MONTANA RISK-BASED CORRECTIVE ACTION FOR PETROLEUM RELEASES (RBCA) 2016 UPDATE

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2016 RBCA Update

- Updated toxicity values
- Added 1- and 2-Methylnaphthalene
- Updated exposure parameters and factors
- Updated volatilization and leaching parameters
- Added conceptual site model information
- Updated and clarified analytical requirements
- Added Air-Phase Hydrocarbon Calculator information
- Expanded to include Tier 2
- Removed business process details and forms covered elsewhere
- Updated and clarified text

Oral Toxicity Changes				
Compound	2009 RBCA Toxicity	2009 Source	2016 RBCA Toxicity	2016 Source
C19-C36 Aliphatics	2.0E+00 mg/kg-d	MADEP 2003	3.0E+00 mg/kg-d	PPRTV 2009
1-Methylnaphthalene	NA	NA	2.9E-02 $(mg/kg\text{-}d)^{-1}$	PPRTV 2008
2-Methylnaphthalene	NA	NA	4.0E-03 mg/kg-d	IRIS 2016

MADEP = Massachusetts Department of Environmental Protection

PPRTV = Provisional Peer Reviewed Toxicity Value

IRIS = Integrated Risk Information System

NA = not applicable

Inhalation Toxicity Changes				
Compound	2009 RBCA Toxicity	2009 Source	2016 RBCA Toxicity	2016 Source
C5-C8 Aliphatics	7.0E-01 mg/m^3	IRIS 2005	6.0E-01 mg/m^3	PPRTV 2009
C9-C12 Aliphatics	2.0E-01 mg/m^3	MADEP 2003	1.0E-01 mg/m^3	PPRTV 2009
C9-C10 Aromatics	5.0E-02 mg/m^3	MADEP 2003	1.0E-01 mg/m^3	PPRTV 2009
C9-C18 Aliphatics	2.0E-01 mg/m^3	MADEP 2003	1.0E-01 mg/m^3	PPRTV 2009
C11-C22 Aromatics	5.0E-02 mg/m^3	MADEP 2003	1.0E-01 mg/m^3	PPRTV 2009

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Exposure Factor Changes – EPA Defaults			
Parameter	2009 Default Parameter	2016 Default Parameter	2016 Source
Adult body weight	70 kg	80 kg	EPA 2014
Residential Exposure Duration	30 years	26 years	EPA 2014
Child Resident Skin Surface Area	2800 cm^2/day	2373 cm^2/day	EPA 2014
Adult Resident Skin Surface Area	5700 cm^2/day	6032 cm^2/day	EPA 2014
Worker Skin Surface Area	3300 cm^2/day	3527 cm^2/day	EPA 2014
Commercial Worker Adherence Factor	0.2 mg/cm^2	0.12 mg/cm^2	EPA 2014
Construction Worker Adherence Factor	0.2 mg/cm^2	0.3 mg/cm^2	EPA 2014

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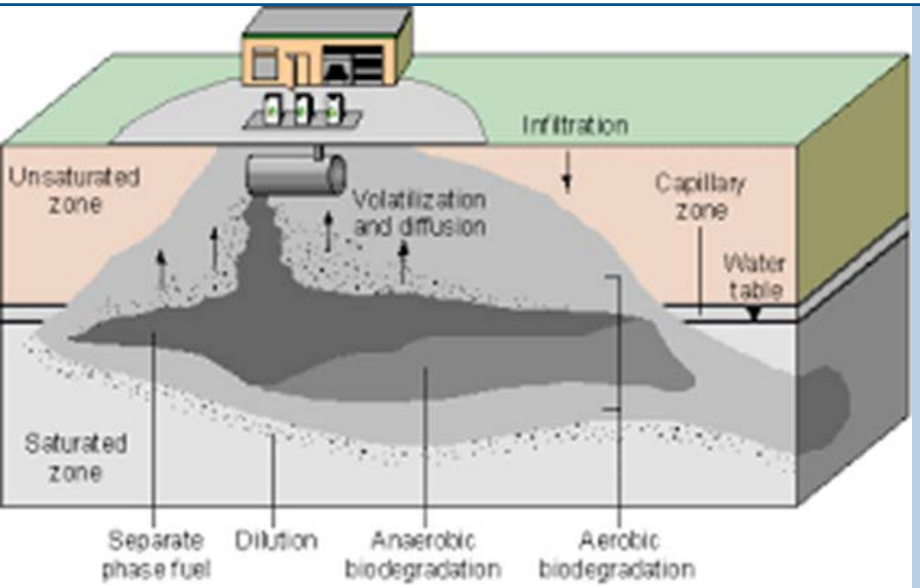

