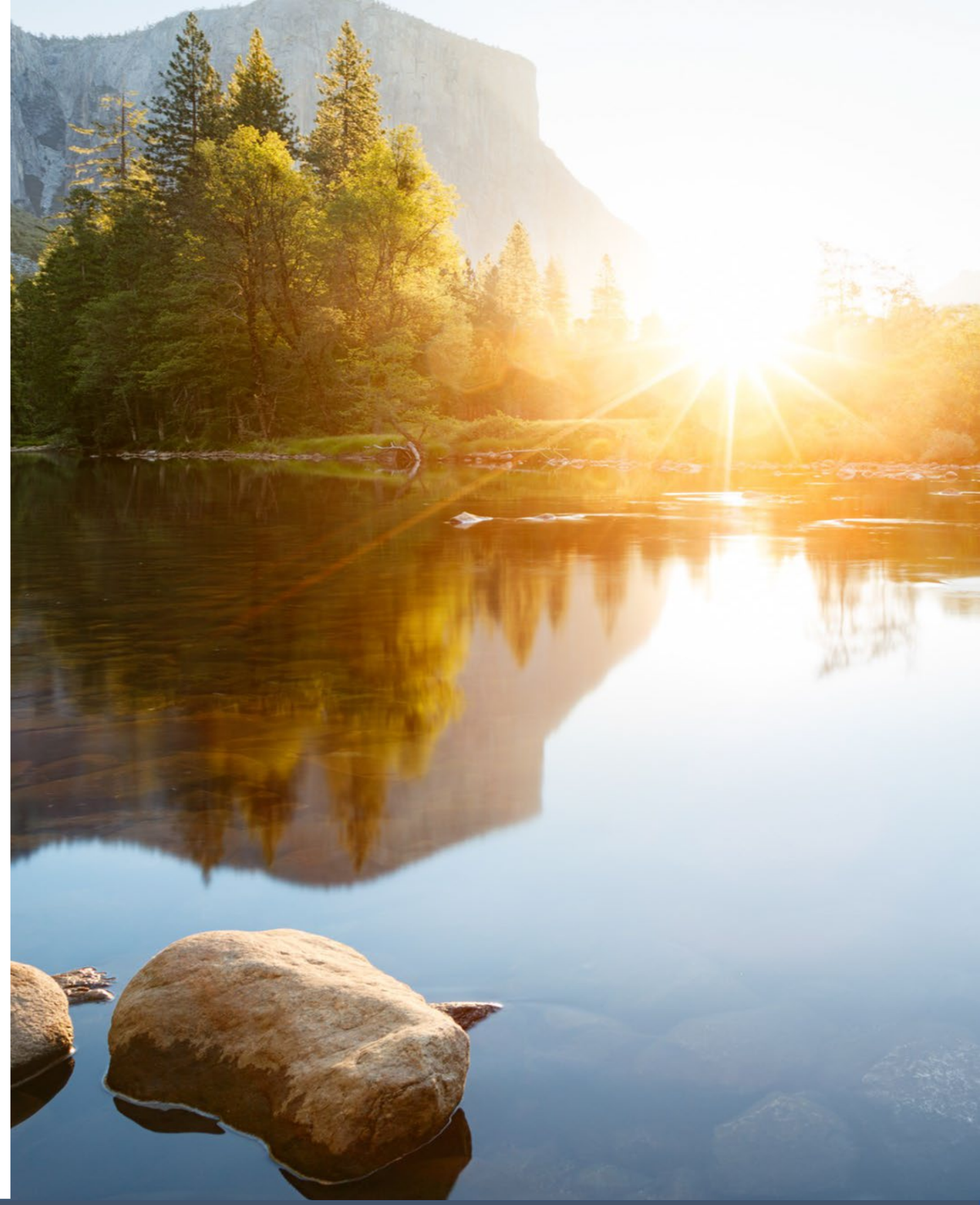
If preserving with methanol in the field, a sample containing no methanol must also be submitted for determining moisture percentage.

Table C: Aqueous Samples

Parameter	Analytical Method	Sample Container/ Preservation	Holding Time
VPH	Montana Method VPH	Three 40-mL VOC vials with zero headspace, acidify with HCl to pH <2: cool to 4±2° C.	14 days to analysis
EPH Screen	Montana Method EPH	Two 1-L amber glass bottle, acidify with 1:1 HCl (or alternate acids, as allowed by method) to pH <2; cool to 4±2° C	14 days to extraction. 40 days to analysis following extraction.
EPH	Montana Method EPH	1-Liter amber glass bottle. Acidify with 1:1 HCl (or alternate acids, as allowed by method) to pH <2; cool to 4±2° C	14 days to EPH Screen extraction, 40 days to analysis following extraction.
VOCs (Drinking Water)	EPA Method 524.2	Three 40-ml vials with zero headspace, acidify with HCl to pH <2, cool to (4 ± 2) °C. Remove chlorine with Ascorbic Acid.	14 days to analysis
VOCs	EPA Method 8260	Three 40-ml vials with zero headspace, acidify with HCl to pH <2, cool to (4 ± 2) °C	14 days to analysis
PAHs (Semi-volatile Organics)	EPA Method 8270	Two 1-liter amber glass bottles **do not acidify**, cool to (4 ± 2) °C. Remove chlorine with ~4 drops of 10% Sodium Thiosulfate ($Na_2S_2O_3$)	7 days to extraction, 40 days to analysis
Lead Scavengers EDB 1,2-DCA	EPA Method 8011 EPA Method 8260[1]	Six 40-ml vials, acidify with HCl to pH <2, cool to (4 ± 2) °C. Remove chlorine with ~4 drops of 10% Sodium Thiosulfate ($Na_2S_2O_3$)	14 days to analysis
RCRA Metals plus zinc (except Hg)	EPA Method 6010/200.7 or 6020/200.8	One 250-ml HDPE bottle, acidify with nitric acid (HNO_3) to pH <2, cool to (4 ± 2) °C; field filtered 0.45 µm for dissolved metals (can also be filtered at lab with advanced arrangements)	6 months
Mercury (Hg)	EPA Method 245.1 or 7470	One 250-ml HDPE bottle, acidify with HNO_3 to pH <2	28 days

