

For each type of surface water body, assign a dilution-weighted population value from table 4-14, based on the number of people included for that type of surface water body. (Note that the dilution-weighted population values in table 4-14 incorporate the dilution weights from table 4-13. Do not multiply the values from table 4-14 by these dilution weights.)

Calculate the value for the potential contamination factor (PC) for the watershed as follows:

$$PC = \frac{1}{10} \sum_{i=1}^n (W_i)$$

where:

W_i = Dilution-weighted population from table 4-14 for surface water body type i .
 n = Number of different surface water body types in the watershed.

If PC is less than 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter this value for the potential contamination factor in table 4-1.

4.1.2.3.2.5 Calculation of population factor value. Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this value in table 4-1.

4.1.2.3.3 Resources. To evaluate the resources factor for the watershed, select the highest value below that applies to the watershed. Assign this value as the resources factor value for the watershed. Enter this value in table 4-1.

Assign a value of 5 if, within the in-water segment of the hazardous substance migration path for the watershed, the surface water is used for one or more of the following purposes:

- Irrigation (5 acre minimum) of commercial food crops or commercial forage crops.
- Watering of commercial livestock.
- Ingredient in commercial food preparation.
- Major or designated water recreation area, excluding drinking water use.

Assign a value of 5 if, within the in-water segment of the hazardous substance migration path for the watershed, the surface water is not used for drinking water, but either of the following applies:

- Any portion of the surface water is designated by a State for drinking water use under section 305(a) of the Clean Water Act, as amended.
- Any portion of the surface water is usable for drinking water purposes.

Assign a value of 0 if none of the above applies.

4.1.2.3.4 Calculation of drinking water threat-targets factor category value. Sum the nearest intake, population, and resources

factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the drinking water threat-targets factor category value for the watershed. Enter this value in table 4-1.

4.1.2.4 Calculation of the drinking water threat score for a watershed. Multiply the drinking water threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the drinking water threat score for the watershed. Enter this value in table 4-1.

4.1.3 Human food chain threat. Evaluate the human food chain threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.3.1 Human food chain threat-likelihood of release. Assign the same likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 4.1.2.1.3 for the drinking water threat. Enter this value in table 4-1.

4.1.3.2 Human food chain threat-waste characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/persistence/bioaccumulation and hazardous waste quantity.

4.1.3.2.1 Toxicity/persistence/bioaccumulation. Evaluate all those hazardous substances eligible to be evaluated for toxicity/persistence in the drinking water threat for the watershed (see section 4.1.2.2).

4.1.3.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.1.3.2.1.2 Persistence. Assign a persistence factor value to each hazardous substance as specified for the drinking water threat (see section 4.1.2.2.1.2), except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest fishery (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2. For contaminated sediments with no identified source, use the point where measurement begins rather than the probable point of entry.

4.1.3.2.1.3 Bioaccumulation potential. Use the following data hierarchy to assign a bioaccumulation potential factor value to each hazardous substance:

- Bioconcentration factor (BCF) data.
- Logarithm of the n-octanol-water partition coefficient ($\log K_{ow}$) data.
- Water solubility data.

Assign a bioaccumulation potential factor value to each hazardous substance from table 4-15.

If BCF data are available for any aquatic human food chain organism for the substance being evaluated, assign the bioaccumulation potential factor value to the hazardous substance as follows:

- If BCF data are available for both fresh water and salt water for the hazardous substance, use the BCF data that correspond to the type of water body (that is, fresh water or salt water) in which the fisheries are located to assign the bioaccumulation potential factor value to the hazardous substance.

- If, however, some of the fisheries being evaluated are in fresh water and some are in salt water, or if any are in brackish water, use the BCF data that yield the higher factor value to assign the bioaccumulation potential factor value to the hazardous substance.

- If BCF data are available for either fresh water or salt water, but not for both, use the available BCF data to assign the bioaccumulation potential factor value to the hazardous substance.

If BCF data are not available for the hazardous substance, use log K_{ow} data to assign a bioaccumulation potential factor value to organic substances, but not to inorganic substances. If BCF data are not available, and if either log K_{ow} data are not available, the log K_{ow} is available but exceeds 6.0, or the substance is an inorganic substance, use water solubility data to assign a bioaccumulation potential factor value.

TABLE 4-15—BIOACCUMULATION POTENTIAL FACTOR VALUES^A

If bioconcentration factor (BCF) data are available for any aquatic human food chain organism, assign a value as follows:^b

BCF	Assigned value
Greater than or equal to 10,000	50,000
1,000 to less than 10,000	5,000
100 to less than 1,000	500
10 to less than 100	50
1 to less than 10	5
Less than 1	0.5

If BCF data are not available, and log K_{ow} data are available and do not exceed 6.0, assign a value to an organic hazardous substance as follows (for inorganic hazardous

substances, skip this step and proceed to the next):

Log K_{ow}	Assigned value
5.5 to 6.0	50,000
4.5 to less than 5.5	5,000
3.2 to less than 4.5	500
2.0 to less than 3.2	50
0.8 to less than 2.0	5
Less than 0.8	0.5

If BCF data are not available, and if either Log K_{ow} data are not available, a log K_{ow} is available but exceeds 6.0, or the substance is an inorganic substance, assign a value as follows:

TABLE 4-15—BIOACCUMULATION POTENTIAL FACTOR VALUES^A—CONCLUDED

Water solubility (mg/l)	Assigned value
Less than 25	50,000
25 to 500	5,000
Greater than 500 to 1,500	500
Greater than 1,500	0.5

If none of these data are available, assign a value of 0.5.

^a Do not round to nearest integer.

^b See text for use of freshwater and saltwater BCF data.

Do not distinguish between fresh water and salt water in assigning the bioaccumulation potential factor value based on log K_{ow} or water solubility data.

If none of these data are available, assign the hazardous substance a bioaccumulation potential factor value of 0.5.

4.1.3.2.1.4 Calculation of toxicity/persistence/bioaccumulation factor value. Assign each hazardous substance a toxicity/persistence factor value from table 4-12, based on the values assigned to the hazardous substance for the toxicity and persistence factors. Then assign each hazardous substance a toxicity/persistence/bioaccumulation factor value from table 4-16, based on the values assigned for the toxicity/persistence and bioaccumulation potential factors. Use the hazardous substance with the highest toxicity/persistence/bioaccumulation factor value for the watershed to assign the value to this factor. Enter this value in table 4-1.

TABLE 4-16—TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^A

Toxicity persistence factor value	Bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
10,000	5×10^8	5×10^7	5×10^6	5×10^5	5×10^4	5,000
4,000	2×10^8	2×10^7	2×10^6	2×10^5	2×10^4	2,000
1,000	5×10^7	5×10^6	5×10^5	5×10^4	5,000	500
700	3.5×10^7	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350
400	2×10^7	2×10^6	2×10^5	2×10^4	2,000	200
100	5×10^6	5×10^5	5×10^4	5,000	500	50

TABLE 4-16—TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^A—Continued

Toxicity persistence factor value	Bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
70	3.5 × 10 ⁶	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350	35
40	2 × 10 ⁶	2 × 10 ⁵	2 × 10 ⁴	2,000	200	20
10	5 × 10 ⁵	5 × 10 ⁴	5,000	500	50	5
7	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350	35	3.5
4	2 × 10 ⁵	2 × 10 ⁴	2,000	200	20	2
1	5 × 10 ⁴	5,000	500	50	5	0.5
0.7	3.5 × 10 ⁴	3,500	350	35	3.5	0.35
0.4	2 × 10 ⁴	2,000	200	20	2	0.2
0.07	3,500	350	35	3.5	0.35	0.035
0.007	350	35	3.5	0.35	0.035	0.0035
0.0007	35	3.5	0.35	0.035	0.0035	0.00035
0	0	0	0	0	0	0

^A Do not round to nearest integer.

4.1.3.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.1.2.2.2 for the drinking water threat. Enter this value in table 4-1.

4.1.3.2.3 *Calculation of human food chain threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.1.3.2.1.4, use its toxicity/persistence factor value and bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the toxicity/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^8 . Then multiply this product by the bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12} . Based on this second product, assign a value from Table 2-7 (section 2.4.3.1) to the human food chain threat-waste characteristics factor category for the watershed. Enter this value in table 4-1.

4.1.3.3 *Human food chain threat-targets.* Evaluate two target factors for each watershed: food chain individual and population. For both factors, determine whether the target fisheries are subject to actual or potential human food chain contamination.

Consider a fishery (or portion of a fishery) within the target distance limit of the watershed to be subject to actual human food chain contamination if any of the following apply:

- A hazardous substance having a bioaccumulation potential factor value of 500 or greater is present either in an observed release by direct observation to the watershed or in a surface water or sediment sample from the watershed at a level that meets the criteria for an observed release to the watershed from the site, and at least a portion of the fishery is within the boundaries of the observed release (that is, it is located either at the point of direct observation or at or be-

tween the probable point of entry and the most distant sampling point establishing the observed release).

- The fishery is closed, and a hazardous substance for which the fishery has been closed has been documented in an observed release to the watershed from the site, and at least a portion of the fishery is within the boundaries of the observed release.

- A hazardous substance is present in a tissue sample from an essentially sessile, benthic, human food chain organism from the watershed at a level that meets the criteria for an observed release to the watershed from the site, and at least a portion of the fishery is within the boundaries of the observed release.

For a fishery that meets any of these three criteria, but that is not wholly within the boundaries of the observed release, consider only the portion of the fishery that is within the boundaries of the observed release to be subject to actual human food chain contamination. Consider the remainder of the fishery within the target distance limit to be subject to potential food chain contamination.

In addition, consider all other fisheries that are partially or wholly within the target distance limit for the watershed, including fisheries partially or wholly within the boundaries of an observed release for the watershed that do not meet any of the three criteria listed above, to be subject to potential human food chain contamination. If only a portion of the fishery is within the target distance limit for the watershed, include only that portion in evaluating the targets factor category.

When a fishery (or portion of a fishery) is subject to actual food chain contamination, determine the part of the fishery subject to Level I concentrations and the part subject to Level II concentrations. If the actual food chain contamination is based on direct observation, evaluate it using Level II concentrations. However, if the actual food chain contamination is based on samples

from the watershed, use these samples and, if available, additional tissue samples from aquatic human food chain organisms as specified below, to determine the part subject to Level I concentrations and the part subject to Level II concentrations:

- Determine the level of actual contamination from samples (including tissue samples from essentially sessile, benthic organisms) that meet the criteria for actual food chain contamination by comparing the exposure concentrations (see section 4.1.2.3) from these samples (or comparable samples) to the health-based benchmarks from table 4-17, as described in section 2.5.1 and 2.5.2. Use only the exposure concentrations for those hazardous substances in the sample (or comparable samples) that meet the criteria for actual contamination of the fishery.

- In addition, determine the level of actual contamination from other tissue samples by comparing the concentrations of hazardous substances in the tissue samples (or comparable tissue samples) to the health-based benchmarks from table 4-17, as described in sections 2.5.1 and 2.5.2. Use only those additional tissue samples and only those hazardous substances in the tissue samples that meet all the following criteria:

- The tissue sample is from a location that is within the boundaries of the actual food chain contamination for the site (that is, either at the point of direct observation or at or between the probable point of entry and the most distant sample point meeting the criteria for actual food chain contamination).

- The tissue sample is from a species of aquatic human food chain organism that spends extended periods of time within the boundaries of the actual food chain contamination for the site and that is not an essentially sessile, benthic organism.

- The hazardous substance is a substance that is also present in a surface water, benthic, or sediment sample from within the target distance limit for the watershed and, for such a sample, meets the criteria for actual food chain contamination.

TABLE 4-17—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN HUMAN FOOD CHAIN

- Concentration corresponding to Food and Drug Administration Action Level (FDAAL) for fish or shellfish.

- Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for oral exposures.

- Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

4.1.3.3.1 *Food chain individual.* Evaluate the food chain individual factor based on the fisheries (or portions of fisheries) within the

target distance limit for the watershed. Assign this factor a value as follows:

- If any fishery (or portion of a fishery) is subject to Level I concentrations, assign a value of 50.

- If not, but if any fishery (or portion of a fishery) is subject to Level II concentrations, assign a value of 45.

- If not, but if there is an observed release of a hazardous substance having a bioaccumulation potential factor value of 500 or greater to surface water in the watershed and there is a fishery (or portion of a fishery) present anywhere within the target distance limit, assign a value of 20.

- If there is no observed release to surface water in the watershed or there is no observed release of a hazardous substance having a bioaccumulation potential factor value of 500 or greater, but there is a fishery (or portion of a fishery) present anywhere within the target distance limit, assign a value as follows:

- Using table 4-13, determine the highest dilution weight (that is, lowest amount of dilution) applicable to the fisheries (or portions of fisheries) within the target distance limit. Multiply this dilution weight by 20 and round to the nearest integer.

- Assign this calculated value as the factor value.

- If there are no fisheries (or portions of fisheries) within the target distance limit of the watershed, assign a value of 0.

Enter the value assigned in table 4-1.

4.1.3.3.2 *Population.* Evaluate the population factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential human food chain contamination. Determine which factor applies for a fishery (or portion of a fishery) as specified in section 4.1.3.3.

4.1.3.3.2.1 *Level I concentrations.* Determine those fisheries (or portions of fisheries) within the watershed that are subject to Level I concentrations.

Estimate the human food chain population value for each fishery (or portion of a fishery) as follows:

- Estimate human food chain production for the fishery based on the estimated annual production (in pounds) of human food chain organisms (for example, fish, shellfish) for that fishery, except: if the fishery is closed and a hazardous substance for which the fishery has been closed has been documented in an observed release to the fishery from a source at the site, use the estimated annual production for the period prior to closure of the fishery or use the estimated annual production from comparable fisheries that are not closed.

- Assign the fishery a value for human food chain population from table 4-18, based on the estimated human food production for the fishery.

- Set boundaries between fisheries at those points where human food chain production changes or where the surface water dilution weight changes.

Sum the human food chain population value for each fishery (and portion of a fishery). Multiply this sum by 10. If the product is less than 1, do not round it to the nearest integer; if 1 or more, round to the nearest integer. Assign the resulting value as the Level I concentrations factor value. Enter this value in table 4-1.

4.1.3.3.2.2 *Level II concentrations.* Determine those fisheries (or portions of fisheries) within the watershed that are subject to Level II concentrations. Do not include any fisheries (or portions of fisheries) already counted under the Level I concentrations factor.

Assign each fishery (or portion of a fishery) a value for human food chain population from table 4-18, based on the estimated human food production for the fishery. Estimate the human food chain production for the fishery as specified in section 4.1.3.3.2.1.

Sum the human food chain population value for each fishery (and portion of a fishery). If this sum is less than 1, do not round it to the nearest integer; if 1 or more, round to the nearest integer. Assign the resulting value as the Level II concentrations factor value. Enter this value in table 4-1.

TABLE 4-18—HUMAN FOOD CHAIN POPULATION VALUES^A

Human food chain production (pounds per year)	Assigned human food chain population value
0	0
Greater than 0 to 100	0.03
Greater than 100 to 1,000	0.3
Greater than 1,000 to 10,000	3
Greater than 10,000 to 100,000	31
Greater than 100,000 to 1,000,000	310
Greater than 10 ⁶ to 10 ⁷	3,100
Greater than 10 ⁷ to 10 ⁸	31,000
Greater than 10 ⁸ to 10 ⁹	310,000
Greater than 10 ⁹	3,100,000

^A Do not round to nearest integer.

4.1.3.3.2.3 *Potential human food chain contamination.* Determine those fisheries (or portions of fisheries) within the watershed that are subject to potential human food chain contamination. Do not include those fisheries (or portion of fisheries) already counted under the Level I or Level II concentrations factors.

Calculate the value for the potential human food chain contamination factor (PF) for the watershed as follows:

$$PF = \frac{1}{10} \sum_{i=1}^n P_i D_i$$

where:

P_i = Human food chain population value for fishery i.

D_i = Dilution weight from table 4-13 for fishery i.

n = Number of fisheries subject to potential human food chain contamination.

In calculating PF:

- Estimate the human food chain population value (P_i) for a fishery (or portion of a fishery) as specified in section 4.1.3.3.2.1.

- Assign the fishery (or portion of a fishery) a dilution weight as indicated in table 4-13 (section 4.1.2.3.1), except: do not assign a dilution weight of 0.5 for a "3-mile mixing zone in quiet flowing river"; instead assign a dilution weight based on the average annual flow.

If PF is less than 1, do not round it to the nearest integer; if PF is 1 or more, round to the nearest integer. Enter the value assigned in table 4-1.

4.1.3.3.2.4 *Calculation of population factor value.* Sum the values for the Level I concentrations, Level II concentrations, and potential human food chain contamination factors for the watershed. Do not round this sum to the nearest integer. Assign it as the population factor value for the watershed. Enter this value in table 4-1.

4.1.3.3.3 *Calculation of human food chain threat-targets factor category value.* Sum the food chain individual and population factor values for the watershed. Do not round this sum to the nearest integer. Assign it as the human food chain threat-targets factor category value for the watershed. Enter this value in table 4-1.

4.1.3.4 *Calculation of human food chain threat score for a watershed.* Multiply the human food chain threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the human food chain threat score for the watershed. Enter this score in table 4-1.

4.1.4 *Environmental threat.* Evaluate the environmental threat for the watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.4.1 *Environmental threat-likelihood of release.* Assign the same likelihood of release factor category value for the environmental threat for the watershed as would be assigned in section 4.1.2.1.3 for the drinking water threat. Enter this value in table 4-1.

4.1.4.2 *Environmental threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: ecosystem toxicity/persistence/bioaccumulation and hazardous waste quantity.

4.1.4.2.1 *Ecosystem toxicity/persistence/bioaccumulation.* Evaluate all those hazardous

substances eligible to be evaluated for toxicity/persistence in the drinking water threat for the watershed (see section 4.1.2.2).

4.1.4.2.1.1 *Ecosystem toxicity.* Assign an ecosystem toxicity factor value from Table 4-19 to each hazardous substance on the basis of the following data hierarchy:

- EPA chronic Ambient Water Quality Criterion (AWQC) for the substance.
- EPA chronic Ambient Aquatic Life Advisory Concentrations (AALAC) for the substance.
- EPA acute AWQC for the substance.
- EPA acute AALAC for the substance.
- Lowest LC₅₀ value for the substance.

In assigning the ecosystem toxicity factor value to the hazardous substance:

• If either an EPA chronic AWQC or AALAC is available for the hazardous substance, use it to assign the ecosystem toxicity factor value. Use the chronic AWQC in preference to the chronic AALAC when both are available.

• If neither is available, use the EPA acute AWQC or AALAC to assign the ecosystem toxicity factor value. Use the acute AWQC in preference to the acute AALAC.

• If none of the chronic and acute AWQCs and AALACs is available, use the lowest LC₅₀ value to assign the ecosystem toxicity factor value.

• If an LC₅₀ value is also not available, assign an ecosystem toxicity factor value of 0 to the hazardous substance and use other hazardous substances for which data are available in evaluating the pathway.

If an ecosystem toxicity factor value of 0 is assigned to all hazardous substances eligible to be evaluated for the watershed (that is, insufficient data are available for evaluating all the substances), use a default value of 100 as the ecosystem toxicity factor value for all these hazardous substances.

With regard to the AWQC, AALAC, or LC₅₀ selected for assigning the ecosystem toxicity factor value to the hazardous substance:

• If values for the selected AWQC, AALAC, or LC₅₀ are available for both fresh water and marine water for the hazardous substance, use the value that corresponds to the type of water body (that is, fresh water or salt water) in which the sensitive environments are located to assign the ecosystem toxicity factor value to the hazardous substance.

• If, however, some of the sensitive environments being evaluated are in fresh water and some are in salt water, or if any are in brackish water, use the value (fresh water or marine) that yields the higher factor value to assign the ecosystem toxicity factor value to the hazardous substance.

• If a value for the selected AWQC, AALAC, or LC₅₀ is available for either fresh water or marine water, but not for both, use the available one to assign an ecosystem toxicity factor value to the hazardous substance.

TABLE 4-19—ECOSYSTEM TOXICITY FACTOR VALUES

If an EPA chronic AWQC^a or AALAC^b is available, assign a value as follows:^c

EPA chronic AWQC or AALAC	Assigned value
Less than 1 µg/l	10,000
1 to 10 µg/l	1,000
Greater than 10 to 100 µg/l	100
Greater than 100 to 1,000 µg/l	10
Greater than 1,000 µg/l	1

If neither an EPA chronic AWQC nor EPA chronic AALAC is available, assign a value based on the EPA acute AWQC or AALAC as follows:^c

EPA acute AWQC or AALAC	Assigned value
Less than 100 µg/l	10,000
100 to 1,000 µg/l	1,000
Greater than 1,000 to 10,000 µg/l	100
Greater than 10,000 to 100,000 µg/l	10
Greater than 100,000 µg/l	1

If neither an EPA chronic or acute AWQC nor EPA chronic or acute AALAC is available, assign a value from the LC₅₀ as follows:

LC ₅₀	Assigned value
Less than 100 µg/l	10,000
100 to 1,000 µg/l	1,000
Greater than 1,000 to 10,000 µg/l	100
Greater than 10,000 to 100,000 µg/l	10
Greater than 100,000 µg/l	1

If none of the AWQCs and AALACs nor the LC₅₀ is available, assign a value of 0.

^a AWQC—Ambient Water Quality Criteria.

^b AALAC—Ambient Aquatic Life Advisory Concentrations.

^c Use the AWQC value in preference to the AALAC when both are available. See text for use of fresh water and marine values.

4.1.4.2.1.2 *Persistence.* Assign a persistence factor value to each hazardous substance as specified in section 4.1.2.2.1.2, except: use the predominant water category (that is lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest sensitive environment (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2. For contaminated sediments with no identified source, use the point where measurement begins rather than the probable point of entry.

4.1.4.2.1.3 *Ecosystem bioaccumulation potential.* Assign an ecosystem bioaccumulation potential factor value to each hazardous substance in the same manner specified for the bioaccumulation potential factor in section 4.1.3.2.1.3, except:

- Use BCF data for all aquatic organisms, not just for aquatic human food chain organisms.

• Use the BCF data that corresponds to the type of water body (that is, fresh water or salt water) in which the sensitive environments (not fisheries) are located.

4.1.4.2.1.4 *Calculation of ecosystem toxicity/persistence/bioaccumulation factor value.* Assign each hazardous substance an ecosystem toxicity/persistence factor value from table 4-20, based on the values assigned to the hazardous substance for the ecosystem toxicity and persistence factors. Then assign each

hazardous substance an ecosystem toxicity/persistence/bioaccumulation factor value from table 4-21, based on the values assigned for the ecosystem toxicity/persistence and ecosystem bioaccumulation potential factors. Select the hazardous substance with the highest ecosystem toxicity/persistence/bioaccumulation factor value for the watershed and use it to assign the value to this factor. Enter this value in table 4-1.

TABLE 4-20—ECOSYSTEM TOXICITY/PERSISTENCE FACTOR VALUES^A

Persistence factor value	Ecosystem toxicity factor value					
	10,000	1,000	100	10	1	0
1.0	10,000	1,000	100	10	1	0
0.4	4,000	400	40	4	0.4	0
0.07	700	70	7	0.7	0.07	0
0.0007	7	0.7	0.07	0.007	0.0007	0

^ADo not round to nearest integer.

TABLE 4-21—ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^A

Ecosystem toxicity persistence factor value	Ecosystem bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
10,000	5 × 10 ⁸	5 × 10 ⁷	5 × 10 ⁶	5 × 10 ⁵	5 × 10 ⁴	5,000
4,000	2 × 10 ⁸	2 × 10 ⁷	2 × 10 ⁶	2 × 10 ⁵	2 × 10 ⁴	2,000
1,000	5 × 10 ⁷	5 × 10 ⁶	5 × 10 ⁵	5 × 10 ⁴	5,000	500
700	3.5 × 10 ⁷	3.5 × 10 ⁶	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350
400	2 × 10 ⁷	2 × 10 ⁶	2 × 10 ⁵	2 × 10 ⁴	2,000	200
100	5 × 10 ⁶	5 × 10 ⁵	5 × 10 ⁴	5,000	500	50
70	3.5 × 10 ⁶	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350	35
40	2 × 10 ⁶	2 × 10 ⁵	2 × 10 ⁴	2,000	200	20
10	5 × 10 ⁵	5 × 10 ⁴	5,000	500	50	5
7	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350	35	3.5
4	2 × 10 ⁵	2 × 10 ⁴	2,000	200	20	2
1	5 × 10 ⁴	5,000	500	50	5	0.5
0.7	3.5 × 10 ⁴	3,500	350	35	3.5	0.35
0.4	2 × 10 ⁴	2,000	200	20	2	0.2
0.07	3,500	350	35	3.5	0.35	0.035
0.007	350	35	3.5	0.35	0.035	0.0035
0.0007	35	3.5	0.35	0.035	0.0035	0.00035
0	0	0	0	0	0	0

^ADo not round to nearest integer.

4.1.4.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.1.2.2.2 for the drinking water threat. Enter this value in table 4-1.

4.1.4.2.3 *Calculation of environmental threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.1.4.2.1.4, use its ecosystem toxicity/persistence factor value and ecosystem bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the ecosystem toxicity/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1 × 10⁸. Then multiply this product by the ecosystem bioaccumulation potential factor

value for this hazardous substance, subject to a maximum product of 1 × 10¹². Based on this second product, assign a value from Table 2-7 (section 2.4.3.1) to the environmental threat-waste characteristics factor category for the watershed. Enter this value in table 4-1.

TABLE 4-22—ECOLOGICAL-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN SURFACE WATER

- Concentration corresponding to EPA Ambient Water Quality Criteria (AWQC) for protection of aquatic life (fresh water or marine).
- Concentration corresponding to EPA Ambient Aquatic Life Advisory Concentrations (AALAC).

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- Select the appropriate AWQC and AALAC as follows:
 - Use chronic value, if available; otherwise use acute value.
 - If the sensitive environment being evaluated is in fresh water, use fresh water value, except: if no fresh water value is available, use marine value if available.

- If the sensitive environment being evaluated is in salt water, use marine value, except: if no marine value is available, use fresh water value if available.
- If the sensitive environment being evaluated is in both fresh water and salt water, or is in brackish water, use lower of fresh water or marine values.

TABLE 4-23—SENSITIVE ENVIRONMENTS RATING VALUES

Sensitive environment	Assigned value
Critical habitat ^a for Federal designated endangered or threatened species Marine Sanctuary National Park Designated Federal Wilderness Area Areas identified under Coastal Zone Management Act ^b Sensitive areas identified under National Estuary Program ^c or Near Coastal Waters Program ^d Critical areas identified under the Clean Lakes Program ^e National Monument ^f National Seashore Recreational Area National Lakeshore Recreational Area	100
Habitat known to be used by Federal designated or proposed endangered or threatened species National Preserve National or State Wildlife Refuge Unit of Coastal Barrier Resources System Coastal Barrier (undeveloped) Federal land designated for protection of natural ecosystems Administratively Proposed Federal Wilderness Area Spawning areas critical ^g for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time Terrestrial areas utilized for breeding by large or dense aggregations of animals ^h National river reach designated as Recreational	75
Habitat known to be used by State designated endangered or threatened species Habitat known to be used by species under review as to its Federal endangered or threatened status Coastal Barrier (partially developed) Federal designated Scenic or Wild River	50
State land designated for wildlife or game management State designated Scenic or Wild River State designated Natural Areas Particular areas, relatively small in size, important to maintenance of unique biotic communities	25
State designated areas for protection or maintenance of aquatic life ⁱ	5

^aCritical habitat as defined in 50 CFR 424.02.
^bAreas identified in State Coastal Zone Management plans as requiring protection because of ecological value.
^cNational Estuary Program study areas (subareas within estuaries) identified in Comprehensive Conservation and Management Plans as requiring protection because they support critical life stages of key estuarine species (Section 320 of Clean Water Act, as amended).
^dNear Coastal Waters as defined in Sections 104(b)(3), 304(1), 319, and 320 of Clean Water Act, as amended.
^eClean Lakes Program critical areas (subareas within lakes, or in some cases entire small lakes) identified by State Clean Lake Plans as critical habitat (Section 314 of Clean Water Act, as amended).
^fUse only for air migration pathway.
^gLimit to areas described as being used for intense or concentrated spawning by a given species.
^hFor the air migration pathway, limit to terrestrial vertebrate species. For the surface water migration pathway, limit to terrestrial vertebrate species with aquatic or semiaquatic foraging habits.
ⁱAreas designated under Section 305(a) of Clean Water Act, as amended.

TABLE 4-24—WETLANDS RATING VALUES FOR SURFACE WATER MIGRATION PATHWAY

Total length of wetlands ^a (miles)	Assigned value
Less than 0.1	0
0.1 to 1	25
Greater than 1 to 2	50
Greater than 2 to 3	75
Greater than 3 to 4	100
Greater than 4 to 8	150
Greater than 8 to 12	250

TABLE 4-24—WETLANDS RATING VALUES FOR SURFACE WATER MIGRATION PATHWAY—Continued

Total length of wetlands ^a (miles)	Assigned value
Greater than 12 to 16	350
Greater than 16 to 20	450
Greater than 20	500

^aWetlands as defined in 40 CFR section 230.3.

4.1.4.3 *Environmental threat-targets.* Evaluate the environmental threat-targets factor category for a watershed using one factor: sensitive environments.

4.1.4.3.1 *Sensitive environments.* Evaluate sensitive environments along the hazardous substance migration path for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination.

Determine which factor applies to each sensitive environment as specified in section 4.1.2.3, except: use ecological-based benchmarks (Table 4-22) rather than health-based benchmarks (Table 3-10) in determining the level of contamination from samples. In determining the level of actual contamination, use a point of direct observation anywhere within the sensitive environment or samples (that is, surface water, benthic, or sediment samples) taken anywhere within or beyond the sensitive environment (or anywhere adjacent to or beyond the sensitive environment if it is contiguous to the migration path).

4.1.4.3.1.1 *Level I concentrations.* Assign value(s) from table 4-23 to each sensitive environment subject to Level I concentrations.

For those sensitive environments that are wetlands, assign an additional value from table 4-24. In assigning a value from table 4-24, include only those portions of wetlands located along the hazardous substance migration path in the area of Level I concentrations. If a wetland is located partially along the area of Level I concentrations and partially along the area of Level II concentrations and/or potential contamination, then solely for purposes of table 4-24, count the portion(s) along the areas of Level II concentrations or potential contamination under the Level II concentrations factor (section 4.1.4.3.1.2) or potential contamination factor (section 4.1.4.3.1.3), as appropriate.

Estimate the total length of wetlands along the hazardous substance migration path (that is, wetland frontage) in the area of Level I concentrations and assign a value from table 4-24 based on this total length. Estimate this length as follows:

- For an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the perimeter of that portion of the wetland subject to Level I concentrations as the length.
- For rivers, use the length of the wetlands contiguous to the in-water segment of the hazardous substance migration path (that is, wetland frontage).
- For lakes, oceans, coastal tidal waters, and Great Lakes, use the length of the wetlands along the shoreline within the target distance limit (that is, wetland frontage along the shoreline).

Calculate the Level I concentrations factor value (SH) for the watershed as follows:

$$SH = 10 \left(WH + \sum_{i=1}^n S_i \right)$$

where:

WH = Value assigned from table 4-24 to wetlands along the area of Level I concentrations.

S_i = Value(s) assigned from table 4-23 to sensitive environment i.

n = Number of sensitive environments from table 4-23 subject to Level I concentrations.

Enter the value assigned in table 4-1.

4.1.4.3.1.2 *Level II concentrations.* Assign value(s) from table 4-23 to each sensitive environment subject to Level II concentrations. Do not include sensitive environments already counted for table 4-23 under the Level I concentrations factor for this watershed.

For those sensitive environments that are wetlands, assign an additional value from table 4-24. In assigning a value from table 4-24, include only those portions of wetlands located along the hazardous substance migration path in the area of Level II concentrations, as specified in section 4.1.4.3.1.1.

Estimate the total length of wetlands along the hazardous substance migration path (that is, wetland frontage) in the area of Level II concentrations and assign a value from table 4-24 based on this total length. Estimate this length as specified in section 4.1.4.3.1.1, except: for an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the perimeter of that portion of the wetland subject to Level II (not Level I) concentrations as the length.

Calculate the Level II concentrations value (SL) for the watershed as follows:

$$SL = WL + \sum_{i=1}^n S_i$$

where:

WL = Value assigned from table 4-24 to wetlands along the area of Level II concentrations.

S_i = Value(s) assigned from table 4-23 to sensitive environment i.

n = Number of sensitive environments from table 4-23 subject to Level II concentrations.

Enter the value assigned in table 4-1.

4.1.4.3.1.3 *Potential contamination.* Assign value(s) from table 4-23 to each sensitive environment subject to potential contamination. Do not include sensitive environments already counted for table 4-23 under the Level I or Level II concentrations factors.

For each type of surface water body in table 4-13 (section 4.1.2.3.1), sum the value(s)

assigned from table 4-23 to the sensitive environments along that type of surface water body, except: do not use the surface water body type "3-mile mixing zone in quiet flowing river." If a sensitive environment is along two or more types of surface water bodies (for example, Wildlife Refuge contiguous to both a moderate stream and a large river), assign the sensitive environment only to that surface water body type having the highest dilution weight value from table 4-13.

For those sensitive environments that are wetlands, assign an additional value from table 4-24. In assigning a value from table 4-24, include only those portions of wetlands located along the hazardous substance migration path in the area of potential contamination, as specified in section 4.1.4.3.1.1. Aggregate these wetlands by type of surface water body, except: do not use the surface water body type "3-mile mixing zone in quiet flowing river." Treat the wetlands aggregated within each type of surface water body as separate sensitive environments solely for purposes of applying table 4-24. Estimate the total length of the wetlands within each surface water body type as specified in section 4.1.4.3.1.1, except: for an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the perimeter of that portion of the wetland subject to potential contamination (or the portion of that perimeter that is within the target distance limit) as the length. Assign a separate value from table 4-24 for each type of surface water body in the watershed.

Calculate the potential contamination factor value (SP) for the watershed as follows:

$$SP = \frac{1}{10} \sum_{j=1}^m [(W_j + S_j) D_j]$$

where:

$$S_j = \sum_{i=1}^n S_{ij}$$

S_{ij} = Value(s) assigned from table 4-23 to sensitive environment i in surface water body type j .

n = Number of sensitive environments from table 4-23 subject to potential contamination.

W_j = Value assigned from table 4-24 for wetlands along the area of potential contamination in surface water body type j .

D_j = Dilution weight from table 4-13 for surface water body type j .

m = Number of different surface water body types from table 4-13 in the watershed.

If SP is less than 1, do not round it to the nearest integer; if SP is 1 or more, round to the nearest integer. Enter this value for the potential contamination factor in table 4-1.

4.1.4.3.1.4 *Calculation of environmental threat-targets factor category value.* Sum the values for the Level I concentrations, Level II concentrations, and potential contamination factors for the watershed. Do not round this sum to the nearest integer. Assign this sum as the environmental threat-targets factor category value for the watershed. Enter this value in table 4-1.

4.1.4.4 *Calculation of environmental threat score for a watershed.* Multiply the environmental threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 60, as the environmental threat score for the watershed. Enter this score in table 4-1.

4.1.5 *Calculation of overland/flood migration component score for a watershed.* Sum the scores for the three threats for the watershed (that is, drinking water, human food chain, and environmental threats). Assign the resulting score, subject to a maximum value of 100, as the surface water overland/flood migration component score for the watershed. Enter this score in table 4-1.

4.1.6 *Calculation of overland/flood migration component score.* Select the highest surface water overland/flood migration component score from the watersheds evaluated. Assign this score as the surface water overland/flood migration component score for the site, subject to a maximum score of 100. Enter this score in table 4-1.

4.2 *Ground water to surface water migration component.* Use the ground water to surface water migration component to evaluate surface water threats that result from migration of hazardous substances from a source at the site to surface water via ground water. Evaluate three types of threats for this component: drinking water threat, human food chain threat, and environmental threat.

4.2.1 *General considerations.*

4.2.1.1 *Eligible surface waters.* Calculate ground water to surface water migration component scores only for surface waters (see section 4.0.2) for which all the following conditions are met:

- A portion of the surface water is within 1 mile of one or more sources at the site having a containment factor value greater than 0 (see section 4.2.2.1.2).

- No aquifer discontinuity is established between the source and the portion of the surface water within 1 mile of the source (see section 3.0.1.2.2). However, if hazardous substances have migrated across an apparent discontinuity within this 1 mile distance, do not consider a discontinuity present in scoring the site.

- The top of the uppermost aquifer is at or above the bottom of the surface water.

Do not evaluate this component for sites consisting solely of contaminated sediments with no identified source.

4.2.1.2 *Definition of hazardous substance migration path for ground water to surface water migration component.* The hazardous substance migration path includes both the ground water segment and the surface water in-water segment that hazardous substances would take as they migrate away from sources at the site:

- Restrict the ground water segment to migration via the uppermost aquifer between a source and the surface water.

- Begin the surface water in-water segment at the probable point of entry from the uppermost aquifer to the surface water. Identify the probable point of entry as that point of the surface water that yields the shortest straight-line distance, within the aquifer boundary (see section 3.0.1.2), from the sources at the site with a containment factor value greater than 0 to the surface water.

-For rivers, continue the in-water segment in the direction of flow (including any tidal flows) for the distance established by the target distance limit (see section 4.2.1.4).

-For lakes, oceans, coastal tidal waters, or Great Lakes, do not consider flow direction. Instead apply the target distance limit as an arc.

-If the in-water segment includes both rivers and lakes (or oceans, coastal tidal waters, or Great Lakes), apply the target distance limit to their combined in-water segments.

Consider a site to be in two or more watersheds for this component if two or more hazardous substance migration paths from the sources at the site do not reach a common point within the target distance limit. If the site is in more than one watershed, define a separate hazardous substance migration path for each watershed. Evaluate the ground water to surface water migration component for each watershed separately as specified in section 4.2.1.5.

4.2.1.3 *Observed release of a specific hazardous substance to surface water in-water segment.* Section 4.2.2.1.1 specifies the criteria for assigning values to the observed release factor for the ground water to surface water

migration component. With regard to an individual hazardous substance, consider an observed release of that hazardous substance to be established for the surface water in-water segment of the ground water to surface water migration component only when the hazardous substance meets the criteria both for an observed release both to ground water (see section 4.2.2.1.1) and for an observed release by chemical analysis to surface water (see section 4.1.2.1.1).

If the hazardous substance meets the section 4.1.2.1.1 criteria for an observed release by chemical analysis to surface water but does not also meet the criteria for an observed release to ground water, do not use any samples of that hazardous substance from the surface water in-water segment in evaluating the factors of this component (for example, do not use the hazardous substance in establishing targets subject to actual contamination or in determining the level of actual contamination for a target).

4.2.1.4 *Target distance limit.* Determine the target distance limit for each watershed as specified in section 4.1.1.2, except: do not extend the target distance limit to a sample location beyond 15 miles unless at least one hazardous substance in a sample from that location meets the criteria in section 4.2.1.3 for an observed release to the surface water in-water segment.

Determine the targets eligible to be evaluated for each watershed and establish whether these targets are subject to actual or potential contamination as specified in section 4.1.1.2, except: do not establish actual contamination based on a sample location unless at least one hazardous substance in a sample from that location meets the criteria in section 4.2.1.3 for an observed release to the surface water in-water segment.

4.2.1.5 *Evaluation of ground water to surface water migration component.* Evaluate the drinking water threat, human food chain threat, and environmental threat for each watershed for this component based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 4-2 indicates the factors included within each factor category for each type of threat.

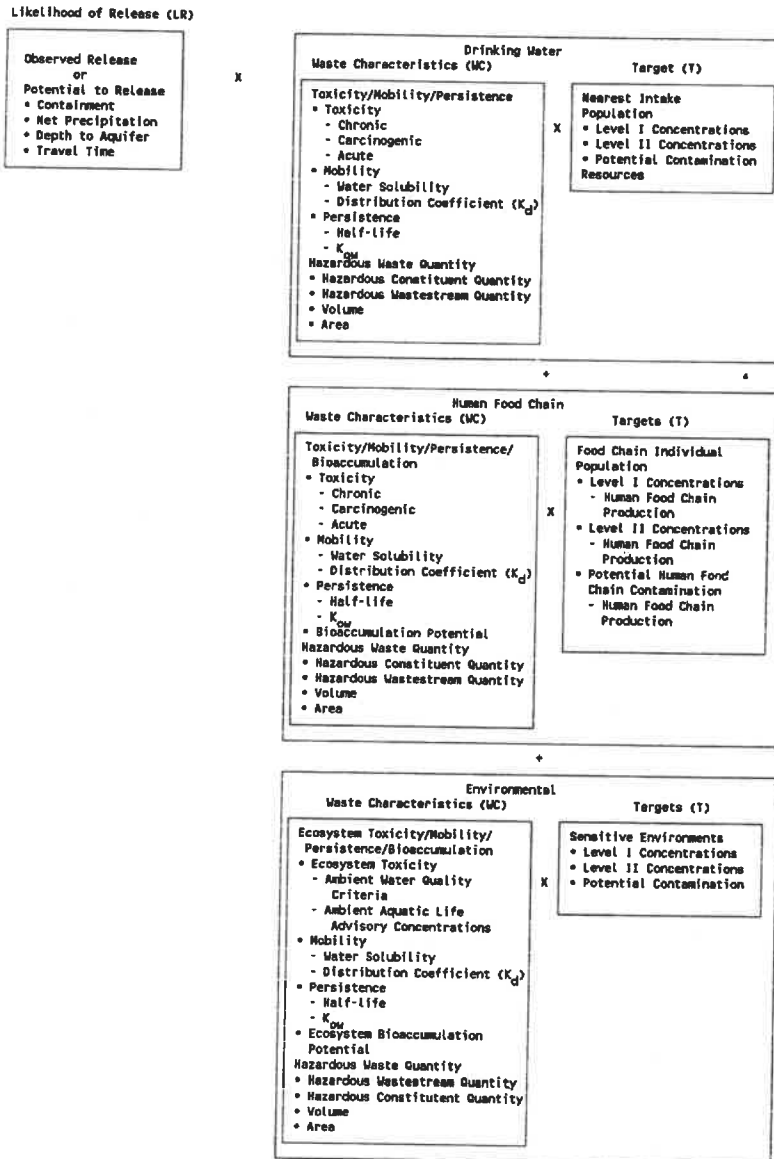


Figure 4-2
OVERVIEW OF GROUND WATER TO SURFACE WATER MIGRATION COMPONENT

Determine the ground water to surface water migration component score (S_{gs}) for a watershed in terms of the factor category values as follows:

$$S_{gs} = \frac{\sum_{i=1}^3 (LR_i)(WC_i)(T_i)}{SF}$$

where:

- LR_i = Likelihood of release factor category value for threat i (that is, drinking water, human food chain, or environmental threat).
- WC_i = Waste characteristics factor category value for threat i.
- T_i = Targets factor category value for threat i.

SF = Scaling factor.

Table 4-25 outlines the specific calculation procedure.

If the site is in only one watershed, assign the ground water to surface water migration component score for that watershed as the ground water to surface water migration component score for the site.

If the site is in more than one watershed:

- Calculate a separate ground water to surface water migration component score for each watershed, using likelihood of release, waste characteristics, and targets applicable to each watershed.
- Select the highest ground water to surface water migration component score from the watersheds evaluated and assign it as the ground water to surface water migration component score for the site.

TABLE 4-25—GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Drinking Water Threat		
Likelihood of Release to Aquifer:		
1. Observed Release	550	_____
2. Potential to Release:		
2a. Containment	10	_____
2b. Net Precipitation	10	_____
2c. Depth to Aquifer	5	_____
2d. Travel Time	35	_____
2e. Potential to Release (lines 2a[2b + 2c + 2d])	500	_____
3. Likelihood of Release (higher of lines 1 and 2e)	550	_____
Waste Characteristics:		
4. Toxicity/Mobility/Persistence	(a)	_____
5. Hazardous Waste Quantity	(a)	_____
6. Waste Characteristics	100	_____
Targets:		
7. Nearest Intake	50	_____
8. Population		
8a. Level I Concentrations	(b)	_____
8b. Level II Concentrations	(b)	_____
8c. Potential Contamination	(b)	_____
8d. Population (lines 8a + 8b + 8c)	_____	_____
9. Resources	5	_____
10. Targets (lines 7 + 8d + 9)	(b)	_____
Drinking Water Threat Score:		
11. Drinking Water Threat Score ((lines 3 × 6 × 10)/82,500, subject to a maximum of 100)	100	_____
Human Food Chain Threat		
Likelihood of Release:		
12. Likelihood of Release (same value as line 3)	550	_____
Waste Characteristics:		
13. Toxicity/Mobility/Persistence/Bioaccumulation	(a)	_____
14. Hazardous Waste Quantity	(a)	_____
15. Waste Characteristics	1,000	_____
Targets:		
16. Food Chain Individual	50	_____
17. Population:		
17a. Level I Concentrations	(b)	_____
17b. Level II Concentrations	(b)	_____
17c. Potential Human Food Chain Contamination	(b)	_____
17d. Population (lines 17a + 17b + 17c)	(b)	_____
18. Targets (Lines 16 + 17d)	(b)	_____
Human Food Chain Threat Score:		
19. Human Food Chain Threat Score ((lines 12 × 15 × 18)/82,500, subject to a maximum of 100)	100	_____
Environmental Threat		
Likelihood of Release:		
20. Likelihood of Release (same value as line 3)	550	_____
Waste Characteristics:		
21. Ecosystem Toxicity/Mobility/Persistence/Bioaccumulation	(a)	_____

TABLE 4-25—GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORESHEET—
Continued

Factor categories and factors	Maximum value	Value assigned
22. Hazardous Waste Quantity	(a)	—
23. Waste Characteristics	1,000	—
Targets:		
24. Sensitive Environments:		
24a. Level I Concentrations	(b)	—
24b. Level II Concentrations	(b)	—
24c. Potential Contamination	(b)	—
24d. Sensitive Environments (lines 24a + 24b + 24c)	(b)	—
25. Targets (value from line 24d)	(b)	—
Environmental Threat Score:		
26. Environmental Threat Score ((lines 20 × 23 × 25)/82,500, subject to a maximum of 60)	60	—
Ground Water to Surface Water Migration Component Score for a Watershed		
27. Watershed Score ^a (lines 11 + 19 + 26, subject to a maximum of 100)	100	—
28. Component Score (S _{gw}) ^c (highest score from Line 27 for all watersheds evaluated, subject to a maximum of 100)	100	—

^a Maximum value applies to waste characteristics category.
^b Maximum value not applicable.
^c Do not round to nearest integer.

4.2.2 *Drinking water threat.* Evaluate the drinking water threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.2.2.1 *Drinking water threat-likelihood of release.* Evaluate the likelihood of release factor category for each watershed in terms of an observed release factor or a potential to release factor.

4.2.2.1.1 *Observed release.* Establish an observed release to the uppermost aquifer as specified in section 3.1.1. If an observed release can be established for the uppermost aquifer, assign an observed release factor value of 550 to that watershed, enter this value in table 4-25, and proceed to section 4.2.2.1.3. If no observed release can be established, assign an observed release factor value of 0, enter this value in table 4-25, and proceed to section 4.2.2.1.2.

4.2.2.1.2 *Potential to release.* Evaluate potential to release only if an observed release cannot be established for the uppermost aquifer. Calculate a potential to release value for the uppermost aquifer as specified in section 3.1.2 and sections 3.1.2.1 through 3.1.2.5. Assign the potential to release value for the uppermost aquifer as the potential to release factor value for the watershed. Enter this value in table 4-25.

4.2.2.1.3 *Calculation of drinking water threat-likelihood of release factor category value.* If an observed release is established for the uppermost aquifer, assign the observed release factor value of 550 as the likelihood of release factor category value for the watershed. Otherwise, assign the potential to release factor value as the likelihood of release factor category value for the watershed. Enter the value assigned in table 4-25.

4.2.2.2 *Drinking water threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/mobility/persistence and hazardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to the uppermost aquifer (see section 3.2). Such hazardous substances include:

- Hazardous substances that meet the criteria for an observed release to ground water.

- All hazardous substances associated with a source that has a ground water containment factor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

4.2.2.2.1 *Toxicity/mobility/persistence.* For each hazardous substance, assign a toxicity factor value, a mobility factor value, a persistence factor value, and a combined toxicity/mobility/persistence factor value as specified in sections 4.2.2.2.1.1 through 4.2.2.2.1.4.

4.2.2.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.2.2.2.1.2 *Mobility.* Assign a ground water mobility factor value to each hazardous substance as specified in section 3.2.1.2.

4.2.2.2.1.3 *Persistence.* Assign a surface water persistence factor value to each hazardous substance as specified in section 4.1.2.2.1.2.

4.2.2.2.1.4 *Calculation of toxicity/mobility/persistence factor value.* First, assign each hazardous substance a toxicity/mobility factor value from table 3-9 (section 3.2.1.3), based on the values assigned to the hazardous substance for the toxicity and mobility factors. Then assign each hazardous substance a toxicity/mobility/persistence factor

value from table 4-26, based on the values assigned for the toxicity/mobility and persistence factors. Use the substance with the highest toxicity/mobility/persistence factor value for the watershed to assign the value to this factor. Enter this value in table 4-25.

4.2.2.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned for the uppermost aquifer in section 3.2.2. Enter this value in table 4-25.

4.2.2.2.3 *Calculation of drinking water threat-waste characteristics factor category*

value. Multiply the toxicity/mobility/persistence and hazardous waste quantity factor values for the watershed, subject to a maximum product of 1×10^8 . Based on this product, assign a value from table 2-7 (section 2.4.3.1) to the drinking water threat-waste characteristics factor category for the watershed. Enter this value in table 4-25.

4.2.2.3 *Drinking water/threat-targets.* Evaluate the targets factor category for each watershed based on three factors: nearest intake, population, and resources.

TABLE 4-26—TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES^A

Toxicity/mobility factor value	Persistence factor value			
	1.0	0.4	0.07	0.0007
10,000	10,000	4,000	700	7
2,000	2,000	800	140	1.4
1,000	1,000	400	70	0.7
200	200	80	14	0.14
100	100	40	7	0.07
20	20	8	1.4	0.014
10	10	4	0.7	0.007
2	2	0.8	0.14	0.0014
1	1	0.4	0.07	7×10^{-4}
0.2	0.2	0.08	0.014	1.4×10^{-4}
0.1	0.1	0.04	0.007	7×10^{-5}
0.02	0.02	0.008	0.0014	1.4×10^{-5}
0.01	0.01	0.004	7×10^{-4}	7×10^{-6}
0.002	0.002	8×10^{-4}	1.4×10^{-4}	1.4×10^{-6}
0.001	0.001	4×10^{-4}	7×10^{-5}	7×10^{-7}
2×10^{-4}	2×10^{-4}	8×10^{-5}	1.4×10^{-5}	1.4×10^{-7}
1×10^{-4}	1×10^{-4}	4×10^{-5}	7×10^{-6}	7×10^{-8}
2×10^{-5}	2×10^{-5}	8×10^{-6}	1.4×10^{-6}	1.4×10^{-8}
2×10^{-6}	2×10^{-6}	8×10^{-7}	1.4×10^{-7}	1.4×10^{-9}
2×10^{-7}	2×10^{-7}	8×10^{-8}	1.4×10^{-8}	1.4×10^{-10}
2×10^{-8}	2×10^{-8}	8×10^{-9}	1.4×10^{-9}	1.4×10^{-11}
2×10^{-9}	2×10^{-9}	8×10^{-10}	1.4×10^{-10}	1.4×10^{-12}
0	0	0	0	0

^ADo not round to nearest integer.

For the nearest intake and population factors, determine whether the target surface water intakes are subject to actual or potential contamination as specified in section 4.1.1.2, subject to the restrictions specified in sections 4.2.1.3 and 4.2.1.4.

When the intake is subject to actual contamination, evaluate it using Level I concentrations or Level II concentrations. Determine which level applies for the intake by comparing the exposure concentrations from a sample (or comparable samples) to health-based benchmarks as specified in section 4.1.2.3, except use only those samples from the surface water in-water segment and only those hazardous substances in such samples that meet the conditions in sections 4.2.1.3 and 4.2.1.4.

4.2.2.3.1 *Nearest intake.* Assign a value to the nearest intake factor as specified in section 4.1.2.3.1 with the following modification. For the intake being evaluated, multiply its dilution weight from table 4-13 (section 4.1.2.3.1) by a value selected from table 4-27.

Use the resulting product, not the value from table 4-13, as the dilution weight for the intake for the ground water to surface water component. Do not round this product to the nearest integer.

Select the value from table 4-27 based on the angle Θ , the angle defined by the sources at the site and either the two points at the intersection of the surface water body and the 1-mile distance ring of any two other points of the surface water body within the 1-mile distance ring, whichever results in the largest angle. (See Figure 4-3 for an example of how to determine Θ .) If the surface water body does not extend to the 1-mile ring at one or both ends, define Θ using the surface water endpoint(s) within the 1-mile ring or any two other points of the surface water body within the 1-mile distance ring, whichever results in the largest angle.

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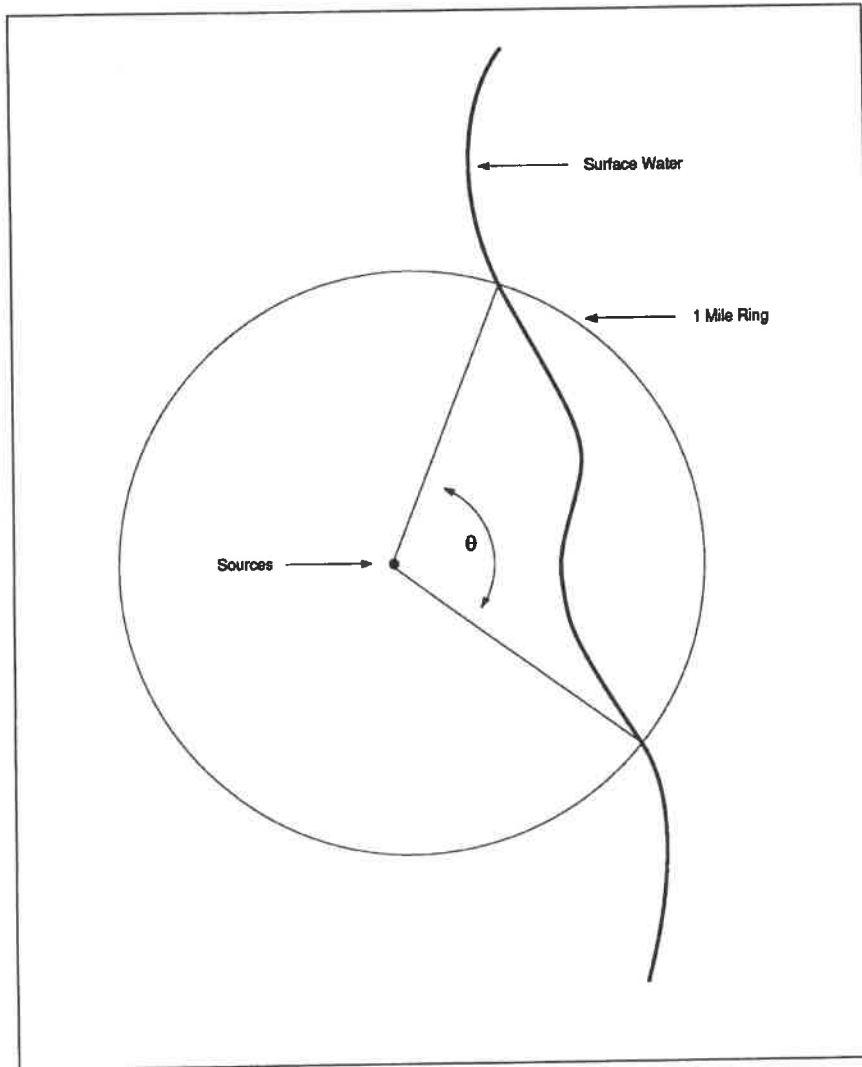
TABLE 4-27—DILUTION WEIGHT ADJUSTMENTS

Angle θ (degrees)	As- signed value ^a
0	0
Greater than 0 to 18	0.05
Greater than 18 to 54	0.1
Greater than 54 to 90	0.2
Greater than 90 to 126	0.3
Greater than 126 to 162	0.4
Greater than 162 to 198	0.5
Greater than 198 to 234	0.6

TABLE 4-27—DILUTION WEIGHT
ADJUSTMENTS—Continued

Angle θ (degrees)	As- signed value ^a
Greater than 234 to 270	0.7
Greater than 270 to 306	0.8
Greater than 306 to 342	0.9
Greater than 342 to 360	1.0

^a Do not round to nearest integer.



**FIGURE 4-3
SAMPLE DETERMINATION OF GROUND WATER
TO SURFACE WATER ANGLE**

TABLE 4-28—TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^A

Toxicity/mobility/persistence factor value	Bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
10,000	5×10^8	5×10^7	5×10^6	5×10^5	5×10^4	5,000
4,000	2×10^8	2×10^7	2×10^6	2×10^5	2×10^4	2,000
2,000	1×10^8	1×10^7	1×10^6	1×10^5	1×10^4	1,000

TABLE 4-28—TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^A—Continued

Toxicity/mobility/persistence factor value	Bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
1,000	5 × 10 ⁷	5 × 10 ⁸	5 × 10 ⁸	5 × 10 ⁴	5,000	500
800	4 × 10 ⁷	4 × 10 ⁸	4 × 10 ⁸	4 × 10 ⁴	4,000	400
700	3.5 × 10 ⁷	3.5 × 10 ⁸	3.5 × 10 ⁸	3.5 × 10 ⁴	3,500	350
400	2 × 10 ⁷	2 × 10 ⁸	2 × 10 ⁸	2 × 10 ⁴	2,000	200
200	1 × 10 ⁷	1 × 10 ⁸	1 × 10 ⁸	1 × 10 ⁴	1,000	100
140	7 × 10 ⁶	7 × 10 ⁷	7 × 10 ⁷	7,000	700	70
100	5 × 10 ⁶	5 × 10 ⁷	5 × 10 ⁷	5,000	500	50
80	4 × 10 ⁶	4 × 10 ⁷	4 × 10 ⁷	4,000	400	40
70	3.5 × 10 ⁶	3.5 × 10 ⁷	3.5 × 10 ⁷	3,500	350	35
40	2 × 10 ⁶	2 × 10 ⁷	2 × 10 ⁷	2,000	200	20
20	1 × 10 ⁶	1 × 10 ⁷	1 × 10 ⁷	1,000	100	10
14	7 × 10 ⁵	7 × 10 ⁶	7,000	700	70	7
10	5 × 10 ⁵	5 × 10 ⁶	5,000	500	50	5
8	4 × 10 ⁵	4 × 10 ⁶	4,000	400	40	4
7	3.5 × 10 ⁵	3.5 × 10 ⁶	3,500	350	35	3.5
4	2 × 10 ⁵	2 × 10 ⁶	2,000	200	20	2
2	1 × 10 ⁵	1 × 10 ⁶	1,000	100	10	1
1.4	7 × 10 ⁴	7,000	700	70	7	0.7
1.0	5 × 10 ⁴	5,000	500	50	5	0.5
0.8	4 × 10 ⁴	4,000	400	40	4	0.4
0.7	3.5 × 10 ⁴	3,500	350	35	3.5	0.35
0.4	2 × 10 ⁴	2,000	200	20	2	0.2
0.2	1 × 10 ⁴	1,000	100	10	1	0.1
0.14	7,000	700	70	7	0.7	0.07
0.1	5,000	500	50	5	0.5	0.05
0.08	4,000	400	40	4	0.4	0.04
0.07	3,500	350	35	3.5	0.35	0.035
0.04	2,000	200	20	2	0.2	0.02
0.02	1,000	100	10	1	0.1	0.01
0.014	700	70	7	0.7	0.07	0.007
0.01	500	50	5	0.5	0.05	0.005
0.008	400	40	4	0.4	0.04	0.004
0.007	350	35	3.5	0.35	0.035	0.0035
0.004	200	20	2	0.2	0.02	0.002
0.002	100	10	1	0.1	0.01	0.001
0.0014	70	7	0.7	0.07	0.007	7 × 10 ⁻⁴
0.001	50	5	0.5	0.05	0.005	5 × 10 ⁻⁴
8 × 10 ⁻⁴	40	4	0.4	0.04	0.004	4 × 10 ⁻⁴
7 × 10 ⁻⁴	35	3.5	0.035	0.035	0.0035	3.5 × 10 ⁻⁴
4 × 10 ⁻⁴	20	2	0.2	0.02	0.002	2 × 10 ⁻⁴
2 × 10 ⁻⁴	10	1	0.1	0.01	0.001	1 × 10 ⁻⁴
1.4 × 10 ⁻⁴	7	0.7	0.07	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵
1 × 10 ⁻⁴	5	0.5	0.05	0.005	5 × 10 ⁻⁴	5 × 10 ⁻⁵
8 × 10 ⁻⁵	4	0.4	0.04	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵
7 × 10 ⁻⁵	3.5	0.35	0.035	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵
4 × 10 ⁻⁵	2	0.2	0.02	0.002	2 × 10 ⁻⁴	2 × 10 ⁻⁵
2 × 10 ⁻⁵	1	0.1	0.01	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵
1.4 × 10 ⁻⁵	0.7	0.07	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶
8 × 10 ⁻⁶	0.4	0.04	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶
7 × 10 ⁻⁶	0.35	0.035	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵	3.5 × 10 ⁻⁶
2 × 10 ⁻⁶	0.1	0.01	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶
1.4 × 10 ⁻⁶	0.07	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁷
8 × 10 ⁻⁷	0.04	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶	4 × 10 ⁻⁷
7 × 10 ⁻⁷	0.035	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵	3.5 × 10 ⁻⁶	3.5 × 10 ⁻⁷
2 × 10 ⁻⁷	0.01	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶	1 × 10 ⁻⁷
1.4 × 10 ⁻⁷	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁷	7 × 10 ⁻⁸
8 × 10 ⁻⁸	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶	4 × 10 ⁻⁷	4 × 10 ⁻⁸
7 × 10 ⁻⁸	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵	3.5 × 10 ⁻⁶	3.5 × 10 ⁻⁷	3.5 × 10 ⁻⁸
2 × 10 ⁻⁸	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶	1 × 10 ⁻⁷	1 × 10 ⁻⁸
1.4 × 10 ⁻⁸	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁷	7 × 10 ⁻⁸	7 × 10 ⁻⁹
8 × 10 ⁻⁹	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶	4 × 10 ⁻⁷	4 × 10 ⁻⁸	4 × 10 ⁻⁹
2 × 10 ⁻⁹	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶	1 × 10 ⁻⁷	1 × 10 ⁻⁸	1 × 10 ⁻⁹
1.4 × 10 ⁻⁹	7 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁷	7 × 10 ⁻⁸	7 × 10 ⁻⁹	7 × 10 ⁻¹⁰
8 × 10 ⁻¹⁰	4 × 10 ⁻⁵	4 × 10 ⁻⁶	4 × 10 ⁻⁷	4 × 10 ⁻⁸	4 × 10 ⁻⁹	4 × 10 ⁻¹⁰
1.4 × 10 ⁻¹⁰	7 × 10 ⁻⁶	7 × 10 ⁻⁷	7 × 10 ⁻⁸	7 × 10 ⁻⁹	7 × 10 ⁻¹⁰	4 × 10 ⁻¹¹

TABLE 4-28—TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^a—Continued

Toxicity/mobility/persistence factor value	Bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
1.4×10^{-11}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}
1.4×10^{-12}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}	7×10^{-13}
0	0	0	0	0	0	0

^a Do not round to nearest integer.