Updated Factors Based Upon EPA Regional Screening Levels (RSLs)

- Updated volatilization factors for direct contact
- Updated organic carbon-water partition coefficients (Koc) for leaching to groundwater
- Updated dimensionless Henry's Law Constants for leaching to groundwater
- Used updated model VSDI v1.3 for fate and transport modeling

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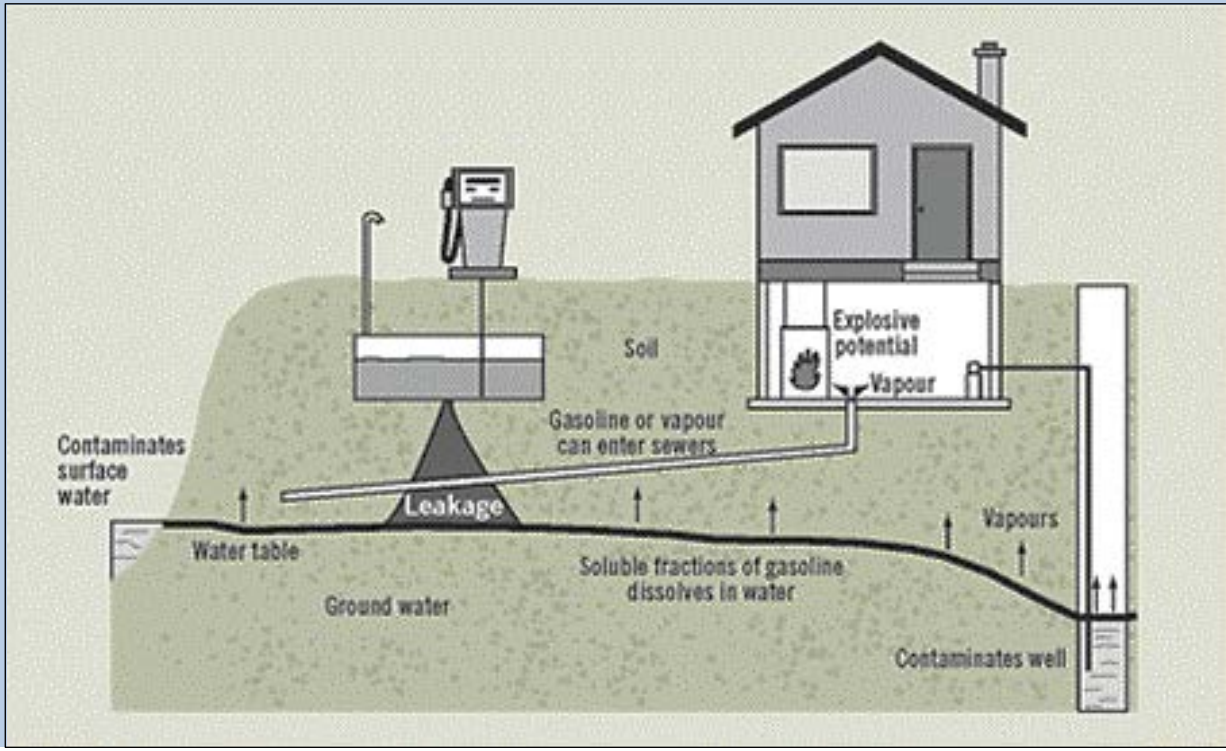
Added Conceptual Site Model (CSM) Discussion and Examples

Importance of CSM:

- Data Collection
- Risk Evaluation
- Remedy Determination



Analytical Requirements

- Explained dry weight and adjusted concentrations
- Added polycyclic aromatic hydrocarbon (PAHs) analytical requirements for heavier products
- Changed to low level 8270 analysis for PAHs
- Added zinc RSL and changed to low level 8260 analysis for waste and unknown oils

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Vapor Intrusion Information

- Use Montana Vapor Intrusion Guidance
- Air-Phase Hydrocarbon Calculator – petroleum ONLY sites

APH VI Screening Level Calculator

Instructions: 1. Compare your analytical results to DEQ/EPA RSL Screening value in Table 1.
2. All compounds that exceed the Table 1: DEQ/EPA RSL Screening values must be added to the to drop down boxes under "Chemical" in Table 2 to view the adjusted screening value.