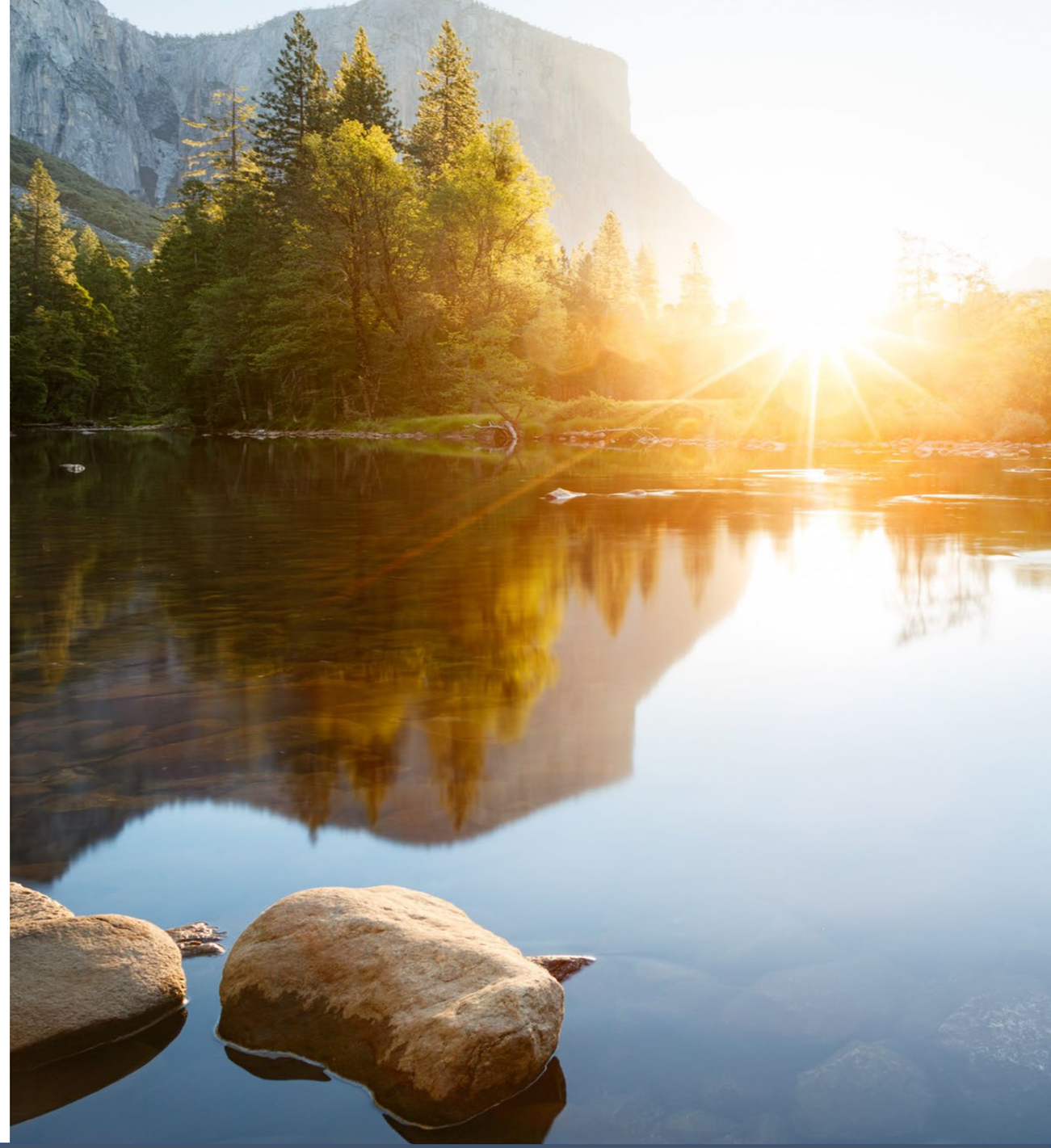
Highlights

- Table 1: Confirmation Soil Table
  - Most conservative RBSLs
- Table 2: All Tier 1 Soil RBSLs
  - New RBSLs
- Table 3: Groundwater RBSLs
  - New RBSLs
- Table 4 (A,B,C): Tier 2 Look Up
  - Depth, number of C/NC analytes



Highlights

- Lab Methods
  - ➢ Massachusetts Method 2018
  - ➢ Methanol Preservation Soil Samples
  - ➢ Analytical Methods Aqueous Samples



Questions?

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