4.2.2.3.2 *Population.* Evaluate the population factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination. Determine which factor applies to an intake as specified in section 4.2.2.3. Determine the population to be counted for that intake as specified in section 4.1.2.3.2, using the target distance limits in section 4.2.1.4 and the hazardous substance migration path in section 4.2.1.2.

4.2.2.3.2.1 *Level I concentrations.* Assign a value to this factor as specified in section 4.1.2.3.2.2.

4.2.2.3.2.2 *Level II concentrations.* Assign a value to this factor as specified in section 4.1.2.3.2.3.

4.2.2.3.2.3 *Potential contamination.* For each applicable type of surface water body in table 4-14, determine the dilution-weighted population value as specified in section 4.1.2.3.2.4. Select the appropriate dilution weight adjustment value from table 4-27 as specified in section 4.2.2.3.1.

Calculate the value for the potential contamination factor (PC) for the watershed as follows:

$$PC = \frac{A}{10} \sum_{i=1}^n W_i$$

where:

A = Dilution weight adjustment value from table 4-27.

W_i = Dilution-weighted population from table 4-14 for surface water body type i.

n = Number of different surface water body types in the watershed.

If PC is less than 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter the value in table 4-25.

4.2.2.3.2.4 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this value in table 4-25.

4.2.2.3.3 *Resources.* Assign a value to the resources factor as specified in section 4.1.2.3.3.

4.2.2.3.4 *Calculation of drinking water threat-targets factor category value.* Sum the

nearest intake, population, and resources factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the drinking water threat-targets factor category value for the watershed. Enter this value in table 4-25.

4.2.2.4 *Calculation of drinking water threat score for a watershed.* Multiply the drinking water threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the drinking water threat score for the watershed. Enter this score in table 4-25.

4.2.3 *Human food chain threat.* Evaluate the human food chain threat for a watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.2.3.1 *Human food chain threat-likelihood of release.* Assign the same likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 4.2.2.1.3 for the drinking water threat. Enter this value in table 4-25.

4.2.3.2 *Human food chain threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/mobility/persistence/bioaccumulation and hazardous waste quantity.

4.2.3.2.1 *Toxicity/mobility/persistence/bioaccumulation.* Evaluate all those hazardous substances eligible to be evaluated for toxicity/mobility/persistence in the drinking water threat for the watershed (see section 4.2.2.2.1).

4.2.3.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.2.3.2.1.2 *Mobility.* Assign a ground water mobility factor value to each hazardous substance as specified for the drinking water threat (see section 4.2.2.2.1.2).

4.2.3.2.1.3 *Persistence.* Assign a surface water persistence factor value to each hazardous substance as specified for the drinking water threat (see section 4.2.2.1.3), except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the

probable point of entry and the nearest fishery (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.1.2.

4.2.3.2.1.4 *Bioaccumulation potential.* Assign a bioaccumulation potential factor value to each hazardous substance as specified in section 4.1.3.2.1.3.

4.2.3.2.1.5 *Calculation of toxicity/mobility/persistence/ bioaccumulation factor value.* Assign each hazardous substance a toxicity/mobility factor value from table 3-9 (section 3.2.1.3), based on the values assigned to the hazardous substance for the toxicity and mobility factors. Then assign each hazardous substance a toxicity/mobility/persistence factor value from table 4-26, based on the values assigned for the toxicity/mobility and persistence factors. Then assign each hazardous substance a toxicity/mobility/persistence/bioaccumulation factor value from table 4-28. Use the substance with the highest toxicity/mobility/persistence/bioaccumulation factor value for the watershed to assign the value to this factor for the watershed. Enter this value in table 4-25.

4.2.3.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.2.2.2 for the drinking water threat. Enter this value in table 4-25.

4.2.3.2.3 *Calculation of human food chain threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.2.3.2.1.5, use its toxicity/mobility/persistence factor value and bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the toxicity/mobility/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^8 . Then multiply this product by the bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12} . Based on this second product, assign a value from table 2-7 (section 2.4.3.1) to the human food chain threat-waste characteristics factor category for the watershed. Enter this value in table 4-25.

4.2.3.3 *Human food chain threat-targets.* Evaluate two target factors for the watershed: food chain individual and population.

For both factors, determine whether the target fisheries are subject to Level I concentrations, Level II concentrations, or potential human food chain contamination. Determine which applies to each fishery (or portion of a fishery) as specified in section 4.1.3.3, subject to the restrictions specified in sections 4.2.1.3 and 4.2.1.4.

4.2.3.3.1 *Food chain individual.* Assign a value to the food chain individual factor as specified in section 4.1.3.3.1 with the following modification. When a dilution weight is used, multiply the appropriate dilution weight from table 4-13 by the adjustment value selected from table 4-27, as specified in section 4.2.2.3.1. Use the resulting product, not the value from table 4-13, as the dilution weight in assigning the factor value. Do not round this product to the nearest integer. Enter the value assigned in table 4-25.

4.2.3.3.2 *Population.* Evaluate the population factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential human food chain contamination. Determine which of these factors is to be applied to each fishery as specified in section 4.2.3.3.

4.2.3.3.2.1 *Level I concentrations.* Assign a value to this factor as specified in section 4.1.3.3.2.1. Enter this value in table 4-25.

4.2.3.3.2.2 *Level II concentrations.* Assign a value to this factor as specified in section 4.1.3.3.2.2. Enter this value in table 4-25.

4.2.3.3.2.3 *Potential human food chain contamination.* Assign a value to this factor as specified in section 4.1.3.3.2.3 with the following modification. For each fishery being evaluated, multiply the appropriate dilution weight for that fishery from table 4-13 by the adjustment value selected from table 4-27, as specified in section 4.2.2.3.1. Use the resulting product, not the value from table 4-13, as the dilution weight for the fishery. Do not round this product to the nearest integer. Enter the value assigned in table 4-25.

4.2.3.3.2.4 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential human food chain contamination for the watershed. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this value in table 4-25.

4.2.3.3.3 *Calculation of human food chain threat-targets factor category value.* Sum the food chain individual and population factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the human food chain threat-targets factor category value for the watershed. Enter this value in table 4-25.

4.2.3.4 *Calculation of human food chain threat score for a watershed.* Multiply the human food chain threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the human food chain threat score for the watershed. Enter this score in table 4-25.

4.2.4 *Environmental threat.* Evaluate the environmental threat for the watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.2.4.1 *Environmental threat-likelihood of release.* Assign the same likelihood of release factor category value for the environmental threat for the watershed as would be assigned in section 4.2.2.1.3 for the drinking water threat. Enter this value in table 4-25.

4.2.4.2 *Environmental threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: ecosystem toxicity/mobility/persistence/bioaccumulation and hazardous waste quantity.

4.2.4.2.1 *Ecosystem toxicity/mobility/persistence/bioaccumulation.* Evaluate all those hazardous substances eligible to be evaluated for toxicity/mobility/persistence in the drinking water threat for the watershed (see section 4.2.2.1).

4.2.4.2.1.1 *Ecosystem toxicity.* Assign an ecosystem toxicity factor value to each hazardous substance as specified in section 4.1.4.2.1.1.

4.2.4.2.1.2 *Mobility.* Assign a ground water mobility factor value to each hazardous substance as specified in section 4.2.2.2.1.2 for the drinking water threat.

4.2.4.2.1.3 *Persistence.* Assign a surface water persistence factor value to each hazardous substance as specified in section 4.2.2.2.1.3 for the drinking water threat, except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest sen-

sitive environment (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2.

4.2.4.2.1.4 *Ecosystem bioaccumulation potential.* Assign an ecosystem bioaccumulation potential factor value to each hazardous substance as specified in section 4.1.4.2.1.3.

4.2.4.2.1.5 *Calculation of ecosystem toxicity/mobility/persistence/ bioaccumulation factor value.* Assign each hazardous substance an ecosystem toxicity/mobility factor value from table 3-9 (section 3.2.1.3), based on the values assigned to the hazardous substance for the ecosystem toxicity and mobility factors. Then assign each hazardous substance an ecosystem toxicity/mobility/persistence factor value from table 4-29, based on the values assigned for the ecosystem toxicity/mobility and persistence factors. Then assign each hazardous substance an ecosystem toxicity/mobility/persistence/bioaccumulation factor value from table 4-30, based on the values assigned for the ecosystem toxicity/mobility/persistence and ecosystem bioaccumulation potential factors. Select the substance with the highest ecosystem toxicity/mobility/persistence/bioaccumulation factor value for the watershed and use it to assign the value to this factor for the watershed. Enter this value in table 4-25.

TABLE 4-29—ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES^A

Ecosystem toxicity/mobility factor value	Persistence factor value			
	1.0	0.4	0.07	0.0007
10,000	10,000	4,000	700	7
2,000	2,000	800	140	1.41,000
1,000	1,000	400	70	0.7
200	200	80	14	0.14
100	100	40	7	0.07
20	20	8	1.4	0.014
10	10	4	0.7	0.007
2	2	0.8	0.14	0.0014
1	1	0.4	0.07	7 × 10 ⁻⁴
0.2	0.2	0.08	0.014	1.4 × 10 ⁻⁴
0.1	0.1	0.04	0.007	7 × 10 ⁻⁵
0.2	0.2	0.008	0.0014	1.4 × 10 ⁻⁵
0.01	0.01	0.004	7 × 10 ⁻⁴	7 × 10 ⁻⁶
0.002	0.002	8 × 10 ⁻⁴	1.4 × 10 ⁻⁴	1.4 × 10 ⁻⁶
0.001	0.001	4 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁷
2 × 10 ⁻⁴	2 × 10 ⁻⁴	8 × 10 ⁻⁵	1.4 × 10 ⁻⁵	1.4 × 10 ⁻⁷
1 × 10 ⁻⁴	1 × 10 ⁻⁴	4 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁸
2 × 10 ⁻⁵	2 × 10 ⁻⁵	8 × 10 ⁻⁶	1.4 × 10 ⁻⁶	1.4 × 10 ⁻⁸
2 × 10 ⁻⁶	2 × 10 ⁻⁶	8 × 10 ⁻⁷	1.4 × 10 ⁻⁷	1.4 × 10 ⁻⁹
2 × 10 ⁻⁷	2 × 10 ⁻⁷	8 × 10 ⁻⁸	1.4 × 10 ⁻⁸	1.4 × 10 ⁻¹⁰
2 × 10 ⁻⁸	2 × 10 ⁻⁸	8 × 10 ⁻⁹	1.4 × 10 ⁻⁹	1.4 × 10 ⁻¹¹
2 × 10 ⁻⁹	2 × 10 ⁻⁹	8 × 10 ⁻¹⁰	1.4 × 10 ⁻¹⁰	1.4 × 10 ⁻¹²
0	0	0	0	0

^A Do not round to nearest integer.

TABLE 4-30—ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^A

Ecosystem toxicity/mobility/persistence factor value	Ecosystem bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
10,000	5 × 10 ⁸	5 × 10 ⁷	5 × 10 ⁶	5 × 10 ⁵	5 × 10 ⁴	5,000
4,000	2 × 10 ⁸	2 × 10 ⁷	2 × 10 ⁶	2 × 10 ⁵	2 × 10 ⁴	2,000
2,000	1 × 10 ⁸	1 × 10 ⁷	1 × 10 ⁶	1 × 10 ⁵	1 × 10 ⁴	1,000
1,000	5 × 10 ⁷	5 × 10 ⁶	5 × 10 ⁵	5 × 10 ⁴	5,000	500
800	4 × 10 ⁷	4 × 10 ⁶	4 × 10 ⁵	4 × 10 ⁴	4,000	400
700	3.5 × 10 ⁷	3.5 × 10 ⁶	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350
400	2 × 10 ⁷	2 × 10 ⁶	2 × 10 ⁵	2 × 10 ⁴	2,000	200
200	1 × 10 ⁷	1 × 10 ⁶	1 × 10 ⁵	1 × 10 ⁴	1,000	100
140	7 × 10 ⁶	7 × 10 ⁵	7 × 10 ⁴	7,000	700	70
100	5 × 10 ⁶	5 × 10 ⁵	5 × 10 ⁴	5,000	500	50
80	4 × 10 ⁶	4 × 10 ⁵	4 × 10 ⁴	4,000	400	40
70	3.5 × 10 ⁶	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350	35
40	2 × 10 ⁶	2 × 10 ⁵	2 × 10 ⁴	2,000	200	20
20	1 × 10 ⁶	1 × 10 ⁵	1 × 10 ⁴	1,000	100	10
14	7 × 10 ⁵	7 × 10 ⁴	7,000	700	70	7
10	5 × 10 ⁵	5 × 10 ⁴	5,000	500	50	5
8	4 × 10 ⁵	4 × 10 ⁴	4,000	400	40	4
7	3.5 × 10 ⁵	3.5 × 10 ⁴	3,500	350	35	3.5
4	2 × 10 ⁵	2 × 10 ⁴	2,000	200	20	2
2	1 × 10 ⁵	1 × 10 ⁴	1,000	100	10	1
1.4	7 × 10 ⁴	7,000	700	70	7	0.7
1.0	5 × 10 ⁴	5,000	500	50	5	0.5
0.8	4 × 10 ⁴	4,000	400	40	4	0.4
0.7	3.5 × 10 ⁴	3,500	350	35	3.5	0.35
0.4	2 × 10 ⁴	2,000	200	20	2	0.2
0.2	1 × 10 ⁴	1,000	100	10	1	0.1
0.14	7,000	700	70	7	0.7	0.07
0.1	5,000	500	50	5	0.5	0.05
0.08	4,000	400	40	4	0.4	0.04
0.07	3,500	350	35	3.5	0.35	0.035
0.04	2,000	200	20	2	0.2	0.02
0.02	1,000	100	10	1	0.1	0.01
0.014	700	70	7	0.7	0.07	0.007
0.01	500	50	5	0.5	0.05	0.005
0.008	400	40	4	0.4	0.04	0.004
0.007	350	35	3.5	0.35	0.035	0.0035
0.004	200	20	2	0.2	0.02	0.002
0.002	100	10	1	0.1	0.01	0.001
0.0014	70	7	0.7	0.07	0.007	7 × 10 ⁻⁴
0.001	50	5	0.5	0.05	0.005	5 × 10 ⁻⁴
8 × 10 ⁻⁴	40	4	0.4	0.04	0.004	4 × 10 ⁻⁴
7 × 10 ⁻⁴	35	3.5	0.35	0.035	0.0035	3.5 × 10 ⁻⁴
4 × 10 ⁻⁴	20	2	0.2	0.02	0.002	2 × 10 ⁻⁴
2 × 10 ⁻⁴	10	1	0.1	0.01	0.001	1 × 10 ⁻⁴
1.4 × 10 ⁻⁴	7	0.7	0.07	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵
1 × 10 ⁻⁴	5	0.5	0.05	0.005	5 × 10 ⁻⁴	5 × 10 ⁻⁵
8 × 10 ⁻⁵	4	0.4	0.04	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵
7 × 10 ⁻⁵	3.5	0.35	0.035	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵
4 × 10 ⁻⁵	2	0.2	0.02	0.002	2 × 10 ⁻⁴	2 × 10 ⁻⁵
2 × 10 ⁻⁵	1	0.1	0.01	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵
1.4 × 10 ⁻⁵	0.7	0.07	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶
8 × 10 ⁻⁶	0.4	0.04	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶
7 × 10 ⁻⁶	0.35	0.035	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵	3.5 × 10 ⁻⁶
2 × 10 ⁻⁶	0.1	0.01	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶
1.4 × 10 ⁻⁶	0.07	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁷
8 × 10 ⁻⁷	0.04	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶	4 × 10 ⁻⁷
7 × 10 ⁻⁷	0.035	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵	3.5 × 10 ⁻⁶	3.5 × 10 ⁻⁷
2 × 10 ⁻⁷	0.01	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶	1 × 10 ⁻⁷
1.4 × 10 ⁻⁷	0.007	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁷	7 × 10 ⁻⁸
8 × 10 ⁻⁸	0.004	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶	4 × 10 ⁻⁷	4 × 10 ⁻⁸
7 × 10 ⁻⁸	0.0035	3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁵	3.5 × 10 ⁻⁶	3.5 × 10 ⁻⁷	3.5 × 10 ⁻⁸
2 × 10 ⁻⁸	0.001	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶	1 × 10 ⁻⁷	1 × 10 ⁻⁸
1.4 × 10 ⁻⁸	7 × 10 ⁻⁴	7 × 10 ⁻⁵	7 × 10 ⁻⁶	7 × 10 ⁻⁷	7 × 10 ⁻⁸	7 × 10 ⁻⁹
8 × 10 ⁻⁹	4 × 10 ⁻⁴	4 × 10 ⁻⁵	4 × 10 ⁻⁶	4 × 10 ⁻⁷	4 × 10 ⁻⁸	4 × 10 ⁻⁹
2 × 10 ⁻⁹	1 × 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶	1 × 10 ⁻⁷	1 × 10 ⁻⁸	1 × 10 ⁻⁹

TABLE 4-30—ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES^A—Continued

Ecosystem toxicity/mobility/persistence factor value	Ecosystem bioaccumulation potential factor value					
	50,000	5,000	500	50	5	0.5
1.4×10^{-9}	7×10^{-5}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}
8×10^{-10}	4×10^{-5}	4×10^{-6}	4×10^{-7}	4×10^{-8}	4×10^{-9}	4×10^{-10}
1.4×10^{-10}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}
1.4×10^{-11}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}
1.4×10^{-12}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}	7×10^{-13}
0	0	0	0	0	0	0

^a Do not round to nearest integer.

4.2.4.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.2.2.2 for the drinking water threat. Enter this value in table 4-25.

4.2.4.2.3 *Calculation of environmental threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.2.4.2.1.5, use its ecosystem toxicity/mobility/persistence factor value and ecosystem bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the ecosystem toxicity/mobility/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^9 . Then multiply this product by the ecosystem bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12} . Based on this product, assign a value from table 2-7 (section 2.4.3.1) to the environmental threat-waste characteristics category for the watershed. Enter the value in table 4-25.

4.2.4.3 *Environmental threat-targets.* Evaluate the environmental threat-targets factor category for a watershed using one factor: sensitive environments.

4.2.4.3.1 *Sensitive environments.* Evaluate sensitive environments for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination. Determine which applies to each sensitive environment as specified in section 4.1.4.3.1, except: use only those samples from the surface water in-water segment and only those hazardous substances in such samples that meet the conditions in sections 4.2.1.3 and 4.2.1.4.

4.2.4.3.1.1 *Level I concentrations.* Assign a value to this factor as specified in section 4.1.4.3.1.1. Enter this value in table 4-25.

4.2.4.3.1.2 *Level II concentrations.* Assign a value to this factor as specified in section 4.1.4.3.1.2. Enter this value in table 4-25.

4.2.4.3.1.3 *Potential contamination.* Assign a value to this factor as specified in section 4.1.4.3.1.3 with the following modification. Multiply the appropriate dilution weight

from table 4-13 for the sensitive environments in each type of surface water body by the adjustment value selected from table 4-27, as specified in section 4.2.2.3.1. Use the resulting product, not the value from table 4-13, as the dilution weight for the sensitive environments in that type of surface water body. Do not round this product to the nearest integer. Enter the value assigned in table 4-25.

4.2.4.3.1.4 *Calculation of environmental threat-targets factor category value.* Sum the values for Level I concentrations, Level II concentrations, and potential contamination for the watershed. Do not round this sum to the nearest integer. Assign this sum as the environmental threat targets factor category value for the watershed. Enter this value in table 4-25.

4.2.4.4 *Calculation of environmental threat score for a watershed.* Multiply the environmental threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 60, as the environmental threat score for the watershed. Enter this score in table 4-25.

4.2.5 *Calculation of ground water to surface water migration component score for a watershed.* Sum the scores for the three threats for the watershed (that is, drinking water, human food chain, and environmental threats). Assign the resulting score, subject to a maximum value of 100, as the ground water to surface water migration component score for the watershed. Enter this score in table 4-25.

4.2.6 *Calculation of ground water to surface water migration component score.* Select the highest ground water to surface water migration component score from the watersheds evaluated. Assign this score as the ground water to surface water migration component score for the site, subject to a maximum score of 100. Enter this score in table 4-25.

4.3 *Calculation of surface water migration pathway score.* Determine the surface water migration pathway score as follows:

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- If only one of the two surface water migration components (overland/flood or ground water to surface water) is scored, assign the score of that component as the surface water migration pathway score.

- If both components are scored, select the higher of the two component scores from sections 4.1.6 and 4.2.6. Assign that score as the surface water migration pathway score.

5.0 SOIL EXPOSURE AND SUBSURFACE INTRUSION PATHWAY

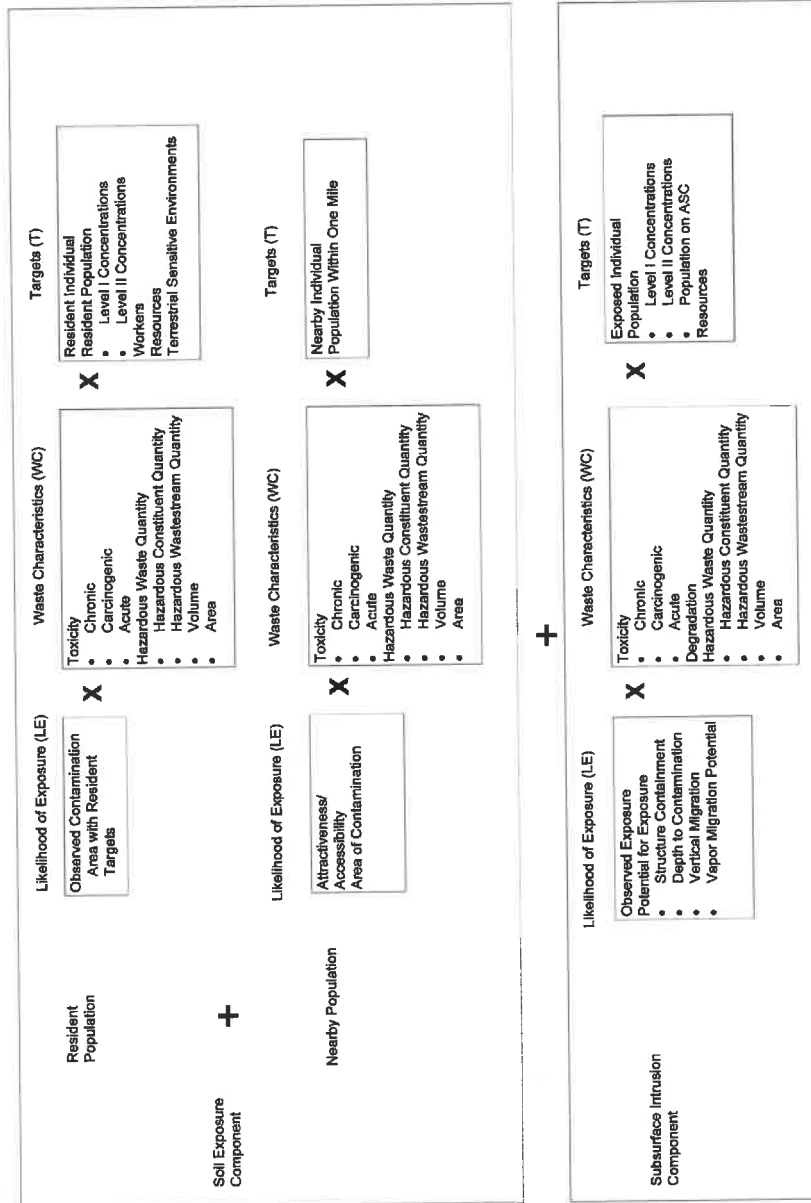
5.0.1 *Exposure components.* Evaluate the soil exposure and subsurface intrusion pathway based on two exposure components:

- Soil exposure component (see section 5.1).

- Subsurface intrusion component (see section 5.2).

Score one or both components considering their relative importance. If only one component is scored, assign its score as the soil exposure and subsurface intrusion pathway score. If both components are scored, sum the two scores and assign it as the soil exposure and subsurface intrusion pathway score, subject to a maximum of 100.

Figure 5-1 Overview of the Soil Exposure and Subsurface Intrusion Pathway



5.1 *Soil exposure component.* Evaluate the soil exposure component based on two threats: Resident population threat and nearby population threat. Evaluate both

threats based on three factor categories: Likelihood of exposure, waste characteristics, and targets. Figure 5-1 indicates the

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factors included within each factor category for each type of threat.

Determine the soil exposure component score (S_{se}) in terms of the factor category values as follows:

$$S_{se} = \frac{\sum_{i=1}^2 (LE_i)(WC_i)(T_i)}{SF}$$

Where:

LE_i = Likelihood of exposure factor category value for threat i (that is, resident population threat or nearby population threat).

WC_i = Waste characteristics factor category value for threat i .

T_i = Targets factor category value for threat i .

SF = Scaling factor.

Table 5-1 outlines the specific calculation procedure.

TABLE 5-1—SOIL EXPOSURE COMPONENT SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Resident Population Threat		
Likelihood of Exposure:		
1. Likelihood of Exposure	550	
Waste Characteristics:		
2. Toxicity	(^a)	
3. Hazardous Waste Quantity	(^a)	
4. Waste Characteristics	100	
Targets:		
5. Resident Individual	50	
6. Resident Population:		
6a. Level I Concentrations	(^b)	
6b. Level II Concentrations	(^b)	
6c. Resident Population (lines 6a + 6b)	(^b)	
7. Workers	15	
8. Resources	5	
9. Terrestrial Sensitive Environments	(^c)	
10. Targets (lines 5 + 6c + 7 + 8 + 9)	(^b)	
Resident Population Threat Score:		
11. Resident Population Threat (lines 1 × 4 × 10)	(^b)	
Nearby Population Threat		
Likelihood of Exposure:		
12. Attractiveness/Accessibility	100	
13. Area of Contamination	100	
14. Likelihood of Exposure	500	
Waste Characteristics:		
15. Toxicity	(^a)	
16. Hazardous Waste Quantity	(^a)	
17. Waste Characteristics	100	
Targets:		
18. Nearby Individual	1	
19. Population Within 1 Mile	(^b)	
20. Targets (lines 18 + 19)	(^b)	
Nearby Population Threat Score:		
21. Nearby Population Threat (lines 14 × 17 × 20)	(^b)	
Soil Exposure Component Score:		
22. Soil Exposure Component Score ^d (S_{se}), (lines [11 + 21]/82,500, subject to a maximum of 100)	100	

^a Maximum value applies to waste characteristics category.

^b Maximum value not applicable.

^c No specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60.

^d Do not round to nearest integer.

5.1.0 *General considerations.* Evaluate the soil exposure component based on areas of observed contamination:

- Consider observed contamination to be present at sampling locations where analytic evidence indicates that:

—A hazardous substance attributable to the site is present at a concentration significantly above background levels for the site (see Table 2-3 in section 2.3 for the criteria for determining analytical significance), and

—This hazardous substance, if not present at the surface, is covered by 2 feet or less of cover material (for example, soil).

- Establish areas of observed contamination based on sampling locations at which there is observed contamination as follows:

—For all sources except contaminated soil, if observed contamination from the site is present at any sampling location within the source, consider that entire source to be an area of observed contamination.

—For contaminated soil, consider both the sampling location(s) with observed contamination from the site and the area lying between such locations to be an area of observed contamination, unless available information indicates otherwise.

- If an area of observed contamination (or portion of such an area) is covered by a permanent, or otherwise maintained, essentially impenetrable material (for example, asphalt) that is not more than 2 feet thick, exclude that area (or portion of the area) in evaluating the soil exposure component.

- For an area of observed contamination, consider only those hazardous substances that meet the criteria for observed contamination for that area to be associated with that area in evaluating the soil exposure component (see section 2.2.2).

If there is observed contamination, assign scores for the resident population threat and the nearby population threat, as specified in sections 5.1.1 and 5.1.2. If there is no observed contamination, assign the soil exposure component of the soil exposure and subsurface intrusion pathway a score of 0.

5.1.1 *Resident population threat.* Evaluate the resident population threat only if there is an area of observed contamination in one or more of the following locations:

- Within the property boundary of a residence, school, or day care center and within 200 feet of the respective residence, school, or day care center, or
- Within a workplace property boundary and within 200 feet of a workplace area, or
- Within the boundaries of a resource specified in section 5.1.1.3.4, or
- Within the boundaries of a terrestrial sensitive environment specified in section 5.1.1.3.5.

If not, assign the resident population threat a value of 0, enter this value in Table 5-1, and proceed to the nearby population threat (section 5.1.2).

5.1.1.1 *Likelihood of exposure.* Assign a value of 550 to the likelihood of exposure factor category for the resident population threat if there is an area of observed contamination in one or more locations listed in section 5.1.1. Enter this value in Table 5-1.

5.1.1.2 *Waste characteristics.* Evaluate waste characteristics based on two factors: toxicity and hazardous waste quantity. Evaluate only those hazardous substances that meet the criteria for observed contamination at the site (see section 5.1.0).

5.1.1.2.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1. Use the hazardous substance with the highest toxicity factor value to assign the value to the toxicity factor for the resident population threat. Enter this value in Table 5-1.

5.1.1.2.2 *Hazardous waste quantity.* Assign a hazardous waste quantity factor value as specified in section 2.4.2. In estimating the hazardous waste quantity, use Table 5-2 and:

- Consider only the first 2 feet of depth of an area of observed contamination, except as specified for the volume measure.
- Use the volume measure (see section 2.4.2.1.3) only for those types of areas of observed contamination listed in Tier C of Table 5-2. In evaluating the volume measure for these listed areas of observed contamination, use the full volume, not just the volume within the top 2 feet.
- Use the area measure (see section 2.4.2.1.4), not the volume measure, for all other types of areas of observed contamination, even if their volume is known. Enter the value assigned in Table 5-1.

TABLE 5-2—HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS FOR SOIL EXPOSURE COMPONENT

Tier	Measure	Units	Equation for assigning value ^a
A	Hazardous Constituent Quantity (C)	lb	C.
B ^b	Hazardous Wastestream Quantity (W)	lb	W/5,000.
C ^b	Volume (V).		
	Surface Impoundment ^c	yd ³	V/2.5.
	Drums ^d	gallon	V/500.
	Tanks and Containers Other Than Drums	yd ³	V/2.5.

TABLE 5-2—HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS FOR SOIL EXPOSURE COMPONENT—Continued

Tier	Measure	Units	Equation for assigning value ^a
D ^b	Area (A).		
	Landfill	ft ²	A/34,000.
	Surface Impoundment	ft ²	A/13.
	Surface Impoundment (Buried/backfilled)	ft ²	A/13.
	Land treatment	ft ²	A/270.
	Pile ^c	ft ²	A/34.
	Contaminated Soil	ft ²	A/34,000.

^aDo not round nearest integer.
^bConvert volume to mass when necessary: 1 ton = 2,000 pounds = 1 cubic yard = 4 drums = 200 gallons.
^cUse volume measure only for surface impoundments containing hazardous substances present as liquids. Use area measures in Tier D for dry surface impoundments and for buried/backfilled surface impoundments.
^dIf actual volume of drums is unavailable, assume 1 drum = 50 gallons.
^eUse land surface area under pile, not surface area of pile.

5.1.1.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity and hazardous waste quantity factor values, subject to a maximum product of 1×10^4 . Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 5-1.

5.1.1.3 *Targets.* Evaluate the targets factor category for the resident population threat based on five factors: Resident individual, resident population, workers, resources, and terrestrial sensitive environments.

In evaluating the targets factor category for the resident population threat, count only the following as targets:

- Resident individual—a person living or attending school or day care on a property with an area of observed contamination and whose residence, school, or day care center, respectively, is on or within 200 feet of the area of observed contamination.
- Worker—a person working on a property with an area of observed contamination and whose workplace area is on or within 200 feet of the area of observed contamination.
- Resources located on an area of observed contamination, as specified in section 5.1.1.
- Terrestrial sensitive environments located on an area of observed contamination, as specified in section 5.1.1.

5.1.1.3.1 *Resident individual.* Evaluate this factor based on whether there is a resident

individual, as specified in section 5.1.1.3, who is subject to Level I or Level II concentrations.

First, determine those areas of observed contamination subject to Level I concentrations and those subject to Level II concentrations as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 5-3 in determining the level of contamination. Then assign a value to the resident individual factor as follows:

- Assign a value of 50 if there is at least one resident individual for one or more areas subject to Level I concentrations.
- Assign a value of 45 if there is no such resident individuals, but there is at least one resident individual for one or more areas subject to Level II concentrations.
- Assign a value of 0 if there is no resident individual.

Enter the value assigned in Table 5-1.

5.1.1.3.2 *Resident population.* Evaluate resident population based on two factors: Level I concentrations and Level II concentrations. Determine which factor applies as specified in sections 2.5.1 and 2.5.2, using the health-based benchmarks from Table 5-3. Evaluate populations subject to Level I concentrations as specified in section 5.1.1.3.2.1 and populations subject to Level II concentrations as specified in section 5.1.1.3.2.2.

TABLE 5-3—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN SOILS

Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for oral exposures.
Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

Count only those persons meeting the criteria for resident individual as specified in section 5.1.1.3. In estimating the number of people living on property with an area of ob-

served contamination, when the estimate is based on the number of residences, multiply

each residence by the average number of persons per residence for the county in which the residence is located.

5.1.1.3.2.1 *Level I concentrations.* Sum the number of resident individuals subject to Level I concentrations and multiply this sum by 10. Assign the resulting product as the value for this factor. Enter this value in Table 5-1.

5.1.1.3.2.2 *Level II concentrations.* Sum the number of resident individuals subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 5-1.

5.1.1.3.2.3 *Calculation of resident population factor value.* Sum the factor values for Level I concentrations and Level II concentrations. Assign this sum as the resident population factor value. Enter this value in Table 5-1.

5.1.1.3.3 *Workers.* Evaluate this factor based on the number of workers that meet the section 5.1.1.3 criteria. Assign a value for these workers using Table 5-4. Enter this value in Table 5-1.

TABLE 5-4—FACTOR VALUES FOR WORKERS

Number of workers	Assigned value
0	0
1 to 100	5
101 to 1,000	10
Greater than 1,000	15

5.1.1.3.4 *Resources.* Evaluate the resources factor as follows:

- Assign a value of 5 to the resources factor if one or more of the following is present on an area of observed contamination at the site:
 - Commercial agriculture.
 - Commercial silviculture.
 - Commercial livestock production or commercial livestock grazing.
- Assign a value of 0 if none of the above are present.

Enter the value assigned in Table 5-1.

5.1.1.3.5 *Terrestrial sensitive environments.* Assign value(s) from Table 5-5 to each terrestrial sensitive environment that meets the eligibility criteria of section 5.1.1.3.

Calculate a value (ES) for terrestrial sensitive environments as follows:

$$ES = \sum_{i=1}^n S_i$$

Where:

S_i = Value(s) assigned from Table 5-5 to terrestrial sensitive environment i.

n = Number of terrestrial sensitive environments meeting section 5.1.1.3 criteria.

Because the pathway score based solely on terrestrial sensitive environments is limited to a maximum of 60, determine the value for the terrestrial sensitive environments factor as follows:

TABLE 5-5—TERRESTRIAL SENSITIVE ENVIRONMENTS RATING VALUES

Terrestrial sensitive environments	Assigned value
Terrestrial critical habitat ^a for Federal designated endangered or threatened species	100
National Park	
Designated Federal Wilderness Area	
National Monument.	
Terrestrial habitat known to be used by Federal designated or proposed threatened or endangered species	75
National Preserve (terrestrial)	
National or State Terrestrial Wildlife Refuge	
Federal land designated for protection of natural ecosystems	
Administratively proposed Federal Wilderness Area	
Terrestrial areas utilized for breeding by large or dense aggregations of animals ^b .	
Terrestrial habitat known to be used by State designated endangered or threatened species	50
Terrestrial habitat known to be used by species under review as to its Federal designated endangered or threatened status	
State lands designated for wildlife or game management	25
State designated Natural Areas	
Particular areas, relatively small in size, important to maintenance of unique biotic communities.	

^aCritical habitat as defined in 50 CFR 424.02.

^bLimit to vertebrate species.

• Multiply the values assigned to the resident population threat for likelihood of exposure (LE), waste characteristics (WC), and ES. Divide the product by 82,500.

—If the result is 60 or less, assign the value ES as the terrestrial sensitive environments factor value.
 —If the result exceeds 60, calculate a value EC as follows:

$$EC = \frac{(60)(82,500)}{(LE)(WC)}$$

Assign the value EC as the terrestrial sensitive environments factor value. Do not round this value to the nearest integer.

Enter the value assigned for the terrestrial sensitive environments factor in Table 5-1.

5.1.1.3.6 *Calculation of resident population targets factor category value.* Sum the values for the resident individual, resident population, workers, resources, and terrestrial sensitive environments factors. Do not round to the nearest integer. Assign this sum as the targets factor category value for the resident population threat. Enter this value in Table 5-1.

5.1.1.4 *Calculation of resident population threat score.* Multiply the values for likelihood of exposure, waste characteristics, and targets for the resident population threat, and round the product to the nearest integer. Assign this product as the resident population threat score. Enter this score in Table 5-1.

5.1.2 *Nearby population threat.* Include in the nearby population only those individuals who live or attend school within a 1-mile travel distance of an area of observed contamination at the site and who do not meet

the criteria for resident individual as specified in section 5.1.1.3.

Do not consider areas of observed contamination that have an attractiveness/accessibility factor value of 0 (see section 5.1.2.1.1) in evaluating the nearby population threat.

5.1.2.1 *Likelihood of exposure.* Evaluate two factors for the likelihood of exposure factor category for the nearby population threat: attractiveness/accessibility and area of contamination.

5.1.2.1.1 *Attractiveness/accessibility.* Assign a value for attractiveness/accessibility from Table 5-6 to each area of observed contamination, excluding any land used for residences. Select the highest value assigned to the areas evaluated and use it as the value for the attractiveness/accessibility factor. Enter this value in Table 5-1.

5.1.2.1.2 *Area of contamination.* Evaluate area of contamination based on the total area of the areas of observed contamination at the site. Count only the area(s) that meet the criteria in section 5.1.0 and that receive an attractiveness/accessibility value greater than 0. Assign a value to this factor from Table 5-7. Enter this value in Table 5-1.

TABLE 5-6—ATTRACTIVENESS/ACCESSIBILITY VALUES

Area of observed contamination	Assigned value
Designated recreational area	100
Regularly used for public recreation (for example, fishing, hiking, softball)	75
Accessible and unique recreational area (for example, vacant lots in urban area)	75
Moderately accessible (may have some access improvements, for example, gravel road), with some public recreation use	50
Slightly accessible (for example, extremely rural area with no road improvement), with some public recreation use	25
Accessible, with no public recreation use	10
Surrounded by maintained fence or combination of maintained fence and natural barriers	5
Physically inaccessible to public, with no evidence of public recreation use	0

TABLE 5-7—AREA OF CONTAMINATION FACTOR VALUES

Total area of the areas of observed contamination (square feet)	Assigned value
Less than or equal to 5,000	5
Greater than 5,000 to 125,000	20
Greater than 125,000 to 250,000	40
Greater than 250,000 to 375,000	60
Greater than 375,000 to 500,000	80
Greater than 500,000	100

5.1.2.1.3 *Likelihood of exposure factor category value.* Assign a value from Table 5-8 to the likelihood of exposure factor category, based on the values assigned to the attractiveness/accessibility and area of contamination factors. Enter this value in Table 5-1.

TABLE 5-8—NEARBY POPULATION LIKELIHOOD OF EXPOSURE FACTOR VALUES

Area of contamination factor value	Attractiveness/accessibility factor value						
	100	75	50	25	10	5	0
100	500	500	375	250	125	50	0
80	500	375	250	125	50	25	0
60	375	250	125	50	25	5	0
40	250	125	50	25	5	5	0
20	125	50	25	5	5	5	0
5	50	25	5	5	5	5	0

5.1.2.2 *Waste characteristics.* Evaluate waste characteristics based on two factors: toxicity and hazardous waste quantity. Evaluate only those hazardous substances that meet the criteria for observed contamination (see section 5.1.0) at areas that can be assigned an attractiveness/accessibility factor value greater than 0.

5.1.2.2.1 *Toxicity.* Assign a toxicity factor value as specified in section 2.4.1.1 to each hazardous substance meeting the criteria in section 5.1.2.2. Use the hazardous substance with the highest toxicity factor value to assign the value to the toxicity factor for the nearby population threat. Enter this value in Table 5-1.

5.1.2.2.2 *Hazardous waste quantity.* Assign a value to the hazardous waste quantity factor as specified in section 5.1.1.2.2, except: consider only those areas of observed contamination that can be assigned an attractiveness/accessibility factor value greater than 0. Enter the value assigned in Table 5-1.

5.1.2.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity and hazardous waste quantity factor values, subject to a maximum product of 1×10^6 . Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 5-1.

5.1.2.3 *Targets.* Evaluate the targets factory category for the nearby population threat based on two factors: nearby individual and population within a 1-mile travel distance from the site.

5.1.2.3.1 *Nearby individual.* If one or more persons meet the section 5.1.1.3 criteria for a resident individual, assign this factor a value of 0. Enter this value in Table 5-1.

If no person meets the criteria for a resident individual, determine the shortest travel distance from the site to any residence or school. In determining the travel distance, measure the shortest overland distance an individual would travel from a residence or

school to the nearest area of observed contamination for the site with an attractiveness/accessibility factor value greater than 0. If there are no natural barriers to travel, measure the travel distance as the shortest straight-line distance from the residence or school to the area of observed contamination. If natural barriers exist (for example, a river), measure the travel distance as the shortest straight-line distance from the residence or school to the nearest crossing point and from there as the shortest straight-line distance to the area of observed contamination. Based on the shortest travel distance, assign a value from Table 5-9 to the nearest individual factor. Enter this value in Table 5-1.

TABLE 5-9—NEARBY INDIVIDUAL FACTOR VALUES

Travel distance for nearby individual (miles)	Assigned value
Greater than 0 to ¼	^a 1
Greater than ¼ to 1	0

^a Assign a value of 0 if one or more persons meet the section 5.1.1.3 criteria for resident individual.

5.1.2.3.2 *Population within 1 mile.* Determine the population within each travel distance category of Table 5-10. Count residents and students who attend school within this travel distance. Do not include those people already counted in the resident population threat. Determine travel distances as specified in section 5.1.2.3.1.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

Based on the number of people included within a travel distance category, assign a distance-weighted population value for that travel distance from Table 5-10.

Calculate the value for the population within 1 mile factor (PN) as follows:

$$PN = \frac{1}{10} \sum_{i=1}^3 W_i$$

Where:

W_i =Distance-weighted population value from Table 5-10 for travel distance category i .

If PN is less than 1, do not round it to the nearest integer; if PN is 1 or more, round to the nearest integer. Enter this value in Table 5-1.

5.1.2.3.3 *Calculation of nearby population targets factor category value.* Sum the values for the nearby individual factor and the population within 1 mile factor. Do not round this sum to the nearest integer. Assign this sum as the targets factor category value for the nearby population threat. Enter this value in Table 5-1.

TABLE 5-10—DISTANCE WEIGHTED POPULATION VALUES FOR NEARBY POPULATION THREAT^A

Travel distance category (miles)	Number of people within the travel distance category											
	0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000
Greater than 0 to ¼	0	0.1	0.4	1.0	4	13	41	130	408	1,303	4,081	13,034
Greater than ¼ to ½	0	0.05	0.2	0.7	2	7	20	65	204	652	2,041	6,517
Greater than ½ to 1	0	0.02	0.1	0.3	1	3	10	33	102	326	1,020	3,258

^ARound the number of people present within a travel distance category to nearest integer. Do not round the assigned distance-weighted population value to nearest integer.

5.1.2.4 *Calculation of nearby population threat score.* Multiply the values for likelihood of exposure, waste characteristics, and targets for the nearby population threat, and round the product to the nearest integer. Assign this product as the nearby population threat score. Enter this score in Table 5-1.

5.1.3 *Calculation of soil exposure component score.* Sum the resident population threat score and the nearby population threat score, and divide the sum by 82,500. Assign the resulting value, subject to a maximum of

100, as the soil exposure component score (S_{se}). Enter this score in Table 5-1.

5.2 *Subsurface intrusion component.* Evaluate the subsurface intrusion component based on three factor categories: likelihood of exposure, waste characteristics, and targets. Figure 5-1 indicates the factors included within each factor category for the subsurface intrusion component.

Determine the component score (S_{si}) in terms of the factor category values as follows:

$$S_{ssi} = \frac{(LE)(WC)(T)}{SF}$$

Where:

LE=Likelihood of exposure factor category value.

WC=Waste characteristics factor category value.

T=Targets factor category value.

SF=Scaling factor.

Table 5-11 outlines the specific calculation procedure.

TABLE 5-11—SUBSURFACE INTRUSION COMPONENT SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Subsurface Intrusion Component:		
Likelihood of Exposure:		
1. Observed Exposure	550	
2. Potential for Exposure:		
2a. Structure Containment	10	
2b. Depth to contamination	10	
2c. Vertical Migration	15	
2d. Vapor Migration Potential	25	
3. Potential for Exposure (lines 2a * (2b + 2c + 2d), subject to a maximum of 500) ...	500	
4. Likelihood of Exposure (higher of lines 1 or 3)	550	
Waste Characteristics:		
5. Toxicity/Degradation	(^e)	
6. Hazardous Waste Quantity	(^e)	
7. Waste Characteristics (subject to a maximum of 100)	100	
Targets:		
8. Exposed Individual	50	
9. Population:		
9a. Level I Concentrations	(^e)	
9b. Level II Concentrations	(^e)	
9c. Population within an Area of Subsurface Contamination	(^e)	
9d. Total Population (lines 9a + 9b + 9c)	(^e)	
10. Resources	5	
11. Targets (lines 8 + 9d + 10)	(^b)	
Subsurface Intrusion Component Score:		
12. Subsurface Intrusion Component (lines 4 × 7 × 11)/82,500 ^c (subject to a maximum of 100)	100	
Soil Exposure and Subsurface Intrusion Pathway Score:		
13. Soil Exposure Component + Subsurface Intrusion Component (subject to a maximum of 100)	100	

^a Maximum value applies to waste characteristics category.
^b Maximum value not applicable.
^c Do not round to the nearest integer.

5.2.0 *General considerations.* The subsurface intrusion component evaluates the threats from hazardous substances that have or could intrude into regularly occupied structures from the subsurface. Evaluate the subsurface intrusion component based on the actual or potential intrusion of hazardous substances into all regularly occupied structures that have structure containment values greater than zero and meet the criteria identified in the section below as being either in an area of observed exposure or in an area of subsurface contamination. These structures may or may not have subunits. Subunits are partitioned areas within a structure with separate heating, ventilating, and air conditioning (HVAC) systems or distinctly different air exchange rates. Subunits include regularly occupied partitioned tenant spaces such as office suites, apartments, condos, common or shared areas, and portions of residential, commercial or industrial structures with separate heating, ventilating, and air conditioning (HVAC) systems.

In evaluating the subsurface intrusion component, consider the following:

- Area(s) of observed exposure: An area of observed exposure is delineated by regularly occupied structures with documented contamination meeting observed exposure cri-

teria; an area of observed exposure includes regularly occupied structures with samples meeting observed exposure criteria or inferred to be within an area of observed exposure based on samples meeting observed exposure criteria (see section 5.2.1.1.1 *Observed exposure*). Establish areas of observed exposure as follows:

- For regularly occupied structures that have no subunits, consider both the regularly occupied structures containing sampling location(s) meeting observed exposure criteria for the site and the regularly occupied structure(s) in the area lying between such locations to be an area of observed exposure (*i.e.*, inferred to be in an area of observed exposure), unless available information indicates otherwise.
- In multi-story, multi-subunit, regularly occupied structures, consider all subunits on a level with sampling locations meeting observed exposure criteria from the site and all levels below, if any, to be within an area of observed exposure, unless available information indicates otherwise.
- In multi-tenant structures, that do not have a documented observed exposure, but are located in an area lying between locations where observed exposures have been documented, consider only those regularly occupied subunits, if any, on the lowest

level of the structure, to be within an area of observed exposure (*i.e.*, inferred to be in an area of observed exposure, unless available information indicates otherwise).

• **Area(s) of subsurface contamination:** An area of subsurface contamination is delineated by sampling locations meeting observed release criteria for subsurface intrusion, excluding areas of observed exposure (see Table 2-3 in section 2.3). The area within an area of subsurface contamination includes potentially exposed populations. If the significant increase in hazardous substance levels cannot be attributed at least in part to the site, and cannot be attributed to other sites, attribution can be established based on the presence of hazardous substances in the area of subsurface contamination. Establish areas of subsurface contamination as follows:

- Exclude those areas that contain structures meeting the criteria defined as an area of observed exposure.
- Consider both the sampling location(s) with subsurface contamination meeting observed release criteria from the site and the area lying between such locations to be an area of subsurface contamination (*i.e.*, inferred to be in an area of subsurface contamination). If sufficient data is available and state of the science shows there is no unacceptable risk due to subsurface intrusion into a regularly occupied structure located within an area of subsurface contamination, that structure can be excluded from the area of subsurface contamination.
- Evaluate an area of subsurface contamination based on hazardous substances that:
 - Meet the criteria for observed exposure of a chemical that has a vapor pressure greater than or equal to one torr or a Henry's constant greater than or equal to 10^{-5} atm-m³/mol, or
 - Meet the criteria for observed release in an area of subsurface contamination and have a vapor pressure greater than or equal to one torr or a Henry's constant greater than or equal to 10^{-5} atm-m³/mol, or
 - Meet the criteria for an observed release in a structure within, or in a sample from below, an area of observed exposure and have a vapor pressure greater than or equal to one torr or a Henry's constant greater than or equal to 10^{-5} atm-m³/mol.
- Evaluate all structures with no subunits that have containment factor values greater than zero, and not documented to meet observed exposure criteria to be in an area of subsurface contamination if they are lying between locations of subsurface intrusion samples meeting observed release criteria.
- Evaluate multi-subunit structures as follows:

- If an observed exposure has been documented based on a gaseous indoor air sample, consider all regularly occupied subunit(s), if any, on the level immediately above the level where an observed exposure has been documented (or has been inferred to be within an area of observed exposure), to be within an area of subsurface contamination. If sufficient data is available and state of the science shows there is no unacceptable risk due to subsurface intrusion on the level immediately above the level where an observed exposure has been documented (or has been inferred to be within an area of observed exposure) that level can be excluded from the area of subsurface contamination.

- If observed release criteria have been met based on a gaseous indoor air sample collected from a level not regularly occupied, consider all regularly occupied subunit(s), if any, on the level immediately above the level where the observed release criteria has been documented, to be within an area of subsurface contamination. If sufficient data is available and state of the science shows there is no unacceptable risk due to subsurface intrusion on the level immediately above the level where the observed release criteria has been documented that level can be excluded from the area of subsurface contamination.

- If any regularly occupied multi-subunit structure is inferred to be in an area of subsurface contamination, consider only those regularly occupied subunit(s), if any, on the lowest level, to be within an area of subsurface contamination. If sufficient data is available and state of the science shows there is no unacceptable risk due to subsurface intrusion on the lowest level, that structure can be excluded from the area of subsurface contamination.

See Section 7.0 for establishing an area of subsurface contamination based on the presence of radioactive hazardous substances.

If there is no area of observed exposure and no area of subsurface contamination, assign a score of 0 for the subsurface intrusion component.

5.2.1 *Subsurface intrusion component.* Evaluate this component only if there is an area of observed exposure or area of subsurface contamination:

- Within or underlying a residence, school, day care center, workplace, or
- Within or underlying a resource specified in section 5.2.1.3.3.

5.2.1.1 *Likelihood of exposure.* Assign a value of 550 to the likelihood of exposure factor category for the subsurface intrusion component if there is an area of observed exposure in one or more locations listed in section 5.2.1. Enter this value in Table 5-11.

5.2.1.1.1 *Observed exposure.* Establish observed exposure in a regularly occupied structure by demonstrating that a hazardous substance has been released into a regularly occupied structure via the subsurface. Base this demonstration on either of the following criteria:

- Direct observation:
 - A solid, liquid, or gaseous material that contains one or more hazardous substances attributable to the site has been observed entering a regularly occupied structure through migration via the subsurface or is known to have entered a regularly occupied structure via the subsurface, or
 - When evidence supports the inference of subsurface intrusion of a material that contains one or more hazardous substances associated with the site into a regularly occupied structure, demonstrated adverse effects associated with that release may be used to establish observed exposure.

- Chemical analysis:
 - Analysis of indoor samples indicates that the concentration of hazardous substance(s) is significantly above the background concentration for the site for that type of sample (see section 2.3).
 - Some portion of the significant increase above background must be attributable to the site to establish the observed exposure. Documentation of this attribution should account for possible concentrations of the hazardous substance(s) in outdoor air or from materials found in the regularly occupied structure, and should provide a rationale for the increase being from subsurface intrusion.

If observed exposure can be established in a regularly occupied structure, assign an observed exposure factor value of 550, enter this value in Table 5-11, and proceed to section 5.2.1.1.3. If no observed exposure can be established, assign an observed exposure fac-

tor value of 0, enter this value in Table 5-11, and proceed to section 5.2.1.1.2.

5.2.1.1.2 *Potential for exposure.* Evaluate potential for exposure only if an observed exposure cannot be established, but an area of subsurface contamination has been delineated. Evaluate potential for exposure based only on the presence of hazardous substances with a vapor pressure greater than or equal to one torr or a Henry's constant greater than or equal to 10^{-5} atm-m³/mol. Evaluate potential for exposure for each area of subsurface contamination based on four factors: Structure containment (see section 5.2.1.1.2.1), depth to contamination (see section 5.2.1.1.2.2), vertical migration (see section 5.2.1.1.2.3) and vapor migration potential (see section 5.2.1.1.2.4). For each area of subsurface contamination, assign the highest value for each factor. If information is insufficient to calculate any single factor value used to calculate the potential for exposure factor values at an identified area of subsurface contamination, information collected for another area of subsurface contamination at the site may be used when evaluating potential for exposure. Calculate the potential for exposure value for the site as specified in section 5.2.1.1.2.5.

5.2.1.1.2.1 *Structure containment.* Calculate containment for eligible hazardous substances within this component as directed in Table 5-12 and enter this value into Table 5-11. Assign each regularly occupied structure within an area of subsurface contamination the highest appropriate structure containment value from Table 5-12 and use the regularly occupied structure at the site with the highest structure containment value in performing the potential for exposure calculation. For all regularly occupied structures with unknown containment features assign a structure containment value of greater than zero for the purposes of evaluating targets (see section 5.2.1.3).

TABLE 5-12—STRUCTURE CONTAINMENT

No.	Evidence of structure containment	Assigned value
1.	Regularly occupied structure with evidence of subsurface intrusion, including documented observed exposure or sampling of bio or inert gases, such as methane and radon.	10
2.	Regularly occupied structure with open preferential subsurface intrusion pathways (e.g., sumps, foundation cracks, unsealed utility lines).	10
3.	Regularly occupied structure with an engineered vapor migration barrier system that does not address all preferential subsurface intrusion pathways.	7
4.	Regularly occupied structure with an engineered passive vapor mitigation system <i>without</i> documented institutional controls (e.g., deed restrictions) or evidence of regular maintenance and inspection.	6
5.	Regularly occupied structure with no visible open preferential subsurface intrusion pathways from the subsurface (e.g., sumps, foundation cracks, unsealed utility lines).	4
6.	Regularly occupied structure with an engineered passive vapor mitigation system (e.g., passive venting) <i>with</i> documented institutional controls (e.g., deed restrictions) or evidence of regular maintenance and inspection.	3
7.	Regularly occupied structure with an engineered, active vapor mitigation system (e.g., active venting) <i>without</i> documented institutional controls (e.g., deed restrictions) and funding in place for on-going operation, inspection and maintenance.	2

TABLE 5-12—STRUCTURE CONTAINMENT—Continued

No.	Evidence of structure containment	Assigned value
8.	Regularly occupied structure with a permanent engineered, active vapor mitigation system (e.g., active venting) with documented institutional controls (e.g., deed restrictions) and funding in place for on-going operation, inspection and maintenance.	1
9.	Regularly occupied structure with a foundation raised greater than 6 feet above ground surface (e.g., structure on stilts) or structure that has been built, and maintained, in a manner to prevent subsurface intrusion.	0

5.2.1.1.2.2 *Depth to contamination.* Assign each area of subsurface contamination a depth to contamination based on the least depth to either contaminated crawl space or subsurface media underlying a regularly occupied structure. Measure this depth to contamination based on the distance between the lowest point of a regularly occupied structure to the highest known point of hazardous substances eligible to be evaluated. Use any regularly occupied structure within an area of subsurface contamination with a structure containment factor value greater than zero. Subtract from the depth to contamination the thickness of any subsurface layer composed of features that would allow channelized flow (e.g., karst, lava tubes, open fractures, as well as manmade preferential pathways such as utility conduits or drainage systems).

Based on this calculated depth, assign a factor value from Table 5-13. If the necessary information is available at multiple locations, calculate the depth to contamination at each location. Use the location having the least depth to contamination to assign the factor value. Enter this value in Table 5-11.

TABLE 5-13—DEPTH TO CONTAMINATION

Depth range ^{1 2}	Depth to contamination assigned value
0 to <10 ft (Including subslab and semi-enclosed or enclosed crawl space contamination)	10
>10 to 20 ft	8
>20 to 50 ft	6
>50 to 100 ft	4
>100 to 150 ft	2
>150 ft	0

¹ If any part of the subsurface profile has channelized flow features, assign that portion of the subsurface profile a depth of 0.

² Measure elevation below any regularly occupied structure within an area of subsurface contamination at a site. Select the regularly occupied structure with the least depth to contamination below a structure.

5.2.1.1.2.3 *Vertical migration.* Evaluate the vertical migration factor for each area of subsurface contamination based on the geologic materials in the interval between the lowest point of a regularly occupied structure and the highest known point of haz-

ardous substances in the subsurface. Use any regularly occupied structure either within an area of subsurface contamination or overlying subsurface soil gas or ground water contamination. Assign a value to the vertical migration factor as follows:

- If the depth to contamination (see section 5.2.1.1.2.2) is 10 feet or less, assign a value of 15.

