

WAC 173-204-562 Sediment cleanup levels based on protection of the benthic community in marine and low salinity sediment. (1) **Applicability.** This section defines sediment cleanup objectives and cleanup screening levels for contaminants based on protection of the benthic community in marine and low salinity sediment. They are used to:

(a) Identify and assess the hazard of sites under WAC 173-204-510 and 173-204-520;

(b) Establish sediment cleanup levels for sites and sediment cleanup units under WAC 173-204-560.

(2) **Marine sediment - Chemical criteria.** The chemical concentration criteria in Table III establish the sediment cleanup objectives and cleanup screening levels chemical criteria for marine sediment. The criteria of this section shall apply to marine sediments for toxicity to the benthic community.

(a) The sediment cleanup objectives of this section establish a no adverse effects level, including no acute or chronic adverse effects, to the benthic community. Chemical concentrations at or below the sediment cleanup objectives correspond to sediment quality that results in no adverse effects to the benthic community.

(b) The cleanup screening levels of this section establish a minor adverse effects level, including acute or chronic effects, to the benthic community. Chemical concentrations at or below the cleanup screening level but greater than the sediment cleanup objective correspond to sediment quality that results in minor adverse effects to the benthic community. The marine chemical and biological cleanup screening levels establish minor adverse effects as the level above which station clusters of potential concern are defined and may be defined as potential cleanup sites for benthic community toxicity, and at or below which station clusters of low concern are defined, per the procedures identified in WAC 173-204-510 and 173-204-520.

(c) The cleanup screening level chemical criteria is exceeded when the sediment chemical concentration for an individual chemical is above the cleanup screening level in Table III.

(d) The sediment cleanup objective chemical criteria is exceeded when the sediment chemical concentration for one or more chemicals is above the sediment cleanup objective in Table III.

(e) Low salinity sediment cleanup screening levels criteria. Reserved: The department shall determine on a case-by-case basis the criteria, methods, and procedures necessary to meet the intent of this part.

(f) For purposes of this section, where chemical analyses indicates a chemical is not detected in a sample, the method detection limit and the practical quantitation limit shall be reported and shall be at or below the sediment cleanup objectives chemical criteria in Table III.

(g) Where chemical criteria in Table III represent the sum of individual compounds or isomers, the following methods shall be applied:

(i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers; and

(ii) Where chemical analyses detect one or more individual compound/isomers, only the detected concentrations will be added to represent the group sum.

(h) For some chemical criteria in Table III, the listed criteria represent concentrations in parts per million "normalized" or expressed on a total organic carbon basis. To normalize to total organic

carbon, the dry weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content (e.g., 0.01 means 1 percent) of the sediment per the equation: ppm OC = (ppb dry weight)/(percent total organic carbon x 1000).

(i) The LPAH criterion in Table III represents the sum of the following "low molecular weight polycyclic aromatic hydrocarbon" compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds as listed.

(j) The HPAH criterion in Table III represents the sum of the following "high molecular weight polycyclic aromatic hydrocarbon" compounds: Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3,-c,d)pyrene, Dibenz(a,h)anthracene, and Benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

(k) The total benzofluoranthenes criterion in Table III represents the sum of the concentrations of the "B," "J," and "K" isomers.

Table III
Marine Sediment
Sediment Cleanup Objectives and
Cleanup Screening Levels
Chemical Criteria

Chemical Parameter	mg/kg Dry Weight (Parts per Million (ppm) Dry Weight)	mg/kg Dry Weight (Parts per Million (ppm) Dry Weight)
	Sediment Cleanup Objective	Cleanup Screening Level
Arsenic	57	93
Cadmium	5.1	6.7
Chromium	260	270
Copper	390	390
Lead	450	530
Mercury	0.41	0.59
Silver	6.1	6.1
Zinc	410	960

Chemical Parameter	mg/kg Organic Carbon (ppm carbon)	mg/kg Organic Carbon (ppm carbon)
	Sediment Cleanup Objective	Cleanup Screening Level
LPAH	370	780
Naphthalene	99	170
Acenaphthylene	66	66
Acenaphthene	16	57
Fluorene	23	79
Phenanthrene	100	480
Anthracene	220	1200
2-Methylnaphthalene	38	64
HPAH	960	5300
Fluoranthene	160	1200
Pyrene	1000	1400
Benz(a)anthracene	110	270
Chrysene	110	460
Total Benzofluoranthenes	230	450
Benzo(a)pyrene	99	210

