CHEMICAL	CAS#	Acute Benchmark (ug/L)	Chronic Benchmark (ug/L)	Source
Metals, ug/L				
Nickel	7440-02-0	74	8.2	1
Vanadium	7440-62-2	100	50	2
Mixtures, µg/L				
Total Petroleum Hydrocarbons GRO	--	None	None	--
Total Petroleum Hydrocarbons DRO	--	None	None	--
Oil Range Organics ORO	--	None	None	--
PAH Mixtures[1]	--	1	1	--

[1]NOTE: Oil Related Organic Compounds are assessed jointly through a mixture approach. Potency divisors are not chemical-specific benchmarks, but are intermediates used in calculating the aggregate toxicity of the mixture.

CHEMICAL	CAS#	Acute Potency Divisor (ug/L)	Chronic Potency Divisor (ug/L)	Source
Oil-Related Organic Compounds, µg/L				
Benzene	71-43-2	27,000	5,300	3
Cyclohexane	110-82-7	1,900	374	3
Ethylbenzene	100-41-4	4,020	790	3
Isopropylbenzene	98-82-8	2,140	420	3
m-Xylene	108-38-3	3,560	700	3
p-Xylene	106-42-3	3,560	700	3
o-Xylene	95-47-6	3,560	700	3
Methylcyclohexane	108-87-2	463	91.0	3
Toluene	108-88-3	8,140	1,600	3
Naphthalene	91-20-3	803	193	4
C1-Naphthalenes	--	340	81.7	4
C2-Naphthalenes	--	126	30.2	4
C3-Naphthalenes	--	46.1	11.1	4
C4-Naphthalenes	--	16.9	4.05	4

Acenaphthylene	208-96-8	1,280	307	4
Acenaphthene	83-32-9	232	55.8	4
Fluorene	86-73-7	164	39.3	4
C1-Fluorenes	--	58.1	14.0	4
C2-Fluorenes	--	22.0	5.30	4
C3-Fluorenes	--	7.99	1.92	4
Phenanthrene	85-01-8	79.7	19.1	4
Anthracene	120-12-7	86.1	20.7	4
C1-Phenanthrenes	--	31.0	7.44	4
C2-Phenanthrenes	--	13.3	3.20	4
C3-Phenanthrenes	--	5.24	1.26	4
C4-Phenanthrenes	--	2.33	0.559	4
Fluoranthene	206-44-0	29.6	7.11	4
Pyrene	129-00-0	42.0	10.1	4
C1-pyrene/fluoranthenes	--	20.3	4.89	4
Benz(a)anthracene	56-55-3	9.28	2.23	4
Chrysene	218-01-9	8.49	2.04	4
C1-Chrysenes	--	3.56	0.856	4
C2-Chrysenes	--	2.01	0.483	4
C3-Chrysenes	--	0.699	0.168	4
C4-Chrysenes	--	0.294	0.0706	4
Perylene	198-55-0	3.75	0.901	4
Benzo(b)fluoranthene	205-99-2	2.82	0.677	4
Benzo(k)fluoranthene	207-08-9	2.67	0.642	4
Benzo(e)pyrene	192-97-2	3.75	0.901	4
Benzo(a)pyrene	50-32-8	3.98	0.957	4
Indeno(1,2,3-cd)pyrene	193-39-5	1.14	0.275	4
Dibenz(a,h) anthracene	53-70-3	1.17	0.282	4
Benzo(g,h,i)perylene	191-24-2	1.83	0.439	4

1 National Recommended Water Quality Criteria. Office of Water and Office of Science and Technology
http://www.epa.gov/waterscience/criteria/wqctable/

2 NOAA Screening Quick Reference Tables
http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf
and
British Columbia Water Quality Guideliness
http://www.env.gov.bc.ca/wat/wq/

and

Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Volume 2 - Aquatic Ecosystems - Rationale and Background Information
http://www.mincos.gov.au/__data/assets/pdf_file/0020/316136/gfmwq-guidelines-vol2-8-3b.pdf

3 Great Lakes Initiative (GLI) Clearinghouse resources Tier II criteria revised February 2009
http://www.epa.gov/gliclearinghouse/

4 U.S. EPA. 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment benchmarks (ESBs) for the Protection of Benthic Organisms. Compendium of Tier 2 Values for Nonionic Organics. U.S. Environmental Protection Agency, Office of Research and Development: Washington DC EPA/600/R-02/016. PB2008-107282. March 2008.
http://www.epa.gov/NHEERL/publications/files/ESB_Compendium_v14_final.pdf