- If the depth to contamination is greater than 10 feet, do not consider layers or portions of layers within the first 10 feet of the depth to contamination (as assigned in section 5.2.1.1.2.2).

- If, for the interval between the lowest point of a regularly occupied structure and the highest point of hazardous substances in the subsurface, all layers that underlie a portion of a regularly occupied structure at the site are karst or otherwise allow channelized flow, assign a value of 15.

- Otherwise:

- Select the lowest effective porosity/permeability layer(s) from within the interval identified above. Consider only layers at least 1 foot thick.—Assign a value for individual layers from Table 5-14 using the hydraulic conductivity of the layer, if available. If the hydraulic conductivity is not available, assign a value based on the type of material in the selected layer.

- If more than one layer has the same assigned porosity/permeability value, include all such layers and sum their thicknesses. Assign a thickness of 0 feet to a layer with channelized flow features found within any area of subsurface contamination at the site.

- Assign a value from Table 5-15 to the vertical migration factor, based on the thickness and assigned porosity/permeability value of the lowest effective porosity/permeability layer(s).

Determine vertical migration only at locations within an area of subsurface contamination at the site. If the necessary subsurface geologic information is available at multiple locations, evaluate the vertical migration factor at each location. Use the location having the highest vertical migration factor value to assign the factor value. Enter this value in Table 5-11.

TABLE 5-14—EFFECTIVE POROSITY/PERMEABILITY OF GEOLOGIC MATERIALS

Type of material	Hydraulic conductivity (cm/sec)	Assigned porosity/permeability value
Gravel; clean sand; highly permeable fractured igneous and metamorphic rocks; permeable basalt; karst limestones and dolomites.	Greater than or equal to 1×10^{-3} .	1
Sand; sandy clays; sandy loams; loamy sands; sandy silts; sediments that are predominantly sand; highly permeable till (coarse-grained, unconsolidated or compact and highly fractured); peat; moderately permeable limestones and dolomites (no karst); moderately permeable sandstone; moderately permeable fractured igneous and metamorphic rocks.	Less than 1×10^{-3} ..	2
Silt; loams; silty loams; loesses; silty clays; sediments that are predominantly silts; moderately permeable till (fine-grained, unconsolidated till, or compact till with some fractures); low permeability limestones and dolomites (no karst); low permeability sandstone; low permeability fractured igneous and metamorphic rocks.	Less than 1×10^{-5} ..	3
Clay; low permeability till (compact unfractured till); shale; unfractured metamorphic and igneous rocks.	Less than 1×10^{-7} ..	4

TABLE 5-15—VERTICAL MIGRATION FACTOR VALUES^A

Assigned porosity/permeability value	Thickness of lowest porosity layer(s) ^b (feet)					
	0 to 5	Greater than 5 to 10	Greater than 10 to 20	Greater than 20 to 50	Greater than 50 to 100	Greater than 100 to 150
1	15	15	14	11	8	6
2	15	14	12	9	6	4
3	15	13	10	7	5	2
4	15	12	9	6	3	1

^AIf depth to contamination is 10 feet or less or if, for the interval being evaluated, all layers that underlie a portion of the structure at the site are karst or have other channelized flow features, assign a value of 15.

^BConsider only layers at least 1 foot thick.

5.2.1.1.2.4 *Vapor migration potential.* Evaluate this factor for each area of subsurface contamination as follows:

- If the depth to contamination (see section 5.2.1.1.2.2) is 10 feet or less, assign a value of 25.

- Assign a value for vapor migration potential to each of the gaseous hazardous substances associated with the area of subsurface contamination (see section 2.2.2) as follows:

- Assign values from Table 5-16 for both vapor pressure and Henry's constant to each hazardous substance. If Henry's constant cannot be determined for a hazardous substance, assign that hazardous substance

a value of 2 for the Henry's constant component.

- Sum the two values assigned to each hazardous substance.

- Based on this sum, assign each hazardous substance a value from Table 5-17 for vapor migration potential.

- Assign a value for vapor migration potential to each area of subsurface contamination as follows:

- Select the hazardous substance associated with the area of subsurface contamination with the highest vapor migration potential value and assign this value as the vapor migration potential factor value for the area of subsurface contamination.

Enter this value in Table 5-11.

TABLE 5-16—VALUES FOR VAPOR PRESSURE AND HENRY'S CONSTANT

	Assigned value
Vapor Pressure (Torr):	
Greater than 10	3
1 to 10	2
Less than 1	0
Henry's Constant (atm-m ³ /mol):	
Greater than 10^{-3}	3
Greater than 10^{-4} to 10^{-3}	2
10^{-5} to 10^{-4}	1
Less than 10^{-5}	0

TABLE 5-17—VAPOR MIGRATION POTENTIAL FACTOR VALUES FOR A HAZARDOUS SUBSTANCE

Sum of values for vapor pressure and Henry's constant	Assigned value
0	0
1 or 2	5
3 or 4	15
5 or 6	25

5.2.1.1.2.5 *Calculation of potential for exposure factor value.* For each identified area of subsurface contamination, sum the factor values for depth to contamination, vertical migration, and vapor migration potential, and multiply this sum by the factor value for structure containment. Select the highest product for any area of subsurface contamination and assign this value as the potential for exposure factor value for the component. Enter this value in Table 5-11.

5.2.1.1.3 *Calculation of likelihood of exposure factor category value.* If observed exposure is established for the site, assign the observed exposure factor value of 550 as the likelihood of exposure factor category value for the site. Otherwise, assign the potential for exposure factor value for the component as the likelihood of exposure value. Enter the value assigned in Table 5-11.

5.2.1.2 *Waste characteristics.* Evaluate waste characteristics based on two factors:

toxicity/degradation and hazardous waste quantity.

5.2.1.2.1 *Toxicity/degradation.* For each hazardous substance, assign a toxicity factor value, a degradation factor value and a combined toxicity/degradation factor value as specified in sections 2.2.3, 2.4.1.2 and 5.2.1.2.1.1 through 5.2.1.2.1.3.

5.2.1.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in sections 2.2.2 and 2.4.1.1.

5.2.1.2.1.2 *Degradation.* Assign a degradation factor value to each hazardous substance as follows:

- For any hazardous substance that meets the criteria for an observed exposure, or if a NAPL is present in the subsurface below an area of observed exposure or area of subsurface contamination at a depth less than or equal to 30 feet, assign that substance a degradation factor value of 1.

- For all other situations, assign a degradation factor value using Table 5-18. Assign the depth to contamination as directed in section 5.2.1.1.2.2, except if evidence indicates that biologically active soil is not present throughout the depth beneath any regularly occupied structure. In this situation, subtract any thickness of non-biologically active soil from the estimated depth to contamination.

TABLE 5-18—DEGRADATION FACTOR VALUE TABLE

Depth to contamination (feet) ^a	Half-life		
	>100 Days	>30 days and ≤100 days	≤30 days
<10	1	1	1
10 to ≤30	1	1	0.1
>30	1	0.5	0.1

^aWhen determining the depth to contamination do not include layers of non-biologically-active soil, nor subsurface intervals with channelized flow (e.g., karst, lava tubes, open fractures, and manmade preferential pathways as directed in section 5.2.1.1.2.2).

Calculate the half-life for each hazardous substance that meets subsurface intrusion observed release criteria as follows:

The half-life of a substance in the subsurface is defined for HRS purposes as the time required to reduce the initial con-

centration of the substance in the subsurface by one-half as a result of the combined decay processes of two components: Biodegradation and hydrolysis.

Estimate the half-life ($t_{1/2}$) of a hazardous substance as follows:

$$t_{1/2} = \frac{1}{1/h + 1/b}$$

Where:

h=Hydrolysis half-life.
b=Biodegradation half-life.

If either of these component half-lives cannot be estimated for the hazardous substance from available data, delete that component half-life from the above equation.

If no half-life information is available for a hazardous substance and the substance is not already assigned a value of 1, unless information indicates otherwise, assign a value of 1.

5.2.1.2.1.3 *Calculation of toxicity/degradation factor value.* Assign each substance a toxicity/degradation value by multiplying the toxicity factor value by the degradation factor value. Use the hazardous substance with the highest combined toxicity/degradation value to assign the factor value to the toxicity/degradation factor for the subsurface intrusion threat. Enter this value in Table 5-11.

5.2.1.2.2 *Hazardous waste quantity.* Assign a hazardous waste quantity factor value as specified in section 2.4.2. Consider only those regularly occupied structures or subunits with a non-zero structure containment value. Also include all regularly occupied structures or subunits that have had mitigation systems installed as part of a removal or other temporary response action. If sufficient structure-specific concentration data is available and state of the science shows there is no unacceptable risk of exposure to populations in a regularly occupied structure or subunit in an area of subsurface contamination, that structure or subunit is not included in the hazardous waste quantity evaluation. In estimating the hazardous waste quantity, use Tables 2-5 and 5-19 and:

- For Tier A, hazardous constituent quantity, use the mass of constituents found in the regularly occupied structure(s) where the observed exposure has been identified.

—For multi-subunit structures, when calculating Tier A, use the mass of constituents found in the regularly occupied subunit space(s) where the observed exposure has been identified.

- For Tier B, hazardous wastestream quantity, use the flow-through volume of the regularly occupied structures where the observed exposure has been identified.

—For multi-subunit structures, when calculating Tier B, use the flow-through volume of the regularly occupied subunit spaces where the observed exposure has been identified.

- For Tier C, volume, use the volume divisor listed in Tier C of Table 5-19. Volume is calculated for those regularly occupied structures located within areas of observed exposure with observed or inferred intrusion and within areas of subsurface contamination.

—In evaluating the volume measure for these listed areas of observed exposure and areas of subsurface contamination based on a gaseous/vapor intrusion or the poten-

tial for gaseous/vapor intrusion, consider the following:

- Calculate the volume of each regularly occupied structure based on actual data. If unknown, use a ceiling height of 8 feet.

- For multi-subunit structures, when calculating Tier C, calculate volume for those subunit spaces with observed or inferred exposure and all other regularly occupied subunit spaces on that level, unless available information indicates otherwise. If the structure has multiple stories, also include the volume of all regularly occupied subunit spaces below the floor with an observed exposure and one story above, unless evidence indicates otherwise.

- For multi-subunit structures within an area of subsurface contamination and no observed or inferred exposure, consider only the volume of the regularly occupied subunit spaces on the lowest story, unless available information indicates otherwise.

- For Tier D, area, if volume is unknown, use the area divisor listed in Tier D of Table 5-19 for those regularly occupied structures within areas of observed exposure with observed or inferred intrusion and within areas of subsurface contamination.

—In evaluating the area measure for these listed areas of observed exposure and areas of subsurface contamination, calculate the area of each regularly occupied structure (including multi-subunit structures) or subunit based on actual footprint area data.

- If the actual footprint area of the structure(s) is unknown, use an area of 1,740 square feet for each structure (or subunit space).

- For multi-subunit structures, when calculating Tier D, calculate area for those subunit spaces with observed or inferred exposure and all other regularly occupied subunit spaces on that level, unless available information indicates otherwise. If the structure has multiple stories, also include the area of all regularly occupied subunit spaces below the floor with an observed exposure and one story above, unless evidence indicates otherwise.

- For multi-subunit structures within an area of subsurface contamination and no observed or inferred exposure, consider only the area of the regularly occupied subunit spaces on the lowest story, unless available information indicates otherwise.

TABLE 5-19—HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS FOR SUBSURFACE INTRUSION COMPONENT

Tier	Measure	Units	Equation for assigning value ^a
A	Hazardous Constituent Quantity (C)	Lb	C
B ^b	Hazardous Wastestream Quantity (W)	Lb	W/5,000
C ^{b,c}	Volume (V) Regularly occupied structure(s) in areas of observed exposure or subsurface contamination.	yd ³	V/2.5
D ^{b,d}	Area (A) Regularly occupied structure(s) in areas of observed exposure or subsurface contamination.	ft ²	A/13

^a Do not round to the nearest integer.
^b Convert volume to mass when necessary: 1 ton=2,000 pounds=1 cubic yard=4 drums=200 gallons.
^c Calculate volume of each regularly occupied structure or subunit space in areas of observed exposure and areas of subsurface contamination—Assume 8-foot ceiling height unless actual value is known.
^d Calculate area of the footprint of each regularly occupied structure in areas of observed exposure and areas of subsurface contamination. If the footprint area of a regularly occupied structure is unknown, use 1,740 square feet as the footprint area of the structure or subunit space.

For the subsurface intrusion component, if the hazardous constituent quantity is adequately determined for all areas of observed exposure, assign the value from Table 2-6 as the hazardous waste quantity factor value. If the hazardous constituent quantity is not adequately determined for one or more areas of observed exposure or if one or more areas of subsurface contamination are present, assign either the value from Table 2-6 or assign a factor value as follows:

- If any target for the subsurface intrusion component is subject to Level I or Level II concentrations (see section 2.5), assign either the value from Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for this component.
- If none of the targets for the subsurface intrusion component is subject to Level I or Level II concentrations and if there has been a removal action that does not permanently interrupt target exposure from subsurface intrusion, and if an area of subsurface contamination exists, assign a factor value as follows:

—Determine the values from Table 2-6 with and without consideration of the removal action.

—If the value that would be assigned from Table 2-6 without consideration of the removal action would be 100 or greater, assign either the value from Table 2-6 with consideration of the removal action or a value of 100, whichever is greater, as the hazardous waste quantity factor value for the component.

—If the value that would be assigned from Table 2-6 without consideration of the removal action would be less than 100, assign a value of 10 as the hazardous waste quantity factor value for the component.

• Otherwise, if none of the targets for the subsurface intrusion component is subject to Level I or Level II concentrations and there has not been a removal action, assign a value

from Table 2-6 or a value of 10, whichever is greater.

Enter the value assigned in Table 5-11.

5.2.1.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity/degradation and hazardous waste quantity factor values, subject to a maximum product of 1×10^9 . Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 5-11.

5.2.1.3 *Targets.* Evaluate the targets factor category for the subsurface intrusion threat based on three factors: Exposed individual, population, and resources in regularly occupied structures with structure containment factors greater than 0. Evaluate only those targets within areas of observed exposure and areas of subsurface contamination (see section 5.2.0).

In evaluating the targets factor category for the subsurface intrusion threat, count only the following as targets:

- Exposed individual—a person living, attending school or day care, or working in a regularly occupied structure with observed exposure or in a structure within an area of observed exposure or within an area of subsurface contamination.

- Population—exposed individuals in a regularly occupied structure within an area of observed exposure or within an area of subsurface contamination.

- Resources—located within an area of observed exposure or within an area of subsurface contamination as specified in section 5.2.1.3.3.

If a formerly occupied structure has been vacated due to subsurface intrusion attributable to the site, count the initial targets as if they were still residing in the structure. In addition, if a removal or temporary response action has occurred that has not completely mitigated the release, count the initial targets as if the removal or temporary

response action has not permanently interrupted target exposure from subsurface intrusion. Evaluate those targets based on conditions at the time of removal of temporary response action.

For populations residing in or working in a multi-subunit structure with multiple stories in an area of observed exposure or area of subsurface contamination, count these targets as follows:

- If there is no observed exposure within the structure, include in the evaluation only those targets, if any, in the lowest occupied level. If sufficient structure-specific concentration data is available and state of the science shows there is no unacceptable risk of exposure to targets in the lowest level, those targets are not included in the evaluation.

- If there is an observed exposure in any level, include in the evaluation those targets in that level, the level above and all levels below. (The weighting of these targets is specified in Section 5.2.1.3.2.) If sufficient structure-specific concentration data is available and state of the science shows there is no unacceptable risk of exposure to targets in the level above where the observed exposure has been documented, those targets are not included in the evaluation.

5.2.1.3.1 *Exposed individual.* Evaluate this factor based on whether there is an exposed individual, as specified in sections 2.5.1, 2.5.2 and 5.2.1.3, who is subject to Level I or Level II concentrations.

First, determine those regularly occupied structures or partitioned subunit(s) within structures in an area of observed exposure subject to Level I concentrations and those subject to Level II concentrations as specified as follows (see section 5.2.0):

- Level I Concentrations: For contamination resulting from subsurface intrusion, compare the hazardous substance concentrations in any sample meeting the observed exposure by chemical analysis criteria to the appropriate benchmark. Use the health-based benchmarks from Table 5-20 to determine the level of contamination.

—If the sample is from a structure with no subunits and the concentration equals or exceeds the appropriate benchmark, assign Level I concentrations to the entire structure.

—If the sample is from a subunit within a structure and the concentration from that subunit equals or exceeds the appropriate benchmark, assign Level I concentrations to that subunit.

- Level II Concentrations: Structures, or subunits within structures, with one or more samples that meet observed exposure by chemical analysis criteria but do not equal or exceed the appropriate benchmark; structures, or subunits, that have an observed exposure by direct observation; and structures

inferred to be in an area of observed exposure based on samples meeting observed exposure, are assigned Level II concentrations.

—For all regularly occupied structures, or subunits in such structures, in an area of observed exposure that are not assigned Level I concentrations, assign Level II concentrations.

Then assign a value to the exposed individual factor as follows:

- Assign a value of 50 if there is at least one exposed individual in one or more regularly occupied structures subject to Level I concentrations.

- Assign a value of 45 if there are no Level I exposed individuals, but there is at least one exposed individual in one or more regularly occupied structures subject to Level II concentrations.

- Assign a value of 20 if there is no Level I or Level II exposed individual but there is at least one individual in a regularly occupied structure within an area of subsurface contamination. Enter the value assigned in Table 5-11.

5.2.1.3.2 *Population.* Evaluate population based on three factors: Level I concentrations, Level II concentrations, and population within an area of subsurface contamination. Determine which factors apply as specified in section 5.2.1.3.1, using the health-based benchmarks from Table 5-20. Evaluate populations subject to Level I and Level II concentrations as specified in section 2.5.

TABLE 5-20—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN THE SUBSURFACE INTRUSION COMPONENT

Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk using the inhalation unit risk. For oral exposures use the oral cancer slope factor.

Screening concentration for noncancer toxicological responses corresponding to the reference dose (RfD) for oral exposure and the reference concentration (RfC) for inhalation exposures.

Count only those persons meeting the criteria for population as specified in section 5.2.1.3. In estimating the number of individuals in structures in an area of observed exposure or area of subsurface contamination if the actual number of residents is not known, multiply each residence by the average number of persons per residence for the county in which the residence is located.

5.2.1.3.2.1 *Level I concentrations.* Assign the population subject to Level I concentrations as follows:

1. Identify all exposed individuals regularly present in an eligible structure with a structure containment value greater than zero, or if the structure has subunits, identify those regularly present in each subunit.

located in an area of observed exposure subject to Level I concentrations as described in sections 5.2.0 and 5.2.1.3.1. Identify only once per structure those exposed individuals that are using more than one eligible subunit of the same structure (e.g., using a common or shared area and other parts of the same structure).

2. For each structure or subunit count the number of individuals residing in or attending school or day care in the structure or subunit.

3. Count the number of full-time and part-time workers in the structure or subunit(s) subject to Level I concentrations. If information is unavailable to classify a worker as full- or part-time, evaluate that worker as being full-time. Divide the number of full-time workers by 3 and the number of part-time workers by 6, and then sum these products with the number of other individuals for each structure or subunit.

4. Sum this combined value for all structures, or subunits, within areas of observed exposure and multiply this sum by 10.

Assign the resulting product as the combined population factor value subject to Level I concentrations for the site. Enter this value in line 9a of Table 5-11.

5.2.1.3.2.2 *Level II concentrations.* Assign the population subject to Level II concentrations as follows:

1. Identify all exposed individuals regularly present in an eligible structure with a structure containment value greater than zero, or if the structure has subunits, identify those regularly present in each subunit, located in an area of observed exposure subject to Level II concentrations as described in sections 5.2.0 and 5.2.1.3.1. Identify only once per structure those exposed individuals that are using more than one eligible subunit of the same structure (e.g., using a common or shared area and other parts of the same structure).

2. Do not include exposed individuals already counted under the Level I concentrations factor.

3. For each structure or subunit(s), count the number of individuals residing in or attending school or day care in the structure, or subunit, subject to Level II concentrations.

4. Count the number of full-time and part-time workers in the structure or subunit(s) subject to Level II concentrations. If information is unavailable to classify a worker as full- or part-time, evaluate that worker as being full-time. Divide the number of full-time workers by 3 and the number of part-time workers by 6, and then sum these products with the number of other individuals for each structure or subunit.

5. Sum the combined population value for all structures within the areas of observed exposure for the site.

Assign this sum as the combined population factor value subject to Level II concentrations for this site. Enter this value in line 9b of Table 5-11.

5.2.1.3.2.3 *Population within area(s) of subsurface contamination.* Assign the population in area(s) of subsurface contamination factor value as follows. If sufficient structure-specific concentration data is available and state of the science shows there is no unacceptable risk of exposure to populations in a regularly occupied structure in an area of subsurface contamination, those populations are not included in the evaluation. (see sections 5.2.0 and 5.2.1.3.1):

1. Identify the regularly occupied structures with a structure containment value greater than zero and the eligible population associated with the structures or portions of structures in each area of subsurface contamination:

- For each regularly occupied structure or portion of a structure in an area of subsurface contamination, sum the number of all individuals residing in or attending school or day care, in the structure or portion of the structure in the area of subsurface contamination.

- Count the number of full-time and part-time workers regularly present in each structure or portion of a structure in an area of subsurface contamination. If information is unavailable to classify a worker as full- or part-time, evaluate that worker as being full-time. Divide the number of full-time workers by 3 and the number of part-time workers by 6. Sum these products with the number of individuals residing in or attending school or day care in the structure.

- Use this sum as the population for the structure.

2. Estimate the depth or distance to contamination at each regularly occupied structure within an area of subsurface contamination based on available sampling data, and categorize each eligible structure based on the depth or distance to contamination and sample media as presented in Table 5-21. Weight the population in each structure using the appropriate weighting factors in Table 5-21. If samples from multiple media are available, use the sample that results in the highest weighting factor.

3. Sum the weighted population in all structures within the area(s) of subsurface contamination and assign this sum as the population within an area of subsurface contamination factor value. Enter this value in line 9c of Table 5-11.

TABLE 5-21—WEIGHTING FACTOR VALUES FOR POPULATIONS WITHIN AN AREA OF SUBSURFACE CONTAMINATION

Eligible populations ^a in structures ^b within an area of subsurface contamination	Population weighting factor
Samples From Within Structures or in Crawl Spaces	
1. Population in a structure with levels of contamination in a semi-enclosed or enclosed crawl space sample meeting observed release criteria or Population in a subunit of a multi-story structure within an area of subsurface contamination located directly above a level in an area of observed exposure or a gaseous indoor air sample meeting observed release criteria or Population within a structure where a mitigation system has been installed as part of a removal or other temporary response action.	0.9
2. Population in a structure where levels of contaminants meeting observed release criteria are inferred based on semi-enclosed or enclosed crawl space samples in surrounding structures, and a NAPL is present in those samples	0.8
3. Population in a structure where levels of contaminants meeting observed release criteria are inferred based on semi-enclosed or enclosed crawl space samples in surrounding structures, but no NAPL is present	0.4
Subsurface Samples From Less Than or Equal to 5 Feet From a Foundation	
4. Population in a structure where levels of contaminants meeting observed release criteria are found or inferred based on any sampling media at or within five feet horizontally or vertically of the structure foundation, and a NAPL is present within that depth	0.8
5. Population in a structure where levels of contaminants meeting observed release criteria are found or inferred based on any sampling media at or within five feet horizontally or vertically of the structure foundation, but no NAPL is present within that depth	0.4
Subsurface Samples From Greater Than 5 Feet But Less Than or Equal to 30 Feet Depth	
6. Population in a structure where levels of contaminants meeting observed release criteria are found or inferred based on any underlying non-ground water subsurface sample at a depth greater than 5 feet but less than or equal to 30 feet from a structure foundation and a NAPL is present within that depth	0.4
7. Population in a structure where levels of contaminants meeting observed release criteria are found or inferred based on any underlying non-ground water subsurface sample at a depth greater than 5 feet but less than or equal to 30 feet, but no NAPL is present within that depth	0.2
8. Population in a structure where levels of contaminants meeting observed release criteria are found or inferred based on underlying ground water samples greater than 5 feet from the structure foundation but less than or equal to 30 feet, and a NAPL is present in those samples	0.2
9. Population in a structure where levels of contaminants meeting observed release criteria are found or inferred based on underlying ground water samples greater than 5 feet from the structure foundation but less than or equal to 30 feet, but no NAPL is present in those samples	0.1
Subsurface Samples From Greater Than 30 Feet Depth	
10. Population in a structure where levels of contaminants meeting observed release criteria are found or inferred based on any underlying sample at depths greater than 30 feet	0.1

^a Eligible populations include residents (including individuals living in, or attending school or day care in the structure), and workers in regularly occupied structures (see HRS Section 5.2.1.3).
^b Eligible structures may include single- or multi-tenant structures where eligible populations reside, attend school or day care, or work. These structures may also be mixed use structures.

5.2.1.3.2.4 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and population within the area(s) of subsurface contamination. Assign this sum as the population factor value. Enter this value in line 9d of Table 5-11.

5.2.1.3.3 *Resources.* Evaluate the resources factor as follows:

- Assign a value of 5 if a resource structure (e.g., library, church, tribal facility) is present and regularly occupied within either an area of observed exposure or area of subsurface contamination.
- Assign a value of 0 if there is no resource structure within an area of observed exposure or area of subsurface contamination.

Enter the value assigned in Table 5-11.

5.2.1.3.4 *Calculation of targets factor category value.* Sum the values for the exposed individual, population, and resources factors. Do not round to the nearest integer. Assign this sum as the targets factor category value for the subsurface intrusion component. Enter this value in Table 5-11.

5.2.2 *Calculation of subsurface intrusion component score.* Multiply the factor category values for likelihood of exposure, waste characteristics, and targets and round the product to the nearest integer. Divide the product by 82,500. Assign the resulting value, subject to a maximum of 100, as the subsurface intrusion component score and enter this score in Table 5-11.

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5.3 *Calculation of the soil exposure and subsurface intrusion pathway score.* Sum the soil exposure component score and subsurface intrusion component score. Assign the resulting value, subject to a maximum of 100, as the soil exposure and subsurface intrusion pathway score (S_{soil}). Enter this score in Table 5-11.

6.0 *Air Migration Pathway*

Evaluate the air migration pathway based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 6-1 indicates the factors included within each factor category.

Determine the air migration pathway score (S_a) in terms of the factor category values as follows:

$$S_a = \frac{(LR)(WC)(T)}{SF}$$

where:

LR = Likelihood of release factor category value.

WC = Waste characteristics factor category value.

T = Targets factor category value.

SF = Scaling factor.

Table 6-1 outlines the specific calculation procedure.

Likelihood of Release (LR)	Waste Characteristics (WC)	Targets (T)
<p>Observed Release or Potential to Release</p> <ul style="list-style-type: none"> • Gas Potential to Release <ul style="list-style-type: none"> - Gas Containment - Gas Source Type - Gas Migration • Particulate Potential to Release <ul style="list-style-type: none"> - Particulate Containment - Particulate Source Type - Particulate Migration Potential 	<p>Toxicity/Mobility</p> <ul style="list-style-type: none"> • Toxicity <ul style="list-style-type: none"> - Chronic - Carcinogenic - Acute • Mobility <ul style="list-style-type: none"> - Gaseous Mobility - Particulate Mobility • Hazardous Waste Quantity • Hazardous Constituent Quantity • Hazardous Wastestream Quantity • Volume • Area 	<p>Nearest Individual Population</p> <ul style="list-style-type: none"> • Level I Concentrations • Level II Concentrations • Potential Contamination Resources • Sensitive Environments • Actual Contamination • Potential Contamination

FIGURE 6-1
OVERVIEW OF AIR MIGRATION PATHWAY

TABLE 6-1—AIR MIGRATION PATHWAY SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Likelihood of Release		
1. Observed Release	550	—
2. Potential to Release:		
2a. Gas Potential to Release	500	—
2b. Particulate Potential to Release	500	—
2c. Potential to Release (higher of lines 2a and 2b)	500	—

TABLE 6-1—AIR MIGRATION PATHWAY SCORESHEET—Continued

Factor categories and factors	Maximum value	Value assigned
3. Likelihood of Release (higher of lines 1 and 2c)	550	—
Waste Characteristics		
4. Toxicity/Mobility	(a)	—
5. Hazardous Waste Quantity	(a)	—
6. Waste Characteristics	100	—
Targets		
7. Nearest Individual	50	—
8. Population:		
8a. Level I Concentrations	(b)	—
8b. Level II Concentrations	(b)	—
8c. Potential Contamination	(b)	—
8d. Population (lines 8a + 8b + 8c)	(b)	—
9. Resources	5	—
10. Sensitive Environments		
10a. Actual Contamination	(c)	—
10b. Potential Contamination	(c)	—
10c. Sensitive Environments (lines 10a + 10b)	(c)	—
11. Targets (lines 7 + 8d + 9 + 10c)	(b)	—
Air Migration Pathway Score		
12. Pathway Score (S _a) [(lines 3 × 6 × 11)/82,500] ^d	100	—

^a Maximum value applies to waste characteristics category.
^b Maximum value not applicable.
^c No specific maximum value applies to factor. However, pathway score based solely on sensitive environments is limited to maximum of 60.
^d Do not round to nearest integer.

6.1 *Likelihood of Release.* Evaluate the likelihood of release factor category in terms of an observed release factor or a potential to release factor.

6.1.1 *Observed release.* Establish an observed release to the atmosphere by demonstrating that the site has released a hazardous substance to the atmosphere. Base this demonstration on either:

- Direct observation—a material (for example, particulate matter) that contains one or more hazardous substances has been seen entering the atmosphere directly. When evidence supports the inference of a release of a material that contains one or more hazardous substances by the site to the atmosphere, demonstrated adverse effects accumulated with that release may be used to establish an observed release.

- Chemical analysis—an analysis of air samples indicates that the concentration of ambient hazardous substance(s) has increased significantly above the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release.

If an observed release can be established, assign an observed release factor value of 550, enter this value in table 6-1, and proceed

to section 6.1.3. If an observed release cannot be established, assign an observed release factor value of 0, enter this value in table 6-1, and proceed to section 6.1.2.

6.1.2 *Potential to release.* Evaluate potential to release only if an observed release cannot be established. Determine the potential to release factor value for the site by separately evaluating the gas potential to release and the particulate potential to release for each source at the site. Select the highest potential to release value (either gas or particulate) calculated for the sources evaluated and assign that value as the site potential to release factor value as specified below.

6.1.2.1 *Gas potential to release.* Evaluate gas potential to release for those sources that contain gaseous hazardous substances—that is, those hazardous substances with a vapor pressure greater than or equal to 10⁻⁹ torr.

Evaluate gas potential to release for each source based on three factors: gas containment, gas source type, and gas migration potential. Calculate the gas potential to release value as illustrated in table 6-2. Combine sources with similar characteristics into a single source in evaluating the gas potential to release factors.

TABLE 6-2—GAS POTENTIAL TO RELEASE EVALUATION

Source	Source type ^a	Gas containment factor value ^b	Gas source type factor value ^c	Gas migration potential factor value ^d	Sum	Gas source value
		A	B	C	(B + C)	A(B + C)
1..						
2..						
3..						
4..						
5..						
6..						
7..						
8..						

Gas Potential to Release Factor (Select the Highest Gas Source Value)

- ^aEnter a Source Type listed in table 6-4.
- ^bEnter Gas Containment Factor Value from section 6.1.2.1.1.
- ^cEnter Gas Source Type Factor Value from section 6.1.2.1.2.
- ^dEnter Gas Migration Potential Factor Value from section 6.1.2.1.3.

6.1.2.1.1 *Gas containment.* Assign each source a value from table 6-3 for gas containment. Use the lowest value from table 6-3 that applies to the source, except: assign a value of 10 if there is evidence of biogas release or if there is an active fire within the source.

TABLE 6-3—GAS CONTAINMENT FACTOR VALUES

Gas containment description	Assigned value
All situations except those specifically listed below	10
Evidence of biogas release	10 ^a
Active fire within source	10 ^a
Gas collection/treatment system functioning, regularly inspected, maintained, and completely covering source	0
Source substantially surrounded by engineering windbreak and no other containment specifically described in this table applies	7
Source covered with essentially impermeable, regularly inspected, maintained cover	0
Uncontaminated soil cover >3 feet:	
• Source substantially vegetated with little exposed soil	0
• Source lightly vegetated with much exposed soil	3
• Source substantially devoid of vegetation	7
Uncontaminated soil cover ≥1 foot and ≥3 feet:	
• Source heavily vegetated with essentially no exposed soil:	
—Cover soil type resistant to gas migration ^b	3
—Cover soil type not resistant to gas migration ^b or unknown	7
• Source substantially vegetated with little exposed soil and cover soil type resistant to gas migration ^b	7
• Other	10
Uncontaminated soil cover <1 foot:	
• Source heavily vegetated with essentially no exposed soil and cover soil type resistant to gas migration ^b	7
• Other	10
Totally or partially enclosed within structurally intact building and no other containment specifically described in this table applies	7
Source consists solely of intact, sealed containers:	
• Totally protected from weather by regularly inspected, maintained cover	0
• Other	3

^aThis value must be used if applicable.
^bConsider moist fine-grained and saturated coarse-grained soils resistant to gas migration. Consider all other soils nonresistant.

6.1.2.1.2 *Gas source type.* Assign a value for gas source type to each source as follows:

- Determine if the source meets the minimum size requirement based on the source hazardous waste quantity value (see section 2.4.2.1.5). If the source receives a source hazardous waste quantity value of 0.5 or more, consider the source to meet the minimum size requirement.

- If the source meets the minimum size requirement, assign it a value from table 6-4 for gas source type.
- If the source does not meet the minimum size requirement, assign it a value of 0 for gas source type.

If no source at the site meets the minimum size requirement, assign each source at the

site a value from table 6-4 for gas source type.

TABLE 6-4—SOURCE TYPE FACTOR VALUES

Source type	Assigned value	
	Gas	Particulate
Active fire area	14	30
Burn pit	19	22
Containers or tanks (buried/below-ground):		
• Evidence of biogas release	33	22
• No evidence of biogas release	11	22
Containers or tanks, not elsewhere specified	28	14
Contaminated soil (excluding land treatment)	19	22
Landfarm/land treatment	28	22
Landfill:		
• Evidence of biogas release	33	22
• No evidence of biogas release	11	22
Pile:		
• Tailings pile	6	28
• Scrap metal or junk pile	6	17
• Trash pile	6	6
• Chemical waste pile	11	28
• Other waste piles	17	28
Surface impoundments (buried/backfilled):		
• Evidence of biogas release	33	22
• No evidence of biogas release	11	22
Surface impoundment (not buried/backfilled):		
• Dry	19	22
• Other	28	0
Other types of sources, not elsewhere specified	0	0

6.1.2.1.3 *Gas migration potential.* Evaluate this factor for each source as follows:

- Assign a value for gas migration potential to each of the gaseous hazardous substances associated with the source (see section 2.2.2) as follows:

- Assign values from table 6-5 for vapor pressure and Henry's constant to each hazardous substance. If Henry's constant cannot be determined for a hazardous substance, assign that hazardous substance a value of 2 for the Henry's constant component.

- Sum the two values assigned to the hazardous substance.

- Based on this sum, assign the hazardous substance a value from table 6-6 for gas migration potential.

- Assign a value for gas migration potential to each source as follows:

- Select three hazardous substances associated with the source:

- If more than three gaseous hazardous substances can be associated with the source, select three that have the highest gas migration potential values.

- If fewer than three gaseous hazardous substances can be associated with a source, select all of them.

- Average the gas migration potential values assigned to the selected hazardous substances.

-Based on this average value, assign the source a gas migration potential value from table 6-7.

TABLE 6-5—VALUES FOR VAPOR PRESSURE AND HENRY'S CONSTANT

Vapor pressure (Torr)	Assigned value
Greater than 10	3
Greater than 10 ⁻³ to 10	2
10 ⁻⁵ to 10 ⁻³	1
Less than 10 ⁻⁵	0
Henry's constant (atm-m ³ /mol)	Assigned value
Greater than 10 ⁻³	3
Greater than 10 ⁻⁵ to 10 ⁻³	2
10 ⁻⁷ to 10 ⁻⁵	1
Less than 10 ⁻⁷	0

TABLE 6-6—GAS MIGRATION POTENTIAL VALUES FOR A HAZARDOUS SUBSTANCE

Sum of values for vapor pressure and Henry's constant	Assigned value
0	0
1 or 2	6
3 or 4	11
5 or 6	17

TABLE 6-7—GAS MIGRATION POTENTIAL VALUES FOR THE SOURCE

Average of gas migration potential values for three hazardous substances ^a	Assigned value
0 to <3	0
3 to <8	6
8 to <14	11
14 to 17	17

^aIf fewer than three hazardous substances can be associated with the source, compute the average based only on those hazardous substances that can be associated.

6.1.2.1.4 *Calculation of gas potential to release value.* Determine the gas potential to release value for each source as illustrated in table 6-2. For each source, sum the gas source type factor value and gas migration potential factor value and multiply this sum by the gas containment factor value. Select the highest product calculated for the sources evaluated and assign it as the gas potential to release value for the site. Enter this value in table 6-1.

6.1.2.2 *Particulate potential to release.* Evaluate particulate potential to release for those sources that contain particulate hazardous substances—that is, those hazardous substances with a vapor pressure less than or equal to 10⁻¹ torr.

Evaluate particulate potential to release for each source based on three factors: particulate containment, particulate source type, and particulate migration potential.

Calculate the particulate potential to release value as illustrated in table 6-8. Combine sources with similar characteristics into a single source in evaluating the particulate potential to release factors.

6.1.2.2.1 *Particulate containment.* Assign each source a value from table 6-9 for particulate containment. Use the lowest value from table 6-9 that applies to the source.

6.1.2.2.2 *Particulate source type.* Assign a value for particulate source type to each source in the same manner as specified for gas sources in section 6.1.2.1.2.

6.1.2.2.3 *Particulate migration potential.* Based on the site location, assign a value from Figure 6-2 for particulate migration potential. Assign this same value to each source at the site.

TABLE 6-8—PARTICULATE POTENTIAL TO RELEASE EVALUATION

Source	Source type ^a	Particulate containment factor value ^b	Particulate type factor value ^c	Particulate migration potential factor value ^d	Sum	Particulate source value
		A	B	C	(B + C)	A (B + C)
1..						
2..						
3..						
4..						
5..						
6..						
7..						
8..						

Particulate Potential to Release Factor Value (Select Highest Particulate Source Value)

- ^aEnter a Source Type listed in table 6-4.
- ^bEnter Particulate Containment Factor Value from section 6.1.2.2.1.
- ^cEnter Particulate Source Type Factor Value from section 6.1.2.2.2.
- ^dEnter Particulate Migration Potential Factor Value from section 6.1.2.2.3.

TABLE 6-9—PARTICULATE CONTAINMENT FACTOR VALUES

Particulate containment description	Assigned value
All situations except those specifically listed below	10
Source contains only particulate hazardous substances totally covered by liquids	0
Source substantially surrounded by engineered windbreak and no other containment specifically described in this table applies	7
Source covered with essentially impermeable, regularly inspected, maintained cover	0
Uncontaminated soil cover >3 feet:	
• Source substantially vegetated with little or no exposed soil	0
• Source lightly vegetated with much exposed soil	3
• Source substantially devoid of vegetation	7
Uncontaminated soil cover ≥1 foot and ≤3 feet:	
• Source heavily vegetated with essentially no exposed soil:	
—Cover soil type resistant to gas migration ^a	3
—Cover soil type not resistant to gas migration ^a or unknown	7
• Source substantially vegetated with little exposed soil and cover soil type resistant to gas migration ^a	7
• Other	10
Uncontaminated soil cover <1 foot:	
• Source heavily vegetated with essentially no exposed soil and cover soil type resistant to gas migration ^a	7
• Other	10
Totally or partially enclosed within structurally intact building and no other containment specifically described in this table applies	7
Source consists solely of containers:	
• All containers contain only liquids	0
• All containers intact, sealed, and totally protected from weather by regularly inspected, maintained cover	0
• All containers intact and sealed	3
• Other	10

^aConsider moist fine-grained and saturated coarse-grained soils resistant to gas migration. Consider all other soils nonresistant.

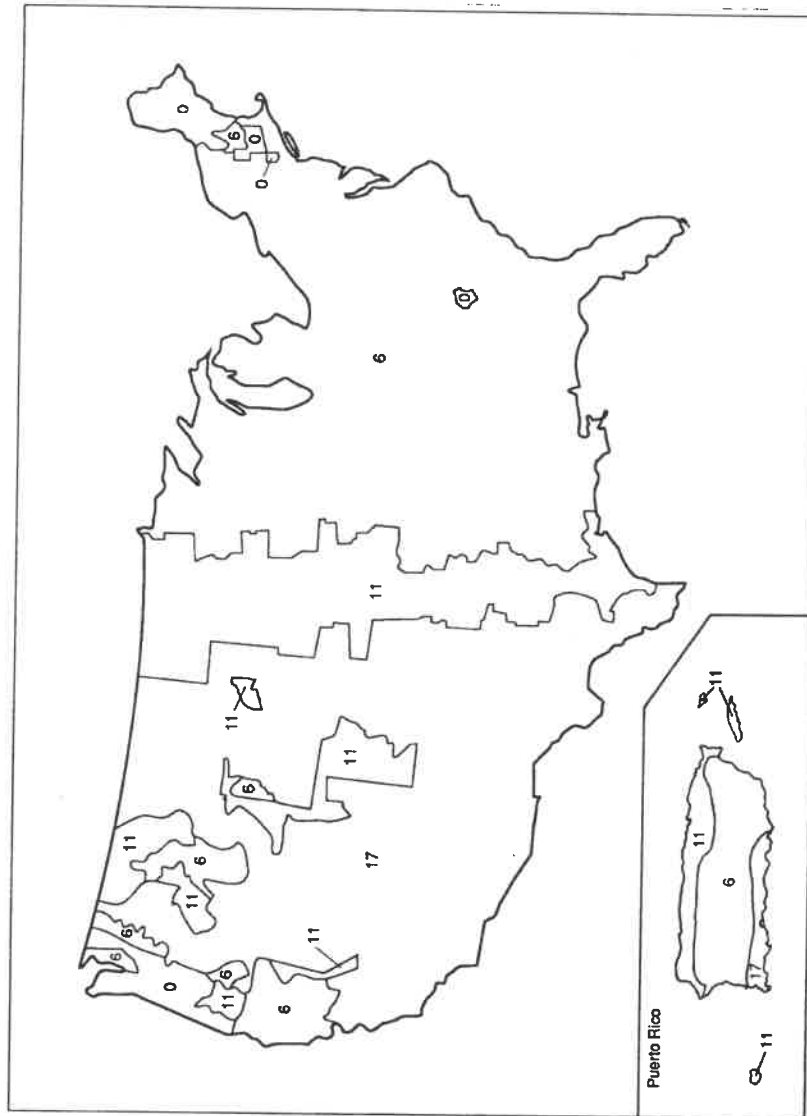


FIGURE 6-2
PARTICULATE MIGRATION POTENTIAL FACTOR VALUES

FIGURE 6-2—PARTICULATE MIGRATION POTENTIAL FACTOR VALUES—CONCLUDED

Location	Particulate migration potential assigned value
Hawaiian Islands	
Hilo, Hawaii	0
Honolulu, Oahu	17
Kahului, Maui	17
Lanai	17
Lihue, Kauai	11
Molokai	17
Pacific Islands	
Guam	6
Johnston Island	17
Koror Island	0
Kwajalein Island	6
Mujuro, Marshall Islands	0
Pago Pago, American Samoa	0
Ponape Island	0
Truk, Caroline Islands	0
Wake Island	17
Yap Island	0
Alaska	
Anchorage	17
Annette	0
Barrow	17
Barter Island	17
Bethel	17
Bettles	17
Big Delta	17
Cold Bay	6
Fairbanks	17
Gulkana	17
Homer	11
Juneau	0
King Salmon	11
Kodiak	0
Kutzebue	17
McGrath	17
Nome	11
St. Paul Island	11
Talkeetna	6
Unalakleet	17
Valdez	0
Yakutat	0
American Virgin Islands	
St. Croix	17
St. John	11
St. Thomas	11
Puerto Rico	
Arecibo	6
Coloso	6
Fajardo	11
Humacao	6
Isabela Station	11
Ponce	17
San Juan	11

For site locations not on Figure 6-2, and for site locations near the boundary points on Figure 6-2, assign a value as follows. First, calculate a Thornthwaite P-E index using the following equation:

$$PE = \sum_{i=1}^{12} 115 [P_i / (T_i - 10)]^{10/9}$$

where:
PE = Thornthwaite P-E index.

P_i = Mean monthly precipitation for month i , in inches.
 T_i = Mean monthly temperature for month i , in degrees Fahrenheit; for any month having a mean monthly temperature less than 28.4 °F, use 28.4 °F.

Based on the calculated Thornthwaite P-E index, assign a source particulate migration potential value to the site from table 6-10. Assign this same value to each source at the site.

TABLE 6-10—PARTICULATE MIGRATION POTENTIAL VALUES

Thornthwaite P-E Index	Assigned value
Greater than 150	0
85 to 150	6
50 to less than 85	11
Less than 50	17

6.1.2.2.4 *Calculation of particulate potential to release value.* Determine the particulate potential to release value for each source as illustrated in table 6-8. For each source, sum its particulate source type factor value and particulate migration potential factor value and multiply this sum by its particulate containment factor value. Select the highest product calculated for the sources evaluated and assign it as the particulate potential to release value for the site. Enter the value in table 6-1.

6.1.2.3 *Calculation of potential to release factor value for the site.* Select the higher of the gas potential to release value assigned in section 6.1.2.1.4 and the particulate potential to release value assigned in section 6.1.2.2.4. Assign the value selected as the site potential to release factor value. Enter this value in table 6-1.

6.1.3 *Calculation of likelihood of release factor category value.* If an observed release is established, assign the observed release factor value of 550 as the likelihood of release factor category value. Otherwise, assign the site potential to release factor value as the likelihood of release factor category value. Enter the value in table 6-1.

6.2 *Waste characteristics.* Evaluate the waste characteristics factor category based on two factors: toxicity/mobility and hazardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to the atmosphere. Such hazardous substances include:

- Hazardous substances that meet the criteria for an observed release to the atmosphere.
- All gaseous hazardous substances associated with a source that has a gas containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 6.1.2.1.1).
- All particulate hazardous substances associated with a source that has a particulate

containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 6.1.2.2.1).

6.2.1 *Toxicity/mobility.* For each hazardous substance, assign a toxicity factor value, a mobility factor value, and a combined toxicity/mobility factor value as specified below. Select the toxicity/mobility factor value for the air migration pathway as specified in section 6.2.1.3.

6.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

6.2.1.2 *Mobility.* Assign a mobility factor value to each hazardous substance as follows:

- Gaseous hazardous substance.

-Assign a mobility factor value of 1 to each gaseous hazardous substance that meets the criteria for an observed release to the atmosphere.

-Assign a mobility factor value from table 6-11, based on vapor pressure, to each gaseous hazardous substance that does not meet the criteria for an observed release.

- Particulate hazardous substance.

-Assign a mobility factor value of 0.02 to each particulate hazardous substance that meets the criteria for an observed release to the atmosphere.

-Assign a mobility factor value from Figure 6-3, based on the site's location, to each particulate hazardous substance that does not meet the criteria for an observed release. (Assign all such particulate hazardous substances this same value.)

-For site locations not on Figure 6-3 and for site locations near the boundary points on Figure 6-3, assign a mobility factor value to each particulate hazardous substance that does not meet the criteria for an observed release as follows:

-Calculate a value M:

$$M = 0.0182 (U^2/[PE]^2)$$

where:

U = Mean average annual wind speed (meters per second).

PE = Thorndwaite P-E index from section 6.1.2.2.3.

-Based on the value M, assign a mobility factor value from table 6-12 to each particulate hazardous substance.

- Gaseous and particulate hazardous substances.

-For a hazardous substance potentially present in both gaseous and particulate forms, select the higher of the factor values for gas mobility and particulate mobility for that substance and assign that value as the mobility factor value for the hazardous substance.

6.2.1.3 *Calculation of toxicity/mobility factor value.* Assign each hazardous substance a toxicity/mobility factor value from table 6-13, based on the values assigned to the hazardous substance for the toxicity and mobility factors. Use the hazardous substance with the highest toxicity/mobility factor value to assign the value to the toxicity/mobility factor for the air migration pathway. Enter this value in table 6-1.

TABLE 6-11—GAS MOBILITY FACTOR VALUES

Vapor pressure (Torr)	Assigned value ^a
Greater than 10 ⁻¹	1.0
Greater than 10 ⁻² to 10 ⁻¹	0.2
Greater than 10 ⁻³ to 10 ⁻²	0.02
Greater than 10 ⁻⁴ to 10 ⁻³	0.002
Less than or equal to 10 ⁻⁴	0.0002

^a Do not round to nearest integer.

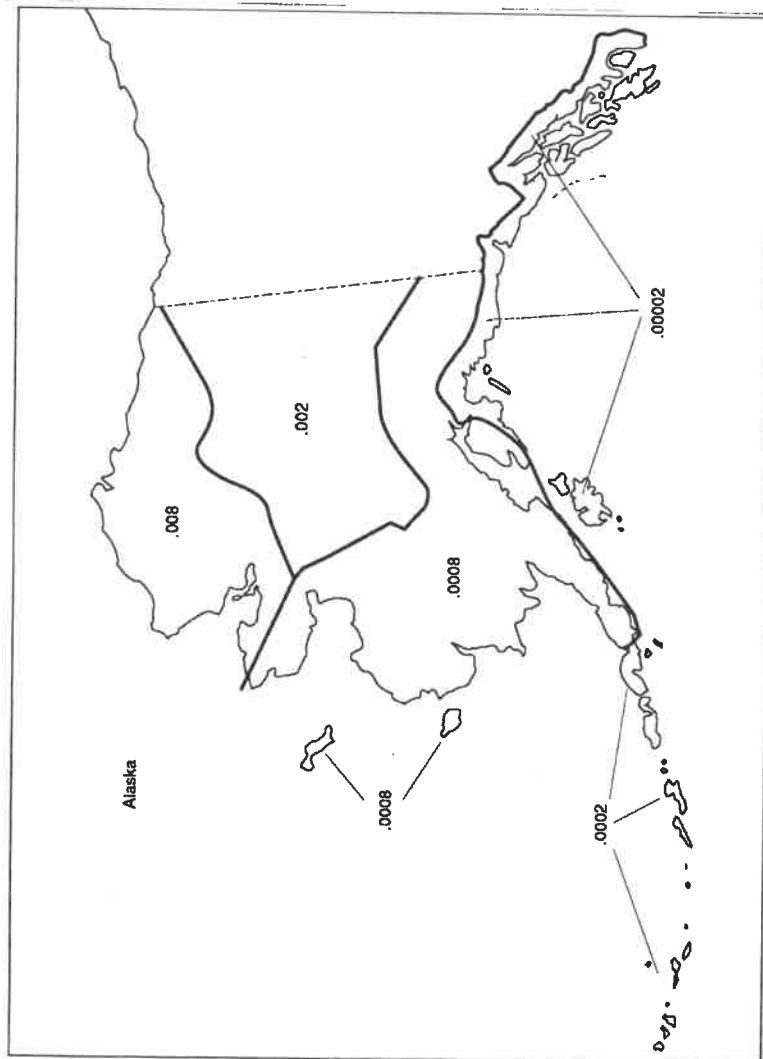
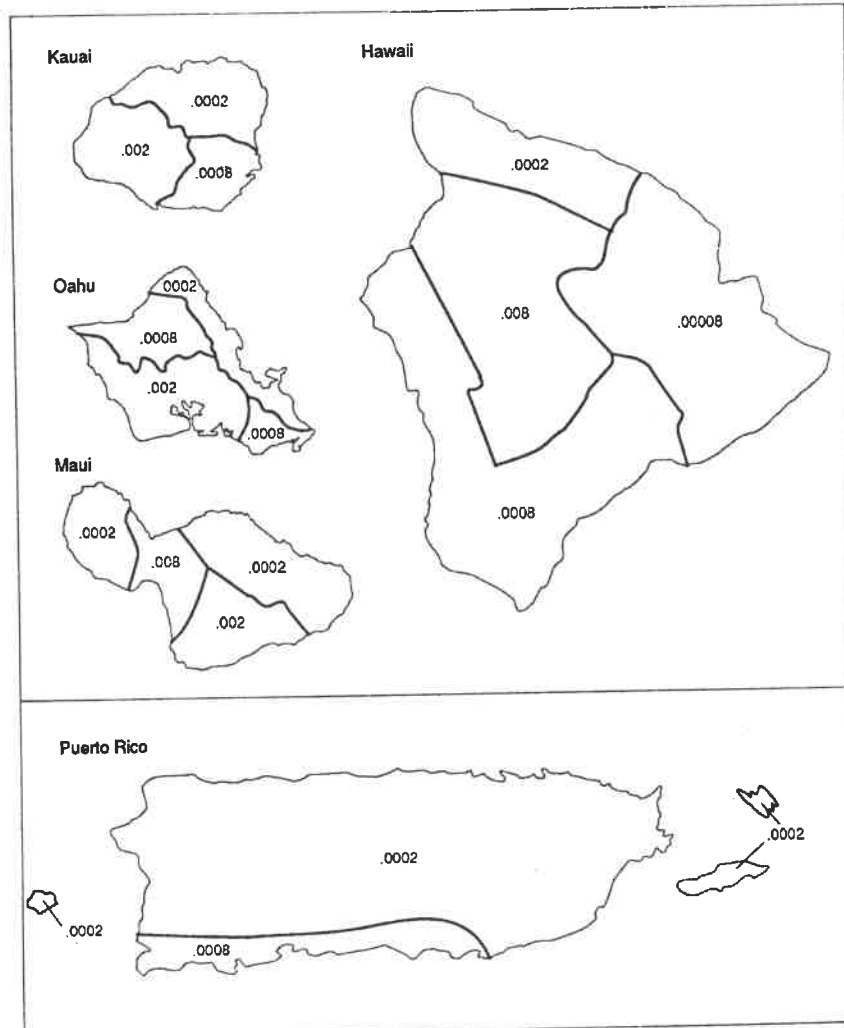


FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES*
(CONTINUED)

* Do not round to nearest integer.



^a Do not round to nearest integer.

**FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES^a
(CONTINUED)**

FIGURE 6-3—PARTICULATE MOBILITY FACTOR VALUES—CONCLUDED

Location	Particulated mobility assigned value
Pacific Islands	
Guam	0.0002
Johnston Island	0.002
Koror Island	0.00008
Kwajalein Island	0.0002
Majuro, Marshall Islands	0.00008
Pago Pago, American Samoa	0.00008
Ponape Island	0.00002
Truk, Caroline Islands	0.00008
Wake Island	0.002
Yap Island	0.00008
American Virgin Islands	
St. Croix	0.0008
St. John	0.0002
St. Thomas	0.0002

TABLE 6-12—PARTICULATE MOBILITY FACTOR VALUES

M	Assigned value*
Greater than 1.4×10^{-2}	0.02
Greater than 4.4×10^{-3} to 1.4×10^{-2}	0.008
Greater than 1.4×10^{-3} to 4.4×10^{-3}	0.002
Greater than 4.4×10^{-4} to 1.4×10^{-3}	0.0008
Greater than 1.4×10^{-4} to 4.4×10^{-4}	0.0002
Greater than 4.4×10^{-5} to 1.4×10^{-4}	0.00008
Less than or equal to 4.4×10^{-5}	0.00002

* Do not round to nearest integer.

TABLE 6-13—TOXICITY/MOBILITY FACTOR VALUES^A

Mobility factor value	Toxicity factor value					
	10,000	1,000	100	10	1	0
1.0	10,000	1,000	100	10	1	0
0.2	2,000	200	20	2	0.2	0
0.02	200	20	2	0.2	0.02	0
0.008	80	8	0.8	0.08	0.008	0
0.002	20	2	0.2	0.02	0.002	0
0.0008	8	0.8	0.08	0.008	0.0008	0
0.0002	2	0.2	0.02	0.002	0.0002	0
0.00008	0.8	0.08	0.008	0.0008	0.00008	0
0.00002	0.2	0.02	0.002	0.0002	0.00002	0

^A Do not round to nearest integer.

6.2.2 *Hazardous waste quantity.* Assign a hazardous waste quantity factor value for the air migration pathway as specified in section 2.4.2. Enter this value in table 6-1.

6.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity/mobility factor value and the hazardous waste quantity factor value, subject to a maximum product of 1×10^8 . Based on this product, assign a value from table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in table 6-1.

6.3 *Targets.*

Evaluate the targets factor category based on four factors: nearest individual, population, resources, and sensitive environments. Include only those targets (for example, individuals, sensitive environments) located within the 4-mile target distance limit, except: if an observed release is established beyond the 4-mile target distance limit, include those additional targets that are specified below in this section and in section 6.3.4.

Evaluate the nearest individual and population factors based on whether the target populations are subject to Level I concentrations, Level II concentrations, or potential

contamination. Determine which applies to a target population as follows.

If no samples meet the criteria for an observed release to air and if there is no observed release by direct observation, consider the entire population within the 4-mile target distance limit to be subject to potential contamination.

If one or more samples meet the criteria for an observed release to air or if there is an observed release by direct observation, evaluate the population as follows:

- Determine the most distant sample location that meets the criteria for Level I concentrations as specified in sections 2.5.1 and 2.5.2 and the most distant location (that is, sample location or direct observation location) that meets the criteria for Level II concentrations. Use the health-based benchmarks from table 6-14 in determining the level of contamination for sample locations. If the most distant Level II location is closer to a source than the most distant Level I sample location, do not consider the Level II location.

- Determine the single most distant location (sample location or direct observation location) that meets the criteria for Level I or Level II concentrations.

• If this single most distant location is within the 4-mile target distance limit, identify the distance categories from table 6-15 in which the selected Level I concentrations sample and Level II concentrations sample (or direct observation location) are located:

-Consider the target population anywhere within this furthest Level I distance category, or anywhere within a distance category closer to a source at the site, as subject to Level I concentrations.

-Consider the target population located beyond any Level I distance categories, up to and including the population anywhere within the furthest Level II distance category, as subject to Level II concentrations.

-Consider the remainder of the target population within the 4-mile target distance limit as subject to potential contamination.

• If the single most distant location is beyond the 4-mile target distance limit, identify the distance at which the selected Level

I concentrations sample and Level II concentrations sample (or direct observation location) are located:

-If the Level I sample location is within the 4-mile target distance limit, identify the target population subject to Level I concentrations as specified above.

-If the Level I sample location is beyond the 4-mile target distance limit, consider the target population located anywhere within a distance from the sources at the site equal to the distance to this sample location to be subject to Level I concentrations and include them in the evaluation.

-Consider the target population located beyond the Level I target population, but located anywhere within a distance from the sources at the site equal to the distance to the selected Level II location, to be subject to Level II concentrations and include them in the evaluation.

-Do not include any target population as subject to potential contamination.

TABLE 6-14—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN AIR

- Concentration corresponding to National Ambient Air Quality Standard (NAAQS).
- Concentration corresponding to National Emission Standards for Hazardous Air Pollutants (NESHAPs).
- Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁶ individual cancer risk for inhalation exposures.
- Screening concentration for noncancer toxicological responses corresponding to the Reference Concentration (RfC) for inhalation exposures.

TABLE 6-15—AIR MIGRATION PATHWAY DISTANCE WEIGHTS

Distance category (miles)	Assigned distance weight ^a
0	1.0
Greater than 0 to ¼	0.25
Greater than ¼ to ½	0.054
Greater than ½ to 1	0.016
Greater than 1 to 2	0.0051
Greater than 2 to 3	0.0023
Greater than 3 to 4	0.0014
Greater than 4	0

^aDo not round to nearest integer.

6.3.1 *Nearest individual.* Assign the nearest individual factor a value as follows:

• If one or more residences or regularly occupied buildings or areas is subject to Level I concentrations as specified in section 6.3, assign a value of 50.

• If not, but if one or more a residences or regularly occupied buildings or areas is subject to Level II concentrations, assign a value of 45.

• If none of the residences and regularly occupied buildings and areas is subject to Level I or Level II concentrations, assign a value to this factor based on the shortest distance to any residence or regularly occu-

ried building or area, as measured from any source at the site with an air migration containment factor value greater than 0. Based on this shortest distance, assign a value from table 6-16 to the nearest individual factor.

Enter the value assigned in table 6-1.

TABLE 6-16—NEAREST INDIVIDUAL FACTOR VALUES

Distance to nearest individual (miles)	Assigned value
Level I concentrations ^a	50
Level II concentrations ^a	45
0 to ¼	20
Greater than ¼ to ½	7
Greater than ½ to 1/2	2
Greater than ½ to 1	1
Greater than 1	0

^aDistance does not apply.