Chemical Parameter	mg/kg Organic Carbon (ppm carbon)	mg/kg Organic Carbon (ppm carbon)
	Sediment Cleanup Objective	Cleanup Screening Level
Indeno(1,2,3 c,d) Pyrene	34	88
Dibenzo (a,h) Anthracene	12	33
Benzo (g,h,i) Perylene	31	78
1,2 Dichlorobenzene	2.3	2.3
1,4 Dichlorobenzene	3.1	9
1,2,4 Trichlorobenzene	0.81	1.8
Hexachlorobenzene	0.38	2.3
Dimethyl Phthalate	53	53
Diethyl Phthalate	61	110
Di-n-butyl Phthalate	220	1700
Butyl Benzyl Phthalate	4.9	64
Bis (2-ethylhexyl) Phthalate	47	78
Di-n-octyl Phthalate	58	4500
Dibenzofuran	15	58
Hexachlorobutadiene	3.9	6.2
N-Nitrosodiphenylamine	11	11
Total PCBs	12	65

	ug/kg Dry Weight (Parts per Billion (ppb) Dry Weight)	ug/kg Dry Weight (Parts per Billion (ppb) Dry Weight)
Phenol	420	1200
2-Methylphenol	63	63
4-Methylphenol	670	670
2,4 Dimethyl Phenol	29	29
Pentachlorophenol	360	690
Benzyl Alcohol	57	73
Benzoic Acid	650	650

(3) **Marine sediment - Biological criteria.** The biological effects criteria in Table IV establish the marine sediment cleanup objectives and cleanup screening levels. The criteria of this section shall apply to marine sediments for toxicity to the benthic invertebrate community.

(a) The sediment cleanup objectives of this section establish a no adverse effects level, including acute or chronic adverse effects, to the benthic community. The sediment cleanup objective biological criteria for a sampling station is exceeded when one of the biological test results is above the sediment cleanup objective as described in Table IV.

(b) The cleanup screening levels of this section establish a minor adverse effects level, including acute or chronic adverse effects, to the benthic community. The cleanup screening level biological criteria for a sampling station is exceeded when:

(i) Any two of the biological test results for a sampling station exceed the sediment cleanup objective in Table IV; or

(ii) One of the biological test results for a sampling station exceeds the cleanup screening level in Table IV.

(c) The acute and chronic effects biological tests of Table V shall be used to:

(i) Confirm designation of marine sediments for benthic community toxicity. The department may require, or any person may perform, biological testing to confirm the designation of marine sediment which either passes or fails the chemical criteria established in subsection (2) of this section. If required, the sediment shall be tested using the procedures in (d) of this subsection; and

(ii) Establish the marine sediment cleanup objective and cleanup screening level for identifying sediment station clusters of potential concern for benthic community toxicity using the procedures of WAC 173-204-510(2); and

(iii) Establish the marine sediment cleanup objective or cleanup screening level for identifying station clusters of low concern using the procedures of WAC 173-204-510(2).

(d) To designate sediment quality using biological criteria, a minimum of the following shall be included in the suite of biological tests for each sediment sample as described in Table V:

(i) Two acute effects tests; and

(ii) One chronic test.

(e) The appropriate control and reference sediment samples shall meet the performance standards described in Table IV. Selection and use of reference sediment must be approved by the department. The department may approve a different performance standard based on latest scientific knowledge.

(f) Use of alternate biological tests may be required by the department and shall be subject to the review and approval of the department under WAC 173-204-130(4).

(g) Any person who designates test sediments using the procedures of this section shall meet the sampling and testing plan requirements of WAC 173-204-600 and records management requirements of WAC 173-204-610. Test sediments designated using the procedures of this section shall be sampled and analyzed using methods approved by the department, and shall use an appropriate quality assurance/quality control program, as determined by the department.

(4) **Marine sediment - Other toxic, radioactive, biological, or deleterious substances criteria.** "Other toxic, radioactive, biological, or deleterious substances" means substances not specified in Table III, that are in, or on, sediments. They shall be at or below levels which cause minor adverse effects in marine biological resources. The department shall determine on a case-by-case basis other criteria, methods, and procedures, such as using the biological criteria of subsection (3)(a) through (g) of this section, necessary to meet the intent of this part.