Table 1

Chemical	DEQ/EPA RSL Screen (µg/m^3)* Residential	Industrial
1,2 Dichloroethane (DCA)	0.23	0.52
1,3 Butadiene	0.1	0.46
Aliphatic (C5-C8)	94	260
Aliphatic (C9-C12)	44	44
Aromatic (C9-C10)	10	44
Benzene	1.3	1.8
Ethylbenzene	1.2	5.5
Ethylene Dibromide (EDB)	0.0052	0.022
MTBE	12	52
Naphthalene	0.39	0.4
Toluene	520	2200
Xylenes (mix of mp & o)	10	44

Table 2

	Chemical	Adjusted RSL (µg/m^3)** Residential	Industrial
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

*DEQ/EPA RSL Screening values are based on a cancer risk of 1 x 10^{-6} (adjusted for 78-year lifespan) and a hazard index of 0.1 for non-carcinogens.
**Adjusted RSL values are based on a cumulative cancer risk of 1 x 10^{-5} (adjusted for 78-year lifespan) and a cumulative hazard index of 1.0 (non-carcinogens) for only those chemicals selected.
Please see DEQ's VI APH Calculator Discussion document for additional information.

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Added Tier 2

- Site-specific screening for direct contact and leaching to groundwater
- Start with Master Table – Table 4

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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 Massachusetts 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	1,400	1,000
MTBE	0.08	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	5,900	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)	0.00002	0.000051	0.000079	0.04	0.18	7.8
1,2-Dichloroethane (DCA)	0.02	0.052	0.079	0.52	2.3	110
For Diesel and Heavy Hydrocarbons measured using the Massachusetts 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	310,000	200,000
C11-C22 Aromatics	370	1,300	2,000	490	5,600	3,900
Acenaphthene	260	870	1,300	450	5,700	3,800
Anthracene	2,600	8,800	14,000	2,200	28,000	19,000
Benz(a)anthracene	6.8	23	35	0.18	3.2	54
Benzo(a)pyrene	2.3	7.5	12	0.02	0.32	5.4
Benzo(b)fluoranthene	23	76	120	0.18	3.2	54
Benzo(k)fluoranthene	230	750	1,200	1.8	32	540
Chrysene	690	2,300	3,500	18	320	5,400
Dibenzo(a,h)anthracene	7.5	24	38	0.02	0.32	5.4
Fluoranthene	550	1,800	2,800	300	3,800	2,500
Fluorene	770	2,600	4,000	300	3,800	2,500
Indeno(1,2,3-cd)pyrene	77	250	380	0.18	3.2	54
Naphthalene	12	40	62	4.3[c]	19[c]	140[n]
Pyrene	3,400	12,000	18,000	220	2,800	1,900
1-Methylnaphthalene	7,000	23,000	36,000	20	81	1,400
2-Methylnaphthalene	2,100	7,000	11,000	30	380	250

c = based upon carcinogenicity

n = based upon non-carcinogenicity

Direct Contact Adjustment

- Leaching to Groundwater addressed
  - Leaching RBSLs are met
  - Groundwater was contaminated and now isn't
  - Leaching to Groundwater Tier 2 analysis completed
- Adjust direct contact RBSLs based upon the number of contaminants present
  - Non-cancer RBSLs are 1/8th of total allowable
  - Cancer RBSLs are 1/10th of total allowable

Adjust RBSLs

- Adjust based upon the number of non-cancer and cancer contaminants actually present above the RBSLs
- If site concentrations meet the adjusted RBSLs, no corrective action may be necessary

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Leaching to Groundwater Adjustment

- Direct contact does not apply
  - Direct contact RBSLs are met
  - Direct contact Tier 2 analysis completed
- Adjust leaching to groundwater RBSLs
  - Calculate site-specific dilution attenuation factor
  - Calculate vadose zone travel time
  - Synthetic precipitation leaching procedure (limited use with petroleum)

Data Needs

- Soil characteristics
- Hydrologic characteristics
- Source characteristics
- Chemical biodegradation

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Also,

- Removed business process details covered elsewhere
- Removed reporting forms
- Updated and clarified text

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Questions?

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