6.3.2 *Population.* In evaluating the population factor, count residents, students, and workers regularly present within the target distance limit. Do not count transient populations such as customers and travelers passing through the area.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

6.3.2.1 *Level of contamination.* Evaluate the population factor based on three factors: Level I concentrations, Level II concentrations, and potential contamination.

Evaluate the population subject to Level I concentrations (see section 6.3) as specified in section 6.3.2.2, the population subject to Level II concentrations as specified in section 6.3.2.3, and the population subject to potential contamination as specified in section 6.3.2.4.

For the potential contamination factor, use population ranges in evaluating the factor as specified in section 6.3.2.4. For the Level I and Level II concentrations factors, use the population estimate, not population ranges, in evaluating both factors.

6.3.2.2 *Level I concentrations.* Sum the number of people subject to Level I concentrations. Multiply this sum by 10. Assign the product as the value for this factor. Enter this value in table 6-1.

6.3.2.3 *Level II concentrations.* Sum the number of people subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in table 6-1.

6.3.2.4 *Potential contamination.* Determine the number of people within each distance

category of the target distance limit (see table 6-15) who are subject to potential contamination. Do not include those people already counted under the Level I and Level II concentrations factors.

Based on the number of people present within a distance category, assign a distance-weighted population value for that distance category from table 6-17. (Note that the distance-weighted population values in table 6-17 incorporate the distance weights from table 6-15. Do not multiply the values from table 6-17 by these distance weights.)

Calculate the potential contamination factor value (PI) as follows:

$$PI = \frac{1}{10} \sum_{i=1}^n W_i$$

where:

W_i = Distance-weighted population from table 6-17 for distance category i .

n = Number of distance categories.

If PI is less than 1, do not round it to the nearest integer; if PI is 1 or more, round to the nearest integer. Enter this value in table 6-1.

6.3.2.5 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value. Enter this value in table 6-1.

TABLE 6-17—DISTANCE-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR AIR PATHWAY^a

Distance category (miles)	Number of people within the distance category												
	0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000
On a source	0	4	17	53	164	522	1,633	5,214	16,325	52,137	163,246	521,360	1,632,455
Greater than 0 to 1/4	0	1	4	13	41	131	408	1,304	4,081	13,034	40,812	130,340	408,114
Greater than 1/4 to 1/2	0	0.2	0.9	3	9	28	88	282	882	2,815	8,815	28,153	88,153
Greater than 1/2 to 1	0	0.06	0.3	0.9	3	8	26	83	261	834	2,612	8,342	26,119
Greater than 1 to 2	0	0.02	0.09	0.3	0.8	3	8	27	83	266	833	2,659	8,326
Greater than 2 to 3	0	0.009	0.04	0.1	0.4	1	4	12	38	120	375	1,199	3,755
Greater than 3 to 4	0	0.005	0.02	0.07	0.2	0.7	2	7	23	73	229	730	2,285

^a Round the number of people present within a distance category to nearest integer. Do not round the assigned distance-weighted population value to nearest integer.

6.3.3 *Resources*. Evaluate the resources factor as follows:

- Assign a value of 5 if one or more of the following resources are present within one-half mile of a source at the site having an air migration containment factor value greater than 0:

- Commercial agriculture.
- Commercial silviculture.
- Major or designated recreation area.

- Assign a value of 0 if none of these resources is present.

Enter the value assigned in table 6-1.

6.3.4 *Sensitive environments*. Evaluate sensitive environments based on two factors: actual contamination and potential contamination. Determine which factor applies as follows.

If no samples meet the criteria for an observed release to air and if there is no observed release by direct observation, consider all sensitive environments located, partially or wholly, within the target distance limit to be subject to potential contamination.

If one or more samples meet the criteria for an observed release to air or if there is an observed release by direct observation, determine the most distant location (that is, sample location or direct observation location) that meets the criteria for an observed release:

- If the most distant location meeting the criteria for an observed release is within the 4-mile target distance limit, identify the distance category from table 6-15 in which it is located:

- Consider sensitive environments located, partially or wholly, anywhere within this distance category or anywhere within a distance category closer to a source at the site as subject to actual contamination.

- Consider all other sensitive environments located, partially or wholly, within the target distance limit as subject to potential contamination.

- If the most distant location meeting the criteria for an observed release is beyond the 4-mile target distance limit, identify the distance at which it is located:

- Consider sensitive environments located, partially or wholly, anywhere within a distance from the sources at the site equal to the distance to this location to be subject to actual contamination and include all such sensitive environments in the evaluation.

- Do not include any sensitive environments as subject to potential contamination.

6.3.4.1 *Actual contamination*. Determine those sensitive environments subject to actual contamination (*i.e.*, those located partially or wholly within a distance category subject to actual contamination). Assign value(s) from table 4-23 (section 4.1.4.3.1.1) to

each sensitive environment subject to actual contamination.

For those sensitive environments that are wetlands, assign an additional value from table 6-18. In assigning a value from table 6-18, include only those portions of wetlands located within distance categories subject to actual contamination. If a wetland is located partially in a distance category subject to actual contamination and partially in one subject to potential contamination, then solely for purposes of table 6-18, count the portion in the distance category subject to potential contamination under the potential contamination factor in section 6.3.4.2. Determine the total acreage of wetlands within those distance categories subject to actual contamination and assign a value from table 6-18 based on this total acreage.

Calculate the actual contamination factor value (EA) as follows:

$$EA = WA + \sum_{i=1}^n S_i$$

where:

WA = Value assigned from table 6-18 for wetlands in distance categories subject to actual contamination.

S_i = Value(s) assigned from table 4-23 to sensitive environment i.

n = Number of sensitive environments subject to actual contamination.

Enter the value assigned in table 6-1.

TABLE 6-18—WETLANDS RATING VALUES FOR AIR MIGRATION PATHWAY^A

Wetland area (acres)	Assigned value
Less than 1	0
1 to 50	25
Greater than 50 to 100	75
Greater than 100 to 150	125
Greater than 150 to 200	175
Greater than 200 to 300	250
Greater than 300 to 400	350
Greater than 400 to 500	450
Greater than 500	500

^AWetlands as defined in 40 CFR section 230.3.

6.3.4.2 *Potential contamination*. Determine those sensitive environments located, partially or wholly, within the target distance limit that are subject to potential contamination. Assign value(s) from table 4-23 to each sensitive environment subject to potential contamination. Do not include those sensitive environments already counted for table 4-23 under the actual contamination factor.

For each distance category subject to potential contamination, sum the value(s) assigned from table 4-23 to the sensitive environments in that distance category. If a sensitive environment is located in more than one distance category, assign the sensitive

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environment only to that distance category having the highest distance weighting value from table 6-15.

For those sensitive environments that are wetlands, assign an additional value from table 6-18. In assigning a value from table 6-18, include only those portions of wetlands located within distance categories subject to potential contamination, as specified in section 6.3.4.1. Treat the wetlands in each separate distance category as separate sensitive environments solely for purposes of applying table 6-18. Determine the total acreage of wetlands within each of these distance categories and assign a separate value from table 6-18 for each distance category.

Calculate the potential contamination factor value (EP) as follows:

$$EP = \frac{1}{10} \sum_{j=1}^m [(W_j + S_j) D_j]$$

$$S_j = \sum_{i=1}^n S_{ij}$$

S_{ij} = Value(s) assigned from table 4-23 to sensitive environment in distance category j.

n = Number of sensitive environments subject to potential contamination.

W_j = Value assigned from table 6-18 for wetland area in distance category j.

D_j = Distance weight from table 6-15 for distance category j.

m = Number of distance categories subject to potential contamination.

If EP is less than 1, do not round it to the nearest integer; if EP is 1 or more, round to the nearest integer. Enter the value assigned in table 6-1.

6.3.4.3 Calculation of sensitive environments factor value. Sum the factor values for actual contamination and potential contamination. Do not round this sum, designated as EB, to the nearest integer.

Because the pathway score based solely on sensitive environments is limited to a maximum of 60, use the value EB to determine the value for the sensitive environments factor as follows:

- Multiply the values assigned to likelihood of release (LR), waste characteristics (WC), and EB. Divide the product by 82,500.

- If the result is 60 or less, assign the value EB as the sensitive environments factor value.

- If the result exceeds 60, calculate a value EC as follows:

$$EC = \frac{(60)(82,500)}{(LR)(WC)}$$

Assign the value EC as the sensitive environments factor value. Do not round this value to the nearest integer.

Enter the value assigned for the sensitive environments factor in table 6-1.

6.3.5 Calculation of targets factor category value. Sum the nearest individual, population, resources, and sensitive environments factor values. Do not round this sum to the nearest integer. Assign this sum as the targets factor category value. Enter this value in table 6-1.

6.4 Calculation of air migration pathway score. Multiply the values for likelihood of release, waste characteristics, and targets, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum value of 100, as the air migration pathway score (S_a). Enter this score in table 6-1.

7.0 Sites Containing Radioactive Substances.

In general, radioactive substances are hazardous substances under CERCLA and should be considered in HRS scoring. Releases of certain radioactive substances are, however, excluded from the definition of "release" in section 101(22) of CERCLA, as amended, and should not be considered in HRS scoring.

Evaluate sites containing radioactive substances using the instructions specified in sections 2 through 6, supplemented by the instructions in this section. Those factors denoted with a "yes" in table 7-1 are evaluated differently for sites containing radioactive substances than for sites containing only nonradioactive hazardous substances, while those denoted with a "no" are not evaluated differently and are not addressed in this section.

TABLE 7-1—HRS FACTORS EVALUATED DIFFERENTLY FOR RADIONUCLIDES

Ground water pathway	Status ^a	Surface water pathway	Status ^a	Soil exposure component of SSSI pathway	Status ^a	Subsurface intrusion component of SSSI pathway	Status ^a	Air pathway	Status ^a
Likelihood of Release		Likelihood of Release		Likelihood of Exposure		Likelihood of Exposure		Likelihood of Release	
Observed Release	Yes	Observed Release	Yes	Observed Contamination.	Yes	Observed Exposure	Yes	Observed Release	Yes
Potential to Release	No	Potential to Release.	No	Attractiveness/Accessibility to Nearby Residents.	No	Potential for Exposure.	Yes	Gas Potential to Release.	No
Containment	No	Overland Flow Containment.	No	Area of Contamination.	No	Structure Containment.	No	Gas Containment	No
Net Precipitation	No	Runoff	No	Vertical migration	Yes	Depth to Contamination	Yes	Gas Source Type	No
Depth to Aquifer	No	Distance to Surface water.	No	Vapor Migration Potential.	No	Vertical migration	No	Gas Migration Potential.	No
Travel Time	No	Flood Frequency	No	Area of Observed Exposure.	No	Vapor Migration Potential.	No	Particulate Potential to Release.	No
		Flood Containment.	No	Area of Sub-surface Contamination.	No	Area of Sub-surface Contamination.	No	Particulate Containment.	No
								Particulate Source Type.	No
								Particulate Migration Potential.	No
Waste Characteristics		Waste Characteristics		Waste Characteristics		Waste Characteristics		Waste Characteristics	
Toxicity	Yes	Toxicity/Ecotoxicity	Yes/Yes	Toxicity	Yes	Toxicity/Degradation.	Yes/Yes	Toxicity	Yes
Mobility	No	Persistence/Mobility.	Yes/No	Hazardous Waste Quantity.	Yes	Hazardous Waste Quantity.	Yes	Mobility	No
Hazardous Waste Quantity	Yes	Bioaccumulation Potential.	No					Hazardous Waste Quantity.	Yes
		Hazardous Waste Quantity.	Yes.						
Targets		Targets		Targets		Targets		Targets	
Nearest Well	Yes ^b	Nearest Intake	Yes ^b	Resident Individual	Yes ^b	Exposed Individual	Yes ^b	Nearest Individual	Yes ^b
Population	Yes ^b	Drinking Water Population.	Yes ^b	Resident Population.	Yes ^b	Population	Yes ^b	Population	Yes ^b
Resources	No	Resources	No	Workers	No	Resources	No	Resources	No

TABLE 7-1—HRS FACTORS EVALUATED DIFFERENTLY FOR RADIONUCLIDES—Continued

Ground water pathway	Status ^a	Surface water pathway	Status ^a	Soil exposure component of SSSI pathway	Status ^a	Subsurface intrusion component of SSSI pathway	Status ^a	Air pathway	Status ^a
Targets	Targets	Targets	Targets	Targets	Targets	Targets	Targets	Targets	Targets
Wellhead Protection Area	No	Sensitive Environments, Human Food Chain Individual, Human Food Chain Population	Yes ^b	Resources	No			Sensitive Environments	No
			Yes ^b	Terrestrial Sensitive Environments	No				
			Yes ^b	Nearby Individual Population Within 1 Mile	No				

a—Factors evaluated differently are denoted by "yes", factors not evaluated differently are denoted by "no".
 b—Difference is in the determination of Level I and Level II concentrations.

In general, sites containing mixed radioactive and other hazardous substances involve more evaluation than sites containing only radionuclides. For sites containing mixed radioactive and other hazardous substances, HRS factors are evaluated based on considerations of both the radioactive substances and the other hazardous substances in order to derive a single set of factor values for each factor category in each of the four pathways. Thus, the HRS score for these sites reflects the combined potential hazards posed by both the radioactive and other hazardous substances.

Section 7 is organized by factor category, similar to sections 3 through 6. Pathway-specific differences in evaluation criteria are specified under each factor category, as appropriate. These differences apply largely to the soil exposure and subsurface intrusion pathway and to sites containing mixed radioactive and other hazardous substances. All evaluation criteria specified in sections 2 through 6 must be met, except where modified in section 7.

7.1 *Likelihood of release/likelihood of exposure.* Evaluate likelihood of release for the three migration pathways and likelihood of exposure for the soil exposure and subsurface intrusion pathway as specified in sections 2 through 6, except: establish an observed release, observed contamination, and/or observed exposure as specified in section 7.1.1. When an observed release or exposure cannot be established for a migration pathway or the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, evaluate potential to release as specified in section 7.1.2. When observed contamination cannot be established, do not evaluate the soil exposure component of the soil exposure and subsurface intrusion pathway.

7.1.1 *Observed release/observed contamination/observed exposure.* For radioactive substances, establish an observed release for each migration pathway by demonstrating that the site has released a radioactive substance to the pathway (or watershed or aquifer, as appropriate); establish observed contamination or observed exposure for the soil exposure and subsurface intrusion pathway as indicated below. Base these demonstrations on one or more of the following, as appropriate to the pathway being evaluated:

- Direct observation:
 - For each migration pathway, a material that contains one or more radionuclides has been seen entering the atmosphere, surface water, or ground water, as appropriate, or is known to have entered ground water or surface water through direct deposition, or
 - For the surface water migration pathway, a source area containing radioactive substances has been flooded at a time that radioactive substances were present and one

or more radioactive substances were in contact with the flood waters.

- For the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, a material that contains one or more radionuclides has been observed entering a regularly occupied structure via the subsurface or is known to have entered a regularly occupied structure via the subsurface. Also, when evidence supports the inference of subsurface intrusion of a material that contains one or more radionuclides by the site into a regularly occupied structure, demonstrated adverse effects associated with that release may also be used to establish observed exposure by direct observation.
 - Analysis of radionuclide concentrations in samples appropriate to the pathway (that is, ground water, soil, air, indoor air, soil gas, surface water, benthic, or sediment samples):
 - For radionuclides that occur naturally and for radionuclides that are ubiquitous in the environment:
 - Measured concentration (in units of activity, for example, pCi per kilogram [pCi/kg], pCi per liter [pCi/L], pCi per cubic meter [pCi/m³]) of a given radionuclide in the sample are at a level that:
 - Equals or exceeds a value 2 standard deviations above the mean site-specific background concentration for that radionuclide in that type of sample, or
 - Exceeds the upper-limit value of the range of regional background concentration values for that specific radionuclide in that type of sample.
 - Some portion of the increase must be attributable to the site to establish the observed release (or observed contamination or observed exposure), and
 - For the soil exposure component of the soil exposure and subsurface intrusion pathway only, the radionuclide must also be present at the surface or covered by 2 feet or less of cover material (for example, soil) to establish observed contamination.
 - For man-made radionuclides without ubiquitous background concentrations in the environment:
 - Measured concentration (in units of activity) of a given radionuclide in a sample equals or exceeds the sample quantitation limit for that specific radionuclide in that type of media and is attributable to the site.
 - However, if the radionuclide concentration equals or exceeds its sample quantitation limit, but its release can also be attributed to one or more neighboring sites, then the measured concentration of that radionuclide must also equal or exceed a value either 2 standard deviations above the mean concentration of

that radionuclide contributed by those neighboring sites or 3 times its background concentration, whichever is lower.

- If the sample quantitation limit cannot be established:
 - If the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-required quantitation limit (CRQL) in place of the sample quantitation limit in establishing an observed release (or observed contamination or observed exposure).
 - If the sample analysis is not performed under the EPA Contract Laboratory Program, use the detection limit in place of the sample quantitation limit.
- For the soil exposure component of the soil exposure and subsurface intrusion pathway only, the radionuclide must also be present at the surface or covered by 2 feet or less of cover material (for example, soil) to establish observed contamination.
- Gamma radiation measurements (applies only to observed contamination or observed exposure in the soil exposure and subsurface intrusion pathway):
 - The gamma radiation exposure rate, as measured in microroentgens per hour ($\mu\text{R/hr}$) using a survey instrument held 1 meter above the ground surface or floor or walls of a structure (or 1 meter away from an aboveground source for the soil exposure component), equals or exceeds 2 times the site-specific background gamma radiation exposure rate.
 - Some portion of the increase must be attributable to the site to establish observed contamination or observed exposure. The gamma-emitting radionuclides do not have to be within 2 feet of the surface of the source.

For the three migration pathways and for the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, if an observed release or observed exposure can be established for the pathway (or component, threat, aquifer, or watershed, as appropriate), assign the pathway (or component, threat, aquifer, or watershed) an observed release or observed exposure factor value of 550 and proceed to section 7.2. If an observed release or observed exposure cannot be established, assign an observed release or observed exposure factor value of 0 and proceed to section 7.1.2.

For the soil exposure component of the soil exposure and subsurface intrusion pathway, if observed contamination can be established, assign the likelihood of exposure factor for resident population a value of 550 if there is an area of observed contamination in one or more locations listed in section 5.1.1; evaluate the likelihood of exposure factor for nearby population as specified in section 5.1.2.1; and proceed to section 7.2. If ob-

served contamination cannot be established, do not evaluate the soil exposure component of the soil exposure and subsurface intrusion pathway.

At sites containing mixed radioactive and other hazardous substances, evaluate observed release (or component, observed contamination or observed exposure) separately for radionuclides as described in this section and for other hazardous substances as described in sections 2 through 6.

For the three migration pathways and the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, if an observed release or observed exposure can be established based on either radionuclides or other hazardous substances, or both, assign the pathway (or threat, aquifer, or watershed) an observed release or observed exposure factor value of 550 and proceed to section 7.2. If an observed release or observed exposure cannot be established based on either radionuclides or other hazardous substances, assign an observed release or observed exposure factor value of 0 and proceed to section 7.1.2.

For the soil exposure component of the soil exposure and subsurface intrusion pathway, if observed contamination can be established based on either radionuclides or other hazardous substances, or both, assign the likelihood of exposure factor for resident population a value of 550 if there is an area of observed contamination in one or more locations listed in section 5.1.1; evaluate the likelihood of exposure factor for nearby population as specified in section 5.1.2.1; and proceed to section 7.2. If observed contamination cannot be established based on either radionuclides or other hazardous substances, do not evaluate the soil exposure component of the soil exposure and subsurface intrusion pathway.

7.1.2 Potential to release/potential for exposure. For the three migration pathways and the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, evaluate potential to release or potential for exposure for sites containing radionuclides in the same manner as specified for sites containing other hazardous substances. Base the evaluation on the physical and chemical properties of the radionuclides, not on their level of radioactivity. For the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, if the potential for exposure is based on the presence of gamma emitting radioactive substances, assign a potential for exposure factor value of 500 only if the contamination is found within 2 feet beneath a regularly occupied structure, otherwise assign a potential for exposure factor value of 0.

For sites containing mixed radioactive and other hazardous substances, evaluate potential to release or potential for exposure considering radionuclides and other hazardous

substances together. Evaluate potential to release for each migration pathway and the potential for exposure for the subsurface intrusion component of the soil exposure and subsurface intrusion pathway as specified in sections 3 through 6, as appropriate.

7.2 Waste characteristics. For radioactive substances, evaluate the human toxicity factor, the ecosystem toxicity factor, the surface water persistence factor, and the hazardous waste quantity factor as specified in the following sections. Evaluate all other waste characteristic factors as specified in sections 2 through 6.

7.2.1 Human Toxicity. For radioactive substances, evaluate the human toxicity factor as specified below, not as specified in section 2.4.1.1.

Assign human toxicity factor values to those radionuclides available to the pathway based on quantitative dose-response parameters for cancer risks as follows:

- Evaluate radionuclides only on the basis of carcinogenicity and assign all radionuclides to weight-of-evidence category A, or weight-of-evidence category "Carcinogenic to Humans".

- Assign a human toxicity factor value from Table 7-2 to each radionuclide based on its slope factor (also referred to as a cancer potency factor).

—For each radionuclide, use the higher of the slope factors for inhalation and ingestion to assign the factor value.

—If only one slope factor is available for the radionuclide use it to assign the toxicity factor value.

—If no slope factor is available for the radionuclide, assign that radionuclide a toxicity factor value of 0 and use other radionuclides for which a slope factor is available to evaluate the pathway.

- If all radionuclides available to a particular pathway are assigned a human toxicity factor value of 0 (that is, no slope factor is available for all the radionuclides), use a default human toxicity factor value of 1,000 as the human toxicity factor value for all radionuclides available to the pathway.

At sites containing mixed radioactive and other hazardous substances, evaluate the toxicity factor separately for the radioactive and other hazardous substances and assign each a separate toxicity factor value. This applies regardless of whether the radioactive and other hazardous substances are physically separated, combined chemically, or simply mixed together. Assign toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in section 2.4.1.1.

At sites containing mixed radioactive and other hazardous substances, if all radionuclides available to a particular pathway are assigned a human toxicity factor value of 0, use a default human toxicity factor value

of 1,000 for all those radionuclides even if nonradioactive hazardous substances available to the pathway are assigned human toxicity factor values greater than 0. Similarly, if all nonradioactive hazardous substances available to the pathway are assigned a human toxicity factor value of 0, use a default human toxicity factor value of 100 for all these nonradioactive hazardous substances even if radionuclides available to the pathway are assigned human toxicity factor values greater than 0.

7.2.2 Ecosystem toxicity. For the surface water environmental threat (see sections 4.1.4 and 4.2.4), assign an ecosystem toxicity factor value to radionuclides (alone or combined chemically or mixed with other hazardous substances) using the same slope factors and procedures specified for the human toxicity factor in section 7.2.1, except: use a default of 100, not 1,000, if all radionuclides eligible to be evaluated for ecosystem toxicity receive an ecosystem toxicity factor value of 0.

TABLE 7-2—TOXICITY FACTOR VALUES FOR RADIONUCLIDES

Cancer slope factor ^a (SF) (pCi) ⁻¹	Assigned value
$3 \times 10^{-11} \leq SF$	10,000
$3 \times 10^{-12} \leq SF < 3 \times 10^{-11}$	1,000
SF < 3×10^{-12}	100
SF not available for the radionuclide	0

^a Radionuclide slope factors are estimates of age-averaged, individual lifetime total excess cancer risk per picocurie of radionuclide inhaled or ingested.

At sites containing mixed radioactive and other hazardous substances, evaluate the ecosystem toxicity factor separately for the radioactive and other hazardous substances and assign each a separate ecosystem toxicity factor value. This applies regardless of whether the radioactive and other hazardous substances are physically separated, combined chemically, or simply mixed together. Assign ecosystem toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in sections 4.1.4.2.1.1 and 4.2.4.2.1.1. If all radionuclides available to a particular pathway are assigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 100 for all these radionuclides even if nonradioactive hazardous substances available to the pathway are assigned ecosystem toxicity factor values greater than 0. Similarly, if all nonradioactive hazardous substances available to the pathway are assigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 100 for all these nonradioactive hazardous substances even if radionuclides available to the pathway are assigned ecosystem toxicity factor values greater than 0.

7.2.3 *Persistence/Degradation.* In determining the surface water persistence factor for radionuclides, evaluate this factor based solely on half-life; do not include sorption to sediments in the evaluation as is done for

nonradioactive hazardous substances. Assign a persistence factor value from Table 4-10 (section 4.1.2.2.1.2) to each radionuclide based on half-life ($t_{1/2}$) calculated as follows:

$$t_{1/2} = \frac{1}{\frac{1}{r} + \frac{1}{v}}$$

Where:

r = Radioactive half-life.

V = Volatilization half-life.

If the volatilization half-life cannot be estimated for a radionuclide from available data, delete it from the equation. Select the portion of Table 4-10 to use in assigning the persistence factor value as specified in section 4.1.2.2.1.2.

At sites containing mixed radioactive and other hazardous substances, evaluate the persistence factor separately for each radionuclide and for each nonradioactive hazardous substance, even if the available data

indicate that they are combined chemically. Assign a persistence factor value to each radionuclide as specified in this section and to each nonradioactive hazardous substance as specified in section 4.1.2.2.1.2. When combined chemically, assign a single persistence factor value based on the higher of the two values assigned (individually) to the radioactive and nonradioactive components.

In determining the subsurface intrusion degradation factor for radionuclides, when evaluating this factor based solely on half-life, assign a degradation factor value from section 5.2.1.2.1.2 to each radionuclide based on half-life ($t_{1/2}$) calculated as follows:

$$t_{1/2} = \frac{1}{\frac{1}{r}}$$

Where:

r = Radioactive half-life.

If no radioactive half-life information is available for a radionuclide and the substance is not already assigned a value of 1, unless information indicates otherwise, assign a value of 1.

At sites containing mixed radioactive and other hazardous substances, evaluate the degradation factor separately for each radionuclide and for each nonradioactive hazardous substance, even if the available data indicate that they are combined chemically. Assign a degradation factor value to each radionuclide as specified in this section and to each nonradioactive hazardous substance as specified in section 5.2.1.2.1.2. If no radioactive half-life information is available for a radionuclide and the substance is not already assigned a value of 1, unless information indicates otherwise, assign a value of 1. Similarly, if no half-life information is available for a nonradioactive substance, and the substance is not already assigned a value of 1, unless information indicates otherwise, assign a value of 1. When combined chemically, assign a single persistence or degradation factor value based on the higher of the two

values assigned (individually) to the radioactive and nonradioactive components.

7.2.4 *Selection of substance potentially posing greatest hazard.* For the subsurface intrusion component of the soil exposure and subsurface intrusion pathway and each migration pathway (or threat, aquifer, or watershed, as appropriate), select the radioactive substance or nonradioactive hazardous substance that potentially poses the greatest hazard based on its toxicity factor value, combined with the applicable mobility, persistence, degradation and/or bioaccumulation (or ecosystem bioaccumulation) potential factor values. Combine these factor values as specified in sections 2 through 6. For the soil exposure component of the soil exposure and subsurface intrusion pathway, base the selection on the toxicity factor alone (see sections 2 and 5).

7.2.5 *Hazardous waste quantity.* To calculate the hazardous waste quantity factor value for sites containing radioactive substances, evaluate source hazardous waste quantity (see section 2.4.2.1) using only the following two measures in the following hierarchy (these measures are consistent with

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Tiers A and B for nonradioactive hazardous substances in sections 2.4.2.1.1 and 2.4.2.1.2):

- Radionuclide constituent quantity (Tier A).
- Radionuclide wastestream quantity (Tier B).

7.2.5.1 *Source hazardous waste quantity for radionuclides.* For each migration pathway, assign a source hazardous waste quantity value to each source having a containment factor value greater than 0 for the pathway being evaluated. For the soil exposure component of the soil exposure and subsurface intrusion pathway, assign a source hazardous waste quantity value to each area of observed contamination, as applicable to the threat being evaluated. For the subsurface intrusion component, assign a source hazardous waste quantity value to each regularly occupied structure located within areas of observed exposure or areas of subsurface

contamination. Allocate hazardous substances and hazardous wastestreams to specific sources (or areas of observed contamination, areas of observed exposure or areas of subsurface contamination) as specified in sections 2.4.2 and 5.2.0.

7.2.5.1.1 *Radionuclide constituent quantity (Tier A).* Evaluate radionuclide constituent quantity for each source (or area of observed contamination or area of observed exposure) based on the activity content of the radionuclides allocated to the source (or area of observed contamination or area of observed exposure) as follows:

- Estimate the net activity content (in curies) for the source (or area of observed contamination or area of observed exposure) based on:
 - Manifests, or
 - Either of the following equations, as applicable:

$$N = 9.1 \times 10^{-7} (V) \sum_{i=1}^n AC_i$$

Where:

- N = Estimated net activity content (in curies) for the source (or area of observed contamination or area of observed exposure).
- V = Total volume of material (in cubic yards) in a source (or area of observed contamination or area of observed exposure) containing radionuclides.

- AC_i = Activity concentration above the respective background concentration (in pCi/g) for each radionuclide i allocated to the source (or area of observed contamination or area of observed exposure).
- n = Number of radionuclides allocated to the source (or area of observed contamination or area of observed exposure) above the respective background concentrations.

or,

$$N = 3.8 \times 10^{-12} (V) \sum_{i=1}^n AC_i$$

Where:

- N = Estimated net activity content (in curies) for the source (or area of observed contamination or area of observed exposure).
- V = Total volume of material (in gallons) in a source (or area of observed contamination or area of observed exposure) containing radionuclides.
- AC_i = Activity concentration above the respective background concentration (in pCi/l) for each radionuclide i allocated to the source (or area of observed contamination or area of observed exposure).

- n = Number of radionuclides allocated to the source (or area of observed contamination or area of observed exposure) above the respective background concentrations.

- Estimate volume for the source (or volume for the area of observed contamination or area of observed exposure) based on records or measurements.
- For the soil exposure component of the soil exposure and subsurface intrusion pathway, in estimating the volume for areas of observed contamination, do not include more than the first 2 feet of depth, except:

for those types of areas of observed contamination listed in Tier C of Table 5-2 (section 5.1.1.2.2), include the entire depth, not just that within 2 feet of the surface.

—For the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, in estimating the volume for areas of observed exposure, only use the volume of air in the regularly occupied structures where observed exposure has been documented.

- Convert from curies of radionuclides to equivalent pounds of nonradioactive hazardous substances by multiplying the activity estimate for the source (or area of observed contamination or area of observed exposure) by 1,000.

- Assign this resulting product as the radionuclide constituent quantity value for the source (or area of observed contamination or area of observed exposure).

If the radionuclide constituent quantity for the source (or area of observed contamination or area of observed exposure) is adequately determined (that is, the total activity of all radionuclides in the source and releases from the source [or in the area of observed contamination or area of observed exposure] is known or is estimated with reasonable confidence), do not evaluate the radionuclide wastestream quantity measure in section 7.2.5.1.2. Instead, assign radionuclide wastestream quantity a value of 0 and proceed to section 7.2.5.1.3. If the radionuclide constituent quantity is not adequately determined, assign the source (or area of observed contamination or area of observed exposure) a value for radionuclide constituent quantity based on the available data and proceed to section 7.2.5.1.2.

7.2.5.1.2 Radionuclide wastestream quantity (Tier B). Evaluate radionuclide wastestream quantity for the source (or area of observed contamination, area of observed exposure, or area of subsurface contamination) based on the activity content of radionuclide wastestreams allocated to the source (or area of observed contamination, area of observed exposure, or area of subsurface contamination) as follows:

- Estimate the total volume (in cubic yards or in gallons) of wastestreams containing radionuclides allocated to the source (or area of observed contamination, area of observed exposure, or area of subsurface contamination).

- Divide the volume in cubic yards by 0.55 (or the volume in gallons by 110) to convert to the activity content expressed in terms of equivalent pounds of nonradioactive hazardous substances.

- Assign the resulting value as the radionuclide wastestream quantity value for the source (or area of observed contamination, area of observed exposure, or area of subsurface contamination).

- For the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, estimate the total wastestream volume for all regularly occupied structures that have a containment value >0 and that are located within areas of observed exposure with observed or inferred intrusion, and within areas of subsurface contamination. Calculate the volume of each regularly occupied structure based on actual data. If unknown, use a ceiling height of 8 feet.

7.2.5.1.3 Calculation of source hazardous waste quantity value for radionuclides. Select the higher of the values assigned to the source (or area of observed contamination, area of observed exposure, and/or area of subsurface contamination) for radionuclide constituent quantity and radionuclide wastestream quantity. Assign this value as the source hazardous waste quantity value for the source (or area of observed contamination, area of observed exposure, or area of subsurface contamination). Do not round to the nearest integer.

7.2.5.2 Calculation of hazardous waste quantity factor value for radionuclides. Sum the source hazardous waste quantity values assigned to all sources (or areas of observed contamination, areas of observed exposure, or areas of subsurface contamination) for the pathway being evaluated and round this sum to the nearest integer, except: if the sum is greater than 0, but less than 1, round it to 1. Based on this value, select a hazardous waste quantity factor value for this pathway from Table 2-6 (section 2.4.2.2).

For a migration pathway, if the radionuclide constituent quantity is adequately determined (see section 7.2.5.1.1) for all sources (or all portions of sources and releases remaining after a removal action), assign the value from Table 2-6 as the hazardous waste quantity factor value for the pathway. If the radionuclide constituent quantity is not adequately determined for one or more sources (or one or more portions of sources or releases remaining after a removal action), assign a factor value as follows:

- If any target for that migration pathway is subject to Level I or Level II concentrations (see section 7.3), assign either the value from Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway.

- If none of the targets for that pathway is subject to Level I or Level II concentrations, assign a factor value as follows:

—If there has been no removal action, assign either the value from Table 2-6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value for that pathway.

—If there has been a removal action:

- Determine values from Table 2-6 with and without consideration of the removal action.

- If the value that would be assigned from Table 2-6 without consideration of the removal action would be 100 or greater, assign either the value from Table 2-6 with consideration of the removal action or a value of 100, whichever is greater, as the hazardous waste quantity factor value for the pathway.
- If the value that would be assigned from Table 2-6 without consideration of the removal action would be less than 100, assign a value of 10 as the hazardous waste quantity factor value for the pathway.

For the soil exposure component of the soil exposure and subsurface intrusion pathway, if the radionuclide constituent quantity is adequately determined for all areas of observed contamination, assign the value from Table 2-6 as the hazardous waste quantity factor value. If the radionuclide constituent quantity is not adequately determined for one or more areas of observed contamination, assign either the value from Table 2-6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value.

For the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, if the radionuclide constituent quantity is adequately determined for all areas of observed exposure, assign the value from Table 2-6 as the hazardous waste quantity factor value. If the radionuclide constituent quantity is not adequately determined for one or more areas of observed exposure, assign either the value from Table 2-6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value.

7.2.5.3 Calculation of hazardous waste quantity factor value for sites containing mixed radioactive and other hazardous substances. For each source (or area of observed contamination, area of observed exposure, or area of subsurface contamination) containing mixed radioactive and other hazardous substances, calculate two source hazardous waste quantity values—one based on radionuclides as specified in sections 7.2.5.1 through 7.2.5.1.3 and the other based on the nonradioactive hazardous substances as specified in sections 2.4.2.1 through 2.4.2.1.5, and sections 5.1.1.2.2, 5.1.2.2.2 and 5.2.1.2.2 (that is, determine each value as if the other type of substance was not present). Sum the two values to determine a combined source hazardous waste quantity value for the source (or area of observed contamination, area of observed exposure, or area of subsurface contamination). Do not round this value to the nearest integer.

Use this combined source hazardous waste quantity value to calculate the hazardous waste quantity factor value for the pathway as specified in section 2.4.2.2, except: if either the hazardous constituent quantity or the radionuclide constituent quantity, or both, are not adequately determined for one or

more sources (or one or more portions of sources or releases remaining after a removal action) or for one or more areas of observed contamination or areas of observed exposure, as applicable, assign the value from Table 2-6 or the default value applicable for the pathway, whichever is greater, as the hazardous waste quantity factor value for the pathway.

7.3 Targets. For radioactive substances, evaluate the targets factor category as specified in section 2.5 and sections 3 through 6, except: Establish Level I and Level II concentrations at sampling locations as specified in sections 7.3.1 and 7.3.2 and establish weighting factors for populations associated with an area of subsurface contamination in the subsurface intrusion component of the soil exposure and subsurface intrusion pathway as specified in section 7.3.3.

For all pathways (components and threats), use the same target distance limits for sites containing radioactive substances as is specified in sections 3 through 6 for sites containing nonradioactive hazardous substances. At sites containing mixed radioactive and other hazardous substances, include all sources (or areas of observed contamination, areas of observed exposure, or areas of subsurface contamination) at the site in identifying the applicable targets for the pathway.

7.3.1 Level of contamination at a sampling location. Determine whether Level I or Level II concentrations apply at a sampling location (and thus to the associated targets) as follows:

- Select the benchmarks from section 7.3.2 applicable to the pathway (or component or threat) being evaluated.
- Compare the concentrations of radionuclides in the sample (or comparable samples) to their benchmark concentrations for the pathway (or component or threat) as specified in section 7.3.2. Treat comparable samples as specified in section 2.5.1.
- Determine which level applies based on this comparison.
- If none of the radionuclides eligible to be evaluated for the sampling location have an applicable benchmark, assign Level II to the actual contamination at that sampling location for the pathway (or component or threat).
- In making the comparison, consider only those samples, and only those radionuclides in the sample, that meet the criteria for an observed release (or observed contamination or observed exposure) for the pathway, except: Tissue samples from aquatic human food chain organisms may also be used for the human food chain threat of the surface water pathway as specified in sections 4.1.3.3 and 4.2.3.3.

7.3.2 Comparison to benchmarks. Use the following media specific benchmarks (expressed in activity units, for example, pCi/l

for water, pCi/kg for soil and for aquatic human food chain organisms, and pCi/m³ for air) for making the comparisons for the indicated pathway (or threat):

- Maximum Contaminant Levels (MCLs)—ground water migration pathway and drinking water threat in surface water migration pathway.

- Uranium Mill Tailings Radiation Control Act (UMTRCA) standards—soil exposure component of the soil exposure and subsurface intrusion pathway only.

- Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁶ individual cancer risk for inhalation exposures (air migration pathway and subsurface intrusion component of the soil exposure and subsurface intrusion pathway) or for oral exposures (ground water migration pathway; drinking water or human food chain threats in surface water migration pathway; and soil exposure and subsurface intrusion pathway).

—For the soil exposure component of the soil exposure and subsurface intrusion pathway, include two screening concentrations for cancer—one for ingestion of surface materials and one for external radiation exposures from gamma-emitting radionuclides in surface materials.

Select the benchmark(s) applicable to the pathway (component or threat) being evaluated. Compare the concentration of each radionuclide from the sampling location to its benchmark concentration(s) for that pathway (component or threat). Use only those samples and only those radionuclides in the sample that meet the criteria for an observed release (or observed contamination or observed exposure) for the pathway, except: Tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any applicable radionuclide from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (component or threat). If more than one benchmark applies to the radionuclide, assign Level I if the radionuclide concentration equals or exceeds the lowest applicable benchmark concentration. In addition, for the soil exposure and subsurface intrusion pathway, assign Level I concentrations at the sampling location if measured gamma radiation exposure rates equal or exceed 2 times the background level (see section 7.1.1).

If no radionuclide individually equals or exceeds its benchmark concentration, but more than one radionuclide either meets the criteria for an observed release (or observed contamination or observed exposure) for the sample or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate a value for index I for these radionuclides as specified in section 2.5.2. If I

equals or exceeds 1, assign Level I to the sampling location. If I is less than 1, assign Level II.

At sites containing mixed radioactive and other hazardous substances, establish the level of contamination for each sampling location considering radioactive substances and nonradioactive hazardous substances separately. Compare the concentration of each radionuclide and each nonradioactive hazardous substance from the sampling location to its respective benchmark concentration(s). Use only those samples and only those substances in the sample that meet the criteria for an observed release (or observed contamination or observed exposure) for the pathway except: Tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of one or more applicable radionuclides or other hazardous substances from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I concentrations. If more than one benchmark applies to a radionuclide or other hazardous substance, assign Level I if the concentration of the radionuclide or other hazardous substance equals or exceeds its lowest applicable benchmark concentration.

If no radionuclide or other hazardous substance individually exceed a benchmark concentration, but more than one radionuclide or other hazardous substance either meets the criteria for an observed release (or observed contamination or observed exposure) for the sample or is eligible to be evaluated for a tissue sample, calculate an index I for both types of substances as specified in section 2.5.2. Sum the index I values for the two types of substances. If the value, individually or combined, equals or exceeds 1, assign Level I to the sample location. If it is less than 1, calculate an index J for the nonradioactive hazardous substances as specified in section 2.5.2. If J equals or exceeds 1, assign Level I to the sampling location. If J is less than 1, assign Level II.

7.3.3 Weighting of targets within an area of subsurface contamination. For the subsurface intrusion component of the soil exposure and subsurface intrusion pathway, assign a weighting factor as specified in section 5.2.1.3.2.3 except when a structure in an area of subsurface contamination is delineated or inferred to be delineated by gamma radiation exposure rates meeting observed release criteria with a depth to contamination of 2 feet or less. For those populations residing, working, or attending school or day care in a structure delineated or inferred to be delineated by gamma radiation exposure rates meeting observed release criteria with

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a depth to contamination of 2 feet or less, assign a weighting factor of 0.9.

[55 FR 51583, Dec. 14, 1990, as amended at 82 FR 2779, Jan. 9, 2017; 83 FR 38037, Aug. 3, 2018]

APPENDIX B TO PART 300—NATIONAL PRIORITIES LIST

TABLE 1—GENERAL SUPERFUND SECTION

State	Site name	City/County	Notes(a)
AK	Salt Chuck Mine	Outer Ketchikan County.	
AL	Alabama Plating Company, Inc.	Vincent.	
AL	American Brass	Headland.	
AL	Ciba-Geigy Corp. (McIntosh Plant)	McIntosh.	
AL	Interstate Lead Co. (ILCO)	Leeds.	
AL	Olin Corp. (McIntosh Plant)	McIntosh.	
AL	Stauffer Chemical Co. (Cold Creek Plant)	Bucks.	
AL	Stauffer Chemical Co. (LeMoyne Plant)	Axis.	
AL	T.H. Agriculture & Nutrition (Montgomery)	Montgomery.	
AL	Triana/Tennessee River	Limestone/Morgan.	
AR	Arkwood, Inc.	Omaha.	
AR	Cedar Chemical Corporation	West Helena	S
AR	MacMillan Ring Free Oil	Norphlet.	
AR	Mid-South Wood Products	Mena.	
AR	Midland Products	Ola/Birta.	
AR	Mountain Pine Pressure Treating, Inc.	Plainview.	
AR	Ouachita Nevada Wood Treater	Reader.	
AR	Popile, Inc.	El Dorado.	
AR	Vertac, Inc.	Jacksonville.	
AZ	Apache Powder Co.	St. David.	
AZ	Hassayampa Landfill	Hassayampa.	
AZ	Indian Bend Wash Area	Scottsdale/Tempe/Phoenix	P
AZ	Iron King Mine—Humboldt Smelter	Dewey-Humboldt.	
AZ	Litchfield Airport Area	Goodyear/Avondale.	
AZ	Motorola, Inc. (52nd Street Plant)	Phoenix.	
AZ	Tucson International Airport Area	Tucson.	
CA	Advanced Micro Devices, Inc.	Sunnyvale.	
CA	Advanced Micro Devices, Inc. (Bldg. 915)	Sunnyvale.	
CA	Aerojet General Corp.	Rancho Cordova.	
CA	Alark Hard Chrome	Riverside.	
CA	AMCO Chemical	Oakland.	
CA	Applied Materials	Santa Clara.	
CA	Argonaut Mine	Jackson.	
CA	Atlas Asbestos Mine	Fresno County.	
CA	Beckman Instruments	Porterville	P
CA	Blue Ledge Mine	Rogue River—Siskiyou National Forest.	
CA	Brown & Bryant, Inc (Arvin Plant)	Arvin.	
CA	CTS Printex, Inc.	Mountain View.	
CA	Casmalia Resources	Casmalia.	
CA	Coast Wood Preserving	Ukiah.	
CA	Copper Bluff Mine	Hoopa.	
CA	Cooper Drum Company	South Gate.	
CA	Crazy Horse Sanitary Landfill	Salinas.	
CA	Del Amo	Los Angeles.	
CA	Fairchild Semiconductor Corp. (Mt View)	Mountain View.	
CA	Fairchild Semiconductor Corp. (S San Jose)	South San Jose.	
CA	Fresno Municipal Sanitary Landfill	Fresno.	
CA	Frontier Fertilizer	Davis.	
CA	Halaco Engineering Company	Oxnard.	
CA	Hewlett-Packard (620-640 Page Mill Road)	Palo Alto.	
CA	Industrial Waste Processing	Fresno.	
CA	Intel Corp. (Mountain View Plant)	Mountain View.	
CA	Intel Corp. (Santa Clara III)	Santa Clara.	
CA	Intel Magnetics	Santa Clara.	
CA	Intersil Inc./Siemens Components	Cupertino.	
CA	Iron Mountain Mine	Redding.	
CA	J.H. Baxter & Co	Weed.	
CA	Jasco Chemical Corp	Mountain View.	
CA	Jervis B. Webb	South Gate.	
CA	Klau/Buena Vista Mine	San Luis Obispo County.	
CA	Koppers Co., Inc. (Oroville Plant)	Oroville.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
CA	Lava Cap Mine	Nevada City.	
CA	Leviathan Mine	Alpine County..	
CA	Lorentz Barrel & Drum Co	San Jose.	
CA	MGM Brakes	Cloverdale.	
CA	McColl	Fullerton.	
CA	McCormick & Baxter Creosoting Co	Stockton.	
CA	Modesto Ground Water Contamination	Modesto.	
CA	Monolithic Memories	Sunnyvale.	
CA	Montrose Chemical Corp	Torrance.	
CA	National Semiconductor Corp	Santa Clara.	
CA	New Idria Mercury Mine	Idria.	
CA	Newmark Ground Water Contamination	San Bernardino.	
CA	Omega Chemical Corporation	Whittier.	
CA	Operating Industries, Inc., Landfill	Monterey Park.	
CA	Pacific Coast Pipe Lines	Fillmore	P
CA	Pemaco Maywood	Maywood.	
CA	Purity Oil Sales, Inc	Malaga.	
CA	Raytheon Corp	Mountain View.	
CA	Rockets, Fireworks, and Flares (RFF)	Rialto.	
CA	San Fernando Valley (Area 1)	Los Angeles.	
CA	San Fernando Valley (Area 2)	Los Angeles/Glendale.	
CA	San Fernando Valley (Area 3)	Glendale.	
CA	San Fernando Valley (Area 4)	Los Angeles.	
CA	San Gabriel Valley (Area 1)	El Monte.	
CA	San Gabriel Valley (Area 2)	Baldwin Park Area.	
CA	San Gabriel Valley (Area 3)	Alhambra.	
CA	San Gabriel Valley (Area 4)	La Puente.	
CA	Selma Treating Co	Selma.	
CA	South Bay Asbestos Area	Alviso.	
CA	Southern Avenue Industrial Area	South Gate.	
CA	Spectra-Physics, Inc	Mountain View.	
CA	Stringfellow	Glen Avon Heights	S
CA	Sulphur Bank Mercury Mine	Clear Lake.	
CA	Synertek, Inc. (Building 1)	Santa Clara.	
CA	TRW Microwave, Inc (Building 825)	Sunnyvale.	
CA	Teledyne Semiconductor	Mountain View.	
CA	United Heckathorn Co	Richmond.	
CA	Valley Wood Preserving, Inc	Turlock.	
CA	Waste Disposal, Inc	Santa Fe Springs.	
CA	Watkins-Johnson Co. (Stewart Division)	Scotts Valley.	
CA	Westinghouse Electric Corp. (Sunnyvale)	Sunnyvale.	
CO	Bonita Peak Mining District	San Juan County.	
CO	Broderick Wood Products	Denver.	
CO	California Gulch	Leadville	P
CO	Captain Jack Mill	Ward.	
CO	Central City-Clear Creek	Idaho Springs.	
CO	Chemical Sales Co	Denver.	
CO	Colorado Smelter	Pueblo.	
CO	Denver Radium Site	Denver	P
CO	Eagle Mine	Mintum/Redcliff.	
CO	Lincoln Park	Canon City.	
CO	Lowry Landfill	Arapahoe County.	
CO	Marshall Landfill	Boulder County	S
CO	Nelson Tunnel/Commodore Waste Rock	Creede.	
CO	Standard Mine	Gunnison National Forest.	
CO	Summitville Mine	Rio Grande County.	
CO	Ureavan Uranium Project (Union Carbide)	(former town of) Ureavan	P*
CO	Vasquez Boulevard and I-70	Denver.	
CT	Barkhamsted-New Hartford Landfill	Barkhamsted.	
CT	Beacon Heights Landfill	Beacon Falls.	
CT	Durham Meadows	Durham.	
CT	Gallup's Quarry	Plainfield.	
CT	Kellogg-Deering Well Field	Norwalk.	
CT	Laurel Park, Inc	Naugatuck Borough	S
CT	Linemaster Switch Corp	Woodstock.	
CT	Precision Plating Corp	Vernon.	
CT	Raymark Industries, Inc	Stratford	A
CT	Scovill Industrial Landfill	Waterbury.	
CT	Solvents Recovery Service New England	Southington.	
CT	Yaworski Waste Lagoon	Canterbury.	
DE	Army Creek Landfill	New Castle County.	
DE	Chem-Solv, Inc	Cheswold.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
DE	Delaware City PVC Plant	Delaware City.	
DE	Delaware Sand & Gravel Landfill	New Castle County.	
DE	Dover Gas Light Co	Dover.	
DE	E.I.Du Pont de Nemours (Newport Landfill)	Newport.	
DE	Halby Chemical Co	New Castle.	
DE	Harvey & Knott Drum, Inc	Kirkwood.	
DE	Hockessin Groundwater	Hockessin.	
DE	Koppers Co., Inc. (Newport Plant)	Newport.	
DE	NCR Corp. (Millsboro Plant)	Millsboro.	
DE	Newark South Ground Water Plume	Newark.	
DE	Standard Chlorine of Delaware, Inc	Delaware City.	
DE	Tybouts Corner Landfill	New Castle County	S
FL	Agrico Chemical Co	Pensacola.	
FL	Airco Plating Co	Miami.	
FL	Alaric Area Ground Water Plume	Tampa.	
FL	American Creosote Works (Pensacola Pit)	Pensacola.	
FL	Anodyne, Inc	North Miami Beach.	
FL	Arka Terra Property	Thonotosassa..	
FL	Cabot/Koppers	Gainesville.	
FL	Chevron Chemical Co. (Ortho Division)	Orlando.	
FL	City Industries, Inc	Orlando.	
FL	Continental Cleaners	Miami.	
FL	Escambia Wood—Pensacola	Pensacola.	
FL	Fairfax St. Wood Treaters	Jacksonville.	
FL	Flash Cleaners	Pompano Beach.	
FL	Florida Petroleum Reprocessors	Fort Lauderdale.	
FL	Florida Steel Corp	Indiantown.	
FL	General Dynamics Longwood	Longwood..	
FL	Harris Corp. (Palm Bay Plant)	Palm Bay.	
FL	Heiena Chemical Co. (Tampa Plant)	Tampa.	
FL	Hollingsworth Solderless Terminal	Fort Lauderdale.	
FL	JJ Seifert Machine	Ruskin.	
FL	Kerr-McGee Chemical Corp-Jacksonville	Jacksonville.	
FL	Landia Chemical Company	Lakeland.	
FL	MRI Corp (Tampa)	Tampa.	
FL	Madison County Sanitary Landfill	Madison.	
FL	Miami Drum Services	Miami.	
FL	Peak Oil Co./Bay Drum Co	Tampa.	
FL	Pepper Steel & Alloys, Inc	Medley.	
FL	Petroleum Products Corp	Pembroke Park.	
FL	Pickettville Road Landfill	Jacksonville.	
FL	Piper Aircraft/Vero Beach Water & Sewer	Vero Beach.	
FL	Post and Lumber Preserving Co. Inc	Quincy.	
FL	Raleigh Street Dump	Tampa..	
FL	Reeves Southeast Galvanizing Corp	Tampa.	
FL	Sanford Dry Cleaners	Sanford..	
FL	Sapp Battery Salvage	Coltondale.	
FL	Sherwood Medical Industries	Deland.	
FL	Solitron Microwave	Port Salerno.	
FL	Southern Solvents, Inc	Tampa.	
FL	Stauffer Chemical Co. (Tampa)	Tampa.	
FL	Stauffer Chemical Co. (Tarpon Springs)	Tarpon Springs.	
FL	Sydney Mine Sludge Ponds	Brandon.	
FL	Taylor Road Landfill	Seffner.	
FL	Tower Chemical Co	Clemont.	
FL	Trans Circuit, Inc.	Lake Park.	
FL	United Metals, Inc	Marianna..	
FL	Wingate Road Municipal Incinerator Dump	Fort Lauderdale.	
FL	Zellwood Ground Water Contamination	Zellwood.	
GA	Alternate Energy Resources	Augusta.	
GA	Armstrong World Industries	Macon.	
GA	Brunswick Wood Preserving	Brunswick.	
GA	Camilla Wood Preserving Company	Camilla.	
GA	Diamond Shamrock Corp. Landfill	Cedartown.	
GA	Firestone Tire & Rubber Co. (Albany Plant)	Albany.	
GA	Hercules 009 Landfill	Brunswick.	
GA	LCP Chemicals Georgia	Brunswick	S
GA	Macon Naval Ordnance Plant	Macon.	
GA	Marzone Inc./Chevron Chemical Co	Tifton.	
GA	Mathis Brothers Landfill	Kensington.	
GA	Peach Orchard Road PCE Ground Water Plume	Augusta.	
GA	T.H. Agriculture & Nutrition (Albany)	Albany.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
GA	Woolfolk Chemical Works, Inc	Fort Valley.	
GU	Ordot Landfill	Guam	S
HI	Del Monte Corp. (Oahu Plantation)	Honolulu County	P
IA	Des Moines TCE	Des Moines.	
IA	Electro-Coatings, Inc	Cedar Rapids.	
IA	Fairfield Coal Gasification Plant	Fairfield.	
IA	Lawrence Todtz Farm	Camanche.	
IA	Mason City Coal Gasification Plant	Mason City.	
IA	Midwest Manufacturing/North Farm	Kellogg.	
IA	PCE Former Dry Cleaner	Atlantic.	
IA	Peoples Natural Gas Co	Dubuque.	
IA	Railroad Avenue Groundwater Contamination	Des Moines.	
IA	Shaw Avenue Dump	Charles City.	
IA	Vogel Paint & Wax Co	Orange City.	
ID	Bunker Hill Mining & Metallurgical	Smetherville.	
ID	Eastern Michaud Flats Contamination	Pocatello.	
ID	Kerr-McGee Chemical Corp. (Soda Springs)	Soda Springs.	
ID	Monsanto Chemical Co. (Soda Springs)	Soda Springs.	
IL	Acme Solvent Reclaiming (Morristown Plant)	Morristown.	
IL	Adams County Quincy Landfills 2&3	Quincy.	
IL	Amoco Chemicals (Joliet Landfill)	Joliet.	
IL	ASARCO Taylor Springs	Taylor Springs.	
IL	Bautsch-Gray Mine	Galena.	
IL	Beloit Corp	Rockton	*P
IL	Byron Salvage Yard	Byron.	
IL	Central Illinois Public Service Co	Taylorville.	
IL	Chemetco	Madison County.	
IL	Cross Brothers Pail Recycling (Pembroke)	Pembroke Township.	
IL	DePue/New Jersey Zinc/Mobil ChemCorp	DePue.	
IL	DuPage County Landfill/Blackwell Forest	Warrenville.	
IL	Eagle Zinc Co Div T L Diamond	Hillsboro.	
IL	Estech General Chemical Company	Calumet City.	
IL	Galesburg/Koppers Co	Galesburg.	
IL	H.O.D. Landfill	Antioch.	
IL	Hegeler Zinc	Danville.	
IL	Indian Refinery—Texaco Lawrenceville	Lawrenceville.	
IL	Interstate Pollution Control, Inc	Rockford.	
IL	Jennison-Wright Corporation	Granite City.	
IL	Johns-Marville Corp	Waukegan.	
IL	Kerr-McGee (Kress Creek/W Branch DuPage)	DuPage County.	
IL	Kerr-McGee (Residential Areas)	West Chicago/DuPage County.	
IL	Lake Calumet Cluster	Chicago.	
IL	LaSalle Electric Utilities	LaSalle.	
IL	Lenz Oil Service, Inc	Lemont.	
IL	Matthiessen and Hegeler Zinc Company	LaSalle.	
IL	MIG/Dewane Landfill	Belvidere.	
IL	NL Industries/Taracorp Lead Smelter	Granite City.	
IL	Old American Zinc Plant	Fairmont City.	
IL	Ottawa Radiation Areas	Ottawa.	
IL	Outboard Marine Corp	Waukegan	S
IL	Pagel's Pit	Rockford.	
IL	Parsons Casket Hardware Co	Belvidere.	
IL	Sandoval Zinc Company	Sandoval.	
IL	Southeast Rockford Gd Wtr Contamination	Rockford.	
IL	Tri-County Landfill/Waste Mgmt Illinois	South Elgin.	
IL	Veisicol Chemical Corp. (Illinois)	Marshall.	
IL	Wauconda Sand & Gravel	Wauconda.	
IL	Woodstock Municipal Landfill	Woodstock.	
IL	Yeoman Creek Landfill	Waukegan.	
IN	American Chemical Service, Inc	Griffith.	
IN	Beck's Lake	South Bend.	
IN	Bennett Stone Quarry	Bloomington.	
IN	Broadway Street Corridor Groundwater Contamination	Anderson.	
IN	Cam-Or Inc	Westville.	
IN	Cliff Drive Groundwater Contamination	Logansport.	
IN	Conrail Rail Yard (Elkhart)	Elkhart.	
IN	Continental Steel Corp	Kokomo.	
IN	Douglass Road/Uniroyal, Inc., Landfill	Mishawaka.	
IN	Elm Street Ground Water Contamination	Terre Haute.	
IN	Envirochem Corp	Zionsville.	
IN	Fisher-Calo	LaPorte.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
IN	Fort Wayne Reduction Dump	Fort Wayne.	
IN	Franklin Street Groundwater Contamination	Spencer.	
IN	Galen Myers Dump/Drum Salvage	Osceola.	
IN	Garden City Ground Water Plume	Garden City.	
IN	Gary Development Company	Gary.	
IN	Himco Dump	Elkhart.	
IN	Jacobsville Neighborhood Soil Contamination	Evansville.	
IN	Keystone Corridor Ground Water Contamination	Indianapolis.	
IN	Kokomo Contaminated Ground Water Plume	Kokomo.	
IN	Lake Sandy Jo (M&M Landfill)	Gary.	
IN	Lakeland Disposal Service, Inc	Claypool.	
IN	Lane Street Ground Water Contamination	Elkhart.	
IN	Lemon Lane Landfill	Bloomington.	
IN	Lusher Street Ground Water Contamination	Elkhart.	
IN	MIDCO I	Gary.	
IN	MIDCO II	Gary.	
IN	Main Street Well Field	Elkhart.	
IN	Marion (Bragg) Dump	Marion.	
IN	Neal's Landfill (Bloomington)	Bloomington.	
IN	Ninth Avenue Dump	Gary.	
IN	North Shore Drive	Elkhart.	
IN	Northside Sanitary Landfill, Inc	Zionsville.	
IN	Pike and Mulberry Streets PCE Plume	Martinsville.	
IN	Prestolite Battery Division	Vincennes.	
IN	Reilly Tar & Chemical (Indianapolis Plant)	Indianapolis.	
IN	Seymour Recycling Corp	Seymour	S
IN	Tippecanoe Sanitary Landfill, Inc	Lafayette.	
IN	U.S. Smelter and Lead Refinery, Inc	East Chicago..	
IN	Wayne Waste Oil	Columbia City.	
KS	57th and North Broadway Streets Site	Wichita Heights.	
KS	Ace Services	Colby.	
KS	Chemical Commodities, Inc	Olathe.	
KS	Cherokee County	Cherokee County.	
KS	Doepke Disposal (Holliday)	Johnson County.	
KS	Former United Zinc & Associated Smelters	Iola.	
KS	Obee Road	Hutchinson.	
KS	Pester Refinery Co	El Dorado.	
KS	Plating, Inc	Great Bend.	
KS	Strother Field Industrial Park	Cowley County.	
KS	Wright Ground Water Contamination	Wright.	
KY	Airco	Calvert City.	
KY	B.F. Goodrich	Calvert City.	
KY	Brantley Landfill	Island.	
KY	Caldwell Lace Leather Co., Inc	Auburn.	
KY	Distler Brickyard	West Point.	
KY	Distler Farm	Jefferson County.	
KY	Fort Hartford Coal Co. Stone Quarry	Olaton.	
KY	Green River Disposal, Inc	Maceo.	
KY	Maxey Flats Nuclear Disposal	Hillsboro.	
KY	National Electric Coil/Cooper Industries	Dayton.	
KY	Smith's Farm	Brooks.	
KY	Tri-City Disposal Co	Shepherdsville.	
LA	Agriculture Street Landfill	New Orleans	P
LA	American Creosote DeRidder	DeRidder.	
LA	American Creosote Works, Inc (Winnfield)	Winnfield.	
LA	Bayou Bonfouca	Slidell.	
LA	Colonial Creosote	Bogalusa.	
LA	Combustion, Inc	Denham Springs.	
LA	Delta Shipyard	Houma.	
LA	EVR-Wood Treating/Evangeline Refining Company	Jennings.	
LA	Madisonville Creosote Works	Madisonville.	
LA	Marion Pressure Treating	Marion.	
LA	Petro-Processors of Louisiana Inc	Scotlandville.	
LA	SBA Shipyard	Jennings.	
MA	Atlas Tack Corp	Fairhaven.	
MA	Baird & McGuire	Holbrook.	
MA	BJAT LLC	Franklin.	
MA	Blackburn & Union Privileges	Walpole.	
MA	Charles-George Reclamation Landfill	Tyngsborough.	
MA	Creese & Cook Tannery (Former)	Danvers.	
MA	Groveland Wells	Groveland.	
MA	Haverhill Municipal Landfill	Haverhill.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
MA	Hocomonco Pond	Westborough.	
MA	Industri-Plex	Woburn.	
MA	Iron Horse Park	Billerica.	
MA	Microfab, Inc. (Former)	Amesbury.	
MA	New Bedford Site	New Bedford	S
MA	Nuclear Metals, Inc	Concord..	
MA	Nyanza Chemical Waste Dump	Ashland.	
MA	Oiln Chemical	Wilmington.	
MA	PSC Resources	Palmer.	
MA	Re-Solve, Inc	Dartmouth.	
MA	Rose Disposal Pit	Lanesboro.	
MA	Silresim Chemical Corp	Lowell.	
MA	Sullivan's Lodge	New Bedford.	
MA	Sutton Brook Disposal Area	Tewksbury..	
MA	W.R. Grace & Co Inc (Acton Plant)	Acton.	
MA	Walton & Lonsbury Inc.	Attleboro.	
MA	Wells G&H	Woburn.	
MD	Bush Valley Landfill	Abingdon.	
MD	Central Chemical	Hagerstown.	
MD	Dwyer Property Ground Water Plume	Elkton.	
MD	Kane & Lombard Street Drums	Baltimore.	
MD	Limestone Road	Cumberland.	
MD	Ordnance Products, Inc.	Cecil County.	
MD	Sand, Gravel & Stone	Elkton.	
MD	Sauer Dump	Dundalk.	
MD	Spectron, Inc	Elkton.	
MD	Woodlawn County Landfill	Woodlawn.	
ME	Callahan Mine	Brooksville.	
ME	Eastern Surplus	Meddybemps.	
ME	Eastland Woolen Mill	Corinna	P
ME	Keddy Mill	Windham.	
ME	Leeds Metal	Leeds.	
ME	McKin Co	Gray.	
ME	Saco Municipal Landfill	Saco.	
ME	West Site/Hows Corners	Plymouth.	
ME	Winthrop Landfill	Winthrop.	
MI	Adam's Plating	Lansing.	
MI	Aircraft Components (D & L Sales)	Benton Harbor	A
MI	Albion-Sheridan Township Landfill	Albion.	
MI	Allied Paper/Portage Ck/Kalamazoo River	Kalamazoo.	
MI	American Anodco, Inc	Ionia.	
MI	Auto Ion Chemicals, Inc	Kalamazoo.	
MI	Barrels, Inc	Lansing.	
MI	Bendix Corp./Allied Automotive	St. Joseph.	
MI	Bofors Nobel, Inc	Muskegon.	
MI	Butterworth #2 Landfill	Grand Rapids.	
MI	Cannelton Industries, Inc	Saulte Saint Marie.	
MI	Chem Central	Wyoming Township.	
MI	Clare Water Supply	Clare.	
MI	DSC McLouth Steel Gibraltar Plant	Gibraltar.	
MI	Duell & Gardner Landfill	Dalton Township.	
MI	Electrovoice	Buchanan.	
MI	Forest Waste Products	Otisville.	
MI	G&H Landfill	Utica.	
MI	Grand Traverse Overall Supply Co	Greilickville.	
MI	Gratiot County Golf Course	St. Louis.	
MI	Gratiot County Landfill	St. Louis	S
MI	H. Brown Co., Inc	Grand Rapids.	
MI	Hedblum Industries	Oscoda.	
MI	Hi-Mill Manufacturing Co	Highlan.	
MI	Ionia City Landfill	Ionia.	
MI	J & L Landfill	Rochester Hills.	
MI	K&L Avenue Landfill	Oshtemo Township.	
MI	Keydon Corp	Muskegon.	
MI	Kentwood Landfill	Kentwood.	
MI	Kysor Industrial Corp	Cadillac.	
MI	Liquid Disposal, Inc	Utica.	
MI	McGraw Edison Corp	Albion.	
MI	McLouth Steel Corp	Trenton.	
MI	Metamora Landfill	Metamora.	
MI	Michigan Disposal (Cork Street Landfill)	Kalamazoo.	
MI	Motor Wheel	Lansing	P