**Table IV
Marine Sediment Cleanup Objectives and Cleanup Screening Levels Biological Criteria**

Biological Test/Endpoint	Performance Standard Control	Performance Standard Reference	Sediment Cleanup Objective for each biological test	Cleanup Screening Level for each biological test
Amphipod				
10-day Mortality	$M_C \leq 10\%$	$M_R \leq 25\%$	$M_T > 25\%$ Absolute and M_T vs M_R SD ($p \leq 0.05$)	$M_T - M_R \geq 30\%$ and M_T vs M_R SD ($p \leq 0.05$)
Larval				
Bivalve or Echinoderm Abnormality/Mortality	$N_C / I \geq 0.70$	$N_R / N_C \geq 0.65$	$(N_R - N_T) / N_C > 0.15$ and N_T / N_C vs N_R / N_C SD ($p \leq 0.10$)	$(N_R - N_T) / N_C > 0.30$ and N_T / N_C vs N_R / N_C SD ($p \leq 0.10$)

Biological Test/Endpoint	Performance Standard Control	Performance Standard Reference	Sediment Cleanup Objective for each biological test	Cleanup Screening Level for each biological test
Juvenile Polychaete				
<i>Neanthes</i> 20-day Growth	$M_C < 10\%$ and $MIG_C > 0.72$ mg/individual/day (or case-by-case)	$MIG_R / MIG_C > 0.80$	$MIG_T / MIG_R < 0.70$ and MIG_T vs MIG_R SD ($p \leq 0.05$)	$MIG_T / MIG_R < 0.50$ and MIG_T vs MIG_R SD ($p \leq 0.05$)
Microtox				
Microtox Decreased Luminescence	case-by-case	case-by-case	$ML_T / ML_R < 0.80$ and ML_T vs ML_R SD ($p = 0.05$)	
Benthic Abundance				
Benthic Abundance	See Table IV legend		$A_T / A_R < 0.50$ For any one of three major taxa Class Crustacea, Phylum Mollusca or Class Polychaeta	$A_T / A_R < 0.50$ For any two of three major taxa Class Crustacea, Phylum Mollusca or Class Polychaeta

Table IV Explanatory Notes:

A = Abundance;
 AFDW = Ash free dry weight;
 C = Control;
 R = Reference;
 T = Test;
 I = Initial count;
 M = Mortality;
 N = Normal survivorship expressed as actual counts;
 MIG = Mean individual growth rate expressed in mg/ind/day AFDW;
 ML = Mean light output;
 SD = Statistically significant difference;
 An exceedance of the criteria requires a statistically significant difference at $p \leq 0.05$ for Amphipod, Juvenile Polychaete, Microtox tests;
 An exceedance of the criteria requires a statistically significant difference at $p \leq 0.10$ for the Larval tests.
 Benthic Abundance: The reference benthic macroinvertebrate assemblage should be representative of areas removed from significant sources of contaminants and, to the extent possible, have the following characteristics:
 (1) The taxonomic richness of benthic macroinvertebrates and the abundances of higher taxonomic groups that reflect seasonality and natural, physical, and chemical conditions (e.g., grain size composition, salinity of sediments, water depth) in a reference area and not be obviously depressed as a result of chemical toxicity;
 (2) Normally abundant species that are known to be sensitive to chemical contaminants are present;
 (3) Normally rare species that are known to become abundant only under chemically disturbed conditions are rare or absent; and
 (4) The abundances of normally rare species that control benthic community structure through physical modification of the sediment are similar to those observed at the test sediment site.

Table V
Types of Marine Sediment Biological Tests, Species, and Applicable Endpoints.

Species/Class, biological test, and endpoint	Acute effects biological test	Chronic effects biological test
Amphipod: <i>Rhepoxynius abronius</i> , <i>Ampelisca abdita</i> , <i>Eohaustorius estuarius</i>		
10-day Mortality	X	
Larval: <i>Crassostrea gigas</i> (Pacific oyster), <i>Mytilus (edulis) galloprovincialis</i> (Blue mussel), <i>Strongylocentrotus purpuratus</i> (Purple sea urchin), <i>Dendraster excentricus</i> (Sand dollar)		
Mortality/Abnormality	X	
Juvenile Polychaete: <i>Neanthes arenaceodentata</i>		
20-day Growth		X
Microtox: <i>Vibrio fisheri</i>		
15-minute exposure; Decreased luminescence		X
Benthic Infauna: Class Crustacea, Polychaeta, Phylum Mollusca		X

(5) Low salinity sediment cleanup screening levels criteria. Reserved: The department shall determine on a case-by-case basis the criteria, methods, and procedures necessary to meet the intent of this part.

[Statutory Authority: Chapter 70.105D RCW. WSR 13-06-014 (Order 08-07), amended and recodified as § 173-204-562, filed 2/25/13, effective 9/1/13. Statutory Authority: RCW 90.48.220. WSR 96-02-058, § 173-204-520, filed 12/29/95, effective 1/29/96. Statutory Authority: Chapters 43.21C, 70.105D, 90.48, 90.52, 90.54 and 90.70 RCW. WSR 91-08-019 (Order 90-41), § 173-204-520, filed 3/27/91, effective 4/27/91.]