U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment benchmarks (ESBs) for the Protection of Benthic Organisms. PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC.
http://www.epa.gov/nheerl/publications/files/PAHESB.pdf

CHEMICAL	CAS#	Acute Benchmark (mg/kg)	Chronic Benchmark (mg/kg)	Source
Metals				
Nickel	7440-02-0	51.6	20.9	1
Vanadium	7440-62-2	--	57	2
Mixtures				
Total Petroleum Hydrocarbons GRO	--	None	None	--
Total Petroleum Hydrocarbons DRO	--	None	None	--
Oil Range Organics ORO	--	None	None	--
PAH Mixtures[1]	--	1	1	--

[1]NOTE: Oil Related Organic Compounds are assessed jointly through a mixture approach. Potency divisors are not chemical-specific benchmarks, but are intermediates used in calculating the aggregate toxicity of the mixture.

CHEMICAL	CAS#	Acute Potency Divisor (ug/kg Organic Carbon)	Chronic Potency Divisor (ug/kg Organic Carbon)	Source
Oil-Related Organic Compounds				
Benzene	71-43-2	3,360,000	660,000	3
Cyclohexane	110-82-7	4,000,000	786,000	3
Ethylbenzene	100-41-4	4,930,000	970,000	3
Isopropylbenzene	98-82-8	5,750,000	1,130,000	3
m-Xylene	108-38-3	4,980,000	980,000	3
p-Xylene	106-42-3	4,980,000	980,000	3
o-Xylene	95-47-6	4,980,000	980,000	3
Methylcyclohexane	108-87-2	4,960,000	976,000	3
Toluene	108-88-3	4,120,000	810,000	3
Naphthalene	91-20-3	1,600,000	385,000	4
C1-Naphthalenes	--	1,850,000	444,000	4
C2-Naphthalenes	--	2,120,000	510,000	4
C3-Naphthalenes	--	2,420,000	581,000	4
C4-Naphthalenes	--	2,730,000	657,000	4
Acenaphthylene	208-96-8	1,880,000	452,000	4

Acenaphthene	83-32-9	2,040,000	491,000	4
Fluorene	86-73-7	2,240,000	538,000	4
C1-Fluorenes	--	2,540,000	611,000	4
C2-Fluorenes	--	2,850,000	686,000	4
C3-Fluorenes	--	3,200,000	769,000	4
Phenanthrene	85-01-8	2,480,000	596,000	4
Anthracene	120-12-7	2,470,000	594,000	4
C1-Phenanthrenes	--	2,790,000	670,000	4
C2-Phenanthrenes	--	3,100,000	746,000	4
C3-Phenanthrenes	--	3,450,000	829,000	4
C4-Phenanthrenes	--	3,790,000	912,000	4
Fluoranthene	206-44-0	2,940,000	707,000	4
Pyrene	129-00-0	2,900,000	697,000	4
C1-pyrene/fluoranthenes	--	3,200,000	770,000	4
Benz(a)anthracene	56-55-3	3,500,000	841,000	4
Chrysene	218-01-9	3,510,000	844,000	4
C1-Chrysenes	--	3,870,000	929,000	4
C2-Chrysenes	--	4,200,000	1,010,000	4
C3-Chrysenes	--	4,620,000	1,110,000	4
C4-Chrysenes	--	5,030,000	1,210,000	4
Perylene	198-55-0	4,020,000	967,000	4
Benzo(b)fluoranthene	205-99-2	4,070,000	979,000	4
Benzo(k)fluoranthene	207-08-9	4,080,000	981,000	4
Benzo(e)pyrene	192-97-2	4,020,000	967,000	4
Benzo(a)pyrene	50-32-8	4,020,000	965,000	4
Indeno(1,2,3-cd)pyrene	193-39-5	4,620,000	1,110,000	4
Dibenz(a,h) anthracene	53-70-3	4,660,000	1,120,000	4
Benzo(g,h,i)perylene	191-24-2	4,540,000	1,090,000	4

1 NOAA National Status and Trends Program Sediment Quality Guidelines (ERL/ERM)
http://response.restoration.noaa.gov/book_shelf/121_sedi_qual_guide.pdf

2 NOAA Screening Quick Reference Tables
http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf
and
Washington Department of Ecology Publ 95-308, 1995 and 97-323a, 1997
Gries and Waldrow Puget Sound Dredged Disposal Analysis Report 1996. http://www.ecy.wa.gov/biblio/wac173204.html

3 U.S. EPA. 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment benchmarks (ESBs) for the Protection of Benthic Organisms. Compendium of Tier 2 Values for Nonionic Organics. U.S. Environmental Protection Agency, Office of Research and Development,