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
MI	Muskegon Chemical Co	Whitehall.	
MI	North Bronson Industrial Area	Bronson.	
MI	Northemaire Plating	Cadillac.	
MI	Organic Chemicals, Inc	Grandville.	
MI	Ott/Story/Cordova Chemical Co	Dallon Township.	
MI	Packaging Corp. of America	Filer City.	
MI	Parsons Chemical Works, Inc	Grand Ledge.	
MI	Peerless Plating Co	Muskegon.	
MI	Petoskey Municipal Well Field	Petoskey.	
MI	Rasmussen's Dump	Green Oak Township.	
MI	Rockwell International Corp. (Allegan)	Allegan.	
MI	Rose Township Dump	Rose Township.	
MI	Roto-Finish Co., Inc	Kalamazoo.	
MI	SCA Independent Landfill	Muskegon Heights.	
MI	Shiawassee River	Howell.	
MI	South Macomb Disposal (Landfills 9 & 9A)	Macomb Township.	
MI	Southwest Ottawa County Landfill	Park Township.	
MI	Sparta Landfill	Sparta Township.	
MI	Spartan Chemical Co	Wyoming.	
MI	Springfield Township Dump	Davisburg.	
MI	State Disposal Landfill, Inc	Grand Rapids.	
MI	Sturgis Municipal Wells	Sturgis.	
MI	Tar Lake	Antrim	P
MI	Ten-Mile Drain	St. Clair Shores..	
MI	Thermo-Chem, Inc	Muskegon.	
MI	Torch Lake	Houghton	P
MI	U.S. Aviox	Howard Township.	
MI	Velsicol Chemical Corp. (Michigan)	St. Louis.	
MI	Verona Well Field	Battle Creek.	
MI	Wash King Laundry	Pleasant Plains Twp.	
MN	Arrowhead Refinery Co	Hermantown.	
MN	Baytown Township Ground Water Plume	Baytown Township.	
MN	Burlington Northern (Brainerd/Baxter)	Brainerd/Baxter.	
MN	FMC Corp. (Fridley Plant)	Fridley.	
MN	Freeway Sanitary Landfill	Burnsville.	
MN	Fridley Commons Park Well Field	Fridley.	
MN	General Mills/Henkel Corp	Minneapolis.	
MN	Joslyn Manufacturing and Supply Co	Brooklyn Center	P
MN	Koppers Coke	St. Paul.	
MN	Kurt Manufacturing Co	Fridley.	
MN	Lehillier/Mankato Site	Lehillier/Mankato.	
MN	Long Prairie Ground Water Contamination	Long Prairie.	
MN	MacGillis & Gibbs/Bell Lumber & Pole C	New Brighton.	
MN	Oakdale Dump	Oakdale.	
MN	Perham Arsenic Site	Perham.	
MN	Reilly Tar&Chem (St. Louis Park Plant)	St. Louis Park	S
MN	Ritari Post & Pole	Sebek.	
MN	South Andover Site	Andover	P
MN	South Minneapolis Residential Soil Contamination	Minneapolis.	
MN	Spring Park Municipal Well Field	Spring Park.	
MN	St. Louis River Site	St. Louis County.	
MN	St. Regis Paper Co	Cass Lake.	
MN	Waite Park Wells	Waite Park.	
MO	Annapolis Lead Mine	Annapolis.	
MO	Armour Road	North Kansas City.	
MO	Bee Cee Manufacturing Co	Malden.	
MO	Big River Mine Tailings/St. Joe Minerals	Desloge.	
MO	Compass Plaza Well TCE	Rogersville.	
MO	Conservation Chemical Co	Kansas City.	
MO	Ellisville Site	Ellisville	P
MO	Fulbright Landfill	Springfield.	
MO	Lee Chemical	Libert.	
MO	Madison County Mines	Fredericktown.	
MO	Minker/Stout/Romaine Creek	Imperial.	
MO	Missouri Electric Works	Cape Girardeau.	
MO	Newton County Mine Tailings	Newton County.	
MO	Newton County Wells	Newton County.	
MO	Oak Grove Village Well	Oak Grove Village.	
MO	Oronogo-Duenweg Mining Belt	Jasper County.	
MO	Pools Prairie	Neosho.	
MO	Quality Plating	Sikeston.	
MO	Riverfront	New Haven.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
MO	Solid State Circuits, Inc	Republic.	
MO	Southwest Jefferson County Mining	Jefferson County..	
MO	Sporlan Valve Plant #1	Washington.	
MO	St. Louis Airport/HIS/Futura Coatings Co	St. Louis County.	
MO	Syntex Facility	Verona.	
MO	Valley Park TCE	Valley Park.	
MO	Vienna Wells	Vienna..	
MO	Washington County Lead District—Furnace Creek	Caledonia.	
MO	Washington County Lead District—Old Mines	Old Mines.	
MO	Washington County Lead District—Potosi	Potosi.	
MO	Washington County Lead District—Richwoods	Richwoods.	
MO	Westlake Landfill	Bridgeton.	
MS	American Creosote Works, Inc	Louisville.	
MS	Chemfax, Inc.	Gulfport.	
MS	Kerr-McGee Chemical Corp—Columbus	Columbus.	
MS	Mississippi Phosphates Corporation	Pascagoula.	
MS	Picayune Wood Treating	Picayune.	
MS	Red Panther Chemical Company	Clarksdale.	
MS	Rockwell International Wheel & Trim	Grenada.	
MS	Sonford Products	Flowood.	
MS	Southeastern Wood Preserving	Canton.	
MT	ACM Smelter and Refinery	Cascade County.	
MT	Anaconda Aluminum Co Columbia Falls Reduction Plant	Columbia Falls.	
MT	Anaconda Co. Smelter	Anaconda.	
MT	Barker Hughesville Mining District	Barker.	
MT	Basin Mining Area	Basin.	
MT	Carpenter Snow Creek Mining District	Neihart.	
MT	East Helena Site	East Helena.	
MT	Fiat Creek IMM	Superior..	
MT	Idaho Pole Co	Bozeman.	
MT	Libby Asbestos	Libby	P
MT	Libby Ground Water Contamination	Libby.	
MT	Lockwood Solvent Ground Water Plume	Billings.	
MT	Milltown Reservoir Sediments	Milltown.	
MT	Montana Pole and Treating	Butte.	
MT	Mouat Industries	Columbus	P
MT	Silver Bow Creek/Butte Area	Sil Bow/Deer Lodge.	
MT	Upper Tenmile Creek Mining Area	Lewis and Clark.	
NC	ABC One Hour Cleaners	Jacksonville.	
NC	Aberdeen Contaminated Ground Water	Aberdeen.	
NC	Aberdeen Pesticide Dumps	Aberdeen.	
NC	Barber Orchard	Waynesville.	
NC	Benfield Industries, Inc.	Hazelwood.	
NC	Blue Ridge Plating	Arden.	
NC	Bypass 601 Ground Water Contamination	Concord	P
NC	Cape Fear Wood Preserving	Fayetteville.	
NC	Carolina Transformer Co	Fayetteville.	
NC	Celanese Corp. (Shelby Fiber Operations)	Shelby/Cleveland	P
NC	Charles Macon Lagoon & Drum Storage	Cordova.	
NC	Chemtronics, Inc	Swannanoa.	
NC	Cristex Drum	Oxford.	
NC	CTS of Asheville, Inc.	Asheville.	
NC	Davis Park Road TCE	Gastonia.	
NC	FCX, Inc. (Statesville Plant)	Statesville.	
NC	FCX, Inc. (Washington Plant)	Washington.	
NC	GMH Electronics	Roxboro..	
NC	Geigy Chemical Corp. (Aberdeen Plant)	Aberdeen.	
NC	General Electric Co/Shepherd Farm	East Flat Rock	P
NC	Hemphill Road TCE	Gastonia.	
NC	Holcomb Creosote Co	Yadkinville.	
NC	Horton Iron and Metal	Wilmington.	
NC	JFD Electronics/Channel Master	Oxford.	
NC	Jadco-Hughes Facility	Belmont.	
NC	Kerr-McGee Chemical Corp-Navassa	Navassa.	
NC	Koppers Co., Inc. (Morrisville Plant)	Morrisville	P
NC	NC State University (Lot 86, Farm Unit #1)	Raleigh.	
NC	National Starch & Chemical Corp	Salisbury.	
NC	North Belmont PCE	North Belmont.	
NC	Ore Knob Mine	Ashe County..	
NC	Potter's Septic Tank Service Pits	Maco.	
NC	Ram Leather Care	Charlotte.	
NC	Sigmon's Septic Tank	Statesville.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
NC	Ward Transformer	Raleigh.	
NC	Wright Chemical Corporation	Riegelwood.	
NE	10th Street Site	Columbus.	
NE	Bruno Co-op Association/Associated Prop	Bruno.	
NE	Cleburn Street Well	Grand Island.	
NE	Garvey Elevator	Hastings.	
NE	Hastings Ground Water Contamination	Hastings.	
NE	Iowa-Nebraska Light & Power Co	Norfolk.	
NE	Lindsay Manufacturing Co	Lindsay.	
NE	Nebraska Ordnance Plant (Former)	Mead.	
NE	Ogallala Ground Water Contamination	Ogallala.	
NE	Old HWY 275 and N 288th Street	Valley.	
NE	Omaha Lead	Omaha/Douglas	P
NE	Parkview Well	Grand Island.	
NE	PCE Southeast Contamination	York.	
NE	PCE/TCE Northeast Contamination	York.	
NE	Sherwood Medical Co	Norfolk.	
NE	West Highway 6 & Highway 281	Hastings.	
NH	Auburn Road Landfill	Londonderry.	
NH	Beede Waste Oil	Plaistow.	
NH	Chlor-Alkali Facility (Former)	Berlin.	
NH	Coakley Landfill	North Hampton.	
NH	Collins & Aikman Plant (Former)	Farmington.	
NH	Dover Municipal Landfill	Dover.	
NH	Fletcher's Paint Works & Storage	Milford.	
NH	Kearsarge Metallurgical Corp	Conway.	
NH	Keefe Environmental Services	Epping.	
NH	Mottolo Pig Farm	Raymond.	
NH	New Hampshire Plating Co	Merrimack.	
NH	Ottati & Goss/Kingston Steel Drum	Kingston.	
NH	Savage Municipal Water Supply	Milford.	
NH	Somersworth Sanitary Landfill	Somersworth.	
NH	South Municipal Water Supply Well	Peterborough.	
NH	Sylvester	NashuaS.	
NH	Tibbetts Road	Barrington.	
NH	Tinkham Garage	Londonderry.	
NH	Troy Mills Landfill	Troy.	
NJ	A. O. Polymer	Sparta/Sussex	P
NJ	American Cyanamid Co.	Bound Brook	P
NJ	Asbestos Dump	Millington	P
NJ	Atlantic Resources Corporation	Sayreville.	
NJ	Bog Creek Farm	Howell Township.	
NJ	Brick Township Landfill	Brick Township.	
NJ	Bridgeport Rental & Oil Services	Bridgeport.	
NJ	Brook Industrial Park	Bound Brook.	
NJ	Bumt Fly Bog	Marlboro Township.	
NJ	CPS/Madison Industries	Old Bridge Township.	
NJ	Caldwell Trucking Co	Fairfield.	
NJ	Chemical Control	Elizabeth.	
NJ	Chemical Insecticide Corp	Edison Township.	
NJ	Chemical Leaman Tank Lines, Inc	Bridgeport.	
NJ	Chemsol, Inc	Piscataway.	
NJ	Ciba-Geigy Corp	Toms River.	
NJ	Cinnaminson Ground Water Contamination	Cinnaminson Township.	
NJ	Combe Fill South Landfill	Chester Township.	
NJ	Cornell Dubilier Electronics Inc	South Plainfield.	
NJ	Cosden Chemical Coatings Corp	Beverly.	
NJ	Curcio Scrap Metal, Inc	Saddle Brook Township.	
NJ	Curtis Specialty Papers, Inc	Milford.	
NJ	D'Imperio Property	Hamilton Township.	
NJ	Dayco Corp./L.E Carpenter Co	Wharton Borough.	
NJ	De Rewal Chemical Co	Kingwood Township.	
NJ	Diamond Alkali Co	Newark.	
NJ	Diamond Head Oil Refinery Div	Keamy.	
NJ	Dover Municipal Well 4	Dover Township.	
NJ	Ellis Property	Evesham Township.	
NJ	Emmell's Septic Landfill	Galloway Township.	
NJ	Evor Phillips Leasing	Old Bridge Township.	
NJ	Ewan Property	Shamong Township.	
NJ	Fair Lawn Well Field	Fair Lawn.	
NJ	Former Kil-Tone Company	Vineland.	
NJ	Franklin Bum	Franklin Township.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
NJ	Fried Industries	East Brunswick Township.	
NJ	Garfield Ground Water Contamination	Garfield.	
NJ	GEMS Landfill	Gloucester Township.	
NJ	Garden State Cleaners Co	Minotola.	
NJ	Global Sanitary Landfill	Old Bridge Township.	
NJ	Goose Farm	Plumstead Township.	
NJ	Helen Kramer Landfill	Mantua Township.	
NJ	Hercules, Inc. (Gibbstown Plant)	Gibbstown.	
NJ	Higgins Disposal	Kingston.	
NJ	Higgins Farm	Franklin Township.	
NJ	Horseshoe Road	Sayreville.	
NJ	Iceland Coin Laundry Area Ground Water Plume	Vineland.	
NJ	Imperial Oil Co., Inc./Champion Chemicals	Morganville.	
NJ	JIS Landfill	Jamesburg/S. Brnswck.	
NJ	Kauffman & Minter, Inc	Jobstown.	
NJ	Kin-Buc Landfill	Edison Township.	
NJ	King of Prussia	Winslow Township.	
NJ	LCP Chemicals Inc	Linden.	
NJ	Landfill & Development Co	Mount Holly.	
NJ	Lang Property	Pemberton Township.	
NJ	Lightman Drum Company	Winslow Township.	
NJ	Lipan Landfill	Pitman.	
NJ	Lone Pine Landfill	Freehold Township.	
NJ	Mansfield Trail Dump	Byram Township.	
NJ	Martin Aaron, Inc	Camden.	
NJ	Matlack, Inc.	Woolwich Township.	
NJ	Maywood Chemical Co	Maywood/Rochelle Park.	
NJ	Matteo & Sons, Inc.	Thorofare.	
NJ	Metaltec/Aerosystems	Franklin Borough.	
NJ	Monitor Devices/Intercircuits Inc	Wall Township.	
NJ	Montgomery Township Housing Development	Montgomery Township.	
NJ	Myers Property	Franklin Township.	
NJ	NL Industries	Pedricktown.	
NJ	Nascolite Corp	Millville.	
NJ	Orange Valley Regional Ground Water Contamination	West Orange/Orange.	
NJ	Pierson's Creek	Newark.	
NJ	PJP Landfill	Jersey City.	
NJ	Pohatcong Valley Ground Water Contaminat	Warren County.	
NJ	Price Landfill	Pleasantville	S
NJ	Puchack Well Field	Pennsauken Township..	
NJ	Quanta Resources	Edgewater.	
NJ	Radiation Technology, Inc	Rockaway Township.	
NJ	Raritan Bay Slag	Old Bridge Township/ Sayreville..	
NJ	Reich Farms	Pleasant Plains.	
NJ	Ringwood Mines/Landfill	Ringwood.	
NJ	Riverside Industrial Park	Newark.	
NJ	Rockaway Borough Well Field	Rockaway Township.	
NJ	Rockaway Township Wells	Rockaway.	
NJ	Rocky Hill Municipal Well	Rocky Hill Borough.	
NJ	Roebing Steel Co	Florence.	
NJ	Rolling Knolls Landfill	Chatham Township.	
NJ	Scientific Chemical Processing	Carlstadt.	
NJ	Sharkey Landfill	Parsippany/Troy Hls.	
NJ	Sherwin-Williams/Hilliards Creek	Gibbsboro.	
NJ	Shieldalloy Corp	Newfield Borough.	
NJ	South Jersey Clothing Co	Minotola.	
NJ	Standard Chlorine	Kearny.	
NJ	Swope Oil & Chemical Co	Pennsauken.	
NJ	Syncon Resins	South Kearny.	
NJ	U.S. Radium Corp	Orange	P
NJ	Unimatic Manufacturing Corporation	Fairfield.	
NJ	United States Avenue Burn	Gibbsboro.	
NJ	Universal Oil Products (Chemical Division	East Rutherford.	
NJ	Ventron/Veisol	Wood Ridge Borough.	
NJ	Vineland Chemical Co., Inc	Vineland.	
NJ	Waldick Aerospace Devices, Inc	Wall Township.	
NJ	Welsbach & General Gas Mantle (Camden)	Camden and Gloucester City.	
NJ	White Chemical Corp	Newark	A
NJ	White Swan Cleaners/Sun Cleaners Area Ground Water Contamination.	Wall Township.	
NJ	Williams Property	Swainton.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
NJ	Woodbrook Road Dump	South Plainfield..	
NJ	Woodland Route 532 Dump	Woodland Township.	
NJ	Woodland Route 72 Dump	Woodland Township.	
NJ	Zschiegner Refining	Howell Township..	
NM	AT&SF Albuquerque	Albuquerque	P
NM	Chevron Questa Mine	Questa.	
NM	Cimarron Mining Corp	Carrizozo	P
NM	Eagle Picher Carefree Battery	Socorro.	
NM	Fruit Avenue Plume	Albuquerque.	
NM	Grants Chlorinated Solvents Plume	Grants.	
NM	Griggs & Walnut Ground Water Plume	Las Cruces..	
NM	Homestake Mining Co	Milan.	
NM	Jackpile-Paguete Uranium Mine	Laguna Pueblo.	
NM	Lea and West Second Street	Roswell.	
NM	McGaffey and Main Groundwater Plume	Roswell.	
NM	North Railroad Avenue Plume	Espanola.	
NM	Prewitt Abandoned Refinery	Prewitt	P
NM	South Valley	Albuquerque	S
NM	United Nuclear Corp	Church Rock.	
NV	Carson River Mercury Site	Lyon/Churchill Cnty.	
NY	American Thermostat Co	South Cairo.	
NY	Applied Environmental Services	Glenwood Landing.	
NY	Black River PCBs	Jefferson County..	
NY	Brewster Well Field	Putnam County.	
NY	Byron Barrel & Drum	Byron.	
NY	Carroll & Dubies Sewage Disposal	Port Jervis.	
NY	Cayuga County Ground Water Contamination	Cayuga County.	
NY	Circuitron Corp	East Farmingdale.	
NY	Claremont Polychemical	Old Bethpage.	
NY	Colesville Municipal Landfill	Town of Colesville.	
NY	Computer Circuits	Hauppauge.	
NY	Cortese Landfill	Village of Narrowsburg.	
NY	Crown Cleaners of Watertown, Inc	Carthage.	
NY	Dewey Loeffel Landfill	Nassau.	
NY	Diaz Chemical Corporation	Holley.	
NY	Eighteenmile Creek	Niagara County.	
NY	Ellenville Scrap Iron and Metal	Ellenville.	
NY	Endicott Village Well Field	Village of Endicott.	
NY	FMC Corp. (Dublin Road Landfill)	Town of Shelby.	
NY	Facet Enterprises, Inc	Elmira.	
NY	Forest Glen Mobile Home Subdivision	Niagara Falls	A
NY	Fulton Avenue	North Hempstead..	
NY	GCL Tie & Treating Inc	Village of Sidney.	
NY	GE Moreau	South Glen Falls.	
NY	General Motors (Central Foundry Division)	Massena.	
NY	Genzale Plating Co	Franklin Square.	
NY	Goldisc Recordings, Inc	Holbrook.	
NY	Gowanus Canal	Brooklyn.	
NY	Haviland Complex	Town of Hyde Park.	
NY	Hertel Landfill	Plattekill.	
NY	Hooker (S Area)	Niagara Falls.	
NY	Hooker Chemical/Ruco Polymer Corp	Hicksville.	
NY	Hopewell Precision Area Contamination	Hopewell Junction.	
NY	Hudson River PCBs	Hudson River.	
NY	Islip Municipal Sanitary Landfill	Islip.	
NY	Johnstown City Landfill	Town of Johnstown.	
NY	Jones Chemicals, Inc	Caledonia.	
NY	Kentucky Avenue Well Field	Horseheads.	
NY	Lawrence Aviation Industries, Inc.	Port Jefferson Station.	
NY	Lehigh Valley Railroad	Le Roy.	
NY	Li Tungsten Corp	Glen Cove.	
NY	Liberty Industrial Finishing	Farmingdale.	
NY	Little Valley	Little Valley	A
NY	MacKenzie Chemical Works, Inc	Central Islip.	
NY	Magna Metals	Cortlandt Manor.	
NY	Malta Rocket Fuel Area	Malta.	
NY	Mattiace Petrochemical Co., Inc	Glen Cove.	
NY	Mercury Refining, Inc	Colonie.	
NY	Mohonk Road Industrial Plant	High Falls.	
NY	Nepera Chemical Co., Inc	Maybrook.	
NY	New Cassel/Hicksville Ground Water Contamination	New Cassel/Hicksville.	
NY	Newtown Creek	Brooklyn/Queens.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
NY	Niagara Mohawk Power Co (Saratoga Spings)	Saratoga Springs.	
NY	Old Bethpage Landfill	Oyster Bay.	
NY	Old Roosevelt Field Contaminated Ground Water Area	Garden City..	
NY	Old Well Field	Olean.	
NY	Orondaga Lake	Syracuse.	
NY	Peninsula Boulevard Ground Water Plume	Hewlett.	
NY	Peter Cooper	Gowanda..	
NY	Pollution Abatement Services	Oswego	S
NY	Port Washington Landfill	Port Washington.	
NY	Preferred Plating Corp	Farmingdale.	
NY	Ramapo Landfill	Ramapo.	
NY	Richardson Hill Road Landfill/Pond	Sidney Center.	
NY	Robintech, Inc./National Pipe Co.	Town of Vestal	P
NY	Rosen Brothers Scrap Yard/Dump	Cortland.	
NY	Rowe Industries Gnd Water Contamination	Noyack/Sag Harbor.	
NY	Saint-Gobain Performance Plastics	Village of Hoosick Falls.	
NY	Sarney Farm	Ameria.	
NY	Sealand Restoration, Inc	Lisbon.	
NY	Shenandoah Road Ground Water Contamination	East Fishkill..	
NY	Sidney Landfill	Sidney.	
NY	Sinclair Refinery	Wellsville.	
NY	Smithtown Ground Water Contamination	Smithtown.	
NY	Solvent Savers	Linclaan.	
NY	Stanton Cleaners Area Ground Water Contamination	Great Neck.	
NY	Tri-Cities Barrel Co., Inc	Port Crane.	
NY	Vestal Water Supply Well 1-1	Vestal.	
NY	Volney Municipal Landfill	Town of Volney.	
NY	Wappinger Creek	Dutchess County.	
NY	Wolf-Alport Chemical Company	Ridgewood.	
NY	York Oil Co	Moira.	
OH	Allied Chemical & Ironton Coke	Ironton.	
OH	Behr Dayton Thermal System VOC Plume	Dayton..	
OH	Big D Campground	Kingsville.	
OH	Buckeye Reclamation	St. Clairsville.	
OH	Chem-Dyne	Hamilton	S
OH	Copley Square Plaza	Copley.	
OH	Donnelsville Contaminated Aquifer	Donnelsville.	
OH	E.H. Schilling Landfill	Hamilton Township.	
OH	East Troy Contaminated Aquifer	Troy.	
OH	Fields Brook	Ashtabula.	
OH	Fultz Landfill	Jackson Township.	
OH	Industrial Excess Landfill	Uniontown.	
OH	Lammers Barrel	Beavercreek.	
OH	Little Scioto River	Manion County..	
OH	Miami County Incinerator	Troy.	
OH	Milford Contaminated Aquifer	Milford.	
OH	Nease Chemical	Salem.	
OH	New Carlisle Landfill	New Carlisle..	
OH	New Lyme Landfill	New Lyme.	
OH	North Sanitary Landfill	Dayton.	
OH	Old Mill	Rock Creek.	
OH	Ormet Corp	Hannibal.	
OH	Peters Cartridge Factory	Kings Mills	P
OH	Powell Road Landfill	Dayton.	
OH	Pristine, Inc	Reading.	
OH	Reilly Tar & Chemical (Dover Plant)	Dover.	
OH	Sanitary Landfill Co. (Industrial Waste)	Dayton.	
OH	Skinner Landfill	West Chester.	
OH	South Point Plant	South Point.	
OH	Summit National	Deerfield Township.	
OH	TRW, Inc. (Minerva Plant)	Minerva.	
OH	United Scrap Lead Co., Inc	Troy.	
OH	Valley Pike VOCs	Riverside.	
OH	Van Dale Junkyard	Marietta.	
OH	West Troy Contaminated Aquifer	Troy.	
OH	Zanesville Well Field	Zanesville.	
OK	Double Eagle Refinery Co.	Oklahoma City.	
OK	Eagle Industries	Midwest City.	
OK	Fourth Street Abandoned Refinery	Oklahoma City.	
OK	Hardage/Criner	Criner.	
OK	Hudson Refinery	Cushing.	
OK	Oklahoma Refining Co	Cyril.	

Environmental Protection Agency

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TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
OK	Tar Creek (Ottawa County)	Ottawa County.	
OK	Tulsa Fuel and Manufacturing	Collinsville.	
OK	Wilcox Oil Company	Creek County.	
OR	Black Butte Mine	Cottage Grove.	
OR	Formosa Mine	Douglas County.	
OR	McCormick & Baxter Creos. Co (Portland)	Portland.	
OR	North Ridge Estates	Klamath Falls.	
OR	Northwest Pipe & Casing/Hall Process Company	Clackamas.	
OR	Portland Harbor	Portland.	
OR	Reynolds Metals Company	Troutdale.	
OR	Taylor Lumber and Treating	Sheridan.	
OR	Teledyne Wah Chang	Albany.	
OR	Union Pacific Railroad Tie Treatment	The Dalles.	
OR	United Chrome Products, Inc	Corvallis.	
PA	A.I.W. Frank/Mid-County Mustang	Exton.	
PA	Avco Lycoming (Williamsport Division)	Williamsport.	
PA	Baghurst Drive	Harleysville.	
PA	Bally Ground Water Contamination	Bally Borough.	
PA	Bell Landfill	Terry Township.	
PA	Bendix Flight Systems Division	Bridgewater Township.	
PA	Berks Sand Pit	Longswamp Township.	
PA	Blosenski Landfill	West Cain Township.	
PA	Boarhead Farms	Bridgeton Township.	
PA	BoRit Asbestos	Ambler.	
PA	Breslube-Penn, Inc	Coraopolis.	
PA	Brown's Battery Breaking	Shoemakersville.	
PA	Butler Mine Tunnel	Pittston.	
PA	Butz Landfill	Stroudsburg.	
PA	Centre County Kepone	State College Borough	P
PA	Chem-Fab	Doylestown.	
PA	Commodore Semiconductor Group	Lower Providence Township.	
PA	Crater Resources/Keystone Coke/Alan Wood	Upper Merion Township.	
PA	Crossley Farm	Hereford Township.	
PA	Croydon TCE	Croydon.	
PA	CryoChem, Inc	Worman.	
PA	Delta Quarries & Disp./Stotler Landfill	Antis/Logan Twps.	
PA	Douglasville Disposal	Douglasville.	
PA	Drake Chemical	Lock Haven.	
PA	Dublin TCE Site	Dublin Borough.	
PA	East Mount Zion	Springettsbury Township.	
PA	Eastern Diversified Metals	Hometown.	
PA	Elizabethtown Landfill	Elizabethtown.	
PA	Fischer & Porter Co	Warminster.	
PA	Foot Mineral Co	East Whiteland Township.	
PA	Franklin Stag Pile (MDC)	Philadelphia.	
PA	Havertown PCP	Haverford.	
PA	Heleva Landfill	North Whitehall Township.	
PA	Hellertown Manufacturing Co	Hellertown.	
PA	Henderson Road	Upper Merion Township.	
PA	Hunterstown Road	Straban Township.	
PA	Industrial Lane	Williams Township.	
PA	Jacks Creek/Sitkin Smelting and Refinery	Maitland.	
PA	Jackson Ceramix	Falls Creek.	
PA	Keystone Sanitation Landfill	Union Township.	
PA	Kimberton Site	Kimberton Borough.	
PA	Lindane Dump	Harrison Township.	
PA	Lord-Shope Landfill	Girard Township.	
PA	Lower Darby Creek Area	Delaware/Philadelphia Counties.	
PA	MW Manufacturing	Valley Township.	
PA	Malvern TCE	Malvern.	
PA	Metal Banks	Philadelphia.	
PA	Metro Container Corporation	Trainer.	
PA	Mill Creek Dump	Erie.	
PA	Modern Sanitation Landfill	Lower Windsor Township.	
PA	North Penn—Area 1	Souderton.	
PA	North Penn—Area 12	Worcester.	
PA	North Penn—Area 2	Hatfield.	
PA	North Penn—Area 5	Montgomery Township.	
PA	North Penn—Area 6	Lansdale	P
PA	North Penn—Area 7	North Wales.	
PA	Novak Sanitary Landfill	South Whitehall Township.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
PA	Occidental Chemical Corp./Firestone Tire	Lower Pottsgrove Township.	
PA	Ohio River Park	Neville Island.	
PA	Old City of York Landfill	Seven Valleys.	
PA	Old Wilmington Road Ground Water Contamination	Sadsburyville.	
PA	Osborne Landfill	Grove City.	
PA	Palmerton Zinc Pile	Palmerton.	
PA	Paoli Rail Yard	Paoli.	
PA	Price Battery	Hamburg.	
PA	Raymark	Halboro.	
PA	Revere Chemical Co	Nockamixon Township.	
PA	Rodale Manufacturing Co., Inc	Emmaus Borough.	
PA	Ryeland Road Arsenic	Heidelberg Township.	
PA	Saegertown Industrial Area	Saegertown.	P
PA	Safety Light Corporation	Bloomsburg.	
PA	Salford Quarry	Lower Salford Township..	
PA	Sharon Steel Corp. (Farrell Wks Disp Area)	Hickory Township.	
PA	Shriver's Corner	Straban Township.	
PA	Stanley Kessler	King of Prussia.	
PA	Strasburg Landfill	Newlin Township.	
PA	Tobyhanna Army Depot	Tobyhanna	P
PA	Tonolli Corp	Nesquehoning.	
PA	Tyson's Dump	Upper Merion Twp.	
PA	UGI Columbia Gas Plant	Columbia.	
PA	Valmont TCE	Hazle Township and West Hazleton.	
PA	Walsh Landfill	Honeybrook Township.	
PA	Watson Johnson Landfill	Richland Township.	
PA	Westinghouse Electronic (Sharon Plant)	Sharon.	
PA	Westinghouse Elevator Co. Plant	Gettysburg.	
PA	Whitmoyer Laboratories	Jackson Township.	
PA	William Dick Lagoons	West Cain Township.	
PR	Cabo Rojo Ground Water Contamination	Cabo Rojo.	
PR	Cidra Ground Water Contamination	Cidra.	
PR	Corozal Well	Corozal.	
PR	Dorado Ground Water Contamination	Dorado.	
PR	Fibers Public Supply Wells	Jobos.	
PR	Hornigas Ground Water Plume	Caguas.	
PR	Juncos Landfill	Juncos.	
PR	Maunabo Area Ground Water Contamination	Maunabo.	
PR	Papelera Puertorriquena, Inc	Utua.	
PR	Pesticide Warehouse I	Arecibo.	
PR	Pesticide Warehouse III	Manati.	
PR	PROTECO	Peñuelas.	
PR	San German Ground Water Contamination	San German.	
PR	Scorpio Recycling, Inc.	Candeleria Ward.	
PR	The Battery Recycling Company	Bo. Cambalache.	
PR	Upjohn Facility	Barceloneta.	
PR	Vega Alta Public Supply Wells	Vega Alta.	
PR	Vega Baja Solid Waste Disposal	Vega Baja.	
RI	Central Landfill	Johnston.	
RI	Centredale Manor Restoration Project	North Providence.	
RI	Davis Liquid Waste	Smithfield.	
RI	Landfill & Resource Recovery, Inc. (L&RR)	North Smithfield.	
RI	Peterson/Puritan, Inc	Lincoln/Cumberland	P
RI	Picillo Farm	Coventry	S
RI	Rose Hill Regional Landfill	South Kingston.	
RI	Stamina Mills, Inc	North Smithfield.	
RI	West Kingston Town Dump/URI Disposal	South Kingston.	
RI	Western Sand & Gravel	Burrillville.	
SC	Aqua-Tech Environmental Inc (Groce Labs)	Greer.	
SC	Barite Hill/Nevada Goldfields	McCormick..	
SC	Beaunit Corp. (Circular Knit & Dye)	Fountain Inn.	
SC	Brewer Gold Mine	Jefferson.	
SC	Burlington Industries Cheraw	Cheraw.	
SC	Carolawn, Inc	Fort Lawn.	
SC	Elmore Waste Disposal	Greer.	
SC	Helena Chemical Co Landfill	Fairfax.	
SC	Kalama Specialty Chemicals	Beaufort.	
SC	Koppers Co., Inc. (Charleston Plant)	Charleston.	
SC	Leonard Chemical Co., Inc	Rock Hill.	
SC	Lexington County Landfill Area	Cayce.	
SC	Macalloy Corporation	North Charleston.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
SC	Medley Farm Drum Dump	Gaffney.	
SC	Palmetto Wood Preserving	Dixiana.	
SC	Para-Chem Southern, Inc	Simpsonville	P
SC	Rock Hill Chemical Co	Rock Hill.	
SC	SCRDI Bluff Road	Columbia	S
SC	SCRDI Dixiana	Cayce.	
SC	Sangamo Weston	Pickens	P
SC	Shuron Inc	Barnwell.	
SC	Townsend Saw Chain Co	Pontiac.	
SC	US Finishing/Cone Mills	Greenville.	
SC	Warchem, Inc	Burton.	
SD	Gilt Edge Mine	Lead.	
TN	Alamo Contaminated Ground Water	Alamo.	
TN	American Creosote Works, (Jackson Plant)	Jackson.	
TN	Arlington Blending & Packaging	Arlington.	
TN	Carrier Air Conditioning Co	Collierville.	
TN	Clinch River Corporation	Harriman.	
TN	Former Custom Cleaners	Memphis.	
TN	Mallory Capacitor Co	Waynesboro.	
TN	Murray-Ohio Dump	Lawrenceburg.	
TN	Ross Metals Inc	Rossville.	
TN	Smalley-Piper	Collierville.	
TN	Smokey Mountain Smellers	Knox County..	
TN	Southside Chattanooga Lead	Chattanooga.	
TN	Tennessee Products	Chattanooga	A
TN	Velsicol Chemical Corp (Hardeman County)	Toone.	
TN	Walker Machine Products, Inc.	Collierville.	
TN	Wrigley Charcoal Plant	Wrigley.	
TX	ALCOA (Point Comfort)/Lavaca Bay	Point Comfort.	
TX	Attebury Grain Storage Facility	Happy..	
TX	Bandera Road Ground Water Plume	Leon Valley.	
TX	Brine Service Company	Corpus Christi.	
TX	Circle Court Ground Water Plume	Willow Park.	
TX	City of Perryton Well No. 2	Perryton.	
TX	Conroe Creosoting Company	Conroe.	
TX	Crystal Chemical Co	Houston.	
TX	Delfasco Forge	Grand Prairie.	
TX	Donna Reservoir and Canal System	Donna.	
TX	East 67th Street Ground Water Plume	Odessa.	
TX	Eldorado Chemical Co., Inc.	Live Oak.	
TX	Falcon Refinery	Ingleside.	
TX	French, Ltd	Crosby.	
TX	Garland Creosoting	Longview.	
TX	Geneva Industries/Fuhrmann Energy	Houston	P
TX	Gulco Marine Maintenance	Freeport..	
TX	Hart Creosoting Company	Jasper.	
TX	Highlands Acid Pit	Highlands.	
TX	Highway 18 Ground Water	Kermit.	
TX	Jasper Creosoting Company Inc	Jasper County.	
TX	Jones Road Ground Water Plume	Harris County.	
TX	Koppers Co Inc (Texarkana Plant)	Texarkana.	
TX	Lane Plating Works, Inc	Dallas.	
TX	Main Street Ground Water Plume	Burnet.	
TX	Malone Service Company, Inc	Texas City..	
TX	Many Diversified Interests, Inc	Houston	P
TX	Midessa Ground Water Plume	Odessa.	
TX	Motco, Inc	La Marque	S
TX	North Cavalcade Street	Houston.	
TX	Odessa Chromium #1	Odessa.	
TX	Patrick Bayou	Deer Park.	
TX	Petro-Chemical Systems, (Turtle Bayou)	Liberty County.	
TX	River City Metal Finishing	San Antonio.	
TX	RSR Corp	Dallas	P
TX	Rockwood Industries Inc	Bell County.	
TX	Sandy Beach Road Ground Water Plume	Azle.	
TX	San Jacinto River Waste Pits	Harris County.	
TX	Sheridan Disposal Services	Hempstead.	
TX	Sikes Disposal Pits	Crosby.	
TX	Sol Lynn/Industrial Transformers	Houston.	
TX	South Cavalcade Street	Houston.	
TX	Sprague Road Ground Water Plume	Odessa.	
TX	Star Lake Canal	Port Neches.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
TX	State Road 114 Ground Water Plume	Levelland.	
TX	Texarkana Wood Preserving Co	Texarkana.	
TX	Tex-Tin Superfund	Texas City, Galveston	P
TX	United Creosoting Co	Conroe.	
TX	US Oil Recovery	Pasadena.	
TX	Van der Horst USA Corporation	Terrell.	
TX	West County Road 112 Ground Water	Midland.	
UT	Bountiful/Woods Cross 5th South PCE Plume	Bountiful/Woods Cross.	
UT	Five Points PCE Plume	Woods Cross/Bountiful.	
UT	Intermountain Waste Oil Refinery	Bountiful..	
UT	Jacobs Smelters	Tooele County	P
UT	Portland Cement (Kiln Dust 2 & 3)	Salt Lake City.	
UT	U.S. Magnesium	Tooele County..	
UT	Utah Power & Light/American Barrel Co	Salt Lake City.	
UT	Wasatch Chemical Co. (Lot 6)	Salt Lake City.	
VA	Abex Corp	Portsmouth.	
VA	Arrowhead Associates/Scovill Corp	Montross.	
VA	Atlantic Wood Industries, Inc	Portsmouth.	
VA	Avtex Fibers, Inc	Front Royal.	
VA	Buckingham County Landfill	Buckingham.	
VA	C & R Battery Co., Inc	Chesterfield County.	
VA	Chisman Creek	York County.	
VA	Culpeper Wood Preservers, Inc	Culpeper.	
VA	First Piedmont Rock Quarry (Route 719)	Pittsylvania County.	
VA	Former Nansemond Ordnance Depot	Suffolk	P
VA	Greenwood Chemical Co	Newtown.	
VA	H & H Inc., Burn Pit	Farrington.	
VA	Hidden Lane Landfill	Sterling.	
VA	Kim-Stan Landfill	Selma.	
VA	L.A. Clarke & Son	Spotsylvania County.	
VA	Peck Iron and Metal	Portsmouth..	
VA	Rentokil, Inc. (Virginia Wood Preserving Division)	Richmond	P
VA	Saltville Waste Disposal Ponds	Saltville.	
VA	Saunders Supply Co	Chuckatuck.	
VA	U.S. Titanium	Piney River.	
VI	Tutu Wellfield	Tutu.	
VT	BFI Sanitary Landfill (Rockingham)	Rockingham.	
VT	Bennington Municipal Sanitary Landfill	Bennington.	
VT	Burgess Brothers Landfill	Woodford.	
VT	Commerce Street Plume	Williston.	
VT	Elizabeth Mine	Strafford..	
VT	Ely Copper Mine	Vershire.	
VT	Jard Company, Inc.	Bennington.	
VT	Old Springfield Landfill	Springfield.	
VT	Parker Sanitary Landfill	Lyndon.	
VT	Pike Hill Copper Mine	Corinth.	
VT	Pine Street Canal	Burlington	S
VT	Pownal Tannery	Pownal.	
WA	American Crossarm & Conduit Co	Chehalis.	
WA	Boomsnub/Airco	Vancouver	S
WA	Bremerton Gasworks	Bremerton.	
WA	Centralia Municipal Landfill	Centralia.	
WA	Colbert Landfill	Colbert.	
WA	Commencement Bay, Near Shore/Tide Flats	Pierce County	P
WA	Commencement Bay, South Tacoma Channel	Tacoma	P
WA	FMC Corp. (Yakima Pit)	Yakima.	
WA	General Electric Co. (Spokane Shop)	Spokane.	
WA	Grain Handling Facility at Freeman	Freeman.	
WA	Greenacres Landfill	Spokane County.	
WA	Hamilton/Labree Roads Ground Water Contamination	Chehalis.	
WA	Harbor Island (Lead)	Seattle	P
WA	Hidden Valley Landfill (Thun Field)	Pierce County.	
WA	Kaiser Aluminum Mead Works	Mead.	
WA	Lakewood Site	Lakewood	P
WA	Lockheed West Seattle	Seattle.	
WA	Lower Duwamish Waterway	Seattle.	
WA	Makah Reservation Warmhouse Beach Dump	Neah Bay.	
WA	Mica Landfill	Mica.	
WA	Midnite Mine	Wellpinit..	
WA	Midway Landfill	Kent.	
WA	Moses Lake Wellfield Contamination	Moses Lake.	
WA	North Market Street	Spokane.	

TABLE 1—GENERAL SUPERFUND SECTION—Continued

State	Site name	City/County	Notes(a)
WA	Northside Landfill	Spokane.	
WA	Oeser Co.	Bellingham.	
WA	Pacific Car & Foundry Co	Renton.	
WA	Pacific Sound Resources	Seattle.	
WA	Palermo Well Field Ground Water Contam	Tumwater.	
WA	Pasco Sanitary Landfill	Pasco.	
WA	Queen City Farms	Maple Valley.	
WA	Quendall Terminals	Fenton.	
WA	Seattle Municipal Landfill (Kent Highlnds)	Kent.	
WA	Western Processing Co., Inc	Kent.	
WA	Wyckoff Co./Eagle Harbor	Bainbridge Island.	
WI	Algoma Municipal Landfill	Algoma.	
WI	Amcast Industrial Corporation	Cedarburg.	
WI	Ashland/Northern States Power Lakefront	Ashland.	
WI	Better Brite Plating Chrome & Zinc Shops	DePere.	
WI	City Disposal Corp. Landfill	Dunn.	
WI	Delavan Municipal Well #4	Delavan.	
WI	Hagen Farm	Stoughton.	
WI	Hechimovich Sanitary Landfill	Williamstown.	
WI	Hunts Disposal Landfill	Caledonia.	
WI	Janesville Ash Beds	Janesville.	
WI	Janesville Old Landfill	Janesville.	
WI	Kohler Co. Landfill	Kohler.	
WI	Lauer I Sanitary Landfill	Menomonee Falls.	
WI	Lemberger Landfill, Inc	Whitelaw.	
WI	Lemberger Transport & Recycling	Franklin Township.	
WI	Madison Metropolitan Sewerage District	Blooming Grove.	
WI	Master Disposal Service Landfill	Brookfield.	
WI	Mid-State Disposal, Inc. Landfill	Cleveland Township.	
WI	Moss-American(Kerr-McGee Oil Co.)	Milwaukee.	
WI	Muskego Sanitary Landfill	Muskego.	
WI	N.W. Mauthe Co., Inc	Appleton	S
WI	National Presto Industries, Inc	Eau Claire.	
WI	Oconomowoc Electroplating Co. Inc	Ashippin.	
WI	Onalaska Municipal Landfill	Onalaska.	
WI	Penta Wood Products	Daniels.	
WI	Refuse Hideaway Landfill	Middleton.	
WI	Ripon City Landfill	Ripon.	
WI	Sauk County Landfill	Excelsior.	
WI	Schmalz Dump	Harrison.	
WI	Scrap Processing Co., Inc	Medford.	
WI	Sheboygan Harbor & River	Sheboygan.	
WI	Spickler Landfill	Spencer.	
WI	Stoughton City Landfill	Stoughton.	
WI	Tomah Municipal Sanitary Landfill	Tomah.	
WI	Waste Mgmt of WI (Brookfield Sanit LF)	Brookfield.	
WI	Wausau Ground Water Contamination	Wausau.	
WV	Big John Salvage—Hoult Road	Fairmont.	
WV	Fike Chemical, Inc	Nitro.	
WV	Hanlin-Allied-Olin	Moundsville.	
WV	Mystery Bridge Road/U.S. Highway 20	Evansville/Natrona	P
WV	North 25th Street Glass and Zinc	Clarksburg.	
WV	Ravenswood PCE Ground Water Plume	Ravenswood.	
WV	Shaffer Equipment/Arbuckle Creek Area	Minden.	
WV	Sharon Steel Corp (Fairmont Coke Works)	Fairmont.	
WV	Vienna Tetrachloroethene	Vienna.	

(a) = Based on issuance of health advisory by Agency for Toxic Substances and Disease Registry (if scored, HRS score need not be greater than or equal to 28.50).

S = State top priority (included among the 100 top priority sites regardless of score).

P = Sites with partial deletion(s).

TABLE 2—FEDERAL FACILITIES SECTION

St	Site name	City/County	Notes(a)
AK	Adak Naval Air Station	Adak.	
AK	Eielson Air Force Base	Fairbanks N Star Borough.	
AK	Elmendorf Air Force Base	Greater Anchorage Borough.	
AK	Fort Richardson (USARMY)	Anchorage.	
AK	Fort Weinwright	Fairbanks N Star Borough.	
AL	Alabama Army Ammunition Plant	Childersburg.	
AL	Anniston Army Depot (SE Industrial Area)	Anniston.	

TABLE 2—FEDERAL FACILITIES SECTION—Continued

St	Site name	City/County	Notes(a)
AL	Redstone Arsenal (USARMY/NASA)	Huntsville.	
AZ	Williams Air Force Base	Chandler.	
AZ	Yuma Marine Corps Air Station	Yuma.	
CA	Alameda Naval Air Station	Alameda.	
CA	Barstow Marine Corps Logistics Base	Barstow.	
CA	Camp Pendleton Marine Corps Base	San Diego County.	
CA	Castle Air Force Base	Merced.	
CA	Concord Naval Weapons Station	Concord.	
CA	Edwards Air Force Base	Kern County.	
CA	El Toro Marine Corps Air Station	El Toro	P
CA	Fort Ord	Marina.	
CA	George Air Force Base	Victorville.	
CA	Hunters Point Naval Shipyard	San Francisco	P
CA	Jet Propulsion Laboratory (NASA)	Pasadena.	
CA	LEHR/Old Campus Landfill (USDOE)	Davis.	
CA	Lawrence Livermore Lab Site 300 (USDOE)	Livermore.	
CA	Lawrence Livermore Laboratory (USDOE)	Livermore.	
CA	March Air Force Base	Riverside.	
CA	Mather Air Force Base	Sacramento.	
CA	McClellan Air Force Base (GW Contam)	Sacramento.	
CA	Moffett Naval Air Station	Sunnyvale.	
CA	Norton Air Force Base	San Bernardino.	
CA	Riverbank Army Ammunition Plant	Riverbank.	
CA	Sacramento Army Depot	Sacramento.	
CA	Sharpe Army Depot	Lathrop.	
CA	Tracy Defense Depot (USARMY)	Tracy.	
CA	Travis Air Force Base	Solano County.	
CO	Air Force Plant PJKS	Waterton.	
CO	Rocky Flats Plant (USDOE)	Jefferson and Boulder Counties.	P
CO	Rocky Mountain Arsenal (USARMY)	Adams County	P
CT	New London Submarine Base	New London.	
DC	Washington Navy Yard	Washington DC.	
DE	Dover Air Force Base	Dover.	
FL	Cecil Field Naval Air Station	Jacksonville	P
FL	Homestead Air Force Base	Homestead.	
FL	Jacksonville Naval Air Station	Jacksonville.	
FL	Pensacola Naval Air Station	Pensacola.	
FL	Tyndall Air Force Base	Panama City.	
FL	Whiting Field Naval Air Station	Milton.	
GA	Marine Corps Logistics Base	Albany.	
GA	Robins Air Force Base(Lf#4/Sludge Lagoon)	Houston County.	
GU	Andersen Air Force Base	Yigo.	
HI	Naval Computer & Telecommunications Area	Oahu.	
HI	Pearl Harbor Naval Complex	Pearl Harbor.	
IA	Iowa Army Ammunition Plant	Middletown.	
ID	Idaho National Engineering Lab (USDOE)	Idaho Falls.	
ID	Mountain Home Air Force Base	Mountain Home.	
IL	Joliet Army Ammunition Plant (LAP Area)	Joliet.	
IL	Joliet Army Ammunition Plant (Mfg Area)	Joliet.	
IL	Sangamo Electric/Crab Orchard NWR (USDOI)	Cartersville.	
IL	Savanna Army Depot Activity	Savanna.	
KS	Fort Riley	Junction City.	
KY	Paducah Gaseous Diffusion Plant (USDOE)	Paducah.	
LA	Louisiana Army Ammunition Plant	Doyline.	
MA	Fort Devens	Fort Devens.	
MA	Hanscom Field/Hanscom Air Force Base	Bedford.	
MA	Natick Laboratory Army Research, D&E Cntr	Natick.	
MA	Naval Weapons Industrial Reserve Plant	Bedford.	
MA	Otis Air National Guard Base/Camp Edwards	Sandwich, Falmouth, Bourne, Mashpee.	P
MA	South Weymouth Naval Air Station	Weymouth.	
MD	Aberdeen Proving Ground (Edgewood Area)	Edgewood.	
MD	Aberdeen Proving Ground (Michaelsville LF)	Aberdeen.	
MD	Andrews Air Force Base	Camp Springs.	
MD	Beltsville Agricultural Research (USDA)	Beltsville.	
MD	Brandywine DRMO	Brandywine.	
MD	Curtis Bay Coast Guard Yard	Anne Arundel County.	
MD	Fort Detrick Area B Ground Water	Frederick.	
MD	Fort George G. Meade	Odenton	P
MD	Indian Head Naval Surface Warfare Center	Indian Head.	
MD	Patuxent River Naval Air Station	St. Mary's County.	

TABLE 2—FEDERAL FACILITIES SECTION—Continued

St	Site name	City/County	Notes(a)
ME	Brunswick Naval Air Station	Brunswick.	
ME	Loring Air Force Base	Limestone.	
ME	Portsmouth Naval Shipyard	Kittery.	
MN	Naval Industrial Reserve Ordnance Plant	Fridley	P
MN	New Brighton/Arden Hills/TCAAP (USARMY)	New Brighton.	
MO	Lake City Army Ammu. Plant (NW Lagoon)	Independence.	
MO	Weldon Spring Former Army Ordnance Works	St. Charles County.	
MO	Weldon Spring Quarry/Plant/Pitts (USDOE)	St. Charles County.	
NC	Camp Lejeune Military Res. (USNAVY)	Onslow County.	
NC	Cherry Point Marine Corps Air Station	Havelock.	
NE	Cornhusker Army Ammunition Plant	Hall County.	
NH	Pease Air Force Base	Portsmouth/Newington.	
NJ	Federal Aviation Admin. Tech. Center	Atlantic County.	
NJ	McGuire Air Force Base #1	Wrightstown.	
NJ	Middlesex Sampling Plant (USDOE)	Middlesex.	
NJ	Naval Air Engineering Center	Lakehurst.	
NJ	Naval Weapons Station Earle (Site A)	Colts Neck.	
NJ	Picatinny Arsenal (USARMY)	Rockaway Township.	
NM	Lee Acres Landfill (USDO1)	Farmington.	
NY	Brookhaven National Laboratory (USDOE)	Upton.	
NY	Griffiss Air Force Base	Rome	P
NY	Plattsburgh Air Force Base	Plattsburgh.	
NY	Seneca Army Depot	Romulus	P
OH	Feed Materials Production Center (USDOE)	Fernald.	
OH	Mound Plant (USDOE)	Miamisburg	P
OH	Wright-Patterson Air Force Base	Dayton.	
OK	Tinker Air Force (Soldier Cr/Bldg 300)	Oklahoma City.	
OR	Fremont Nat. Forest Uranium Mines (USDA)	Lakeview.	
OR	Umatilla Army Depot (Lagoons)	Hermiston.	
PA	Letterkenny Army Depot (SE Area)	Chambersburg	P
PA	Letterkenny Army Depot (PDO Area)	Franklin County	P
PA	Naval Air Development Center (8 Areas)	Warminster Township.	
PA	Navy Ships Parts Control Center	Mechanicsburg.	
PA	Tobyhanna Army Depot	Tobyhanna	P
PA	Willow Grove Naval Air & Air Res. Stn.	Willow Grove.	
PR	Atlantic Fleet Weapons Training Area—Vieques	Island of Vieques ¹	S
RI	Davisville Naval Construction Batt Cent	North Kingston.	
RI	Newport Naval Education/Training Center	Newport.	
SC	Parris Island Marine Corps Recruit Depot	Parris Island.	
SC	Savannah River Site (USDOE)	Aiken.	
SD	Ellsworth Air Force Base	Rapid City	P
TN	Memphis Defense Depot (DLA)	Memphis.	
TN	Milan Army Ammunition Plant	Milan.	
TN	Oak Ridge Reservation (USDOE)	Oak Ridge.	
TX	Air Force Plant #4 (General Dynamics)	Fort Worth.	
TX	Lone Star Army Ammunition Plant	Texarkana.	
TX	Longhorn Army Ammunition Plant	Kamack.	
TX	Pantex Plant (USDOE)	Pantex Village.	
UT	700 South 1600 East PCE Plume	Salt Lake City.	
UT	Hill Air Force Base	Ogden.	
UT	Monticello Mill Tailings (USDOE)	Monticello	P
UT	Ogden Defense Depot (DLA)	Ogden.	
UT	Tooele Army Depot (North Area)	Tooele.	
VA	Defense General Supply Center (DLA)	Chesterfield County.	
VA	Fort Eustis (US Army)	Newport News.	
VA	Langley Air Force Base/NASA Langley Cntr	Hampton.	
VA	Marine Corps Combat Development Command	Quantico.	
VA	Naval Amphibious Base Little Creek	Virginia Beach.	
VA	Naval Surface Warfare—Dahlgren	Dahlgren.	
VA	Naval Weapons Station—Yorktown	Yorktown.	
VA	Naval Weapons Station Yorktown—Cheatham Annex	Williamsburg.	
VA	Norfolk Naval Base (Sewells Pt Nvl Cmpx)	Norfolk.	
VA	Norfolk Naval Shipyard	Portsmouth.	
VA	St. Juliens Creek Annex (U.S. Navy)	Chesapeake.	
WA	American Lake Gardens/McChord AFB	Tacoma.	
WA	Bangor Naval Submarine Base	Silverdale.	
WA	Bangor Ordnance Disposal (USNAVY)	Bremerton.	
WA	Fairchild Air Force Base (4 Waste Areas)	Spokane County.	
WA	Fort Lewis Logistics Center	Tillicum.	
WA	Hanford 100-Area (USDOE)	Benton County	P
WA	Hanford 200-Area (USDOE)	Benton County.	
WA	Hanford 300-Area (USDOE)	Benton County.	

TABLE 2—FEDERAL FACILITIES SECTION—Continued

St	Site name	City/County	Notes(a)
WA	Jackson Park Housing Complex (USNAVY)	Kitsap County.	
WA	Naval Air Station, Whidbey Island (Ault)	Whidbey Island.	
WA	Naval Undersea Warfare Station (4 Areas)	Keyport.	
WA	Old Navy Dump/Manchester Lab (USEPA/NOAA)	Manchester.	
WA	Puget Sound Naval Shipyard Complex	Bremerton.	
WV	Allegany Ballistics Laboratory (USNAVY)	Mineral.	
WV	West Virginia Ordnance (USARMY)	Point Pleasant	P
WY	F.E. Warren Air Force Base	Cheyenne.	

¹ Only the Vieques portions of the AFWTA are included in appendix B to Part 300, the National Priorities List. The Culebra portions of the AFWTA (that were included in the NPL proposal AFWTA on August 13, 2004) are not included at this time due to ongoing negotiations between the Commonwealth of Puerto Rico and the Department of the Army.

Notes:
 (a) A = Based on issuance of health advisory by Agency for Toxic Substances and Disease Registry (if scored, HRS score need not be greater than or equal to 28.50).
 S = State top priority (included among the 100 top priority sites regardless of score).
 P = Sites with partial deletion(s).

[62 FR 15576, Apr. 1, 1997]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting part 300, appendix B, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and at www.govinfo.gov.

APPENDIX C TO PART 300—SWIRLING FLASK DISPERSANT EFFECTIVENESS TEST, REVISED STANDARD DISPERSANT TOXICITY TEST, AND BIOREMEDIATION AGENT EFFECTIVENESS TEST

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1.0 Introduction

1.1 *Scope and Application.* The methods described below apply to "dispersants, surface washing agents, surface collecting agents, bioremediation agents, and miscellaneous oil spill control agents" involving subpart J (Use of Dispersants and Other Chemicals) in 40 CFR part 300 (National Oil and Hazardous Substances Pollution Contingency Plan). They are revisions and additions to the EPA's Standard Dispersant Effectiveness and Toxicity Tests (1). The new Swirling Flask Dispersant Effectiveness Test is used only for testing dispersants. The Revised Standard Dispersant Toxicity Test is used for testing dispersants, as well as surface washing agents, surface collecting agents, and miscellaneous oil spill control agents. The bioremediation agent effectiveness test is used for testing bioremediation agents only.

1.2 *Definitions.* The definitions of dispersants, surface washing agents, surface collecting agents, bioremediation agents, and miscellaneous oil spill control agents are provided in 40 CFR 300.5.

2.0 *Swirling Flask Dispersant Effectiveness Test*

2.1 *Summary of Method.* This protocol was developed by Environment Canada to provide

a relatively rapid and simple testing procedure for evaluating dispersant effectiveness (2). It uses a modified Erlenmeyer flask to which a side spout has been added for removing subsurface samples of water near the bottom of the flask without disturbing a surface oil layer. Seawater and a surface layer of oil are added to the flask. Turbulent mixing is provided by placing the flask on a standard shaker table at 150 rpm for 20 minutes to induce a swirling motion to the liquid contents. Following shaking, the flask is immediately removed from the shaker table and maintained in a stationary position for 10 minutes to allow the oil that will reform a slick to return to the water's surface. A sample of water for chemical analysis is then removed from the bottom of the flask through the side spout, extracted with methylene chloride (dichloromethane-DCM), and analyzed for oil content by UV-visible absorption spectrophotometry at wavelengths of 340, 370, and 400 nm (2).

2.2 Apparatus.

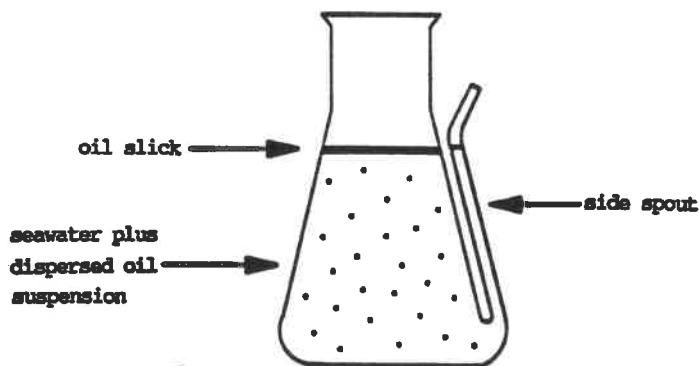
2.2.1 *Modified Erlenmeyer Flask.* Use 125-ml glass Erlenmeyer flasks that have been modified to include an attachment of a glass side spout that extends from the bottom of the flask upward to the neck region, as shown in Figure 1.

2.2.2 *Shaker Table.* Use a shaker table with speed control unit with variable speed (40-400 rpm) and an orbital diameter of approximately 0.75 inches (2 cm) to provide turbulence to solutions in test flasks.

2.2.3 *Spectrophotometer.* Use a UV-visible spectrophotometer capable of measuring absorbance at 340, 370, and 400 nm. A Hitachi Model U-2000 or equivalent is acceptable for this purpose.

2.2.4 *Glassware.* Glassware should consist of 5-, 10-, 25-, 100-, and 500-ml graduated cylinders; 125-ml separatory funnels with Teflon stopcocks; and 10-, 100-, and 1,000-ml volumetric flasks and micropipettes.

Figure 1
Swirling Flask Test Apparatus



2.3 Reagents. 2.3.1 *Synthetic seawater.* The synthetic sea salt "Instant Ocean," manufactured by Aquarium Systems of Mentor, OH, can be used for this purpose. The synthetic seawater solution is prepared by dissolving 34 g of the salt mixture in 1 liter of distilled water (*i.e.*, a salinity of 34 ppt). Table 1 provides a list of the ion composition of the seasalt mixture.

TABLE 1—MAJOR ION COMPOSITION OF "INSTANT OCEAN" SYNTHETIC SEA SALT

Major Ion	% Total Weight	Ionic Concentration at 34 ppt salinity (mg/l)
Chloride (Cl ⁻)	47.470	18,740
Sodium (Na ⁺)	26.280	10,454
Sulfate (SO ₄ ⁻)	6.602	2,631
Magnesium (Mg ⁼)	3.230	1,256
Calcium (Ca ⁼)	1.013	400

TABLE 1—MAJOR ION COMPOSITION OF "INSTANT OCEAN" SYNTHETIC SEA SALT—Continued

Major Ion	% Total Weight	Ionic Concentration at 34 ppt salinity (mg/l)
Potassium (K ⁼)	1.015	401
Bicarbonate (HCO ₃ ⁻)	0.491	194
Boron (B)	0.015	6.0
Strontium (Sr ⁼)	0.001	7.5
SOLIDS TOTAL	86.11%	34,089.50
Water	13.88	
TOTAL	99.99%	

Following the preparation, the saltwater solution is allowed to equilibrate to the ambient temperature of the laboratory and should be in the range of 22 ± 3 °C.

2.3.2 *Test oil.* Two EPA/American Petroleum Institute (API) standard reference oils,

Prudhoe Bay and South Louisiana crude, should be used for this test. These oils can be obtained from the Resource Technology Corporation, 2931 Soldier Springs Road, P.O. Box 1346, Laramie, WY 82070, (307) 742-5452. These oils have been thoroughly homogenized, as well as characterized physically and chemically for previous EPA and API studies. Various selected parameters are presented in table 2.

TABLE 2—TEST OIL CHARACTERISTICS

	Prudhoe Bay crude oil	South Louisiana crude oil
Specific gravity ¹	0.894 kg/l	0.840 kg/l
API gravity ¹	26.8 degrees	37.0 degrees
Sulfur	1.03 wt%	0.23 wt%
Sulfur compounds, profile.		
Nitrogen	0.20 wt%	0.031 wt%
Vanadium	21 mg/l	0.95 mg/l
Nickel	11 mg/l	1.1 mg/l
Simulated distillation profile.		
Infrared spectrum.		
UV fluorescence spectrum.		
Pour Point	+ 25 °F	0 °F
Viscosity		
at 40 °C	14.09 cST	3.582 cST
at 100 °C	4.059 cST	1.568 cST
Index	210	(²)

¹At 15 °C

²Not calculable when viscosity at 100 °C is less than 2.0.

2.3.3 *Methylene Chloride (Dichloromethane-DCM), pesticide quality.* For extraction of all sample water and oil-standard water samples.

2.4 *Pretest preparation.* 2.4.1 *Preparation and analysis of oil standards.* 2.4.1.1 Standard solutions of oil for calibrating the UV-visible spectrophotometer are prepared with the specific reference oils and dispersant used for a particular set of experimental test runs. For experiments with no dispersant, only oil is used to make the standard solution. For experiments with the oil plus dispersant, the standard is made with a 1:10 (v:v) mixture of the dispersant to the test oil (i.e., a dispersant-to-oil ratio of 1:10). This ratio is used in the test tank with dispersant added. The presence of water and certain dispersants in DCM extracts can affect absorbance readings in a spectrophotometer. All standard solutions of oil (and dispersant, if present) should be prepared in a stepwise manner that reflects the analytical protocol used for the experimental water samples.

2.4.1.2 To prepare the standards, prepare a parent oil-DCM standard by mixing 1 part oil (plus ½ part premixed dispersant, if applicable) to 9 parts DCM (i.e., 1:10 dilution of the oil v:v). Add a specific volume of the parent oil-DCM standard to 30 ml of synthetic seawater in a separatory funnel. Extract the oil-water mixture with 5-ml volumes of DCM after 15 seconds of vigorous shaking followed

by a 2 minute stationary period to allow for phase separation for each extraction. Repeat the extraction using a total of three 5-ml portions of DCM. Adjust the final DCM volume for the combined extracts to 20 ml with DCM in a 25-ml graduated cylinder.

2.4.1.3 The quantities of oil used to achieve the desired concentrations in the final 20-ml DCM extracts for the standard oil-solutions are summarized in table 3. Specific masses for oil amounts in standards are determined as volumes of oil multiplied by the density of the oil.

2.4.2 *Linear stability calibration of UV-Visible spectrophotometer.*

2.4.2.1 Before DCM-extracts of dispersed oil-water samples can be analyzed for their oil content, the UV-visible spectrophotometer must meet an instrument stability calibration criterion. This criterion is determined with the six oil standards identified in table 3. Determine the absorbance of standards at each of the three analytical wavelengths (i.e., 340, 370, and 400 nm). Determine the response factors (RFs) for the test oil at each of the three analytical wavelengths using the following equation:

$$RF_x = C/A_x \quad (1)$$

where:

RF_x = Response factor at wavelength x (x = 340, 370, or 400 nm)

C = Oil concentration, in mg of oil/ml of DCM in standard solution

A_x = Spectrophotometric absorbance of wavelength x

TABLE 3—OIL STANDARD SOLUTIONS: CONCENTRATIONS IN FINAL DCM EXTRACTIONS¹

Final oil concentration (mg/ml of DCM)	Final extract volume (ml of DCM)	Total amount of oil in standard (mg)	Volume of parent oil-DCM std (μl) added to saltwater
4.0	20.0	80.0	890
2.0	20.0	40.0	440
1.0	20.0	20.0	220
0.50	20.0	10.0	110
0.10	20.0	2.0	22
0.05	20.0	1.0	11

¹ Assuming an oil density of 0.9 g/ml and an extraction efficiency of 100% for oil from the 30-ml of seawater.

2.4.2.2 Instrument stability for the initial calibration is acceptable when the RFs for the five highest standard extracts of oil are <20% different from the overall mean value for the five standards. If this criterion is satisfied, analysis of sample extracts can begin. RFs for the lowest concentration (0.05 mg oil/ml DCM) are not included in the consideration because the absorbance is close to the detection limit of the spectrophotometer (with associated high variability in the value) for the 1-cm path-length cell used for measurements. Absorbances ≥3.5 are not included because absorbance saturation occurs at and above this value.

2.4.2.3 If one or more of the standard oil extracts do not meet this linear-stability criterion, then the "offending" standard(s) can be prepared a second time (*i.e.*, extraction of the specified amount of oil from 30-ml or seawater for the "offending" standard according to the pretest preparation procedure). If replacement of the reanalyzed standard solution(s) in the standard curve meets the linear-stability criterion (*i.e.*, no RF >20% different from the overall mean), then analysis of sample extracts can begin.

2.4.2.4 If the initial-stability criterion is still not satisfied, analysis of sample extract cannot begin and the source of the problem (*e.g.*, preparation protocol for the oil standards, spectrophotometer stability, etc.) must be corrected.

2.4.2.5 The initial six-point calibration of the UV-visible spectrophotometer at the oil concentrations identified is required at least once per test day.

2.5 Test procedure. 2.5.1 Preparation of premixed dispersant oil. Prepare a premixed dispersant oil by mixing 1 part dispersant to 10 parts oil. Store this mixture in a glass container. The dispersant effectiveness test procedures are listed in steps 1-20:

1. Prepare 4 replicates (same test oil and dispersant), one control (*i.e.*, no dispersant), and one method blank and run at the same time on the shaker table.

2. Add 120±2 ml of synthetic seawater to each of the modified 125-ml glass Erlenmeyer flasks. Measure and record the water temperature.

3. Place the flasks securely into the attached slot on the shaker table.

4. Carefully add 100 µl of an oil-dispersant solution onto the center of the water's surface using a positive displacement pipette.

5. Agitate the flasks for 20±1 minutes at 150±10 rpm on the shaker table.

6. After the 20±1 minutes shaking, remove the flasks from the shaker table and allow them to remain stationary for 10±1 minutes for oil droplet "settling."

7. At the conclusion of the 10-minute settling period, carefully decant a 30-ml sample through the side spout of the test flasks into a 50-ml graduated cylinder.

NOTE: Discard the first 1-2 ml of sample water to remove nonhomogeneous water-oil initially contained in the spout.

8. Transfer the samples from the graduated cylinder into a 125- or 250-ml glass separatory funnel fitted with a Teflon stopcock.

9. Add 5 ml of pesticide-quality DCM to the separatory funnel and shake vigorously for 15 seconds. Release the pressure carefully from the separatory funnel through the stopcock into a fume hood.

10. Allow the funnel to remain in a stationary position for 2 minutes to allow phase-separation of the water and DCM.

11. Drain the DCM layer from the separatory funnel into a glass-stoppered, 25-ml graduated glass cylinder.

12. Repeat the DCM-extraction process two additional times.

13. Combine the three extracts in the graduated cylinder and adjust the final volume to 20-ml with additional DCM.

14. Analyze the samples using a UV-spectrophotometer at 340, 370, and 400 nm-wavelengths and determine the quantity of oil as follows:

$$C_x = (A_x) \times (RF_x) \times (V_{DCM}) \times (V_{TW}/V_{EW}) \quad (2)$$

where:

C_x = Total mass of dispersed oil in swirling flask at wavelength x ($x = 340, 370, \text{ or } 400 \text{ nm}$)

A_x = Spectrophotometric absorbance at wavelength x

RF_x = Mean response factor at wavelength x (determined from equation 1)

V_{DCM} = Final volume of DCM-extract of water sample (20 ml)

V_{TW} = Total water volume in swirling flask vessel (120 ml)

V_{EW} = Volume of water extracted for dispersed oil content (30 ml)

15. Obtain three concentration values for oil in each experimental water sample (340, 370, and 400 nm).

16. Determine the mean of three values as follows:

$$C_{\text{mean}} = (C_{340} + C_{370} + C_{400})/3 \quad (3)$$

NOTE: Means will be used for all dispersion-performance calculations. Samples where one of the values for C_{340} , C_{370} , or C_{400} is more than 30% different from C_{mean} will be flagged. Whenever oil measurements are flagged as having a concentration based on one wavelength as >30% different from C_{mean} , raw data will be evaluated to establish that the measurements are valid. In addition, attempts will be made to correlate the difference to oil type, dispersant test, or dispersant used. If no errors or correlations are apparent and >10% of all oil measurements are flagged, the mean concentration data will be used in the calculation for dispersant performance and the subject data will be flagged.

17. Determine the dispersant performance (*i.e.*, percent of oil that is dispersed, or EFF) based on the ratio of oil dispersed in the test system to the total oil added to the system as follows:

$$\text{EFF (in \%)} = (C_{\text{mean}}/C_{\text{TOT}}) \times 100 \quad (4)$$

where:

C_{mean} = Mean value for total mass of dispersed oil in the swirling flask determined by spectrophotometric analysis

C_{TOT} = Total mass of oil initially added to the experimental swirling flask

18. Calculate EFF using equation 4 for coupled experiments with and without dispersant (EFF_c and EFF_a, respectively). EFF_c is

the effectiveness of the control and represents natural dispersion of the oil in the test apparatus. EFF_d is the measured uncorrected value.

19. Calculate the final dispersant performance of a chemical dispersant agent after correcting for natural dispersion using equation 5.

$$EFF_D = EFF_d - EFF_c \quad (5)$$

where:

EFF_D = % dispersed oil due to dispersant only

EFF_d = % dispersed oil with dispersant added
 EFF_c = % dispersed oil with no dispersant added

20. Calculate the average dispersant effectiveness value by summing the corrected values (EFF_D) for each of the four replicates for each of the two test oils and dividing this sum by eight.

2.6 *Performance criterion.* The dispersant product tested will remain in consideration for addition to the NCP Product Schedule if the average dispersant effectiveness, as calculated in section 2.5 above, is at least 45% (i.e., 50%±5%).

2.7 *Quality Control (QC) procedures for measurements of oil concentrations.* 2.7.1 *UV-visible spectrophotometric measurements.* At least 5% of all UV-visible spectrophotometric measurements will be performed in duplicate as a QC check on the analytical measurement method. The absorbance values for the duplicates should agree within ±5% of their mean value.

2.7.2 *Method blanks.* Analytical method blanks involve an analysis of seawater blanks (i.e., seawater but no oil or dispersant in a swirling flask vessel) through testing and analytical procedures (3, pp 79-80). Method blanks are analyzed with a frequency of at least 1 for every 12 experimental swirling flask samples. Oil concentrations in method blanks must be <5% of that occurring for 100% dispersion of oil in testing apparatus.

3.0 Revised standard dispersant toxicity test

3.1 *Summary of method.* The standard toxicity test for dispersants and other products involves exposing two species (*Menidia beryllina* (silversides) and *Mysidopsis bahia* (mysid shrimp)) to five concentrations of the test product and No. 2 fuel oil alone and in a 1:10 mixture of product to oil. To aid in comparing results from assays performed by different workers, reference toxicity tests are conducted using dodecyl sodium sulfate (DSS) as a reference toxicant. The test length is 96 hours for *Menidia* and 48 hours for *Mysidopsis*. LC_{50} s are calculated based on mortality data at the end of the exposure period (for method of calculation, see section 3.6 below).

3.2 *Selection and preparation of test materials.*

3.2.1 Test organisms.

3.2.1.1 *Menidia beryllina.* Obtain fish (silversides) from a single source for each series of toxicity tests. In-house cultures are recommended wherever it is cost-effective; however, organisms are available from commercial suppliers. Information on the source of test organisms and any known unusual condition to which fish were exposed before use should be included in the data report. Use of animals previously treated with pesticides or chemotherapeutic agents should be avoided. Organisms should not be used if they appear to be unhealthy, discolored, or show signs of stress. Use 7-day old larval fish. Fish should be cultured in accordance with the methods outlined in Middaugh, et al. (5). There should be no need to acclimate organisms to the 25±1 °C temperature recommended for the toxicity tests if laboratory stock cultures of *Menidia* are maintained at the recommended culture temperature of 25±1 °C. If test organisms must be obtained from a commercial source, it may become necessary to acclimate test fish to the test temperature of 25±1 °C, a pH of 8.0±0.2, and 20±2 ppt salinity since changes in temperature may occur during shipping. Eliminate groups of fish having a mortality of more than 10% during the first 48 hours, and more than 5% thereafter. During acclimation, organisms should be maintained on a diet of freshly hatched *Artemia* (brine shrimp) nauplii. Feed the fish daily to satiation during the acclimation period, and once daily during the 96-hour test. Care should be taken daily to remove excess food and fecal material from beakers during the test. Use only those organisms that feed actively and that appear to be healthy. Organisms should be free of disease, external parasites, and any signs of physical damage or stress. Discard any fish injured or dropped while handling.

3.2.1.2 *Mysidopsis bahia.* Several methods for culturing *Mysidopsis bahia* (mysid shrimp) may be used and are noted in appendix A of Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (6). To ensure uniformity of mysids, recently hatched mysids should be collected daily from stock cultures and identified by the date of hatch. Mysids used in 48-hour tests should be from a single day's collection, but may have an age range of 5-7 days old. In cases where in-house cultures of mysids are unavailable, organisms may be purchased from a commercial source. Information on the source of test organisms should be submitted in the data report.

3.2.2 *Preparation of experimental water.* Filtered natural seawater is recommended for use since it represents a natural source of saltwater containing an inherent population of microorganisms. Synthetic seawater formulated according to the following method can serve as an acceptable alternative to filtered, natural seawater for toxicity tests

performed in laboratories in which natural seawater is unavailable.

3.2.3 *Synthetic seawater formation.* To prepare standard seawater, mix technical-grade salts with 900 liters of distilled or demineralized water in the order and quantities listed in table 4. These ingredients must be added in the order listed and each ingredient must be dissolved before another is added. Stir constantly after each addition during preparation until dissolution is complete. Add distilled or demineralized water to make up to 1,000 liters. The pH should now be 8.0±0.2. To attain the desired salinity of 20±1 ppt, dilute again with distilled or demineralized water at time of use.

3.3 *Sampling and storage of test materials.* Toxicity tests are performed with No. 2 fuel oil having the characteristics defined in table 5. Store oil used for toxicity tests in sealed containers to prevent the loss of volatiles and other changes. For ease in handling and use, it is recommended that 1,000-ml glass containers be used. To ensure comparable results in the bioassay tests, use oils packaged and sealed at the source. Dispose of unused oil in each open container on completion of dosing to prevent its use at a later date when it may have lost some of its volatile components. Run all tests in a bioassay series with oil from the same container and with organisms from the same group collected or secured from the same source.

TABLE 4—SYNTHETIC SEAWATER
[Toxicity Test]

Salt	(g) ¹
NaF	1.9
SrCl ₂ · 6H ₂ O	13.0
H ₂ BO ₂	20.0
KBr	67.0
KCl	466.0
CaCl ₂ · 2H ₂ O	733.0
Na ₂ SO ₄	2,660.0
MgCl ₂ · 6H ₂ O	3,330.0
NaCl	15,650.0
Na ₂ SiO ₃ · 9H ₂ O	13.0
EDTA ²	0.4
NaHCO ₃	133.0

¹ Amount added to 900 liters of water, as described in the text.

² Ethylenediaminetetraacetate tetrasodium salt.

3.4 *General test conditions and procedures for toxicity tests.*

3.4.1 *Temperature.* For these toxicity tests, use test solutions with temperatures of 25±1 °C.

3.4.2 *Dissolved oxygen and aeration.*

3.4.2.1 *Menidia.* Because oils contain toxic, volatile materials, and because the toxicity of some water-soluble fractions of oil and degradation products are changed by oxidation, special care must be used in the oxygenation of test solutions. Aeration during the test is generally not recommended but should be used to maintain the required dis-

solved oxygen (DO) in cases where low DO is observed. The DO content of test solutions must not drop below 60% saturation during the first 48 hours of a static acute (96-hour) test and must remain between 40-100% after the first 48 hours of the test. Aeration at a rate of 100±15 bubbles per minute is supplied by a serological pipette as needed for maintenance of DO. If aeration is necessary, all test chambers should be aerated. At this rate, and with the proper weight of fish, DO concentration should remain slightly above 4 ppm over a 96-hour period. Take DO measurements daily.

TABLE 5—TEST OIL CHARACTERISTICS: NO. 2
FUEL OIL

Characteristic	Min-imum	Max-imum
Gravity (°API)	32.1	42.8
Viscosity kinematic at 100 °F (cs)	2.35	3.00
Flash point (°F)	150	..
Pour point (°F) .....	..	0
Cloud point (°F) .....	..	10
Sulfur (wt %) .....	..	0.35
Aniline point (°F)	125	180
Carbon residue (wt %) .....	..	0.16
Water (vol %) .....	..	0
Sediment (wt %) .....	..	0
Aromatics (vol %)	10	15
Distillation:		
IBP (°F)	347	407
10% (°F)	402	456
50% (°F)	475	530
90% (°F)	542	606
End Point (°F)	596	655
Neutralization No .....	..	0.05

3.4.2.2 *Mysidopsis.* Achieve sufficient DO by ensuring that the surface area to volume ratio of the test solution exposed is large enough. Oxygen content should remain high throughout the test because of the low oxygen demand of the organisms. Aeration is not recommended during 48-hour acute toxicity tests unless the DO falls below 60% saturation.

3.4.3 *Controls.* With each fish or mysid test or each series of simultaneous tests of different solutions, perform a concurrent control test in exactly the same manner as the other tests and under the conditions prescribed or selected for those tests. Use the diluent water alone as the medium in which the controls are held. There must be no more than 10% mortality among the controls during the course of any valid test.

3.4.4 *Reference toxicant.* To aid in comparing results from tests performed by different workers and to detect changes in the condition of the test organisms that might lead to different results, perform reference toxicity tests with reagent grade DSS in addition to the usual control tests. Prepare a stock solution of DSS immediately before use by adding 1 gram of DSS per 500 ml of test water solution. Use exploratory tests before the full scale tests are begun to determine the

amount of reference standard to be used in each of the five different concentrations.

3.4.5 *Number of organisms.* At a minimum, 20 organisms of a given species are exposed for each test concentration. For the toxicity test procedures using *Menidia*, place 10 fish in each of two jars. For the toxicity tests using *Mysidopsis*, place 10 larvae in each of two containers.

3.4.6 *Transfer of organisms.* Organisms should be handled as little as possible in order to minimize stress. Transfer *Menidia* and *Mysidopsis* from the acclimatization aquaria to the test chambers with a pipette or a wide-bore, smooth glass tube (4 to 8 mm internal diameter) fitted with a rubber bulb. Dip nets should be avoided when handling larval fish and mysids. Do not hold fish out of the water longer than necessary and discard any specimen accidentally dropped or otherwise mishandled during transfer.

3.4.6.1 *Mysidopsis.* To have the mysids ready for study, mysids may be sorted 24 hours prior to initiation of the 48-hour test. Transfer the mysids to a beaker containing a small volume of water; this vessel serves as a holding chamber during randomized transfer of the organisms to test solutions. Mysids are randomly selected from the batch of mysids in the holding chamber, and transferred to 50-ml beakers containing a small volume of seawater. One mysid is added per beaker using a small piece of flexible 500- μ m screening until all of the beakers contain one mysid. The process of random selection and sorting is continued until the appropriate number of mysids has been delivered to each of the 50-ml beakers. The mysids are gently released from the 50-ml beakers into larger beakers filled with an appropriate volume of 20-ppt seawater (25 °C) to bring the total volume to 200 ml. The beakers are randomly placed into a temperature-controlled water bath to acclimate overnight at 25 °C. The mysids are transferred to larger beakers (1-liter) for the 48-hour test after the addition of 800 ml of the test solution. A total of 10 mysids per beaker are used for 48-hour acute toxicity tests. A minimum of two replicate chambers are used for each test concentration and control.

3.4.6.2 *Menidia and Mysidopsis* are fed 50 brine shrimp nauplii/organism daily during the 96-hour and 48-hour tests. Excess food should be removed daily by aspirating with a pipette.

3.4.7 *Test duration and observations.* 3.4.7.1 *Menidia.* Observe the number of dead fish in each test container and record at the end of each 24-hour period. Fish are considered dead upon cessation of respiratory and all other overt movements, whether spontaneous or in response to mild mechanical prodding. Remove dead fish as soon as observed. Also note and report when the behavior of test fish deviates from that of control fish. Such behavioral changes would include variations

in opercular movement, coloration, body orientation, movement, depth in container, schooling tendencies, and others. Abnormal behavior of the test organisms (especially during the first 24 hours) is a desirable parameter to monitor in a toxicity test because changes in behavior and appearance may precede mortality. Toxicants can reduce an organism's ability to survive natural stresses. In these cases, the mortality is not directly attributed to the toxicant, but most certainly is an indirect effect. Reports on behavioral changes during a toxicity test can give insight into the non-acute effects of the tested material. At the end of the 96-hour period, terminate the fish tests and determine the LC₅₀ values. The acute toxicity test is terminated after four days of exposure. The number of surviving fish are counted and recorded for each chamber in accordance with standard EPA methods (6). The LC₅₀ is calculated using survival data from the test in accordance with the methods described in the guidelines (6).

3.4.7.2 *Mysidopsis.* Terminate the mysid test after 48 hours of incubation. To count the dead animals accurately, place the exposure vessels on a light table such that light passes through the bottom of the vessel. Most of the dead mysids will be on the bottom of the beaker and can readily be seen against the background of the light table. Also search the top of the liquid for mysids trapped there by surface tension. Exercise caution when determining death of the animals. Occasionally, an animal appears dead, but closer observation shows slight movement of an appendage or a periodic spasm of its entire body. For these tests, animals exhibiting any movement when touched with a pipette tip are considered alive. Account for all test animals to ensure accuracy since *Mysidopsis bahia* may disintegrate or be cannibalized by other mysids. Consider individuals not accounted for as dead. At the end of 48 hours of exposure, terminate the mysid assay and determine the LC₅₀ values in accordance with the methods described in the guidelines (6).

3.4.8 *Physical and chemical determinations.*

3.4.8.1 *Menidia.* Determine the temperature, DO, and pH of the test solutions before the fish are added and at 24-, 48-, 72-, and 96-hour exposure intervals. It is necessary to take measurements from only one of the replicates of each of the toxicant series.

3.4.8.2 *Mysidopsis.* Determine the temperature, DO, and pH of the test solutions before the nauplii are added and at the 24- and 48-hour exposure interval. Measure DO and pH in only one of the replicates of each of the toxicant series.

3.4.9 *Testing laboratory.* An ordinary heated or air-conditioned laboratory room with thermostatic controls suitable for maintaining the prescribed test temperatures generally will suffice to conduct the toxicity

tests. Where ambient temperatures cannot be controlled to 25 ± 1 °C, use water baths with the necessary temperature controls.

3.4.10 *Test containers.* For tests with fish or mysids, use 1-liter glass beakers measuring approximately 10 cm in diameter. In conducting the test, add to each beaker 1 liter of the test solution or seawater formulation aerated to saturation with DO. To add the liter volume easily and accurately, use a large volume (1-liter) graduated cylinder. Process all required glassware before each test. Immerse in normal hexane for 10 minutes. Follow this with a thorough rinse with hot tap water; three hot detergent scrubs; an additional hot tap-water rinse; and three rinses with distilled water. Oven or air dry the glassware in a reasonably dust-free atmosphere.

3.5 *Preparation of test concentrations.* 3.5.1 *Menidia.* Place test jars (approximately 22.5 cm in height, 15 cm in diameter, 11 cm in diameter at the mouth) containing 2 liters of synthetic seawater on a reciprocal shaker. The shaker platform should be adapted to hold firmly six of the toxicity test jars. Add the desired amount of the petroleum product (if applicable) under test directly to each test jar. Dispense the appropriate amount of toxicant (if applicable) into the jars with a pipette. Tightly cap the test jars and shake for 5 minutes at approximately 315 to 333 2-cm (0.75-inch) strokes per minute in a reciprocal shaker or at approximately 150 to 160 rpm on orbital shakers. At the completion of shaking, remove the jars from the shaker and dispense 1 liter of the mixture to each of the 1-liter glass beakers. Randomly place beakers in a constant-temperature water bath or room, take water quality measurements, add fish, and initiate aeration.

3.5.2 *Mysidopsis.* 3.5.2.1 To prepare test solutions for products and oil/product mixtures, blend or mix the test solutions with an electric blender having: speeds of 10,000 rpm or less; a stainless-steel cutting assembly; and a 1-liter borosilicate jar. To minimize foaming, blend at speeds below 10,000 rpm.

3.5.2.2 For the product test solution, add 550 ml of the synthetic seawater to the jar, then with the use of a gas-tight calibrated glass syringe with a Teflon-tipped plunger, add 0.55 ml of the product and mix for 5 seconds.

3.5.2.3 For the oil test solution, add 550 ml of the synthetic seawater to the jar. Then with the use of a gas-tight calibrated glass syringe equipped with a Teflon-tipped plunger, add 0.55 ml of the oil and mix for 5 seconds.

3.5.2.4 For the oil/product mixture, add 550 ml of the synthetic seawater to the mixing jar. While the blender is in operation, add 0.5 ml of the oil under study with the use of a calibrated syringe with a Teflon-tipper plunger and then 0.05 ml of the product as indicated above. Blend for 5 seconds after addi-

tion of product. These additions provide test solutions of the product, oil, and the oil/product mixture at concentrations of 1,000 ppm.

3.5.2.5 Immediately after the test solutions are prepared, draw up the necessary amount of test solution with a gas-tight Teflon-tipped glass syringe of appropriate size and dispense into each of the five containers in each series. If the series of five concentrations to be tested are 10, 18, 32, 56, and 100 ppm, the amount of the test solution in the order of the concentrations listed above would be as follows: 10, 18, 32, 56, and 100 ml.

3.5.2.6 Each time a syringe is to be filled for dispensing to the series of test containers, start the mixer and withdraw the desired amount in the appropriate syringe while the mixer is in operation. Turn off immediately after the sample is taken to limit the loss of volatiles.

3.5.2.7 Use exploratory tests before the full-scale test is set up to determine the concentration of toxicant to be used in each of the five different concentrations. After adding the required amounts of liquid, bring the volume in each of the test containers up to 800 ml with the artificial seawater. To ensure keeping each of the series separate, designate on the lid of each container the date, the material under test, and its concentration.

3.5.2.8 When the desired concentrations are prepared, gently release into each beaker the 10 test *Mysidopsis* (previously transferred into 200 ml of medium). This provides a volume of 1 liter in each test chamber. A pair of standard cover glass forceps with flat, bent ends is an ideal tool for handling and tipping the small beaker without risk of contaminating the medium.

3.5.2.9 After adding the test animals, incubate the test beakers at 25 ± 1 °C for 48 hours. Recommended lighting is 2,000 lumens/m² (200 ft-c) of diffused, constant, fluorescent illumination.

3.5.2.10 Wash the blender thoroughly after use and repeat the above procedures for each series of tests. Wash the blender as follows: rinse with normal hexane; pour a strong solution of laboratory detergent into the blender to cover the blades; fill the container to about half of its volume with hot tap water; operate the blender for about 30 seconds at high speed; remove and rinse twice with hot tap water, mixing each rinse for 5 seconds at high speed; and then rinse twice with distilled water, mixing each rinse for 5 seconds at high speed.

3.6 *Calculating and reporting.* At the end of the test period, the toxicity tests are terminated and the LC₅₀ values are determined.

3.6.1 *Calculations.* The LC_{50} is the concentration lethal to 50% of the test population. It can be calculated as an interpolated value based on percentages of organisms surviving at two or more concentrations, at which less than half and more than half survived. The LC_{50} can be estimated with the aid of computer programs or graphic techniques (log paper). The 95% confidence intervals for the LC_{50} estimate should also be determined.

3.6.2 *Reporting.* The test product and oil and their source and storage are described in the toxicity test report. Note any observed changes in the experimental water or the test solutions. Also include the species of fish used; the sources, size, and condition of the fish; data of any known treatment of the fish for disease or infestation with parasites before their use; and any observations on the fish behavior at regular intervals during the tests. In addition to the calculated LC_{50} values, other data necessary for interpretation (e.g., DO, pH, other physical parameters, and the percent survival at the end of each day of exposure at each concentration of toxicant) should be reported.

3.7 Summary of procedures. 3.7.1 *Menidia:*

1. Prepare adequate stocks of the appropriate standard dilution water.

2. Add 2 liters of the standard dilution water to the test jars. Each test consists of 5 replicates of each of 5 concentrations of the test material, a control series of 5 beakers, and a standard reference series of 5 different concentrations for a total of 35 beakers. Simultaneous performance of toxicity tests on the oil, product, and oil/product mixture requires a total of 105 beakers.

3. Add the determined amount (quarter points on the log scale) of test material to the appropriate jars. Preliminary tests will be necessary to define the range of definitive test concentrations.

4. Cap the jars tightly with the Teflon-lined screw caps and shake for 5 minutes at 315 to 333 2-cm (0.75-inch) strokes per minute on a reciprocal shaker.

5. Remove the jars from the shaker, take water quality data, dispense 1 liter of solution to the 1-liter glass beaker, and add 10 acclimated fish per beaker.

6. Aerate with 100±15 bubbles per minute through a 1-ml serological pipette, as needed, to maintain DO above 4.0 mg/l.

7. Observe and record mortalities, water quality, and behavioral changes every 24 hours.

8. After 96 hours, terminate the test, and calculate LC_{50} values and corresponding confidence limits.

3.7.2 *Mysidopsis:*

1. Initiate the procedure for hatching the *Mysidopsis* in sufficient time before the toxicity test is to be conducted so that 5-7 day old larvae are available.

2. With the use of a small pipette, transfer 10 *Mysidopsis* into small beakers, each containing 200 ml of the proper synthetic seawater.

3. To prepare the test stock product and oil solutions, add 550 ml of the artificial seawater to the prescribed blender jar. By means of a gas-tight glass syringe with a Teflon-tipped plunger, add 0.55 ml of the product (or oil) and mix at 10,000 rpm for 5 seconds. To prepare the test stock oil/product mixture, add 550 ml of the standard seawater to the blender jar. While the blender is in operation (10,000 rpm), add 0.5 ml of the oil, then 0.05 ml of the product with the use of a calibrated syringe with a Teflon-tipped plunger. Blend for 5 seconds after adding the product. One ml of these stock solutions added to the 100 ml of standard seawater in the test containers yields a concentration of 10 ppm product, oil, or oil/product combination (the test will be in a ratio of 1 part product to 10 parts of oil).

4. Each test consists of 5 replications of each of 5 concentrations of the material under study, a control series of 5 beakers and a standard reference series of 5 different concentrations, for a total of 35 beakers. Simultaneous performance of toxicity tests on the oil, product, and oil/product mixture requires a total of 105 beakers. Immediately after preparing the test solution of the product or oil/product solution, and using an appropriately sized syringe, draw up the necessary amount of test solution and dispense into each of the five containers in each series. Each time a syringe is to be filled for dispensing to the series of test containers, start the mixer and withdraw the desired amount in the appropriate syringe while the mixer is in operation. Turn mixer off immediately after the sample is taken to limit the loss of volatiles. After adding the required amount of the test oil/product or product mixture, bring the volume of liquid in each of the test containers up to 800 ml with the artificial seawater. When the desired concentrations have been prepared, gently release into each beaker the 10 mysids previously transferred into 200 ml of medium. This provides a volume of 1 liter in each test chamber.

5. Wash the blender as prescribed for each series of tests.

6. Incubate the test beakers at 25±1 °C for 48 hours with the prescribed lighting.

7. Terminate the experiment after 48 hours, observe and record the mortalities, and determine the LC_{50} s and corresponding confidence limits.

4.0 *Bioremediation agent effectiveness test*

4.1 *Summary of method.* The bioremediation agent effectiveness testing protocol is designed to determine a product's ability to biodegrade oil by quantifying changes in the

oil composition resulting from biodegradation. The protocol tests for microbial activity and quantifies the disappearance of saturated hydrocarbons and polynuclear aromatic hydrocarbons (PAHs). The sample preparation procedure extracts the oil phase into dichloromethane (DCM), with a subsequent solvent exchange into hexane. To effectively accomplish the goals of the testing protocol, it is necessary to normalize the concentration of the various analytes in oil to a non-biodegradable marker, either C₂- or C₃-phenanthrene, C₂-chrysene, or hopane¹ (7). The test method targets the relatively easy to degrade normal alkanes and the more resistant and toxic PAHs. It normalizes their concentrations to C₂- or C₃-phenanthrene, C₂-chrysene, or C₃₀17α(H), 21β (H)-hopane on an oil weight basis (mg marker/kg oil, mg target analyte/kg oil). The analytical technique uses a high resolution gas chromatograph/mass spectrometer (GC/MS) because of its high degree of chemical separation and spectral resolution. GC/MS has long been used to study the weathering and fate of oil spilled into the environment. For quantitative analyses, the instrument is operated in the selective ion detection (SIM) mode at a scan rate of greater than 1.5 scans per second to maximize the linear quantitative range and precision of the instrument. The sample preparation method does not exclude analysis of selected samples by GC/MS in the full scanning mode of operation to qualitatively assess changes in the oil not accounted for by the SIM approach. Performed concurrently with the chemical analysis described above is a microbiological analysis. The microbiological analysis is performed to determine and monitor the viability of the microbial cultures being studied. Under this procedure, microbial enumerations of hydrocarbon degraders are performed at each sampling event using a microtiter Most Probable Number (MPN) determination.

4.2 *Apparatus.* The following materials and equipment are required for the protocol: Appropriate flasks and other glassware; sterile tubes; graduated cylinders (100-ml); deionized water; p-iodonitrotetrazolium violet dye; weighing pans or paper; 250-ml borosilicate glass Erlenmeyer flasks with screw tops; Pasteur pipettes; laboratory notebook; microtiter MPN plates (24-well) multi-channel pipetting device; dilution tube and caps; autoclave; environmental room or incubator; balance accurate to 0.1 mg (XD-400); GC/MS instrument equipped with a DB-5 capillary column (30 m, 0.25-mm I.D., and 0.25-μm film thickness) and a split/splitless injection port operating in the splitless mode, such as Hewlett-Packard 5890/5971 GC/

¹ Although any of these biomarkers can be used to conduct this test, it is recommended that hopane be used.

MS (recommended for use); and an autosampler for testing multiple samples.

4.3 *Reagents and culture medium.* 4.3.1 *Preparation of seawater.* All products are tested in clean natural seawater. Clean natural seawater means that the source of this seawater must not be heavily contaminated with industrial or other types of effluent. For example, seawater should not be obtained from a source near shipping channels or discharges of industrial or municipal wastewater, or with high turbidity. The seawater is used within seven days of collection. No microbial inoculum is added.

4.3.2 *Preparation of oil.* A medium weight crude oil, Alaska North Slope (ANS), is artificially weathered by heating to 521 °F to remove the light end hydrocarbons prior to experimental start-up (ANS 521). The method is described in the Draft International Standard ISO/DIS 8708 "Crude Petroleum Oil—Determination of Distillation Characteristics Using 15 Theoretical Plates Columns" by the International Organization for Standardization (8). The ANS521 crude oil can be obtained from the National Environmental Technology Applications Center's (NETAC) Bioremediation Products Evaluation Center (BPEC), University of Pittsburgh Applied Research Center, 615 William Pitt Way, Pittsburgh, PA, 15238, (412) 826-5511. The crude oil is heated to 190 °C (374 °F) under atmospheric pressure. The system is then cooled and placed under vacuum (or under an atmospheric pressure of 20 mm Hg) for the final distillation to an atmospheric equivalent boiling point of 272 °C (521 °F).

4.3.3 *Preparation of mineral nutrient solution.* If a commercial product is strictly a microbial agent and does not contain its own nutrients, a mineral nutrient solution will be provided if requested by the product manufacturer or vendor. If a commercial product contains its own nutrients, no further nutrients will be added. The nutrient solution is a modified salt solution and is described below.

4.3.3.1 *Nutrient preparation:*

1. N&P Salts. The following salts are added to distilled water and made up to a 1,000-ml volume. Adjust final pH to 7.8. The solution is sterilized by autoclaving at 121 °C at 15 psig for 20 minutes or by filtering through a sterile 0.22 μm membrane filter.

Na₂ HPO₄·2H₂O—18.40 g
KNO₃—76.30 g

2. MgSO₄·7H₂O solution. Dissolve 22.50 g in 1,000 ml distilled water. The solution is sterilized by autoclaving at 121 °C at 15 psig for 20 minutes.

3. CaCl₂ solution. Dissolve 27.50 g in 1,000 ml of distilled water. The solution is sterilized by autoclaving at 121 °C at 15 psig for 20 minutes.

4. FeCl₃·6H₂O solution. Dissolve 0.25 g in 1,000 ml of distilled water. The solution is

sterilized by autoclaving at 121 °C at 15 psig for 20 minutes.

5. Trace Element Solution. The following salts are added to distilled water and made up to a 1,000-ml volume. The solution is sterilized by autoclaving at 121 °C at 15 psig for 20 minutes.

- MnSO₄·H₂O—30.2 mg
- H₃BO₃—57.2 mg
- ZnSO₄·7H₂O—42.8 mg
- (NH₄)₆Mo₇(O₂)₄—34.7 mg

The pH of the nutrient solution is adjusted with a pH meter calibrated at room temperature (approximately 25 °C) using commercial buffers of pH 4.0, 7.0, and 10.0 (Fisher Scientific), as appropriate, prior to use. The pH is adjusted with concentrated HCl or 10 M NaOH, as appropriate.

4.3.3.2 Final concentrations: Ten (10) ml of solution 1 and 2 ml of solutions 2-5 are added

to non-sterile seawater and made up to a 1,000-ml volume immediately prior to test start-up. This seawater/mineral nutrient solution is used for all flasks containing products requiring nutrient supplements and for the flasks containing no commercial additive. Seawater without the above nutrient solutions is used for products containing their own source of nutrients.

4.4 Pretest preparation.

4.4.1 Experimental setup.

4.4.1.1 The procedure consists of an experimental shaker flask setup and the specific set of microbiological and chemical analyses that are performed on individual product samples. The following test flasks (labeled with unique identifiers) are prepared and set up on a gyratory shaker at day 0 to reflect the following treatment design:

Treatment	No. of samples at sampling times			Total No. of analytical determinations		
	Day 0	Day 7	Day 28	Microbial counts	Gravimetric	GC/MS
Control	3	3	3	9	9	9
Nutrient	3	3	3	9	9	9
Product	3	3	3	9	9	9

Control = Oil + Seawater
 Nutrient = Oil + Seawater + Nutrient
 Product = Oil + Seawater + Product (+ Nutrient, if required).

4.4.1.2 For each test, a sheet listing the number of flasks, types of controls, number of replicates, product to be tested, and other information is prepared. The following steps should be adhered to for the experimental setup:

1. Borosilicate glass Erlenmeyer flasks (250-ml) are thoroughly cleaned and autoclaved for 20 minutes at 120 °C at 15 psi, then dried in the drying oven.
2. Flasks are labeled with the appropriate code: product or control, sample day, and letter indicating replicate.
3. 100 ml of seawater is added to each flask.
4. For nutrient and product treatments that require the addition of nutrients, seawater containing the nutrient solution is prepared.
5. Pasteur pipettes should be sterilized in advance. Break off the tip to provide a larger opening prior to sterilization.
6. Pour the approximate amount of oil to be used from the large stock bottle into a sterile beaker. Keep the beaker covered when oil is not being removed.
7. The labeled flasks containing seawater and other additions, as necessary, are placed on the balance. The flask is tared. The appropriate amount of oil (0.5 g) is added drop by drop using a sterile Pasteur pipette with the tip broken off to provide a wider opening. Care is taken to avoid splashing the oil or getting it on the sides of flasks. Precautions

are taken when handling and charging the flasks to minimize the likelihood of contamination by exogenous microbes. This includes using a new sterile pipette for each series of flasks.

8. The weight of the oil is recorded in the laboratory notebook.

9. The product is prepared and added to the appropriate flasks according to the manufacturer's or vendor's instructions.

10. Flasks are carried upright and carefully placed in the holders on the shaker table to minimize the amount of oil that might adhere to the side of the flasks. Flasks in which a significant amount of oil is splashed on the sides are redone.

11. The prepared flasks are shaken at 200 rpm at 20 °C until such time that they will be removed for sampling.

4.4.2 Sampling. The control and treatments (nutrient and product flasks) are sampled three times over a 28-day period: day 0, day 7, and day 28. The entire flask is sacrificed for analysis; a 0.5-ml aliquot is removed from each flask for the microbiological analysis and the remainder of each flask is used for the chemical analysis. Specific procedures for both the microbiological and chemical analysis are described below. At the time of each sampling event, physical observations of each flask should be recorded.

4.5 *Microbiological analysis.* To monitor the viability of the microbial cultures being studied, microbial enumerations of hydrocarbon degraders are performed at each sampling event using a microtiter MPN determination. This is used as an indicator of the relative change in biomass. This test design relies on using growth response as an indication of enhanced activity as compared to a "no addition" control.

4.5.1 *Media preparation.* Media for microbial enumerations are carefully prepared according to manufacturer's or other instructions and sterilized using appropriate methods.

4.5.1.1 *General media treatment:* Buy Bushnell-Haas (B-H) broth in quantities to last no longer than one year. Use media on a first-in, first-out basis. When practical, buy media in quarter-pound multiples, rather than one-pound multiples to keep supply sealed as long as possible. Keep an inventory of media, including kind, amount, lot number, expiration date, date received, and date opened. Check inventory before reordering media. Discard media that are caked, discolored, or show other deterioration.

4.5.1.2 *Sterile saline (pH adjusted):*

1. Weigh 30 g of NaCl.
2. Dissolve in enough water to make 1,000 ml.
3. Adjust pH to 8.0 with NaOH (10M and 0.5M).
4. Sterilize by autoclaving for 15 minutes at 15 psig.

4.5.1.3 *Standard nutrient concentrate (add 1 ml to each 100 ml of Bushnell-Haas medium for MPNs):*

1. Weigh compounds listed below, dissolve in DIH₂O, dilute to 1 liter.

Potassium Phosphate, monobasic KH₂ PO₄—0.633 g

Potassium Phosphate, dibasic K₂ HPO₄—1.619 g

Sodium Phosphate, dibasic Na₂ HPO₄—2.486 g

Ammonium Chloride NH₄ Cl—3.850 g

Magnesium Sulfate, heptahydrate MgSO₄·7H₂O—4.500 g

Calcium Chloride, dihydrate CaCl₂·2H₂O—7.290 g

Ferric Chloride, hexahydrate FeCl₃·6H₂O—0.250 g

Trace Elements

Manganese Sulfate, monohydrate MnSO₄·H₂O—6.04 mg

Boric Acid H₃ BO₃—11.44 mg

Zinc Sulfate, heptahydrate ZnSO₄·7H₂O—8.56 mg

Ammonium Molybdate, tetrahydrate (NH₄)₆Mo₇O₂₄·4H₂O—6.94 mg

2. Adjust pH to 6.0.

3. Stir solution for approximately 3 hours, then filter through a Buchner funnel using #1 paper, which will retain approximately 3.8 g of insolubles.

4. Then filter through a 0.45 micron filter into sterile bottles.

5. Cap bottles, label, and store in refrigerator until used.

4.5.1.4 *Quality assurance/Quality control (QA/QC):*

1. Periodically check the effectiveness of sterilization using commercially available tapes or *Bacillus stearothermophilus* spore suspensions, following the instructions with these products.

2. Maintain a media log book that includes the dates, kinds and amounts of media made, pH, and any problems or observations.

3. Before use, check plates and tubes for signs of contamination, drying, or other problems.

4.5.1.5 *Safety/Special precautions:*

1. Note any safety or other precautions for particular media.

2. Note precautions to be followed when using the autoclave.

3. Use gloves and other protective clothes when handling media.

4. Use care in handling hot media.

4.5.2 *Microbial enumeration.* Standardized techniques for performing Most Probable Number microbial enumerations are described below.

4.5.2.1 *Dilutions:*

1. Prior to sacrificing each flask, remove 0.5 ml of water from each flask and add it to a tube of 4.5 ml sterile phosphate buffer (1:10 dilution) as prepared in the *Standard Methods for the Examination of Water and Wastewater* (9). Using sterile technique, mix and perform serial dilutions (0.5 ml of previous dilution to 4.5 ml of sterile phosphate buffer) to 10⁻⁹ dilution.

4.5.2.2 *Inoculating MPN plates (oil degrader):*

1. Prepare sufficient sterile 0.4 M NaCl (23.4 g NaCl/1,000 ml B-H) and B-H at pH 7.0 to fill the number of wells required for the test (1.75 ml/well).

2. Using sterile technique, add 1.75 ml of B-H broth to each well.

3. Label the top of the plate with the proper dilution for each row.

4. Add 0.1 ml of fluid from each dilution tube to each well in the appropriate row, starting with the most dilute.

5. After adding the fluid to all the wells, add 20 µl of sterilized No. 2 fuel oil to the top of each well.

6. Incubate each plate at 20 °C.

7. After 14 days of incubation, add 100 µl of p-iodotetrazolium violet dye (50 mg/10 ml of D.I. water) to each well to determine growth.

8. View plates against a white background to determine if color is present. Development of a purple or pink color upon standing for 45 minutes constitutes a positive test.

9. Record the number of positive wells and the dilutions at which they occur.

10. Enter data into a computerized enumeration method using "MPN Calculator" software program (version 2.3 or higher) by

Albert J. Klee, U.S. EPA Office of Research and Development, Risk Reduction Engineering Laboratory, Cincinnati, OH.

4.5.2.3 *Quality assurance/Quality control:*

1. Check pH of medium before preparing wells (pH should be approximately 8.0). Adjust pH, if necessary, with dilute NaOH.

2. Keep prepared tetrazolium violet dye solution in the refrigerator in an amber bottle when not in use.

3. Have all laboratory personnel periodically run MPNs on the same sample to test precision.

4.5.2.4 *Safety/Special precautions:*

1. Use sterile technique in preparing solutions, dilutions, plates, and MPN wells.

2. Do not pipette potentially hazardous solutions by mouth.

3. Autoclave all plates and wells before discarding.

4.6 *Chemical analysis of oil composition.*

4.6.1 *Sample procedure.* After 0, 7, and 28 days of incubation on a rotary shaker, the appropriate flasks are sacrificed and extracted with dichloromethane and spiked with a surrogate recovery standard. A 10-ml aliquot of the DCM layer is used for the gravimetric analysis. If significant biodegradation is evident in the results of the gravimetric analysis, then a solvent exchange into hexane takes place prior to the GC/MS analysis. Follow steps 1-19 below when preparing for the chemical analysis.

1. After 0, 7, and 28 days of rotary shaking and incubating at 20 °C, the reaction vessels are sacrificed. Prior to the chemical analysis, a 0.5-ml sample of the aqueous phase is removed for the microbiological analysis (see Microbial Enumeration above).

2. A surrogate recovery standard is prepared in the following manner: 1,000 mg of *d*₁₀-phenanthrene and 1,000 mg of 5 α -androstane are measured into a 500-ml volumetric flask and DCM is added to the mark to produce a 2,000-ng/ μ l stock solution.

3. A 100- μ l aliquot of the surrogate solution is added to each test flask. The final concentration of surrogates in each flask is approximately 4 ng/ μ l of solvent in the final extract. The aliphatics and marker data should be corrected for percent recovery of the 5 α -androstane surrogate and the aromatics for the *d*₁₀-phenanthrene surrogate.

4. The contents of the flask are placed into a 250-ml separatory funnel.

5. Measure a total volume of 50 ml DCM for use in the extraction. Use 3 10-ml fractions to rinse the flask into the funnel and transfer the remaining aliquot of DCM to the funnel.

6. Stopper and mix vigorously by shaking (approximately 50 times) while ventilating properly.

7. Each funnel is set aside to allow the DCM and water layers to partition. This may take 5-10 minutes for some products, or up to

3 hours if the product has caused the formation of an emulsion.

8. Drain the first 10 ml of the DCM (bottom) layer, collect, cap, uniquely label, and use for gravimetric analysis (see below). Drain the remaining 40 ml and dry it by passing it through a funnel packed with anhydrous sodium sulfate.

9. Assemble a Kuderna-Danish (KD) concentrator by attaching a Snyder column to an evaporation flask with a graduated concentrator tube. Align vertically and partially immerse concentrator tube in a water bath (10). Set the water bath to the appropriate temperature to maintain proper distillation.

10. Collect the de-watered extract into the KD concentrator.

11. Evaporate DCM to approximately 10 ml, then add approximately 50 ml of the exchange solvent (hexane) and concentrate the volume to 10 ml.

12. Rinse the flask into the concentrator tube with 50 ml hexane and concentrate to 10 ml. Repeat one more time with 50 ml of hexane.

13. Remove concentrator tube with the recovered 10 ml of sample volume. The heavier residual material should be present as a precipitate (bottom layer).

14. Centrifuge to aid the separation of the hexane from the precipitant fraction.

15. Place hexane-soluble fraction (top layer)—approximately 1.0 ml—into a GC/MS vial for analysis (see GC/MS Analysis Procedure below). If column fouling and deterioration of separation characteristics occur, an alumina column sample cleanup method can be considered (see Alternative GC/MS Sample Cleanup Procedure below).

16. Analyze by GC/MS using the conditions determined by the U.S. EPA Risk Reduction Engineering Laboratory, Water and Hazardous Waste Treatment Research Division, in Cincinnati, OH, which follows U.S. EPA Method 8270 (see GC/MS Analysis Procedure below).

17. Calculate surrogate recovery. If surrogate recovery is less than 85 percent for the marker relative to the surrogate recovery standard (*d*₁₀-phenanthrene), then the water layer should be extracted again using three separate extractions with DCM. Pool the three extractions with original extract and concentrate to 10 ml, and reanalyze by GC/MS.

18. Drain the seawater into a storage sample vial/container.

19. Seal the vial with a Teflon-lined cap and store frozen. This water layer is kept in case additional extractions are necessary.

4.6.2 *Gravimetric analysis.* The initial means to evaluate the effectiveness of a bioremediation agent for oil spill response is through gravimetric analysis. A statistically significant difference ($p < 0.05$) in analytical weight

of the oil from the control system as compared to the analytical weight of the oil treated with a bioremediation agent indicates biodegradation has successfully occurred. Hence, the disappearance of oil should be accompanied by significant decreases in total oil residue weight of extractable materials versus a control. If no significant decrease in oil residue weight is observed, the need to perform further chemical analysis should be evaluated. Follow steps 1-3 to conduct the gravimetric analysis.

1. The 10 ml of DCM extract (from Sample Procedure step 8 above) is placed in a small vial and concentrated to dryness by nitrogen blowdown techniques using a steady stream of nitrogen (pre-purified gas). If the oil is severely biodegraded, a larger volume of DCM (>10 ml) may be necessary for the gravimetric analysis.

2. The residue is weighed 3 times for the gravimetric weight of oil. Record the weight of the oil.

3. Compare statistically ($p < 0.05$) the weight of the product treatment versus the weight of the control from each respective time period. If a significant decrease is observed in the sampling (flask containing bioremediation agent) weight, then proceed with the remainder of the sample procedure.

4.6.3 GC/MS analysis. Often, analysis of saturated and aromatic hydrocarbons by capillary gas chromatography of DCM extracts leads to column fouling and deterioration of separation characteristics. An alternative, simple "one-step" alumina sample cleanup procedure can be performed on oil before injection; this cleanup removes both asphaltenes and polar compounds and can be applied to DCM extracts as well. This procedure is described in steps 1-11 below.

4.6.3.1 Alternative GC/MS sample cleanup procedure:

1. Weigh 4.0 g alumina (neutral, 80-200 mesh) into scintillation vials covered loosely with aluminum foil caps. Prepare one scintillation vial per sample. Heat for 18 hours at 300 °C or longer. Place in a desiccator of silica until needed.

2. Add 5.0 ml of DCM to a glass luerlok multi-fit syringe (e.g., BD #2471) with stopcock (e.g., Perfectum #6021) in closed position, stainless steel syringe needle (18 gauge), and PTFE frits. Clamp in a vertical position.

3. Transfer 4.0 g of prepared alumina to a plastic weighing boat and fill syringe slowly while applying continuous vibration (e.g., Conair # HM 11FF1).

4. Add a second PTFE frit and push into place on top of the alumina bed.

5. Drain 5.0 ml DCM to the top level of the column frit to await sample addition and discard DCM.

6. Weigh 50 mg ± 0.1 mg ANS521 oil into a tared vial.

7. Premeasure 10 ml of DCM into a graduated cylinder. Add 0.2 to 0.3 ml of the DCM to the tared oil vial. Mix and transfer solvent to the column bed with a Pasteur pipette. Open stopcock and collect in a 10-ml volumetric flask. Repeat until approximately 1.0 ml (do not exceed 1.0 ml) of DCM has rinsed the vial and inner walls of the syringe body into the 10-ml flask.

8. Transfer balance of DCM from the graduated cylinder to the column and regulate the solvent flow rate to approximately 1 to 2 ml/minute. Collect all eluent in the 10-ml flask.

9. Transfer a known volume of eluent to another scintillation vial and blow down to dryness (nitrogen).

10. Determine and record weight.

11. Dissolve in 1.0 ml hexane for the GC/MS analysis procedure (see below).

4.6.3.2 GC/MS analysis procedure:

Immediately prior to injection, an internal standard solution of four deuterated compounds is spiked into the sample extracts and injected. Samples are quantified using the internal standard technique (10) for both the aliphatic and aromatic fractions of the oil extracts in order to provide sufficient information that the oil is being degraded. To help ensure that the observed decline in target analytes is caused by biodegradation rather than by physical loss from mishandling or inefficient extraction, it is necessary to normalize the concentrations of the target analytes via a "conserved internal marker." Conserved internal markers that have been found useful for quantification are C₂- or C₃-phenanthrene, C₂-chrysene, and C₃₀17 α (H),21 β (H)-hopane. Deuterated internal standards are used to calculate the relative response factor (RRF) for the target analyte(s). To compute the "normalized concentrations," the target analyte concentration at a given sampling time is simply divided by the selected conserved analyte concentration at the same sampling time (11). Conduct the GC/MS analysis using the following procedure.