EPA/600/R-02/016. PB2008-107282. March 2008.
http://www.epa.gov/NHEERL/publications/files/ESB_Compendium_v14_final.pdf

4 U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment benchmarks (ESBs) for the Protection of Benthic Organisms. PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC.
http://www.epa.gov/nheerl/publications/files/PAHESB.pdf

CHEMICAL	CAS#	Human Health Benchmark Child Swimmer ug/L	Source
Volatile Organic Compounds, µg/L			
Benzene	71-43-2	89,000	1
Cumene	98-82-8	60,000	1, 6
Cyclohexane	110-82-7		
Ethylbenzene	100-41-4	14,000	1, 2, 4
Isopropylbenzene	98-82-8		
m,p-Xylene	179601-23-1		
m - Xylene	108-38-3	54,000	1
p - Xylene	106-42-3	58,000	1
Mixture - Xylene	1330-20-7	120000	1, 2
Methylcyclohexane	108-87-2		
o-Xylene	95-47-6	60,000	1
Toluene	108-88-3	370,000	1, 2
Semivolatile Organic Compounds, µg/L			
2-Methylnaphthalene	91-57-6	520	1, 2
Polyaromatic Hydrocarbons (PAHs) µg/L			
Naphthalene	91-20-3	5,300	1
Acenaphthylene	208-96-8	76,000	
Acenaphthene	83-32-9	67,000	1
Fluorene	86-73-7	37,000	1, 6
Phenanthrene	85-01-8		
Anthracene	120-12-7	67,000	1, 2
Fluoranthene	206-44-0	11,000	1, 6
Pyrene	129-00-0	12,000	1, 2
Benzo(a)anthracene	56-55-3	40	7
Chrysene	218-01-9	3,800	7
Benzo(b)fluoranthene	205-99-2	46	7
Benzo(a)pyrene	50-32-8	2.7	1
Indeno(1,2,3-cd)pyrene	193-39-5	22	7
Dibenz(a,h) anthracene	53-70-3	2.8	7
Benzo(g,h,i)perylene	191-24-2		
Metals, µg/L			
Nickel	7440-02-0	44,000	1, 6
Vanadium	7440-62-2	16,000	8

Mixtures, µg/L	
Total Petroleum Hydrocarbons - Gas Range Organics	
Total Petroleum Hydrocarbons - Diesel Range Organics	
Total Petroleum Hydrocarbons - Oil Range Organics	

REFERENCES:

1. EPA's Integrated Risk Information System (IRIS) - http://www.epa.gov/iris/

2. The Provisional Peer Reviewed Toxicity Values (PPRTVs) derived by EPA's Superfund Health Risk Technical Support Center (STSC) for the EPA Superfund program. http://hhpprtv.ornl.gov/

3. The Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs) - http://www.atsdr.cdc.gov/mrls/index.html

4. The California Environmental Protection Agency (OEHHA) Office of Environmental Health Hazard Assessment's Chronic Reference Exposure Levels (RELS) from December 18, 2008 and the Cancer Potency Values from December 17, 2008. http://www.oehha.ca.gov/risk

5. PPRTVa – These are screening toxicity values developed by EPA's Superfund Program found in an appendix of certain PPRTV assessments; less confidence in this value than in PPRTV.

6. HEAST (Health Effects Assessment Summary Tables) – An annual health effects summary table used at both EPA's Superfund and RCRA sites that provides a comprehensive listing of provisional risk assessment information relative to oral and inhalation route

7. These are Toxicity Equivalent Factors generated by EPA's Environmental Criteria and Assessment Office based on the oral slope factor for benzo(a) pyrene.

8. Value developed using special considerations because standard equations do not apply and/or external adjustments to the screening levels are recommended based on the Risk Screening Level (RSL) User's Guide (December 2009)

When measured PAHs do not include alkyl compounds, multipliers are used for certain PAHs to account for the associated presence
of unmeasured alkylated PAHs. These alkylation multipliers were derived from an analysis of a tarball recovered early in the Horizon spill.
As oil weathers, the ratio of parent to alkyl-substituted PAHs changes, with the ratio of alkylated compounds to parent compounds increasing.
While these ratios are only estimates, they are important to assessing potential risks because the toxic potency created by the alkylated PAHs
is expected to exceed that of the parent PAHs by many-fold. As more data on the composition of the oil become available, these factors should

be revisited and revised as appropriate.

PAH	Alkylation Multiplier (unitless)
Naphthalene	120
Fluorene	14
Phenanthrene	6.8
Pyrene	2.1
Chrysene	5