1. One (1) ml of the hexane extract (from Sample Procedure step 15 above) is placed into a 1.5-ml vial for use on the autosampler of the GC/MS instrument.

2. To this solution, 20 μ l of a 500-ng/ μ l solution of the internal standards is added and the vial is capped for injection. The final concentration of the internal standards in each sample is 10 ng/ μ l. This solution contains 4 deuterated compounds: d₈-naphthalene, d₁₀-anthracene, d₁₂-chrysene, and d₁₂-perylene.

3. At the start of any analysis period, the mass spectrometer (MS) is tuned to PFTBA by an autotune program, such as the Hewlett-Packard quicktune routine, to reduce operator variability. Set the GC/MS in the SIM mode at a scan rate of 1.5 scans/second to maximize the linear quantitative range

and precision of the instrument. Set all other conditions to those specified in Instrument Configuration and Calibration section below.

4. An instrument blank and a daily standard are analyzed prior to analysis of unknowns. Internal standards are combined with the sample extracts and coinjected with each analysis to monitor the instrument's performance during each run.

5. Information that should be included on the acquisition form include operator's name and signature, date of extraction, date and time of autotune, date of injection(s), instrument blank, daily standard mix injection, GC column number, and standards for the 5-point calibration curve.

6. If the instrument is operated for a period of time greater than 12 hours, the tune will be checked and another daily standard analyzed prior to continuing with analyses.

TABLE 6—ANALYTES LISTED UNDER THE CORRESPONDING INTERNAL STANDARD USED FOR CALCULATING RRFs

Internal Standard	d ₈ -naphthalene	d ₁₀ -anthracene	d ₁₂ -chrysene	d ₁₂ -perylene
Alkanes	nC10-nC15	nC16-nC23 .. Pristane	nC24-nC29	nC30-nC35. C ₃₀ 17β(H), 21α(H)-hopane.
Aromatics	Naphthalene	Phytane. 5α-androstene. Dibenzothiophene. Fluorene	Fluoranthene Pyrene	Benzo(b)fluoranthene. Benzo(k)fluoranthene. Benzo(e)pyrene. Benzo(a)pyrene. Perylene. Indeno(g,h,i)pyrene. Dibenzo(a,h)anthracene. Benzo(1,2,3-cd)perylene.
		Anthracene ... Phenanthrene	Chrysene	

7. The MS is calibrated using a modified version of EPA Method 8270 (10). Specifically, the concentrations of internal standards are 10 ng/μl instead of 40 ng/μl. A five-point calibration curve is obtained for each compound listed in table 6 prior to sample analysis at 1, 5, 10, 25, and 50 ng/μl. A 5-point calibration must be conducted on a standard mix of compounds to determine RRFs for the analytes. The standard mix (excluding the marker) for this calibration curve may be obtained from Absolute Standards, Inc., 498 Russell St., New Haven, CT, 06513, (800) 368-1131. If C₃₀17β(H),21α(H)-hopane is used, it may be obtained from Dr. Charles Kennicutt II, Geochemical and Environmental Research Group, Texas A&M University, 833 Graham Rd., College Station, TX, 77845, (409) 690-0095.

8. Calculate each compound's relative response factor to its corresponding deuterated internal standard indicated above, using the following equation:

$$RRF = (A_x C_{is}) / (A_{is} C_x) (6)$$

where:

RRF = relative response factor

A_x = peak area of the characteristic ion for the compound being measured (analyte)

A_{is} = peak area of the characteristic ion for the specific internal standard

C_x = concentration of the compound being measured (ng/μl)

C_{is} = concentration of the specific internal standard (10 ng/μl). (This concentration is a constant in this equation for the calibration curve.)

9. Identify each analyte based on the integrated abundance from the primary characteristic ion indicated in table 7.

10. Quantitate each analyte using the internal standard technique. The internal standard used shall be the one nearest the retention time of that of a given analyte (Table 8).

TABLE 7—PRIMARY IONS MONITORED FOR EACH TARGET ANALYTE DURING GC/MS ANALYSIS

Compound	Ion
n-alkanes (C ₁₀ -C ₃₅)	85
Pristane	85
Phytane	85
Naphthalene	128
C1-naphthalenes	142
C2-naphthalenes	156
C3-naphthalenes	170
C4-naphthalenes	184
Fluorene	166
C1-fluorenes	180
C2-fluorenes	194
C3-fluorenes	208
Dibenzothiophenes	184
C1-dibenzothiophenes	198
C2-dibenzothiophenes	212
C3-dibenzothiophenes	226
Anthracene	178
Phenanthrene	178
C1-phenanthrenes	192
C2-phenanthrenes	206
C3-phenanthrenes	220
Fluoranthene/pyrene	202
C1-pyrenes	216
C2-pyrenes	230
Chrysene	228
C1-chrysenes	242

TABLE 7—PRIMARY IONS MONITORED FOR EACH TARGET ANALYTE DURING GC/MS ANALYSIS—Continued

Compound	Ion
C2-chrysenes	256
Hopanes (177 family)	177
Hopanes (191 family)	191
Steranes (217 family)	217
Benzo(b)fluoranthene	252
Benzo(k)fluoranthene	252
Benzo(e)pyrene	252
Benzo(a)pyrene	252
Perylene	252

TABLE 7—PRIMARY IONS MONITORED FOR EACH TARGET ANALYTE DURING GC/MS ANALYSIS—Continued

Compound	Ion
Ideno(g,h,i)pyrene	276
Dibenzo(a,h)anthracene	278
Benzo(1,2,3-cd)perylene	276
d ₈ -naphthalene	136
d ₁₀ -anthracene	188
d ₁₀ -phenanthrene	188
d ₁₂ -chrysene	240
d ₁₂ -perylene	264
α-androstane	260

TABLE 8—ANALYTES AND REFERENCE COMPOUNDS

Compound	Reference compound	Compound	Reference compound
n-C10	n-C10	C2-naphthalene	Naphthalene.
n-C11	n-C11	C3-naphthalene	Naphthalene.
n-C12	n-C12	C4-naphthalene	Naphthalene.
n-C13	n-C13	Fluorene	Fluorene.
n-C14	n-C14	C1-fluorene	Fluorene.
n-C15	n-C15	C2-fluorene	Fluorene.
n-C16	n-C16	C3-fluorene	Fluorene.
n-C17	n-C17	Dibenzothiophene	Dibenzothiophene.
Pristane	Pristane	C1-dibenzothiophene	Dibenzothiophene.
n-C18	n-C18	C2-dibenzothiophene	Dibenzothiophene.
Phytane	Phytane	C3-dibenzothiophene	Dibenzothiophene.
n-C19	n-C19	Phenanthrene	Phenanthrene.
n-C20	n-C20	Anthracene	Anthracene.
n-C21	n-C21	C1-phenanthrene	Phenanthrene.
n-C22	n-C22	C2-phenanthrene	Phenanthrene.
n-C23	n-C23	C3-phenanthrene	Phenanthrene.
n-C24	n-C24	Fluoranthene	Fluoranthene.
n-C25	n-C25	Pyrene	Pyrene.
n-C26	n-C26	C1-pyrene	Pyrene.
n-C27	n-C27	C2-pyrene	Pyrene.
n-C28	n-C28	Chrysene	Chrysene.
n-C29	n-C29	C1-chrysene	Chrysene.
n-C30	n-C30	C2-chrysene	Chrysene.
n-C31	n-C31	Benzo(b)fluoranthene	Benzo(b)fluoranthene.
n-C32	n-C32	Benzo(k)fluoranthene	Benzo(k)fluoranthene.
n-C33	n-C33	Benzo(e)pyrene	Benzo(e)pyrene.
n-C34	n-C34	Benzo(a)pyrene	Benzo(a)pyrene.
n-C35 C ₃₀ 17α,21β-hopane	n-C35 C ₃₀ 17α,21β-hopane	Perylene ideno(g,h,i)pyrene	Perylene ideno(g,h,i)pyrene.
5α-androstane	5α-androstane	Dibenzo(a,h)anthracene	Dibenzo(a,h)anthracene.
C1-naphthalene	Naphthalene	Benzo(1,2,3-cd)perylene	Benzo(1,2,3-cd)perylene.

11. Use equation 7 to calculate the concentration of analytes in ng/mg (ppm) oil:

$$\text{Concentration (ng/mg)} = (A_x I_s V_i \times 1,000) / (A_{is}(\text{RRF})V_i M_o)(7)$$

where:

A_x = peak area of characteristic ion for compound being measured

I_s = amount of internal standard injected, in ng (i.e., 20 ng)

V_i = volume of the total DCM extract (50 ml)

A_{is} = peak area of the characteristic ion of the internal standard

RRF = relative response factor

V_i = volume of the extract injected (2 μl)

M_o = total mass of the oil added to the flask, mg

12. Compute the "normalized concentrations" for each target analyte concentration

at a given sampling time (equation 7) by simply dividing by the conserved internal marker concentration at the same sampling time.

4.6.4 *Generally accepted laboratory procedures.* Samples are immediately logged into the laboratory, where they will be given a unique sample identification based on Julian data and the number logged in. Prior to the analysis of any experimental samples, a five-point standard curve is prepared. One of the mid-range standard curve concentration levels is analyzed daily before sample analysis as a continuing standard. RRF's for all target analytes *should* be within 25% of the standard curve response values at day 0, and at any sampling event the check standard percent difference from the initial five-point calibration must not exceed 20% between the

before and after daily standard mix (see below). The collected GC/MS data are initially processed by a macro routine, which performs extracted chromatographic plots of the target compounds, integrates the target compounds, and shows integration results to include tabular numbers. The integration values are then transferred to a spreadsheet format to be quantified. Because of the complexity of the analyte matrix (oil), a very high degree of manual verification and re-integration of the spectral data is required.

4.6.5 *QA/QC procedures.* The reliability of this method is dependent on the QA/QC procedures followed. Before and after each analytical batch (approximately 10 samples), analyze one procedural blank, one duplicate, and one calibration verification standard (10 ng/ μ l). Analyze one reference crude oil standard. The instrument's performance and reproducibility are validated routinely in this manner. Surrogate recoveries should be within 70 to 120%, and duplicate relative percent difference values should be $\pm 20\%$. A control chart of the standard oil should be prepared and monitored. Variations of analytes in the control chart should be no more than 25% from the historical averages. Injection port discrimination for n-C25 and greater alkanes must be carefully monitored; the ratio of RRF n-C32/RRF n-C21 alkanes should not be allowed to fall below 80%. The mass discrimination can be reduced by replacing the quartz liner in the injection port after every analytical batch. The instrument's performance and reproducibility are validated routinely by analyzing the reference crude oil standard. All analyses are recorded in instrument logs detailing operating conditions, date and time, file name, etc. After analysis, the sample extracts are archived at refrigeration temperatures. To document QA/QC, the following information is contained in the detailed quantitative reports: average RRF derived from the standard curve; RRF from the daily standard; percent relative standard deviation; area of target analyte; concentration determined both on a weight and volume basis; and values for any surrogates and internal standards.

4.6.6 *Instrument configuration and calibration.* A 2-ml aliquot of the hexane extract prepared by the above procedure is injected into a GC/MS instrument, such as the Hewlett-Packard 5890/5971 GC/MS (recommended for use). This instrument should be equipped with a DB-5 capillary column (30 m, 0.25-mm I.D., and 0.25- μ m film thickness) and a split/splitless injection port operating in the splitless mode. Table 9 summarizes the temperature program used for the analysis. This temperature program has been optimized to give the best separation and sensitivity for analysis of the desired compounds on the instrument. Prior to the sample analysis, a five-point calibration must be conducted on

a standard mix of the compounds listed in table 7 to determine RRF's for the analyses.

TABLE 9—OPERATING CONDITIONS AND TEMPERATURE PROGRAM OF GC/MS

Operating conditions					
Injector port—290 °C					
Transfer line—320 °C					
Total run time—73 minutes					
Column flow rate (He)—1.0 ml/minute					
Temperature Program					
Level	Temp. 1, °C	Time 1, minutes	Rate, °C/minute	Temp 2, °C	Time 2, minutes
Level 1	55	3	5	280	5
Level 2	280	0	3	310	10

4.7 *Statistical analysis.* The determination of a bioremediation agent's effectiveness will be partially based upon the results of a statistical analysis of the shaker flask experiment. The experimental design for this test is a two factorial design. This two-way analysis of variance (ANOVA) will be used to determine data trends. The statistical method is designed to test various types of bioremediation treatments including microbial, nutrient, enzyme, and combination products. The following is a summary of the statistical methods to be used to evaluate the analytical data obtained from all product tests. The experimental design, data analysis methodology, interpretation of results, required documentation, and a numeric example are outlined below.

4.7.1 *Experimental design.* The experimental design for this test is known as a factorial experiment with two factors. The first factor is product/control group; the second factor is time (measured in days). For example, if two groups (product A and a non-nutrient control) are tested at each of three points in time (day 0, 7, and 28), the experiment is called a 2×3 factorial experiment. There will be three replications (replicated shaker flasks) of each group-time combination.

4.7.2 *Data analysis methods.* For each analyte and each product used, a product is considered a success by the demonstration of a statistically significant difference between the mean analyte degradation by the product and the mean analyte degradation by the non-nutrient control. Such a determination will be made by performing an ANOVA on the sample data. The technical aspects of this procedure are outlined in Snedecor and Cochran (12). Most statistical software packages support the use of two-way ANOVA. However, the format required for the input data differs among the various commercial packages. Whichever package is used, the following ANOVA table will be provided as part of the output. In the Degree of Freedom

column of table 10, p = the number of product/control groups, t = the number of days at which each group is analyzed, and n = the number of replications. For the example of the 2×3 factorial experiment discussed

above, $p = 2$, $t = 3$, and $n = 3$. The significance of the F-statistics (as indicated by their corresponding p-values) are used to interpret the analysis.

TABLE 10—TWO-WAY ANOVA TABLE

Source	Degree of freedom (df)	Sum of squares	Mean square	F-Statistic	p-Value
Group	$p-1$	SSG	MSG-MSG/MSE	MSG/MSE	¹
Time	$t-1$	SST	MST-MST/MSE	MST/MSE	¹
Interaction	$(p-1)(t-1)$	SSI	MSI-MSI/MSE	MSI/MSE	¹
Error	$p(t(n-1))$	SSE	MSE-SSE		
Total	$npt-1$	SSTOT			

¹To be determined from the value of the F-statistic.

4.7.3 Interpretation. 4.7.3.1 If the F-statistic for the interaction is significant at the 0.05 level (i.e., p-value is less than 0.05), the data indicate that the mean response of at least two groups being tested differ for at least one point in time. In order to find out which groups and at which points in time the difference occurs, pairwise comparisons between the group means should be conducted for all time points. These comparisons can be made using protected least squared difference (LSD) or Dunnett mean separation techniques. The protected LSD procedure is detailed in Snedecor and Cochran (12); the Dunnett procedure is outlined in Montgomery (13). For both methods, the mean square error (MSE) from the two-way ANOVA table should be used to compute the separation values.

4.7.3.2 If the F-statistic for the interaction is not significant at the 0.05 level (i.e., p-value not less than 0.05), but the F-statistic for the group is significant (i.e., p-value is less than 0.05), the data indicate that any differences that exist among the group means are consistent across time. To find out which group means differ, a pairwise comparison of the group means should be carried out by pooling data across all points in time. Again, the MSE from the two-way ANOVA table should be used to compute the separation values.

4.7.3.3 If the F-statistic corresponding to both interaction and group are not significant at the 0.05 level, the data indicate no difference between the group means at any point in time. In this case, no further analysis is necessary.

4.7.3.4 Finally, Snedecor and Cochran (12) use caution concerning the use of multiple comparisons. If many such comparisons are being conducted, then about 5% of the tested differences will erroneously be concluded as significant. The researcher must guard against such differences causing undue attention.

4.7.4 Required documentation. 4.7.4.1 The following documents should be included to summarize the findings from a product test.

1. Data listings for each analyte that was analyzed. These should show all raw data.

2. A table of summary statistics for each analyte. The table should include the mean, standard deviation, and sample size for each group at each day.

3. An ANOVA table for each analyte. The table should be of the same format as table 10.

4. A clear summary of the mean separations (if mean separations were necessary). The mean separation methods (LSD or Dunnett), the significance level, the minimum significant difference value, and the significant differences should be clearly marked on each output page.

5. All computer outputs should be included. No programming alterations are necessary. The specific computer package used to analyze the data should be included in the report.

Example. An analysis of the total aromatic data (in ppm) was conducted for the following three groups:

- Group 1: Non-nutrient Control
- Group 2: Nutrient Control
- Group 3: Test Product

4.7.4.2 The raw data are shown in table 11. Note the three replications for each group-time combination.

TABLE 11—PRODUCT TEST DATA, TOTAL AROMATICS (PPM)

	Group 1	Group 2	Group 3
Day 0	8153	7912	7711
	8299	8309	8311
	8088	8111	8200
Day 7	8100	7950	6900
	8078	8200	6702
	7999	8019	5987
Day 28	8259	8102	4000
	8111	7754	3875
	8344	7659	3100

4.7.4.3 Table 12 gives the summary statistics (number of observations, means, and

standard deviations) for each group-time combination.

TABLE 12—SUMMARY STATISTICS FOR PRODUCT TEST DATA TOTAL AROMATICS (PPM)

Time	Product	n	Mean	Standard deviation
Day 0	Group 1	3	8,180.0	108.1
	Group 2	3	8,110.7	198.5
	Group 3	3	8,074.0	319.2
Day 7	Group 1	3	8,059.0	53.1
	Group 2	3	8,056.3	129.1

TABLE 12—SUMMARY STATISTICS FOR PRODUCT TEST DATA TOTAL AROMATICS (PPM)—Continued

Time	Product	n	Mean	Standard deviation
Day 28	Group 3	3	6,529.7	480.3
	Group 1	3	8,238.0	117.9
	Group 2	3	7,838.3	233.2
	Group 3	3	3,658.3	487.6

4.7.4.4 Table 13 shows the results of the two-way ANOVA.

TABLE 13—EXAMPLE TWO-WAY ANOVA TABLE

Source	df	Sum of squares	Mean square	F-statistic	p-value
Group	2	23,944,856.41	11,972,428.70	151.94	0.0001
Time	2	10,954,731.19	5,477,365.59	69.51	0.0001
Interaction	4	19,347,589.04	4,836,897.26	61.39	0.0001
Error	18	1,418,303.33	78,794.63		
Total	26	55,665,480.96			

4.7.4.5 From table 13, it can be seen that the F-statistic for interaction is significant (F = 61.39, p = 0.0001). This indicates that group differences exist for one or more days. Protected LSD mean separations were then conducted for each day to determine which group differences exist. The results are summarized in table 14. Note that means with the same letter (T grouping) are not significantly different.

TABLE 14—PAIRWISE PROTECTED LSD MEAN SEPARATION

T grouping	Mean	n	Interaction
A	8,338.0	3	Group 1, Day 28.
A	8,180.0	3	Group 1, Day 0.
A	8,110.7	3	Group 2, Day 0.
A	8,074.0	3	Group 3, Day 0.
A	8,059.0	3	Group 1, Day 7.
A	8,056.3	3	Group 2, Day 7.
A	7,838.3	3	Group 2, Day 28.
B	6,529.7	3	Group 3, Day 7.
C	3,658.3	3	Group 3, Day 28.

Significant Level = 0.05.
 Degrees of Freedom = 18.
 Mean Square Error = 78794.63.
 Critical Value = 2.10.
 Least Significant Difference = 481.52.

4.7.4.6 The grouping letters indicate that the product mean values (group 3) at day 7 and day 28 are significantly different from those of both the nutrient control (group 2) and the non-nutrient control (group 1) for those days. No other significant differences are shown. Therefore, in terms of total aromatic degradation, the test indicates the desired statistically significant difference be-

tween the mean of the product and the mean of the non-nutrient control.

5.0 Bioremediation agent toxicity test
 [Reserved]

6.0 Summary technical product test data format.

The purpose of this format is to summarize in a standard and convenient presentation the technical product test data required by the U.S. Environmental Protection Agency before a product may be added to EPA's NCP Product Schedule, which may be used in carrying out the National Oil and Hazardous Substances Pollution Contingency Plan. This format, however, is not to preclude the submission of all the laboratory data used to develop the data summarized in this format. Sufficient data should be presented on both the effectiveness and toxicity tests to enable EPA to evaluate the adequacy of the summarized data. A summary of the technical product test data should be submitted in the following format. The numbered headings should be used in all submissions. The sub-headings indicate the kinds of information to be supplied. The listed subheadings, however, are not exhaustive; additional relevant information should be reported where necessary. As noted, some subheadings may apply only to particular types of agents.

- I. Name, Brand, or Trademark
- II. Name, Address, and Telephone Number of Manufacturer
- III. Name, Address, and Telephone Numbers of Primary Distributors
- IV. Special Handling and Worker Precautions for Storage and Field Application

1. Flammability.
2. Ventilation.
3. Skin and eye contact; protective clothing; treatment in case of contact.
4. Maximum and minimum storage temperatures; optimum storage temperature range; temperatures of phase separations and chemical changes.

V. Shelf Life

VI. Recommended Application Procedure

1. Application method.
2. Concentration, application rate (e.g., gallons of dispersant per ton of oil).
3. Conditions for use: water salinity, water temperature, types and ages of pollutants.

VII. Toxicity (Dispersants, Surface Washing Agents, Surface Collecting Agents, and Miscellaneous Oil Spill Control Agents)

Materials Tested	Species	LC ₅₀ (ppm)
Product	Menidia beryllina	96-hr.
	Mysidopsis bahia 2	48-hr.
No. 2 fuel oil	Menidia beryllina	96-hr.
	Mysidopsis bahia	48-hr.
Product and No. 2 fuel oil (1:10)	Menidia beryllina	96-hr.
	Mysidopsis bahia	48-hr.

VIII.(a). *Effectiveness (bioremediation agents)*. Raw data must be reported according to the format shown below. The first column lists the names of the analytes measured by GC/MS (SIM), the surrogate standards, and various ratios and sums. In the next three columns, the concentration of the analytes (ng/mg oil), the concentration of the analytes corrected for the recovery of the

surrogate standard (α -androstane for alkanes, d₁₀-phenanthrene for aromatics), and the concentration of corrected analytes normalized against the conserved internal marker, respectively, are reported for the first replicate from the first sampling event. These three columns are each repeated for the next two replicates, giving 9 total columns for the product of interest. The next 9 columns are the same as the product columns except they are for the non-nutrient control. The last nine columns are for the nutrient control. Thus, a total of 28 columns are needed in the spreadsheet. This spreadsheet is for the first sampling event (day 0). Two more identical spreadsheets will be needed for each of the next two sampling events (days 7 and 28). For the statistical analysis, a report showing the two-way analysis of variance (ANOVA) table created by the software used by the investigator must be shown in its entirety along with the name of the software package used. Another print-out showing the mean separation table (protected LSD test results) generated by the software must be reported. The statistical analyses are conducted using the sum of the alkane concentrations and the sum of the aromatics concentrations from the raw data table. Thus, two ANOVAs are run for each sampling event, one for total alkanes and one for total aromatics, giving a total of 6 ANOVAs for a product test (2 ANOVAs \times 3 sampling events). Only if significant differences are detected by a given ANOVA will it be necessary to run a protected LSD test.

BIOREMEDIATION AGENT EFFECTIVENESS TEST RAW DATA

[Date: . Testing Date: 0, 7, 28 (Circle One). Initial Oil Weight: .]

	Product Replicate 1			Product Replicate 2
	Concentration ng/mg	Surrogate corrected ng/mg	Normalized to marker ng/mg	
Alkane Analyte				
n-C10.				
n-C11.				
n-C12.				
n-C13.				
n-C14.				
n-C15.				
n-C16.				
n-C17.				
pristane.				
n-C18.				
phytane.				
n-C19.				
n-C20.				
n-C21.				
n-C22.				
n-C23.				
n-C24.				
n-C25.				
n-C26.				
n-C27.				
n-C28.				
n-C29.				
n-C30.				
n-C31.				
n-C32.				

BIOREMEDIATION AGENT EFFECTIVENESS TEST RAW DATA—Continued

[Date: . Testing Date: 0, 7, 28 (Circle One). Initial Oil Weight: .]

	Product Replicate 1			Product Replicate 2
	Concentration ng/mg	Surrogate corrected ng/mg	Normalized to marker ng/mg	
n-C33.				
n-C34.				
n-C35.				
n-C36.				
α-androstane.				
Total alkanes.				
n-C17:pristane.				
n-C18:phytane.				
Aromatic Analyte:				
naphthalene.				
C1-naphthalenes.				
C2-naphthalenes.				
C3-naphthalenes.				
C4-naphthalenes.				
dibenzothiophene.				
fluorene.				
C1-fluorenes.				
C2-fluorenes.				
C3-fluorenes.				
C1-dibenzothiophenes.				
C2-dibenzothiophenes.				
C3-dibenzothiophenes.				
phenanthrene.				
anthracene.				
C1-phenanthrenes.				
C2-phenanthrenes.				
C3-phenanthrenes.				
naphthobenzothio.				
C1-naphthobenzothio.				
C2-naphthobenzothio.				
C3-naphthobenzothio.				
fluoranthene.				
pyrene.				
C1-pyrenes.				
C1-pyrenes.				
chrysene.				
benzo(a)anthracene.				
C1-chrysenes.				
c2-chrysenes.				
benzo(b)fluoranth.				
benzo(k)fluoranth.				
benzo(e)pyrene.				
benzo(a)pyrene.				
perylene.				
indeno(1,2,3-cd)per.				
benzo(g,h,i)pyrene.				
dibenz(ah)anthrac.				
α,β-hopane.				
d8-naphthalene.				
d10-phenanthrene.				
d12-chrysene.				
d12-perylene.				
Total aromatics.				
Grav. weight oil.				
No. oil degraders/ml

VIII.(b). Toxicity (Bioremediation Agents) [Reserved]

IX. Microbiological Analysis (Bioremediation Agents)

X. Physical Properties of Dispersant/Surface Washing Agent/Surface Collecting Agent/Miscellaneous Oil Spill Control Agent:

1. Flash Point: (°F)

2. Pour Point: (°F)

3. Viscosity: _____ at _____ °F (furol seconds)

4. Specific Gravity: _____ at _____ °F

5. pH: (10% solution if hydrocarbon based)

6. Surface Active Agents (Dispersants and Surface Washing Agents)²

7. Solvents (Dispersants and Surface Washing Agents)

8. Additives (Dispersants and Surface Washing Agents)

9. Solubility (Surface Collecting Agents)

XI. Analysis for Heavy Metals, Chlorinated Hydrocarbons, and Cyanide (Dispersants, Surface Washing Agents, Surface Collecting Agents, and Miscellaneous Oil Spill Control Agents):

Compounds	Concentration (ppm)
Arsenic.	
Cadmium.	
Chromium.	
Copper.	
Lead.	
Mercury.	
Nickel.	
Zinc.	
Cyanide.	
Chlorinated Hydrocarbons	

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[59 FR 47458, Sept. 15, 1994]

APPENDIX D TO PART 300—APPROPRIATE ACTIONS AND METHODS OF REMEDIATING RELEASES

(a) This appendix D to part 300 describes types of remedial actions generally appropriate for specific situations commonly found at remedial sites and lists methods for remediating releases that may be considered by the lead agency to accomplish a particular response action. This list shall not be considered inclusive of all possible methods of remediating releases and does not limit the lead agency from selecting any other actions deemed necessary in response to any situation.

(b) In response to contaminated soil, sediment, or waste, the following types of response actions shall generally be considered: removal, treatment, or containment of the soil, sediment, or waste to reduce or eliminate the potential for hazardous substances or pollutants or contaminants to contaminate other media (ground water, surface water, or air) and to reduce or eliminate the potential for such substances to be inhaled, absorbed, or ingested.

²If the submitter claims that the information presented under this subheading is confidential, this information should be submitted on a separate sheet of paper clearly labeled according to the subheading and entitled "Confidential Information."

(1) Techniques for removing contaminated soil, sediment, or waste include the following:

- (i) Excavation.
- (ii) Hydraulic dredging.
- (iii) Mechanical dredging.

(2) Techniques for treating contaminated soil, sediment, or waste include the following:

(i) Biological methods, including the following:

(A) Treatment via modified conventional wastewater treatment techniques.

(B) Anaerobic, aerated, and facultative lagoons.

(C) Supported growth biological reactors.

(D) Microbial biodegradation.

(ii) Chemical methods, including the following:

(A) Chlorination.

(B) Precipitation, flocculation, sedimentation.

(C) Neutralization.

(D) Equalization.

(E) Chemical oxidation.

(iii) Physical methods, including the following:

(A) Air stripping.

(B) Carbon absorption.

(C) Ion exchange.

(D) Reverse osmosis.

(E) Permeable bed treatment.

(F) Wet air oxidation.

(G) Solidification.

(H) Encapsulation.

(I) Soil washing or flushing.

(J) Incineration.

(c) In response to contaminated ground water, the following types of response actions will generally be considered: Elimination or containment of the contamination to prevent further contamination, treatment and/or removal of such ground water to reduce or eliminate the contamination, physical containment of such ground water to reduce or eliminate potential exposure to such contamination, and/or restrictions on use of the ground water to eliminate potential exposure to the contamination.

(1) Techniques that can be used to contain or restore contaminated ground water include the following:

(i) Impermeable barriers, including the following:

(A) Slurry walls.

(B) Grout curtains.

(C) Sheet pilings.

(ii) Permeable treatment beds.

(iii) Ground-water pumping, including the following:

(A) Water table adjustment.

(B) Plume containment.

(iv) Leachate control, including the following:

(A) Subsurface drains.

(B) Drainage ditches.

(C) Liners.

(2) Techniques suitable for the control of contamination of water and sewer lines include the following:

(i) Grouting.

(ii) Pipe relining and sleeving.

(iii) Sewer relocation.

(d)(1) In response to contaminated surface water, the following types of response actions shall generally be considered: Elimination or containment of the contamination to prevent further pollution, and/or treatment of the contaminated water to reduce or eliminate its hazard potential.

(2) Techniques that can be used to control or remediate surface water include the following:

(i) Surface seals.

(ii) Surface water diversions and collection systems, including the following:

(A) Dikes and berms.

(B) Ditches, diversions, waterways.

(C) Chutes and downpipes.

(D) Levees.

(E) Seepage basins and ditches.

(F) Sedimentation basins and ditches.

(G) Terraces and benches.

(iii) Grading.

(iv) Revegetation.

(e) In response to air emissions, the following techniques will be considered:

(1) Pipe vents.

(2) Trench vents.

(3) Gas barriers.

(4) Gas collection.

(5) Overpacking.

(6) Treatment for gaseous emissions, including the following:

(i) Vapor phase adsorption.

(ii) Thermal oxidation.

(f) Alternative water supplies can be provided in several ways, including the following:

(i) Individual treatment units.

(ii) Water distribution system.

(iii) New wells in a new location or deeper wells.

(iv) Cisterns.

(v) Bottled or treated water.

(vi) Upgraded treatment for existing distribution systems.

(g) Temporary or permanent relocation of residents, businesses, and community facilities may be provided where it is determined necessary to protect human health and the environment.

[55 FR 8865, Mar. 8, 1990]

APPENDIX E TO PART 300—OIL SPILL RESPONSE

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1.0 Introduction.

1.1 Background. The Oil Pollution Act of 1990 (OPA) amends the Federal Water Pollution Control Act (FWPCA), commonly referred to as the Clean Water Act (CWA), to require the revision of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). In revising the NCP, the need to separate the response requirements for oil discharges and release of hazardous substances, pollutants, and contaminants became evident.

1.2 Purpose/objective. This document compiles general oil discharge response requirements into one appendix to aid participants and responders under the national response system (NRS). This appendix provides the organizational structure and procedures to prepare for and respond to oil discharges. Nothing in this appendix alters the meaning or policy stated in other sections or subparts of the NCP.

1.3 Scope.

(a) This appendix applies to discharges of oil into or upon the navigable waters of the United States and adjoining shorelines, the waters of the contiguous zone, or waters of the exclusive economic zone, or which may affect the natural resources belonging to, appertaining to, or under the exclusive management authority of the United States.

(b) This appendix is designed to facilitate efficient, coordinated, and effective response to discharges of oil in accordance with the authorities of the CWA. It addresses:

(1) The national response organization that may be activated in response actions, the responsibilities among the federal, state, and

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local governments, and the resources that are available for response.

(2) The establishment of regional and area contingency plans.

(3) Procedures for undertaking removal actions pursuant to section 311 of the CWA.

(4) Listing of federal trustees for natural resources for purposes of the CWA.

(5) Procedures for the participation of other persons in response actions.

(6) Procedures for compiling and making available cost documentation for response actions.

(7) National procedures for the use of dispersants and other chemicals in removals under the CWA.

(c) In implementing the NCP provisions compiled in this appendix, consideration shall be given to international assistance plans and agreements, security regulations and responsibilities based on international agreements, federal statutes, and executive orders. Actions taken pursuant to the provisions of any applicable international joint contingency plans shall be consistent with the NCP to the greatest extent possible. The Department of State shall be consulted, as appropriate, prior to taking action that may affect its activities.

1.4 Abbreviations. This section of the appendix provides abbreviations relating to oil.

(a) Department and Agency Title Abbreviations:

ATSDR—Agency for Toxic Substances and Disease Registry
CDC—Centers for Disease Control
DOC—Department of Commerce
DOD—Department of Defense
DOE—Department of Energy
DOI—Department of Interior
DOJ—Department of Justice
DOL—Department of Labor
DOS—Department of State
DOT—Department of Transportation
EPA—Environmental Protection Agency
FEMA—Federal Emergency Management Agency
GSA—General Services Administration
HHS—Department of Health and Human Services
NIOSH—National Institute for Occupational Safety and Health
NOAA—National Oceanic and Atmospheric Administration
OSHA—Occupational Safety and Health Administration
RSPA—Research and Special Programs Administration
USCG—United States Coast Guard
USDA—United States Department of Agriculture

NOTE: Reference is made in the NCP to both the Nuclear Regulatory Commission and the National Response Center. In order to avoid confusion, the NCP will spell out Nuclear Regulatory Commission and use the

abbreviation "NRC" only with respect to the National Response Center.

(b) Operational Abbreviations:

AC—Area Committee
ACP—Area Contingency Plan
DRAT—District Response Advisory Team
DRG—District Response Group
ERT—Environmental Response Team
ESF—Emergency Support Functions
FCO—Federal Coordinating Officer
FRERP—Federal Radiological Emergency Response Plan
FRP—Federal Response Plan
LEPC—Local Emergency Planning Committee
NCP—National Contingency Plan
NFFC—National Pollution Funds Center
NRC—National Response Center
NRS—National Response System
NRT—National Response Team
NSF—National Strike Force
NSFCC—National Strike Force Coordination Center
OSC—On-Scene Coordinator
OSLTF—Oil Spill Liability Trust Fund
POLREP—Pollution Report
PIAT—Public Information Assist Team
RCP—Regional Contingency Plan
RERT—Radiological Emergency Response Team
RRT—Regional Response Team
SERC—State Emergency Response Commission
SONS—Spill of National Significance
SSC—Scientific Support Coordinator
SUPSALV—United States Navy Supervisor of Salvage
USFWS—United States Fish and Wildlife Service

1.5 Definitions. Terms not defined in this section have the meaning given by CERCLA, the OPA, or the CWA. This appendix restates the NCP definitions relating to oil.

Activation means notification by telephone or other expeditious manner or, when required, the assembly of some or all appropriate members of the RRT or NRT.

Area Committee (AC) as provided for by CWA sections 311(a)(18) and (j)(4), means the entity appointed by the President consisting of members from qualified personnel of federal, state, and local agencies with responsibilities that include preparing an area contingency plan for an area designated by the President.

Area contingency plan (ACP) as defined by CWA sections 311(a)(19) and (j)(4) means the plan prepared by an Area Committee that is developed to be implemented in conjunction with the NCP and RCP, in part to address removal of a worst case discharge and to mitigate or prevent a substantial threat of such a discharge from a vessel, offshore facility, or onshore facility operating in or near an area designated by the President.

Bioremediation agents means microbiological cultures, enzyme additives, or nutrient additives that are deliberately introduced into an oil discharge and that will significantly increase the rate of biodegradation to mitigate the effects of the discharge.

Burning agents means those additives that, through physical or chemical means, improve the combustibility of the materials to which they are applied.

CERCLA is the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

Chemical agents means those elements, compounds, or mixtures that coagulate, disperse, dissolve, emulsify, foam, neutralize, precipitate, reduce, solubilize, oxidize, concentrate, congeal, entrap, fix, make the pollutant mass more rigid or viscous, or otherwise facilitate the mitigation of deleterious effects or the removal of the oil pollutant from the water. Chemical agents include biological additives, dispersants, sinking agents, miscellaneous oil spill control agents, and burning agents, but do not include solvents.

Claim in the case of a discharge under CWA means a request, made in writing for a sum certain, for compensation for damages or removal costs resulting from an incident.

Claimant as defined by section 1001 of the OPA means any person or government who presents a claim for compensation under Title I of the OPA.

Clean natural seawater means that the source of this seawater must not be heavily contaminated with industrial or other types of effluent.

Coastal waters for the purpose of classifying the size of discharges, means the waters of the coastal zone except for the Great Lakes and specified ports and harbors on inland rivers.

Coastal zone as defined for the purpose of the NCP, means all United States waters subject to the tide, United States waters of the Great Lakes, specified ports and harbors on inland rivers, waters of the contiguous zone, other waters of the high seas subject to the NCP, and the land surface or land substrata, ground waters, and ambient air proximal to those waters. The term coastal zone delineates an area of federal responsibility for response action. Precise boundaries are determined by EPA/USCG agreements and identified in federal regional contingency plans.

Coast Guard District Response Group (DRG) as provided for by CWA sections 311(a)(20) and (j)(3), means the entity established by the Secretary of the department in which the USCG is operating within each USCG district and shall consist of: the combined USCG personnel and equipment, including firefighting equipment, of each port within

the district; additional prepositioned response equipment; and a district response advisory team.

Contiguous zone means the zone of the high seas, established by the United States under Article 24 of the Convention on the Territorial Sea and Contiguous Zone, which is contiguous to the territorial sea and which extends nine miles seaward from the outer limit of the territorial sea.

Damages as defined by section 1001 of the OPA means damages specified in section 1002(b) of the Act, and includes the cost of assessing these damages.

Discharge as defined by section 311(a)(2) of the CWA, includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil, but excludes discharges in compliance with a permit under section 402 of the CWA, discharges resulting from circumstances identified and reviewed and made a part of the public record with respect to a permit issued or modified under section 402 of the CWA, and subject to a condition in such permit, or continuous or anticipated intermittent discharges from a point source, identified in a permit or permit application under section 402 of the CWA, that are caused by events occurring within the scope of relevant operating or treatment systems. For purposes of the NCP, discharge also means substantial threat of discharge.

Dispersants means those chemical agents that emulsify, disperse, or solubilize oil into the water column or promote the surface spreading of oil slicks to facilitate dispersal of the oil into the water column.

Exclusive economic zone as defined in OPA section 1001, means the zone established by Presidential Proclamation Numbered 5030, dated March 10, 1983, including the ocean waters of the areas referred to as "eastern special areas" in Article 3(1) of the Agreement between the United States of America and the Union of Soviet Socialist Republics on the Maritime Boundary, signed June 1, 1990.

Facility as defined by section 1001 of the OPA means any structure, group of structures, equipment, or device (other than a vessel) which is used for one or more of the following purposes: exploring for, drilling for, producing, storing, handling, transferring, processing, or transporting oil. This term includes any motor vehicle, rolling stock, or pipeline used for one or more of these purposes.

Federal Response Plan (FRP) means the agreement signed by 25 federal departments and agencies in April 1987 and developed under the authorities of the Earthquake Hazards Reduction Act of 1977 and the Disaster Relief Act of 1974, as amended by the Stafford Disaster Relief Act of 1988.

First federal official means the first federal representative of a participating agency of

the National Response Team to arrive at the scene of a discharge or a release. This official coordinates activities under the NCP and may initiate, in consultation with the OSC, any necessary actions until the arrival of the predesignated OSC.

Indian tribe as defined in OPA section 1001, means any Indian tribe, band, nation, or other organized group or community, but not including any Alaska Native regional or village corporation, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians and has governmental authority over lands belonging to or controlled by the Tribe.

Inland waters for the purposes of classifying the size of discharges, means those waters of the United States in the inland zone, waters of the Great Lakes, and specified ports and harbors on inland rivers.

Inland zone means the environment inland of the coastal zone excluding the Great Lakes, and specified ports and harbors on inland rivers. The term inland zone delineates an area of federal responsibility for response action. Precise boundaries are determined by EPA/USCG agreements and identified in federal regional contingency plans.

Lead administrative trustee means a natural resource trustee who is designated on an incident-by-incident basis for the purpose of preassessment and damage assessment and chosen by the other trustees whose natural resources are affected by the incident. The lead administrative trustee facilitates effective and efficient communication during response operations between the OSC and the other natural resource trustees conducting activities associated with damage assessment and is responsible for applying to the OSC for access to response operations resources on behalf of all trustees for initiation of damage assessment.

Lead agency means the agency that provides the OSC to plan and implement response actions under the NCP.

Miscellaneous oil spill control agent is any product, other than a dispersant, sinking agent, surface washing agent, surface collecting agent, bioremediation agent, burning agent, or sorbent that can be used to enhance oil spill cleanup, removal, treatment, or mitigation.

National Pollution Funds Center (NPFC) means the entity established by the Secretary of Transportation whose function is the administration of the Oil Spill Liability Trust Fund (OSLTF). Among the NPFC's duties are: providing appropriate access to the OSLTF for federal agencies and states for removal actions and for federal trustees to initiate the assessment of natural resource damages; providing appropriate access to the OSLTF for claims; and coordinating cost recovery efforts.

National Response System (NRS) is the mechanism for coordinating response actions by all levels of government in support of the OSC. The NRS is composed of the NRT, RRTs, OSC, Area Committees, and Special Teams and related support entities.

National Strike Force (NSF) is a special team established by the USCG, including the three USCG Strike Teams, the Public Information Assist Team (PIAT), and the National Strike Force Coordination Center. The NSF is available to assist OSCs in their preparedness and response duties.

National Strike Force Coordination Center (NSFCC), authorized as the National Response Unit by CWA section 311(a)(23) and (j)(2), means the entity established by the Secretary of the department in which the USCG is operating at Elizabeth City, North Carolina, with responsibilities that include administration of the USCG Strike Teams, maintenance of response equipment inventories and logistic networks, and conducting a national exercise program.

Natural resources means land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the exclusive economic zone defined by the Magnuson Fishery Conservation and Management Act of 1976), any state or local government, any foreign government, any Indian tribe, or, if such resources are subject to a trust restriction on alienation, any member of an Indian tribe.

Navigable waters means the waters of the United States, including the territorial seas.

(1) For purposes of the Clean Water Act, 33 U.S.C. 1251 *et seq.* and its implementing regulations, subject to the exclusions in paragraph (2) of this definition, the term "waters of the United States" means:

(i) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(ii) All interstate waters, including interstate wetlands;

(iii) The territorial seas;

(iv) All impoundments of waters otherwise identified as waters of the United States under this section;

(v) All tributaries, as defined in paragraph (3)(iii) of this definition, of waters identified in paragraphs (1)(i) through (iii) of this definition;

(vi) All waters adjacent to a water identified in paragraphs (1)(i) through (v) of this definition, including wetlands, ponds, lakes, oxbows, impoundments, and similar waters;

(vii) All waters in paragraphs (1)(vii)(A) through (E) of this definition where they are determined, on a case-specific basis, to have a significant nexus to a water identified in

paragraphs (1)(i) through (iii) of this definition. The waters identified in each of paragraphs (1)(vii)(A) through (E) of this definition are similarly situated and shall be combined, for purposes of a significant nexus analysis, in the watershed that drains to the nearest water identified in paragraphs (1)(i) through (iii) of this definition. Waters identified in this paragraph shall not be combined with waters identified in paragraph (1)(vi) of this definition when performing a significant nexus analysis. If waters identified in this paragraph are also an adjacent water under paragraph (1)(vi), they are an adjacent water and no case-specific significant nexus analysis is required.

(A) *Prairie potholes*. Prairie potholes are a complex of glacially formed wetlands, usually occurring in depressions that lack permanent natural outlets, located in the upper Midwest.

(B) *Carolina bays and Delmarva bays*. Carolina bays and Delmarva bays are ponded, depressional wetlands that occur along the Atlantic coastal plain.

(C) *Pocosins*. Pocosins are evergreen shrub and tree dominated wetlands found predominantly along the Central Atlantic coastal plain.

(D) *Western vernal pools*. Western vernal pools are seasonal wetlands located in parts of California and associated with topographic depression, soils with poor drainage, mild, wet winters and hot, dry summers.

(E) *Texas coastal prairie wetlands*. Texas coastal prairie wetlands are freshwater wetlands that occur as a mosaic of depressions, ridges, intermound flats, and mima mound wetlands located along the Texas Gulf Coast.

(viii) All waters located within the 100-year floodplain of a water identified in paragraphs (1)(i) through (iii) of this definition and all waters located within 4,000 feet of the high tide line or ordinary high water mark of a water identified in paragraphs (1)(i) through (v) of this definition where they are determined on a case-specific basis to have a significant nexus to a water identified in paragraphs (1)(i) through (iii) of this definition. For waters determined to have a significant nexus, the entire water is a water of the United States if a portion is located within the 100-year floodplain of a water identified in paragraphs (1)(i) through (iii) of this definition or within 4,000 feet of the high tide line or ordinary high water mark. Waters identified in this paragraph shall not be combined with waters identified in paragraph (1)(vi) of this definition when performing a significant nexus analysis. If waters identified in this paragraph are also an adjacent water under paragraph (1)(vi), they are an adjacent water and no case-specific significant nexus analysis is required.

(2) The following are not "waters of the United States" even where they otherwise

meet the terms of paragraphs (1)(iv) through (viii) of this definition.

(i) Waste treatment systems (other than cooling ponds meeting the criteria of this paragraph) are not waters of the United States.

(ii) Prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

(iii) The following ditches:

(A) Ditches with ephemeral flow that are not a relocated tributary or excavated in a tributary.

(B) Ditches with intermittent flow that are not a relocated tributary, excavated in a tributary, or drain wetlands.

(C) Ditches that do not flow, either directly or through another water, into a water identified in paragraphs (1)(i) through (iii) of this definition.

(iv) The following features:

(A) Artificially irrigated areas that would revert to dry land should application of water to that area cease;

(B) Artificial, constructed lakes and ponds created in dry land such as farm and stock watering ponds, irrigation ponds, settling basins, fields flooded for rice growing, log cleaning ponds, or cooling ponds;

(C) Artificial reflecting pools or swimming pools created in dry land;

(D) Small ornamental waters created in dry land;

(E) Water-filled depressions created in dry land incidental to mining or construction activity, including pits excavated for obtaining fill, sand, or gravel that fill with water;

(F) Erosional features, including gullies, rills, and other ephemeral features that do not meet the definition of tributary, non-wetland swales, and lawfully constructed grassed waterways; and

(G) Puddles.

(v) Groundwater, including groundwater drained through subsurface drainage systems.

(vi) Stormwater control features constructed to convey, treat, or store stormwater that are created in dry land.

(vii) Wastewater recycling structures constructed in dry land; detention and retention basins built for wastewater recycling; groundwater recharge basins; percolation ponds built for wastewater recycling; and water distributary structures built for wastewater recycling.

(3) In this definition, the following terms apply:

(i) *Adjacent*. The term *adjacent* means bordering, contiguous, or neighboring a water identified in paragraphs (1)(i) through (v) of this definition, including waters separated by constructed dikes or barriers, natural

river berms, beach dunes, and the like. For purposes of adjacency, an open water such as a pond or lake includes any wetlands within or abutting its ordinary high water mark. Adjacency is not limited to waters located laterally to a water identified in paragraphs (1)(i) through (v) of this definition. Adjacent waters also include all waters that connect segments of a water identified in paragraphs (1)(i) through (v) or are located at the head of a water identified in paragraphs (1)(i) through (v) of this definition and are bordering, contiguous, or neighboring such water. Waters being used for established normal farming, ranching, and silviculture activities (33 U.S.C. 1344(f)) are not adjacent.

(ii) *Neighboring*. The term *neighboring* means:

(A) All waters located within 100 feet of the ordinary high water mark of a water identified in paragraphs (1)(i) through (v) of this definition. The entire water is neighboring if a portion is located within 100 feet of the ordinary high water mark;

(B) All waters located within the 100-year floodplain of a water identified in paragraphs (1)(i) through (v) of this definition and not more than 1,500 feet from the ordinary high water mark of such water. The entire water is neighboring if a portion is located within 1,500 feet of the ordinary high water mark and within the 100-year floodplain;

(C) All waters located within 1,500 feet of the high tide line of a water identified in paragraphs (1)(i) or (1)(iii) of this definition, and all waters within 1,500 feet of the ordinary high water mark of the Great Lakes. The entire water is neighboring if a portion is located within 1,500 feet of the high tide line or within 1,500 feet of the ordinary high water mark of the Great Lakes.

(iii) *Tributary* and *tributaries*. The terms *tributary* and *tributaries* each mean a water that contributes flow, either directly or through another water (including an impoundment identified in paragraph (1)(iv) of this definition), to a water identified in paragraphs (1)(i) through (iii) of this definition that is characterized by the presence of the physical indicators of a bed and banks and an ordinary high water mark. These physical indicators demonstrate there is volume, frequency, and duration of flow sufficient to create a bed and banks and an ordinary high water mark, and thus to qualify as a tributary. A tributary can be a natural, man-altered, or man-made water and includes waters such as rivers, streams, canals, and ditches not excluded under paragraph (2) of this definition. A water that otherwise qualifies as a tributary under this definition does not lose its status as a tributary if, for any length, there are one or more constructed breaks (such as bridges, culverts, pipes, or dams), or one or more natural breaks (such as wetlands along the run of a stream, debris piles, boulder fields, or a stream that flows

underground) so long as a bed and banks and an ordinary high water mark can be identified upstream of the break. A water that otherwise qualifies as a tributary under this definition does not lose its status as a tributary if it contributes flow through a water of the United States that does not meet the definition of tributary or through a non-jurisdictional water to a water identified in paragraphs (1)(i) through (iii) of this definition.

(iv) *Wetlands*. The term *wetlands* means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

(v) *Significant nexus*. The term *significant nexus* means that a water, including wetlands, either alone or in combination with other similarly situated waters in the region, significantly affects the chemical, physical, or biological integrity of a water identified in paragraphs (1)(i) through (iii) of this definition. The term "in the region" means the watershed that drains to the nearest water identified in paragraphs (1)(i) through (iii) of this definition. For an effect to be significant, it must be more than speculative or insubstantial. Waters are similarly situated when they function alike and are sufficiently close to function together in affecting downstream waters. For purposes of determining whether or not a water has a significant nexus, the water's effect on downstream (1)(i) through (iii) waters shall be assessed by evaluating the aquatic functions identified in paragraphs (3)(v)(A) through (I) of this definition. A water has a significant nexus when any single function or combination of functions performed by the water, alone or together with similarly situated waters in the region, contributes significantly to the chemical, physical, or biological integrity of the nearest water identified in paragraphs (1)(i) through (iii) of this definition. Functions relevant to the significant nexus evaluation are the following:

- (A) Sediment trapping,
- (B) Nutrient recycling,
- (C) Pollutant trapping, transformation, filtering, and transport,
- (D) Retention and attenuation of flood waters,
- (E) Runoff storage,
- (F) Contribution of flow,
- (G) Export of organic matter,
- (H) Export of food resources, and
- (I) Provision of life cycle dependent aquatic habitat (such as foraging, feeding, nesting, breeding, spawning, or use as a nursery area) for species located in a water identified in paragraphs (1)(i) through (iii) of this section.

(vi) *Ordinary high water mark*. The term *ordinary high water mark* means that line on

the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

(vii) *High tide line*. The term *high tide line* means the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

(4) *Applicability date*. This definition is applicable beginning on February 6, 2020.

Offshore facility as defined by section 311(a)(11) of the CWA means any facility of any kind located in, on, or under any of the navigable waters of the United States, and any facility of any kind which is subject to the jurisdiction of the United States and is located in, on, or under any other waters, other than a vessel or a public vessel.

Oil as defined by section 311(a)(1) of the CWA means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil. Oil, as defined by section 1001 of the OPA means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil, but does not include petroleum, including crude oil or any fraction thereof, which is specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601) and which is subject to the provisions of that Act.

Oil Spill Liability Trust Fund means the fund established under section 9509 of the Internal Revenue Code of 1986 (26 U.S.C. 9509).

On-scene coordinator (OSC) means the federal official pre-designated by the EPA or the USCG to coordinate and direct response under subpart D.

Onshore facility as defined by section 311(a)(10) of the CWA, means any facility (including, but not limited to, motor vehicles and rolling stock) of any kind located in, on,

or under any land within the United States other than submerged land.

On-site means the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of a response action.

Person as defined by section 1001 of the OPA, means an individual, corporation, partnership, association, state, municipality, commission, or political subdivision of a state, or any interstate body.

Public vessel as defined by section 311(a)(4) of the CWA, means a vessel owned or bareboat-chartered and operated by the United States, or by a state or political subdivision thereof, or by a foreign nation, except when such vessel is engaged in commerce.

Remove or removal as defined by section 311(a)(8) of the CWA, refers to containment and removal of oil or hazardous substances from the water and shorelines or the taking of such other actions as may be necessary to minimize or mitigate damage to the public health or welfare (including, but not limited to, fish, shellfish, wildlife, public and private property, and shorelines and beaches) or to the environment. For the purpose of the NCP, the term also includes monitoring of action to remove a discharge.

Removal costs as defined by section 1001 of the OPA means the costs of removal that are incurred after a discharge of oil has occurred, or in any case in which there is a substantial threat of a discharge of oil the costs to prevent, minimize, or mitigate oil pollution from such an incident.

Responsible party as defined by section 1001 of the OPA means the following:

(a) *Vessels*—In the case of a vessel, any person owning, operating, or demise chartering the vessel.

(b) *Onshore Facilities*—In the case of an onshore facility (other than a pipeline), any person owning or operating the facility, except a federal agency, state, municipality, commission, or political subdivision of a state, or any interstate body, that as the owner transfers possession and right to use the property to another person by lease, assignment, or permit.

(c) *Offshore Facilities*—In the case of an offshore facility (other than a pipeline or a deepwater port licensed under the Deepwater Port Act of 1974 (33 U.S.C. 1501 *et seq.*)), the lessee or permittee of the area in which the facility is located or the holder of a right of use and easement granted under applicable state law or the Outer Continental Shelf Lands Act (43 U.S.C. 1301-1356) for the area in which the facility is located (if the holder is a different person than the lessee or permittee), except a federal agency, state, municipality, commission, or political subdivision of a state, or any interstate body, that as owner transfers possession and right to

use the property to another person by lease, assignment, or permit.

(d) Deepwater Ports—In the case of a deepwater port licensed under the Deepwater Port Act of 1974 (33 U.S.C. 1501-1524), the licensee.

(e) Pipelines—In the case of a pipeline, any person owning or operating the pipeline.

(f) Abandonment—In the case of an abandoned vessel, onshore facility, deepwater port, pipeline, or offshore facility, the person who would have been responsible parties immediately prior to the abandonment of the vessel or facility.

Sinking agents means those additives applied to oil discharges to sink floating pollutants below the water surface.

Size classes of discharges refers to the following size classes of oil discharges which are provided as guidance to the OSC and serve as the criteria for the actions delineated in subpart D. They are not meant to imply associated degrees of hazard to public health or welfare, nor are they a measure of environmental injury. Any oil discharge that poses a substantial threat to public health or welfare or the environment or results in significant public concern shall be classified as a major discharge regardless of the following quantitative measures:

(a) Minor discharge means a discharge in inland waters of less than 1,000 gallons of oil or a discharge to the coastal waters of less than 10,000 gallons of oil.

(b) Medium discharge means a discharge of 1,000 to 10,000 gallons of oil to the inland waters or a discharge of 10,000 to 100,000 gallons of oil to the coastal waters.

(c) Major discharge means a discharge of more than 10,000 gallons of oil to the inland waters or more than 100,000 gallons of oil to the coastal waters.

Sorbents means essentially inert and insoluble materials that are used to remove oil and hazardous substances from water through adsorption, in which the oil or hazardous substance is attracted to the sorbent surface and then adheres to it, absorption, in which the oil or hazardous substance penetrates the pores of the sorbent material, or a combination of the two. Sorbents are generally manufactured in particulate form for spreading over an oil slick or as sheets, rolls, pillows, or booms. The sorbent material may consist of, but is not limited to, the following materials:

(a) Organic products—

- (1) Peat moss or straw;
- (2) Cellulose fibers or cork;
- (3) Corn cobs;
- (4) Chicken or duck feathers.

(b) Mineral compounds—

- (1) Volcanic ash or perlite;
- (2) Vermiculite or zeolite.

(c) Synthetic products—

- (1) Polypropylene;
- (2) Polyethylene;

(3) Polyurethane;

(4) Polyester.

Specified ports and harbors means those ports and harbor areas on inland rivers, and land areas immediately adjacent to those waters, where the USCG acts as predesignated on-scene coordinator. Precise locations are determined by EPA/USCG regional agreements and identified in federal regional contingency plans and area contingency plans.

Spill of national significance (SONS) means a spill which due to its severity, size, location, actual or potential impact on the public health and welfare or the environment, or the necessary response effort, is so complex that it requires extraordinary coordination of federal, state, local, and responsible party resources to contain and cleanup the discharge.

State means the several states of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the U.S. Virgin Islands, the Commonwealth of the Northern Marianas, and any other territory or possession over which the United States has jurisdiction. For purposes of the NCP, the term includes Indian tribes as defined in the NCP except where specifically noted.

Surface collecting agents means those chemical agents that form a surface film to control the layer thickness of oil.

Surface washing agent is any product that removes oil from solid surfaces, such as beaches and rocks, through a detergency mechanism and does not involve dispersing or solubilizing the oil into the water column.

Tank vessel as defined by section 1001 of OPA means a vessel that is constructed or adapted to carry, or that carries, oil or hazardous material in bulk as cargo or cargo residue, and that: (1) is a vessel of the United States; (2) operates on the navigable waters; or (3) transfers oil or hazardous material in a place subject to the jurisdiction of the United States.

Threat of discharge, see definition for discharge.

Trustee means an official of a federal natural resources management agency designated in subpart G of the NCP or a designated state official or Indian tribe or, in the case of discharges covered by the OPA, a foreign government official, who may pursue claims for damages under section 1006 of the OPA.

United States when used in relation to section 311(a)(5) of the CWA, mean the states, the District of Columbia, the Commonwealth of Puerto Rico, the Northern Mariana Islands, Guam, American Samoa, the U.S. Virgin Islands, and the Pacific Island Governments.

Vessel as defined by section 311(a)(3) of the CWA means every description of watercraft

or other artificial contrivance used, or capable of being used, as a means of transportation on water other than a public vessel.

Volunteer means any individual accepted to perform services by the lead agency which has authority to accept volunteer services (for examples, see 16 U.S.C. 742f(c)). A volunteer is subject to the provisions of the authorizing statute and the NCP.

Worst case discharge as defined by section 311(a)(24) of the CWA means, in the case of a vessel, a discharge in adverse weather conditions of its entire cargo, and in the case of an offshore facility or onshore facility, the largest foreseeable discharge in adverse weather conditions.

2.0 National response system.

2.1 Overview. The national response system (NRS) is the mechanism for coordinating response actions by all levels of government in support of the OSC. The NRS is composed of the National Response Team (NRT), Regional Response Teams (RRTs), On-scene coordinator (OSC), Area Committees, and Special Teams and related support entities. The NRS functions as an incident command system (ICS) under the direction of the OSC. Typical of an ICS, the NRS is capable of expanding or contracting to accommodate the response effort required by the size or complexity of the discharge.

2.2 Priorities. (a) Safety of human life must be given the highest priority during every response action. This includes any search and rescue efforts in the general proximity of the discharge and the insurance of safety of response personnel.

(b) Stabilizing the situation to preclude the event from worsening is the next priority. All efforts must be focused on saving a vessel that has been involved in a grounding, collision, fire or explosion, so that it does not compound the problem. Comparable measures should be taken to stabilize a situation involving a facility, pipeline, or other source of pollution. Stabilizing the situation includes securing the source of the spill and/or removing the remaining oil from the container (vessel, tank, or pipeline) to prevent additional oil spillage, to reduce the need for follow-up response action, and to minimize adverse impact to the environment.

(c) The response must use all necessary containment and removal tactics in a coordinated manner to ensure a timely, effective response that minimizes adverse impact to the environment.

(d) All parts of this national response strategy should be addressed concurrently, but safety and stabilization are the highest priorities. The OSC should not delay containment and removal decisions unnecessarily and should take actions to minimize adverse impact to the environment that begins as soon as a discharge occurs, as well as

actions to minimize further adverse environmental impact from additional discharges.

(e) The priorities set forth in this section are broad in nature, and should not be interpreted to preclude the consideration of other priorities that may arise on a site-specific basis.

2.3 Responsibility. (a) The predesignated OSC has the responsibility to direct response actions and coordinate all other response efforts at the scene of an oil discharge or threatened discharge. The OSC monitors or directs all federal, state, local, and private removal actions, or arranges for the removal of an actual or threatened oil discharge, removing and if necessary, requesting authority to destroy a vessel. Additionally, the CWA requires the OSC to direct all federal, state, local, and private removal actions to any incident that poses a substantial threat to the public health or welfare.

(b) Cleanup responsibility for an oil discharge immediately falls on the responsible party, unless the discharge poses a substantial threat to public health or welfare. In a large percentage of oil discharges, the responsible party shall conduct the cleanup. If the responsible party does conduct the removal, the OSC shall ensure adequate surveillance over whatever actions are initiated.

(1) If effective actions are not being taken to eliminate the threat, or if removal is not being properly done, the OSC should, to the extent practicable under the circumstances, so advise the responsible party. If the responsible party does not respond properly, the OSC shall take appropriate response actions and should notify the responsible party of the potential liability for federal response costs incurred by the OSC pursuant to the OPA and CWA. Where practicable, continuing efforts should be made to encourage response by responsible parties.

(2) If the Administrator of EPA or the Secretary of the department in which the USCG is operating determines that there may be an imminent and substantial threat to the public health or welfare or the environment of the United States (including fish, shellfish, and wildlife, public and private property, shorelines, beaches, habitats, and other living and nonliving natural resources under the jurisdiction or control of the United States, because of an actual or threatened discharge of oil from any vessel or offshore or onshore facility into or upon the navigable waters of the United States), the Administrator or Secretary may request the U.S. Attorney General to secure the relief from any person, including the owner or operator of the vessel or facility necessary to abate a threat or, after notice to the affected state, take any other action authorized by section 311 of the CWA including administrative orders, that may be necessary to protect the public health or welfare.

(3) The responsible party is liable for costs of federal removal and damages in accordance with section 311(f) of the CWA, section 1002 of the OPA, and other federal laws.

(c) In those incidents where a discharge or threat of discharge poses a substantial threat to the public health or welfare of the United States, the OSC shall direct all federal, state, or private actions to remove the discharge or to mitigate or prevent the threat of such a discharge, as appropriate. The OSC shall also request immediate activation of the RRT.

(d) During responses to any discharge the OSC may request advice or support from the Special Teams and any local support units identified by the Area Committee. Examples include scientific advice from the Scientific Support Coordinator (SSC), technical guidance or prepositioned equipment from the District Response Group (DRG), or public information assistance from the National Strike Force (NSF).

(e) When an oil discharge exceeds the response capability of the region in which it occurs, transects regional boundaries, or involves a substantial threat to the public health or welfare, substantial amounts of property, or substantial threats to the natural resources, the NRT should be activated as an emergency response team. If appropriate the RRT Chairman may contact the NRT Chairman and request the NRT activation.

3.0 *Components of national response system and responsibilities.*

The NRS is the mechanism for coordinating response actions by all levels of government in support of the OSC. The NRS organization is divided into national, regional, and area levels. The national level comprises the NRT, the National Strike Force Coordination Center (NSFCC), and the National Response Center (NRC). The regional level is comprised of the RRT. The area level is made up of the OSC, Special Teams, and Area Committees. The basic framework for the response management structure is a system (e.g., a unified command system), that brings together the functions of the federal government, the state government, and the responsible party to achieve an effective and efficient response, where the OSC retains authority.

3.1 *National.*

3.1.1 *National response team.* (a) National planning and coordination is accomplished

through the NRT. The NRT consists of representatives from the USCG, EPA, Federal Emergency Management Agency (FEMA), Department of Defense (DOD), Department of Energy (DOE), Department of Agriculture (DOA), Department of Commerce (DOC), Department of Health and Human Services (HHS), Department of the Interior (DOI), Department of Justice (DOJ), Department of Labor (DOL), Department of Transportation (DOT), Department of State (DOS), Nuclear Regulatory Commission, and General Services Administration (GSA). Each agency shall designate a member to the team and sufficient alternates to ensure representation, as agency resources permit. The NRT will consider requests for membership on the NRT from other agencies. Other agencies may request membership by forwarding such requests to the chair of the NRT (see Figure 1).

(b) The chair of the NRT shall be the representative of the EPA and the vice chair shall be the representative of the USCG, with the exception of periods of activation because of response action. During activation, the chair shall be the member agency providing the OSC. The vice chair shall maintain records of NRT activities along with national, regional, and area plans for response actions.

(c) While the NRT desires to achieve a consensus on all matters brought before it, certain matters may prove unresolvable by this means. In such cases, each agency serving as a participating agency on the NRT may be accorded one vote in NRT proceedings.

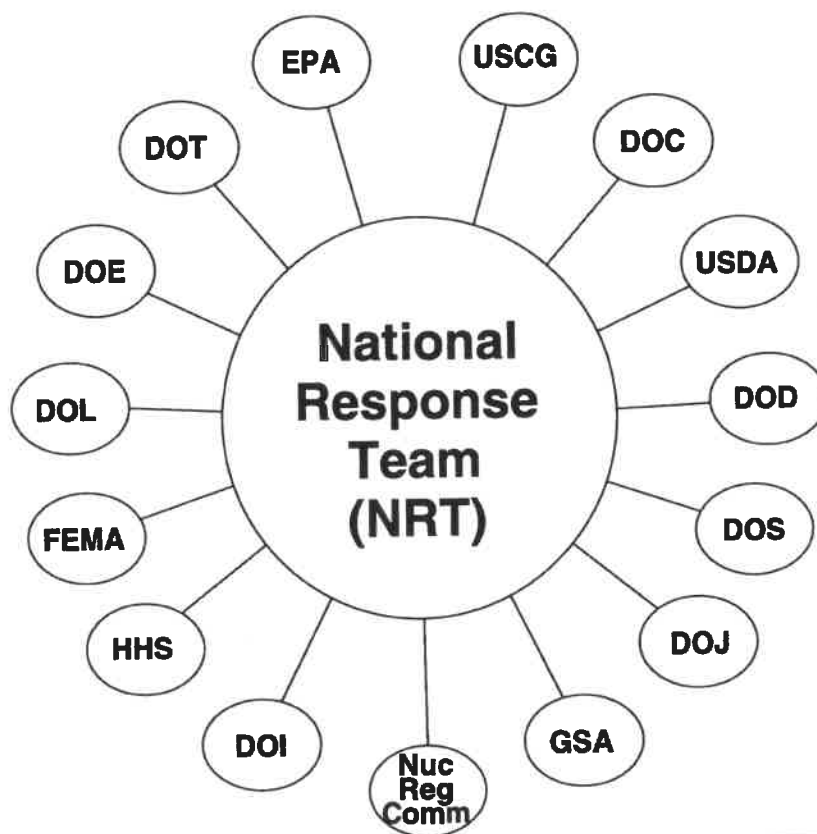
(d) The NRT may establish such bylaws, procedures, and committees as it deems appropriate to further the purposes for which it is established.

(e) The NRT shall evaluate methods of responding to discharges, shall recommend any changes needed in the response organization, and shall recommend to the Administrator of EPA changes to the NCP designed to improve the effectiveness of the national response system, including drafting of regulatory language.

(f) The NRT shall provide policy and program direction to the RRTs.

(g) The NRT may consider and make recommendations to appropriate agencies on the training, equipping, and protection of response teams and necessary research, development, demonstration, and evaluation to improve response capabilities.

Figure 1



(h) Direct planning and preparedness responsibilities of the NRT include:

(1) Maintaining national preparedness to respond to a major discharge of oil that is beyond regional capabilities;

(2) Monitoring incoming reports from all RRTs and activating for a response action, when necessary;

(3) Coordinating a national program to assist member agencies in preparedness planning and response, and enhancing coordination of member agency preparedness programs;

(4) Developing procedures, in coordination with the NSFCC, as appropriate, to ensure the coordination of federal, state, and local governments, and private response to oil discharges;

(5) Monitoring response-related research and development, testing, and evaluation activities of NRT agencies to enhance coordination, avoid duplication of effort, and facilitate research in support of response activities;

(6) Developing recommendations for response training and for enhancing the coordination of available resources among agencies with training responsibilities under the NCP;

(7) Reviewing regional responses to oil discharges, including an evaluation of equipment readiness and coordination among responsible public agencies and private organizations; and

(8) Assisting in developing a national exercise program, in coordination with the

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NSFCC to ensure preparedness and coordination nationwide.

(i) The NRT shall consider matters referred to it for advice or resolution by an RRT.

(j) The NRT should be activated as an emergency response team:

(1) When an oil discharge:

(A) Exceeds the response capability of the region in which it occurs;

(B) Transects regional boundaries; or

(C) Involves a substantial threat to the public health or welfare, substantial amounts of property, or substantial threats to natural resources;

(2) If requested by any NRT member.

(k) When activated for a response action, the NRT will meet at the call of the chair and may:

(1) Monitor and evaluate reports from the OSC and recommend to the OSC, through the RRT, actions to combat the discharge;

(2) Request other federal, state and local governments, or private agencies, to provide resources under their existing authorities to combat a discharge, or to monitor response operations; and

(3) Coordinate the supply of equipment, personnel, or technical advice to the affected region from other regions or districts.

3.1.2 National response center. (a) The NRC, located at USCG Headquarters, is the national communications center, continuously manned for handling activities related to response actions, including those involving discharges of oil. The NRC acts as the single point of contact for all pollution incident reporting, and as the NRT communications center. Notice of discharges must be made by telephone through a toll free number or a special number (Telecommunication Device for the Deaf (TDD) and collect calls accepted). Upon receipt of a notification of discharge, the NRC shall promptly notify the OSC. The telephone report is distributed to any interested NRT member agency or federal entity that has established a written agreement or understanding with the NRC.

(b) The Commandant, USCG, in conjunction with other NRT agencies, provides the necessary personnel, communications, plotting facilities, and equipment for the NRC.

(c) Notice of an oil discharge in an amount equal to or greater than the reportable quantity must be made immediately in accordance with 33 CFR part 153, subpart B. Notification will be made to the NRC Duty Officer, HQ USCG, Washington, DC, telephone (800) 424-8802 or (202) 267-2675. All notices of discharges received at the NRC will be relayed immediately by telephone to the OSC.

3.1.3 National strike force coordination center. NSFCC, located in Elizabeth City, North Carolina, may assist the OSC by providing information on available spill removal resources, personnel, and equipment. The NSFCC can provide the following support to the OSC:

(a) Technical assistance, equipment, and other resources to augment the OSC staff during spill response;

(b) Assistance in coordinating the use of private and public resources in support of the OSC during a response to or a threat of a worst case discharge of oil;

(c) Review of the area contingency plan, including an evaluation of equipment readiness and coordination among responsible public agencies and private organizations;

(d) Assistance in locating spill response resources for both response and planning, using the NSFCC's national and international computerized inventory of spill response resources;

(e) Coordination and evaluation of pollution response exercises; and

(f) Inspection of district prepositioned pollution response equipment.

3.2 Regional. (a) Regional planning and coordination of preparedness and response actions is accomplished through the RRT. In the case of a discharge of oil, preparedness activities shall be carried out in conjunction with Area Committees as appropriate. The RRT agency membership parallels that of the NRT, but also includes state and local representation. The RRT provides: (1) the appropriate regional mechanism for development and coordination of preparedness activities before a response action is taken and for coordination of assistance and advice to the OSC during such response actions; and (2) guidance to Area Committees, as appropriate, to ensure inter-area consistency and consistency of individual ACPs with the RCP and NCP.

(b) The two principal components of the RRT mechanism are a standing team, which consists of designated representatives from each participating federal agency, state governments, and local governments (as agreed upon by the states); and incident-specific teams formed from the standing team when the RRT is activated for a response. On incident-specific teams, participation by the RRT member agencies will relate to the technical nature of the incident and its geographic location.

(1) The standing team's jurisdiction corresponds to the standard federal regions, except for Alaska, Oceania in the Pacific, and the Caribbean area, each of which has a separate standing RRT. The role of the standing RRT includes communications systems and procedures, planning, coordination, training, evaluation, preparedness, and related matters on a regionwide basis. It also includes coordination of Area Committees for these functions in areas within their respective regions, as appropriate.

(2) The role of the incident-specific team is determined by the operational requirements of the response to a specific discharge. Appropriate levels of activation and/or notification of the incident-specific RRT, including

participation by state and local governments, shall be determined by the designated RRT chair for the incident, based on the RCP. The incident-specific RRT supports the designated OSC. The designated OSC manages response efforts and coordinates all other efforts at the scene of a discharge.

(c) The representatives of EPA and the USCG shall act as co-chairs of the RRTs except when the RRT is activated. When the RRT is activated for response actions, the chair is the member agency providing the OSC.

(d) Each participating agency should designate one member and at least one alternate member to the RRT. Agencies whose regional subdivisions do not correspond to the standard federal regions may designate additional representatives to the standing RRT to ensure appropriate coverage of the standard federal region. Participating states may also designate one member and at least one alternate member to the RRT. Indian tribal governments may arrange with the RRT for representation appropriate to their geographical location. All agencies and states may also provide additional representatives as observers to meetings of the RRT.

(e) RRT members should designate representatives and alternates from their agencies as resource personnel for RRT activities, including RRT work planning, and membership on incident-specific teams in support of the OSCs.

(f) Federal RRT members or their representatives should provide OSCs with assistance from their respective federal agencies commensurate with agency responsibilities, resources, and capabilities within the region. During a response action, the members of the RRT should seek to make available the resources of their agencies to the OSC as specified in the RCP and ACP.

(g) RRT members should nominate appropriately qualified representatives from their agencies to work with OSCs in developing and maintaining ACPs.

(h) Affected states are encouraged to participate actively in all RRT activities. Each state Governor is requested to assign an office or agency to represent the state on the appropriate RRT; to designate representatives to work with the RRT in developing RCPs; to plan for, make available, and coordinate state resources for use in response actions; and to serve as the contact point for coordination of response with local government agencies, whether or not represented on the RRT. The state's RRT representative should keep the State Emergency Response Commission (SERC) apprised of RRT activities and coordinate RRT activities with the SERC. Local governments are invited to participate in activities on the appropriate RRT as provided by state law or as arranged by the state's representative. Indian tribes are also invited to participate in such activities.

(i) The standing RRT shall recommend changes in the regional response organization as needed, revise the RCP as needed, evaluate the preparedness of the participating agencies and the effectiveness of ACPs for the federal response to discharges, and provide technical assistance for preparedness to the response community. The RRT should:

(1) Review and comment, to the extent practicable, on local emergency response plans or other issues related to the preparation, implementation, or exercise of such plans upon request of a local emergency planning committee;

(2) Evaluate regional and local responses to discharges on a continuing basis, considering available legal remedies, equipment readiness, and coordination among responsible public agencies and private organizations, and recommend improvements;

(3) Recommend revisions of the NCP to the RRT, based on observations of response operations;

(4) Review OSC actions to ensure that RCPs and ACPs are effective;

(5) Encourage the state and local response community to improve its preparedness for response;

(6) In coordination with the Area Committee and in accordance with any applicable laws, regulations, or requirements, conduct advance planning for use of dispersants, surface washing agents, surface collecting agents, burning agents, bioremediation agents, or other chemical agents in accordance with subpart J of this part;

(7) Be prepared to provide response resources to major discharges or releases outside the region;

(8) Conduct or participate in training and exercises as necessary to encourage preparedness activities of the response community within the region;

(9) Meet at least semiannually to review response actions carried out during the preceding period, consider changes in RCPs, and recommend changes in ACPs;

(10) Provide letter reports on RRT activities to the RRT twice a year, no later than January 31 and July 31; and

(11) Ensure maximum participation in the national exercise program for announced and unannounced exercises.

(j)(1) The RRT may be activated by the chair as an incident-specific response team when a discharge:

(A) Exceeds the response capability available to the OSC in the place where it occurs;

(B) Transects state boundaries;

(C) May pose a substantial threat to the public health or welfare, or to regionally significant amounts of property; or

(D) Is a worst case discharge, as defined in section 1.5 of this appendix.

(2) The RRT shall be activated during any discharge upon a request from the OSC, or

from any RRT representative, to the chair of the RRT. Requests for RRT activation shall later be confirmed in writing. Each representative, or an appropriate alternate, should be notified immediately when the RRT is activated.

(3) During prolonged removal or remedial action, the RRT may not need to be activated or may need to be activated only in a limited sense, or may need to have available only those member agencies of the RRT who are directly affected or who can provide direct response assistance.

(4) When the RRT is activated for a discharge or release, agency representatives will meet at the call of the chair and may:

(A) Monitor and evaluate reports from the OSC, advise the OSC on the duration and extent of response, and recommend to the OSC specific actions to respond to the discharge;

(B) Request other federal, state, or local governments, or private agencies, to provide resources under their existing authorities to respond to a discharge or to monitor response operations;

(C) Help the OSC prepare information releases for the public and for communication with the NRT;

(D) If the circumstances warrant, make recommendations to the regional or district head of the agency providing the OSC that a different OSC should be designated; and

(E) Submit pollution reports to the NRC as significant developments occur.

(5) RCPs shall specify detailed criteria for activation of RRTs.

(6) At the regional level, a Regional Response Center (RRC) may provide facilities and personnel for communications, information storage, and other requirements for coordinating response. The location of each RRC should be provided in the RCP.

(7) When the RRT is activated, affected states may participate in all RRT deliberations. State government representatives participating in the RRT have the same status as any federal member of the RRT.

(8) The RRT can be deactivated when the incident-specific RRT chair determines that the OSC no longer requires RRT assistance.

(9) Notification of the RRT may be appropriate when full activation is not necessary, with systematic communication of pollution reports or other means to keep RRT members informed as to actions of potential concern to a particular agency, or to assist in later RRT evaluation of regionwide response effectiveness.

(k) Whenever there is insufficient national policy guidance on a matter before the RRT, a technical matter requiring solution, a question concerning interpretation of the NCP, or a disagreement on discretionary actions among RRT members that cannot be resolved at the regional level, it may be referred to the NRT for advice.

3.3 Area.

3.3.1 On-scene coordinator. The OSC is the federal official predesignated by EPA or the USCG to coordinate and direct federal responses under subpart D of the NCP. The USCG shall provide OSCs for oil discharges, including discharges from facilities and vessels under the jurisdiction of another federal agency, within or threatening the coastal zone. EPA shall provide OSCs for discharges into or threatening the inland zone. In carrying out a response, the OSC may direct or monitor all federal, state, and private actions to remove a discharge. In contingency planning and removal, the OSC coordinates, directs, and reviews the work of other agencies, Area Committees, responsible parties, and contractors to assure compliance with the NCP, decision document, consent decree, administrative order, and lead agency-approved plans applicable to the response.

3.3.2 Area committees. (a) Area Committees shall be responsible for: (1) preparing an ACP for their areas; (2) working with appropriate federal, state, and local officials to enhance the contingency planning of those officials and to assure pre-planning of joint response efforts, including appropriate procedures for mechanical recovery, dispersal, shoreline cleanup, protection of sensitive environmental areas, and protection, rescue, and rehabilitation of fisheries and wildlife; and (3) working with appropriate federal, state, and local officials to expedite decisions for the use of dispersants and other mitigating substances and devices.

(b) The OSC is responsible for overseeing development of the ACP in the area of the OSC's responsibility. The ACP, when implemented in conjunction with other provisions of the NCP, shall be adequate to remove a worst case discharge, and to mitigate and prevent a substantial threat of such a discharge, from a vessel, offshore facility, or onshore facility operating in or near the area.

3.3.3 Special teams. (a) Special teams include: NOAA/EPA's SSCs; EPA's Environmental Response Team (ERT); and USCG's NSF; DRGs; and NPFC (see Figure 2).

(b) SSCs may be designated by the OSC as the principal advisors for scientific issues, communication with the scientific community, and coordination of requests for assistance from state and federal agencies regarding scientific studies. The SSC strives for a consensus on scientific issues affecting the response, but ensures that differing opinions within the community are communicated to the OSC.

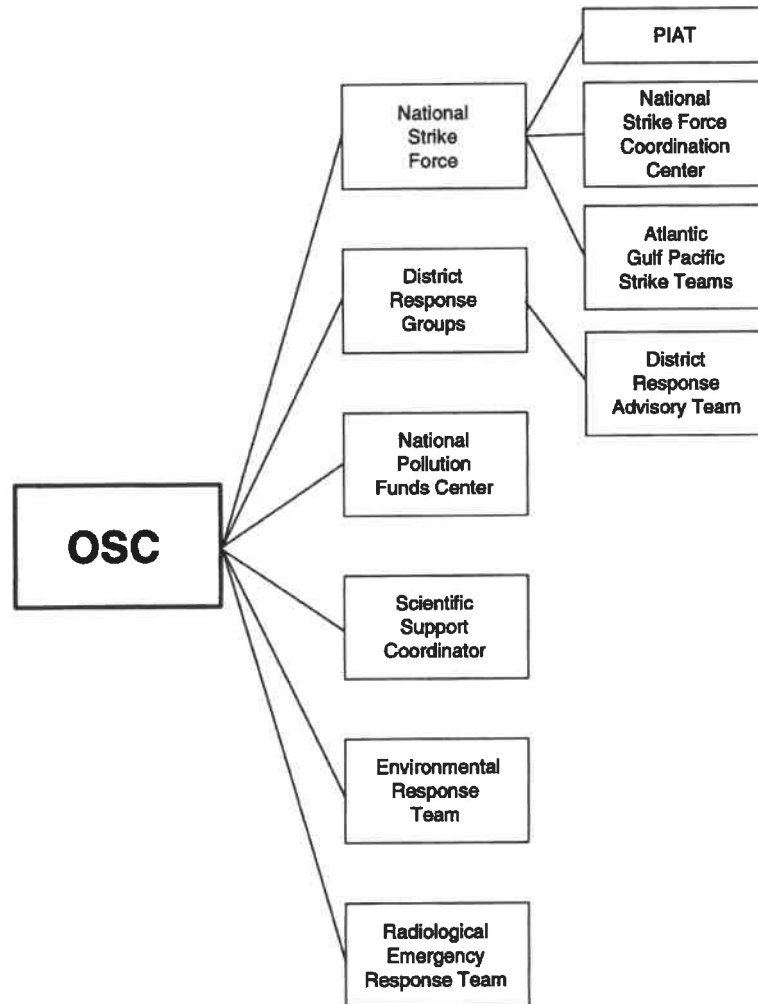
(1) Generally, SSCs are provided by NOAA in the coastal zones, and by EPA in the inland zone. OSC requests for SSC support may be made directly to the SSC assigned to the area or to the agency member of the RRT. NOAA SSCs may also be requested through

NOAA's SSC program office in Seattle, WA. NOAA SSCs are assigned to USCG Districts and are supported by a scientific support team that includes expertise in environmental chemistry, oil slick tracking, pollut-

ant transport modeling, natural resources at risk, environmental tradeoffs of countermeasures and cleanup, and information management.

Figure 2

National Response System Special Teams



(2) During a response, the SSC serves on the federal OSC's staff and may, at the request of the OSC, lead the scientific team and be responsible for providing scientific support for operational decisions and for coordinating on-scene scientific activity. Depending on the nature and location of the incident, the SSC integrates expertise from governmental agencies, universities, community representatives, and industry to assist the OSC in evaluating the hazards and potential effects of releases and in developing response strategies.

(3) At the request of the OSC, the SSC may facilitate the OSC's work with the lead administrative trustee for natural resources to ensure coordination between damage assessment data collection efforts and data collected in support of response operations.

(4) SSCs support the RRTs and the Area Committees in preparing regional and area contingency plans and in conducting spill training and exercises. For area plans, the SSC provides leadership for the synthesis and integration of environmental information required for spill response decisions in support of the OSC.

(c)(1) SUPSALV has an extensive salvage/search and recovery equipment inventory with the requisite knowledge and expertise to support these operations, including specialized salvage, firefighting, and petroleum, oil and lubricants offloading capability.

(2) When possible, SUPSALV will provide equipment for training exercises in support of national and regional contingency planning objectives.

(3) The OSC/RPM may request assistance directly from SUPSALV. Formal requests are routed through the Chief of Naval Operations (N312).

(d) The ERT is established by the EPA in accordance with its disaster and emergency responsibilities. The ERT has expertise in treatment technology, biology, chemistry, hydrology, geology and engineering.

(1) The ERT can provide access to special decontamination equipment and advice to the OSC in hazard evaluation; risk assessment; multimedia sampling and analysis program; on-site safety, including development and implementation plans; cleanup techniques and priorities; water supply decontamination and protection; application of dispersants; environmental assessment; degree of cleanup required; and disposal of contaminated material. The ERT also provides both introductory and intermediate level training courses to prepare response personnel.

(2) OSC or RRT requests for ERT support should be made to the EPA representative on the RRT; EPA Headquarters, Director, Emergency Response Division; or the appropriate EPA regional emergency coordinator.

(e) The NSF is a special team established by the USCG, including the three USCG

Strike Teams, the Public Information Assist Team (PIAT), and the NSFCC. The NSF is available to assist OSCs in their preparedness and response duties.

(1) The three Strike Teams (Atlantic, Gulf, and Pacific) provide trained personnel and specialized equipment to assist the OSC in training for spill response, stabilizing and containing the spill, and in monitoring or directing the response actions of the responsible parties and/or contractors. The OSC has a specific team designated for initial contact and may contact that team directly for any assistance.

(2) The NSFCC can provide the following support to the OSC:

—Technical assistance, equipment and other resources to augment the OSC staff during spill response;

—Assistance in coordinating the use of private and public resources in support of the OSC during a response to or a threat of a worst case discharge of oil;

—Review of the ACP, including an evaluation of equipment readiness and coordination among responsible public agencies and private organizations;

—Assistance in locating spill response resources for both response and planning, using the NSFCC's national and international computerized inventory of spill response resources;

—Coordination and evaluation of pollution response exercises; and

—Inspection of district prepositioned pollution response equipment.

(3) PIAT is an element of the NSFCC staff which is available to assist OSCs to meet the demands for public information during a response or exercise. Its use is encouraged any time the OSC requires outside public affairs support. Requests for PIAT assistance may be made through the NSFCC or NRC.

(f)(1) The DRG assists the OSC by providing technical assistance, personnel, and equipment, including pre-positioned equipment. Each DRG consists of all Coast Guard personnel and equipment, including marine firefighting equipment, in its district, additional pre-positioned equipment, and a District Response Advisory Team (DRAT) that is available to provide support to the OSC in the event that a spill exceeds local response capabilities. Each DRG:

(A) Shall provide technical assistance, equipment, and other resources as available when requested by an OSC through the USCG representative to the RRT;

(B) Shall ensure maintenance of all USCG response equipment within its district;

(C) May provide technical assistance in the preparation of the ACP; and

(D) Shall review each of those plans that affect its area of geographic responsibility.

(2) In deciding where to locate personnel and pre-positioned equipment, the USCG shall give priority emphasis to:

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(A) The availability of facilities for loading and unloading heavy or bulky equipment by barge;

(B) The proximity to an airport capable of supporting large military transport aircraft;

(C) The flight time to provide response to oil spills in all areas of the Coast Guard district with the potential for marine casualties;

(D) The availability of trained local personnel capable of responding in an oil spill emergency; and

(E) Areas where large quantities of petroleum products are transported.

(g) The NPFCA is responsible for implementing those portions of Title I of the OPA that have been delegated to the Secretary of the department in which the Coast Guard is operating. The NPFCA is responsible for addressing funding issues arising from discharges and threats of discharges of oil. The NPFCA:

(1) Issues Certificates of Financial Responsibility to owners and operators of vessels to pay for costs and damages that are incurred by their vessels as a result of oil discharges;

(2) Provides funding for various response organizations for timely abatement and removal actions related to oil discharges;

(3) Provides equitable compensation to claimants who sustain costs and damages from oil discharges when the responsible party fails to do so;

(4) Recovers monies from persons liable for costs and damages resulting from oil discharges to the full extent of liability under the law; and

(5) Provides funds to initiate natural resources damage assessment.

(h) The organizational concepts of the national response system discussed above are depicted in Figure 3.

4.0 Preparedness activities.

4.1 Federal contingency plans. This section summarizes emergency preparedness activities relating to discharges of oil and describes the three levels of contingency planning under the national response system.

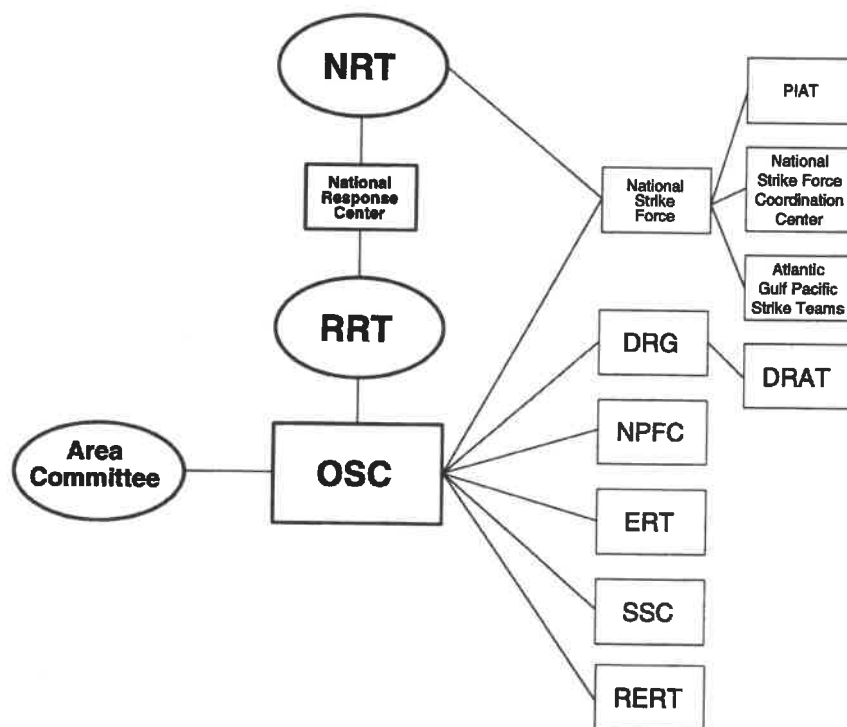
4.1.1 National contingency plan. (a) The NCP provides for efficient, coordinated, and effective response to discharges of oil in accordance with the authorities of the CWA. It provides for:

(1) The national response organization that may be activated in response actions and specifies responsibilities among the federal, state, and local governments and describes resources that are available for response;

(2) The establishment of requirements for federal, regional, and area contingency plans;

(3) Procedures for undertaking removal actions pursuant to section 311 of the CWA;

National Response System Organization



(4) Procedures for involving state governments in the initiation, development, selection, and implementation of response actions;

(5) Listing of federal trustees for natural resources for purposes of the CWA;

(6) Procedures for the participation of other persons in response actions; and

(7) National procedures for the use of dispersants and other chemicals in removals under the CWA.

(b) In implementing the NCP, consideration shall be given to international assistance plans and agreements, security regulations and responsibilities based on international agreements, federal statutes, and executive orders. Actions taken pursuant to the provisions of any applicable international joint contingency plans shall be consistent with the NCP, to the greatest extent possible. The Department of State shall

be consulted, as appropriate, prior to taking action which may affect its activities.

4.1.2 Regional contingency plans. The RRTs, working with the states, shall develop federal RCPs for each standard federal region, Alaska, Oceania in the Pacific, and the Caribbean to coordinate timely, effective response by various federal agencies and other organizations to discharges of oil. RCPs shall, as appropriate, include information on all useful facilities and resources in the region, from government, commercial, academic, and other sources. To the greatest extent possible, RCPs shall follow the format of the NCP and be coordinated with state emergency response plans, ACPs, and Title III local emergency response plans. Such coordination should be accomplished by working with the SERCs in the region covered by the RCP. RCPs shall contain lines of demarcation between the inland and coastal zones,

as mutually agreed upon by the USCG and the EPA.

4.1.3 Area contingency plans. (a) Under the direction of an OSC and subject to approval by the lead agency, each Area Committee, in consultation with the appropriate RRTs, DRGs, the NSFCC, SSCs, Local Emergency Planning Committees (LEPCs), and SERCs, shall develop an ACP for its designated area. This plan, when implemented in conjunction with other provisions of the NCP, shall be adequate to remove a worst case discharge, and to mitigate or prevent a substantial threat of such a discharge, from a vessel, off-shore facility, or onshore facility operating in or near the area.

(b) The areas of responsibility may include several Title III local planning districts, or parts of such districts. In developing the ACP, the OSC shall coordinate with affected SERCs and LEPCs. The ACP shall provide for a well coordinated response that is integrated and compatible to the greatest extent possible with all appropriate response plans of state, local, and non-federal entities, and especially with Title III local emergency response plans.

(c) The ACP shall include the following:

(1) A description of the area covered by the plan, including the areas of special economic or environmental importance that might be impacted by a discharge;

(2) A description in detail of the responsibilities of an owner or operator and of federal, state, and local agencies in removing a discharge, and in mitigating or preventing a substantial threat of a discharge;

(3) A list of equipment (including fire-fighting equipment), dispersants, or other mitigating substances and devices, and personnel available to an owner or operator and federal, state, and local agencies, to ensure an effective and immediate removal of a discharge, and to ensure mitigation or prevention of a substantial threat of a discharge (this may be provided in an appendix or by reference to other relevant emergency plans (e.g., state or LEPC plans), which may include such equipment lists);

(4) A description of procedures to be followed for obtaining an expedited decision regarding the use of dispersants; and

(5) A detailed description of how the plan is integrated into other ACPs and tank vessel, offshore facility, and onshore facility response plans approved by the President, and into operating procedures of the NSFCC.

4.1.4 Fish and Wildlife and sensitive environments plan annex. (a) In order to provide for coordinated, immediate and effective protection, rescue, and rehabilitation of, and minimization of risk of injury to, fish and wildlife resources and habitat, Area Committees shall incorporate into each ACP a detailed annex containing a Fish and Wildlife and Sensitive Environments Plan that is consistent with the RCP and NCP. The annex

shall be prepared in consultation with the U.S. Fish and Wildlife Service (FWS) and NOAA and other interested natural resource management agencies and parties. It shall address fish and wildlife resources and their habitat, and shall include other areas considered sensitive environments in a separate section of the annex, based upon Area Committee recommendations. The annex shall provide the necessary information and procedures to immediately and effectively respond to discharges that may adversely affect fish and wildlife and their habitat and sensitive environments, including provisions for a response to a worst case discharge. Such information shall include the identification of appropriate agencies and their responsibilities, procedures to notify these agencies following a discharge or threat of a discharge; protocols for obtaining required fish and wildlife permits and other necessary permits, and provisions to ensure compatibility of annex-related activities with removal operations.

(b) The annex shall:

(1) Identify and establish priorities for fish and wildlife resources and their habitats and other important sensitive areas requiring protection from any direct or indirect effects from discharges that may occur. These effects include, but are not limited to, any seasonal or historical use, as well as all critical, special, significant or otherwise designated protected areas.

(2) Provide a mechanism to be used during a spill response for timely identification of protection priorities of those fish and wildlife resources and habitats and sensitive environmental areas that may be threatened or injured by a discharge. These include as appropriate, not only marine and freshwater species, habitats, and their food sources, but also terrestrial wildlife and their habitats that may be affected directly by onshore oil or indirectly by oil-related factors, such as loss or contamination of forage. The mechanism shall also provide for expeditious evaluation and appropriate consultations on the effects to fish and wildlife, their habitat, and other sensitive environments from the application of chemical countermeasures or other countermeasures not addressed under paragraph (3) of this section.

(3) Identify potential environmental effects on fish and wildlife, their habitat, and other sensitive environments resulting from removal actions or countermeasures, including the option of no removal. Based on this evaluation of potential environmental effects, the annex should establish priorities for application of countermeasure and removal actions to habitats within the geographic region of the ACP. The annex should establish methods to minimize the identified effects on fish and wildlife because of response activities, including, but not limited to, disturbance of sensitive areas and habitats; illegal or inadvertent taking or disturbance of

fish and wildlife or specimens by response personnel; and fish and wildlife, their habitat, and environmentally sensitive areas coming in contact with various cleaning or bioremediation agents. Furthermore, the annex should identify the areas where the movement of oiled debris may pose a risk to resident, transient, or migratory fish and wildlife, and other sensitive environments and should discuss measures to be considered for removing such oiled debris in a timely fashion to reduce such risk.

(4) Provide for pre-approval of application of specific countermeasures or removal actions that, if expeditiously applied, will minimize adverse spill-induced impacts to fish and wildlife resources, their habitat, and other sensitive environments. Such pre-approval plans must be consistent with paragraphs (2) and (3) of this section and subpart J requirements of the NCP, and must have the concurrence of the natural resource trustees.

(5) Provide monitoring plan(s) to evaluate the effectiveness of different countermeasures or removal actions in protecting the environment. Monitoring should include "set-aside" or "control" areas, where no mitigative actions are taken.

(6) Identify and plan for the acquisition and utilization of necessary response capabilities for protection, rescue, and rehabilitation of fish and wildlife resources and habitat. This may include appropriately permitted private organizations and individuals with appropriate expertise and experience. The suitable organizations should be identified in cooperation with natural resource law enforcement agencies. Such capabilities shall include, but not be limited to, identification of facilities and equipment necessary for deterring sensitive fish and wildlife from entering oiled areas, and for capturing, holding, cleaning, and releasing injured wildlife. Plans for the provision of such capabilities shall ensure that there is no interference with other OSC removal operations.

(7) Identify appropriate federal and state agency contacts and alternates responsible for coordination of fish and wildlife rescue and rehabilitation and protection of sensitive environments; identify and provide for required fish and wildlife handling and rehabilitation permits necessary under federal and state laws; and provide guidance on the implementation of law enforcement requirements included under current federal and state laws and corresponding regulations. Requirements include, but are not limited to procedures regarding the capture, transport, rehabilitation, release of wildlife exposed to or threatened by oil, and disposal of contaminated carcasses of wildlife.

(8) Identify and secure the means for providing, if needed, the minimum required Occupational Safety and Health Administra-

tion (OSHA) training for volunteers, including those who assist with injured wildlife.

(9) Evaluate the compatibility between this annex and non-federal response plans (including those of vessels, facilities and pipelines) on issues affecting fish and wildlife, their habitat, and sensitive environments.

4.2 OPA facility and vessel response plans

This section describes and cross-references the regulations that implement section 311(j)(5) of the CWA. A tank vessel, as defined under section 2101 of title 46, U.S. Code, an offshore facility, and an onshore facility that, because of its location, could reasonably expect to cause substantial harm to the environment by discharging into or on the navigable waters, adjoining shorelines, or exclusive economic zone must prepare and submit a plan for responding, to the maximum extent practicable, to a worst case discharge, and to a substantial threat of such a discharge, of oil or a hazardous substance. These response plans are required to be consistent with applicable Area Contingency Plans. These regulations are codified as follows:

- (a) For tank vessels, these regulations are codified in 33 CFR part 155;
- (b) For offshore facilities, these regulations are codified in 30 CFR part 254;
- (c) For non-transportation related onshore facilities, these regulations are codified in 40 CFR part 112.20;
- (d) For transportation-related onshore facilities, these regulations are codified in 33 CFR part 154;
- (e) For pipeline facilities, these regulations are codified in 49 CFR part 194; and
- (f) For rolling stock, these regulations are codified in 49 CFR part 106 et al.

4.3 Relation to others plans.

4.3.1 *Federal response plans.* In the event of a declaration of a major disaster by the President, the FEMA may activate the Federal Response Plan (FRP). A Federal Coordinating Officer (FCO), designated by the President, may implement the FRP and coordinate and direct emergency assistance and disaster relief of impacted individuals, business, and public services under the Robert T. Stafford Disaster Relief Act. Delivery of federal assistance is facilitated through twelve functional annexes to the FRP known as Emergency Support Functions (ESFs). EPA coordinates activities under ESF #10—Hazardous Materials, which addresses preparedness and response to hazardous materials and oil incidents caused by a natural disaster or other catastrophic event. In such cases, the OSC should coordinate response

activities with the FCO, through the incident-specific ESF #10 Chair, to ensure consistency with federal disaster assistance activities.

4.3.2 Tank Vessel and Facility Response Plans. (a) Under CWA section 311(j)(5), tank vessels, offshore facilities, and certain on-shore facilities are required to prepare and submit response plans for review and approval by the President for the carriage, storage, and transportation of oil and hazardous substances. Separate regulations published by the appropriate federal agencies provide for required response plan development and/or approval.

(b) These plans shall be developed to coordinate responsible party actions with the OSC and the ACP response strategies, for response to oil discharges within the inland and coastal zones of the United States.

4.4 Pre-approval authority.

(a) RRTs and Area Committees shall address, as part of their planning activities, the desirability of using appropriate dispersants, surface washing agents, surface collecting agents, bioremediation agents, or miscellaneous oil spill control agents listed on the NCP Product Schedule, and the desirability of using appropriate burning agents. RCPs and ACPs shall, as appropriate, include applicable preauthorization plans and address the specific contexts in which such products should and should not be used. In meeting the provisions of this paragraph, preauthorization plans may address factors such as the potential sources and types of oil that might be spilled, the existence and location of environmentally sensitive resources that might be impacted by spilled oil, available product and storage locations, available equipment and adequately trained operators, and the available means to monitor product application and effectiveness. The RRT representatives from EPA and the states with jurisdiction over the waters of the area to which a preauthorization plan applies and the DOC and DOI natural resource trustees shall review and either approve, disapprove, or approve with modification the preauthorization plans developed by Area Committees, as appropriate. Approved preauthorization plans shall be included in the appropriate RCPs and ACPs. If the RRT representatives from EPA and the states with jurisdiction over the waters of the area to which a preauthorization plan applies and the DOC and DOI natural resource trustees approve in advance the use of certain products under specified circumstances as described in the preauthorization plan, the OSC may authorize the use of the products without obtaining the specific concurrences described in paragraphs (b) and (c) of this section.

(b) For spill situations that are not addressed by the preauthorization plans devel-

oped pursuant to paragraph (a) of this section, the OSC, with the concurrence of the EPA representative to the RRT and, as appropriate, the concurrence of the RRT representatives from the states with jurisdiction over the navigable waters threatened by the discharge, and in consultation with the DOC and DOI natural resource trustees, when practicable, may authorize the use of dispersants, surface washing agents, surface collecting agents, bioremediation agents, or miscellaneous oil spill control agents on the oil discharge, provided that the products are listed on the NCP Product Schedule.

(c) The OSC, with the concurrence of the EPA representative to the RRT and, as appropriate, the concurrence of the RRT representatives from the states with jurisdiction over the navigable waters threatened by the discharge, and in consultation with the DOC and DOI natural resource trustees, when practicable, may authorize the use of burning agents on a case-by-case basis.

(d) The OSC may authorize the use of any dispersant, surface washing agent, surface collecting agent, other chemical agent, burning agent, bioremediation agent, or miscellaneous oil spill control agent, including products not listed on the NCP Product Schedule, without obtaining the concurrence of the EPA representative to the RRT and, as appropriate, the RRT representatives from the states with jurisdiction over the navigable waters threatened by the discharge, when, in the judgment of the OSC, the use of the product is necessary to prevent or substantially reduce a hazard to human life. Whenever the OSC authorizes the use of a product pursuant to this paragraph, the OSC is to inform the EPA RRT representative and, as appropriate, the RRT representatives from the affected states and, when practicable, the DOC/DOI natural resource trustees of the use of a product, including products not on the Schedule, as soon as possible. Once the threat to human life has subsided, the continued use of a product shall be in accordance with paragraphs (a), (b), and (c) of this section.

(e) Sinking agents shall not be authorized for application to oil discharges.

(f) When developing preauthorization plans, RRTs may require the performance of supplementary toxicity and effectiveness testing of products, in addition to the test methods specified in § 300.915 and described in appendix C to part 300, due to existing site-specific or area-specific concerns.

4.5 Area response drills. The OSC periodically shall conduct drills of removal capability (including fish and wildlife response), without prior notice, in areas for which ACPs are required and under relevant tank vessel and facility response plans.

5.0 Response operations.

(a) The OSC shall direct response efforts and coordinate all other efforts at the scene of a discharge. As part of the planning and preparation for response, OSCs shall be predesignated by the regional or district head of the lead agency.

(b) The first federal official affiliated with an NRT member agency to arrive at the scene of a discharge should coordinate activities under the NCP and is authorized to initiate, in consultation with the OSC, any necessary actions normally carried out by the OSC until the arrival of the predesignated OSC. This official may initiate federal OSLTF-financed actions only as authorized by the OSC or, if the OSC is unavailable, the authorized representative of the lead agency.

(c) The OSC shall, to the extent practicable, collect pertinent facts about the discharge, such as its source and cause; the identification of responsible parties; the nature, amount, and location of discharged materials; the probable direction and time of travel of discharged materials; whether the discharge is a worst case discharge; the pathways to human and environmental exposure; the potential impact on human health, welfare, and safety and the environment; whether the discharge poses a substantial threat to the public health or welfare; the potential impact on natural resources and property which may be affected; priorities for protecting human health and welfare and the environment; and appropriate cost documentation.

(d) The OSC's efforts shall be coordinated with other appropriate federal, state, local, and private response agencies. OSCs may designate capable persons from federal, state, or local agencies to act as their on-scene representatives. State and local governments, however, are not authorized to take actions under subpart D of the NCP that involve expenditures of the OSLTF unless an appropriate contract or cooperative agreement has been established.

(e) The OSC should consult regularly with the RRT and NSFCC, as appropriate, in carrying out the NCP and keep the RRT and NSFCC, as appropriate, informed of activities under the NCP.

(f) The OSC should evaluate incoming information and immediately advise FEMA of potential major disaster situations.

(g) The OSC is responsible for addressing worker health and safety concerns at a response scene.

(h) In those instances where a possible public health emergency exists, the OSC should notify the HHS representative to the RRT. Throughout response actions, the OSC may call upon the OSHA and HHS representative for assistance on worker health and safety issues.

(i) All federal agencies should plan for emergencies and develop procedures for dealing with oil discharges and releases of hazardous substances, pollutants, or contaminants from vessels and facilities under their jurisdiction. All federal agencies, therefore, are responsible for designating the office that coordinates response to such incidents in accordance with the NCP and applicable federal regulations and guidelines.

(j)(1) The OSC shall ensure that the natural resource trustees are promptly notified of discharges.

(2) The OSC shall coordinate all response activities with the affected natural resource trustees and shall consult with the affected trustees on the appropriate removal action to be taken.

(3) Where the OSC becomes aware that a discharge may affect any endangered or threatened species, or their habitat, the OSC shall consult with DOI, DOC/NOAA, and, if appropriate, the cognizant federal land managing agency.

(k) The OSC shall submit pollution reports (POLREPs) to the RRT and other appropriate agencies as significant developments occur during response actions, through communications networks or procedures agreed to by the RRT and covered in the RCP.

(l) The OSC should ensure that all appropriate public and private interests are kept informed and that their concerns are considered throughout a response, to the extent practicable.

5.1 Phase I—Discovery or notification. (a) A discharge of oil may be discovered through:

(1) A report submitted by the person in charge of a vessel or facility, in accordance with statutory requirements;

(2) Deliberate search by patrols;

(3) Random or incidental observation by government agencies or the public; or

(4) Other sources.

(b) Any person in charge of a vessel or a facility shall, as soon as he or she has knowledge of any discharge from such vessel or facility in violation of section 311(b)(3) of the CWA, immediately notify the NRC. Notification shall be made to the NRC Duty Officer, HQ USCG, Washington, DC, telephone (800) 424-8802 or (202) 267-2675. If direct reporting to the NRC is not practicable, reports may be made to the USCG or EPA predesignated OSC for the geographic area where the discharge occurs. The EPA predesignated OSC may also be contacted through the regional 24-hour emergency response telephone number. All such reports shall be promptly relayed to the NRC. If it is not possible to notify the NRC or predesignated OSC immediately, reports may be made immediately to the nearest Coast Guard unit. In any event, such person in charge of the vessel or facility shall notify the NRC as soon as possible.

(c) Any other person shall, as appropriate, notify the NRC of a discharge of oil.

(d) Upon receipt of a notification of discharge, the NRC shall promptly notify the OSC. The OSC shall ensure notification of the appropriate state agency of any state which is, or may reasonably be expected to be, affected by the discharge. The OSC shall then proceed with the following phases as outlined in the RCP and ACP.

5.2 Phase II—Preliminary assessment and initiation of action

(a) The OSC is responsible for promptly initiating a preliminary assessment.

(b) The preliminary assessment shall be conducted using available information, supplemented where necessary and possible by an on-scene inspection. The OSC shall undertake actions to:

(1) Evaluate the magnitude and severity of the discharge or threat to public health or welfare or the environment;

(2) Assess the feasibility of removal; and

(3) To the extent practicable, identify potentially responsible parties.

(c) Where practicable, the framework for the response management structure is a system (e.g., a unified command system), that brings together the functions of the federal government, the state government, and the responsible party to achieve an effective and efficient response, where the OSC maintains authority.

(d) Except in a case when the OSC is required to direct the response to a discharge that may pose a substantial threat to the public health or welfare (including, but not limited to fish, shellfish, wildlife, other natural resources, and the public and private beaches and shorelines of the United States), the OSC may allow the responsible party to voluntarily and promptly perform removal actions, provided the OSC determines such actions will ensure an effective and immediate removal of the discharge or mitigation or prevention of a substantial threat of a discharge. If the responsible party does conduct the removal, the OSC shall ensure adequate surveillance over whatever actions are initiated. If effective actions are not being taken to eliminate the threat, or if removal is not being properly done, the OSC should, to the extent practicable under the circumstances, so advise the responsible party. If the responsible party does not respond properly, the OSC shall take appropriate response actions and should notify the responsible party of the potential liability for federal response costs incurred by the OSC pursuant to the OPA and CWA. Where practicable, continuing efforts should be made to encourage response by responsible parties.

(1) In carrying out a response under this section, the OSC may:

(A) Remove or arrange for the removal of a discharge, and mitigate or prevent a substantial threat of a discharge, at any time;

(B) Direct or monitor all federal, state, and private actions to remove a discharge; and

(C) Remove and, if necessary, destroy a vessel discharging, or threatening to discharge, by whatever means are available.

(2) If the discharge results in a substantial threat to the public health or welfare of the United States (including, but not limited to fish, shellfish, wildlife, other natural resources, and the public and private beaches and shorelines of the United States), the OSC must direct all response efforts, as provided in section 5.3.4 of this appendix. The OSC should declare as expeditiously as practicable to spill response participants that the federal government will direct the response. The OSC may act without regard to any other provision of the law governing contracting procedures or employment of personnel by the federal government in removing or arranging for the removal of such a discharge.

(e) The OSC shall ensure that the natural resource trustees are promptly notified in the event of any discharge of oil, to the maximum extent practicable as provided in the Fish and Wildlife and Sensitive Environments Plan annex to the ACP for the area in which the discharge occurs. The OSC and the trustees shall coordinate assessments, evaluations, investigations, and planning with respect to appropriate removal actions. The OSC shall consult with the affected trustees on the appropriate removal action to be taken. The trustees will provide timely advice concerning recommended actions with regard to trustee resources potentially affected. The trustees also will assure that the OSC is informed of their activities in natural resource damage assessment that may affect response operations. The trustees shall assure, through the lead administrative trustee, that all data from the natural resource damage assessment activities that may support more effective operational decisions are provided in a timely manner to the OSC. When circumstances permit, the OSC shall share the use of non-monetary response resources (i.e., personnel and equipment) with the trustees, provided trustee activities do not interfere with response actions. The lead administrative trustee facilitates effective and efficient communication between the OSC and the other trustees during response operations and is responsible for applying to the OSC for non-monetary federal response resources on behalf of all trustees. The lead administrative trustee is also responsible for applying to the National Pollution Funds Center for funding for initiation of damage assessment for injuries to natural resources.

5.3 Patterns of response.

5.3.1 Determinations to initiate response and special conditions.

(a) In accordance with the CWA, the Administrator of EPA or the Secretary of the department in which the USCG is operating, as appropriate, is authorized to act for the

United States to take response measures deemed necessary to protect the public health or welfare or environment from discharges of oil.

(b) The Administrator of EPA or the Secretary of the department in which the USCG is operating, as appropriate, is authorized to initiate and, in the case of a discharge posing a substantial threat to public health or welfare is required to initiate and direct, appropriate response activities when the Administrator or Secretary determines that any oil is discharged or there is a substantial threat of such discharge from any vessel or offshore or onshore facility into or on the navigable waters of the United States, on the adjoining shorelines to the navigable waters, into or on the waters of the exclusive economic zone, or that may affect natural resources belonging to, appertaining to, or under exclusive management authority of the United States.

(c) In addition to any actions taken by a state or local government, the Administrator of EPA or the Secretary of the department in which the USCG is operating may request the U.S. Attorney General to secure the relief from any person, including the owner or operator of the vessel or facility necessary to abate a threat or, after notice to the affected state, take any other action authorized by section 311 of the CWA, including issuing administrative orders, that may be necessary to protect the public health or welfare, if the Administrator or Secretary determines that there may be an imminent and substantial threat to the public health or welfare or the environment of the United States, including fish, shellfish, and wildlife, public and private property, shorelines, beaches, habitats, and other living and non-living natural resources under the jurisdiction or control of the United States, because of an actual or threatened discharge of oil from any vessel or offshore or onshore facility into or upon the navigable waters of the United States.

(d) Response actions to remove discharges originating from operations conducted subject to the Outer Continental Shelf Lands Act shall be in accordance with the NCP.

(e) Where appropriate, when a discharge involves radioactive materials, the lead or support federal agency shall act consistent with the notification and assistance procedures described in the appropriate Federal Radiological Plan. For the purpose of the NCP, the Federal Radiological Emergency Response Plan (FRERP) (50 FR 46542, November 8, 1985) is the appropriate plan. Most radiological discharges and releases do not result in FRERP activation and should be handled in accordance with the NCP. However, releases from nuclear incidents subject to requirements for financial protection established by the Nuclear Regulatory Commission under the Price-Anderson amendments (section

170) of the Atomic Energy Act are specifically excluded from CERCLA and NCP requirements.

(f) Removal actions involving nuclear weapons should be conducted in accordance with the joint Department of Defense, Department of Energy, and FEMA Agreement for Response to Nuclear Incidents and Nuclear Weapons Significant Incidents (January 8, 1981).

(g) If the situation is beyond the capability of state and local governments and the statutory authority of federal agencies, the President may, under the Disaster Relief Act of 1974, act upon a request by the Governor and declare a major disaster or emergency and appoint a FCO to coordinate all federal disaster assistance activities. In such cases, the OSC would continue to carry out OSC responsibilities under the NCP, but would coordinate those activities with the FCO to ensure consistency with other federal disaster assistance activities.

(h) In the event of a declaration of a major disaster by the President, FEMA may activate the FRP. An FCO, designated by the President, may implement the FRP and coordinate and direct emergency assistance and disaster relief of impacted individuals, business, and public services under the Robert T. Stafford Disaster Relief Act. Delivery of federal assistance is facilitated through twelve functional annexes to the FRP known as ESFs. EPA coordinates activities under ESF #10—Hazardous Materials, which addresses preparedness and response to hazardous materials and oil incidents caused by a natural disaster or other catastrophic event. In such cases, the OSC/RPM should coordinate response activities with the FCO, through the incident-specific ESF #10 Chair, to ensure consistency with federal disaster assistance activities.

5.3.2 General pattern of response. (a) When the OSC receives a report of a discharge, actions normally should be taken in the following sequence:

(1) Investigate the report to determine pertinent information such as the threat posed to public health or welfare or the environment, the type and quantity of polluting material, and the source of the discharge.

(2) Officially classify the size (*i.e.*, minor, medium, major) and type (*i.e.*, substantial threat to the public health or welfare, worst case discharge) of the discharge and determine the course of action to be followed to ensure effective and immediate removal, mitigation, or prevention of the discharge. Some discharges that are classified as a substantial threat to the public health or welfare may be further classified as a spill of national significance by the Administrator of EPA or the Commandant of the USCG. The appropriate course of action may be prescribed in 5.3.4, 5.3.5, and 5.3.6 of this appendix.

(A) When the reported discharge is an actual or potential major discharge, the OSC shall immediately notify the RRT and the NRC.

(B) When the investigation shows that an actual or potential medium discharge exists, the OSC shall recommend activation of the RRT, if appropriate.

(C) When the investigation shows that an actual or potential minor discharge exists, the OSC shall monitor the situation to ensure that proper removal action is being taken.

(3) If the OSC determines that effective and immediate removal, mitigation, or prevention of a discharge can be achieved by private party efforts, and where the discharge does not pose a substantial threat to the public health or welfare, determine whether the responsible party or other person is properly carrying out removal. Removal is being done properly when:

(A) The responsible party is applying the resources called for in its response plan to effectively and immediately remove, minimize, or mitigate threat(s) to public health and welfare and the environment; and

(B) The removal efforts are in accordance with applicable regulations, including the NCP. Even if the OSC supplements responsible party resources with government resources, the spill response will not be considered improper, unless specifically determined by the OSC.

(4) Where appropriate, determine whether a state or political subdivision thereof has the capability to carry out any or all removal actions. If so, the OSC may arrange funding to support these actions.

(5) Ensure prompt notification of the trustees of affected natural resources in accordance with the applicable RCP and ACP.

(b) Removal shall be considered complete when so determined by the OSC in consultation with the Governor or Governors of the affected states. When the OSC considers removal complete, OSLTF removal funding shall end. This determination shall not preclude additional removal actions under applicable state law.

5.3.3 Containment, countermeasures, and cleanup. (a) Defensive actions shall begin as soon as possible to prevent, minimize, or mitigate threat(s) to the public health or welfare or the environment. Actions may include but are not limited to: analyzing water samples to determine the source and spread of the oil; controlling the source of discharge; source and spread control or salvage operations; placement of physical barriers to deter the spread of the oil and to protect natural resources and sensitive ecosystems; measuring and sampling; control of the water discharged from upstream impoundment; and the use of chemicals and other materials in accordance with subpart J of part 300 of the NCP to restrain the spread of

the oil and mitigate its effects. The ACP should be consulted for procedures to be followed for obtaining an expedited decision regarding the use of dispersants and other products listed on the NCP Product Schedule.

(b) As appropriate, actions shall be taken to recover the oil or mitigate its effects. Of the numerous chemical or physical methods that may be used, the chosen methods shall be the most consistent with protecting public health and welfare and the environment. Sinking agents shall not be used.

(c) Oil and contaminated materials recovered in cleanup operations shall be disposed of in accordance with the RCP, ACP, and any applicable laws, regulations, or requirements. RRT and Area Committee guidelines may identify the disposal options available during an oil spill response and may describe what disposal requirements are mandatory or may not be waived by the OSC. ACP guidelines should address: the sampling, testing, and classifying of recovered oil and oiled debris; the segregation and stockpiling of recovered oil and oiled debris; prior state disposal approvals and permits; and the routes; methods (e.g. recycle/reuse, on-site burning, incineration, landfilling, etc.); and sites for the disposal of collected oil, oiled debris, and animal carcasses; procedures for obtaining waivers, exemptions, or authorizations associated with handling or transporting waste materials. The ACPs may identify a hierarchy of preferences for disposal alternatives, with recycling (reprocessing) being the most preferred, and other alternatives preferred based on priorities for health or the environment.

5.3.4 Response to a substantial threat to the public health or welfare. (a) The OSC shall determine whether a discharge results in a substantial threat to public health or welfare (including, but not limited to, fish, shellfish, wildlife, other natural resources, the public and private beaches, and shorelines of the United States). Factors to be considered by the OSC in making this determination include, but are not limited to, the size of the discharge, the character of the discharge, and the nature of the threat to public health or welfare. Upon obtaining such information, the OSC shall conduct an evaluation of the threat posed, based on the OSC's experience in assessing other discharges and consultation with senior lead agency officials and readily available authorities on issues outside the OSC's technical expertise.

(b) If the investigation by the OSC shows that the discharge poses or may present a substantial threat to public health or welfare, the OSC shall direct all federal, state, or private actions to remove the discharge or to mitigate or prevent the threat of such a discharge, as appropriate. In directing the response in such cases, the OSC may act without regard to any other provision of law

governing contracting procedures or employment of personnel by the federal government to:

(1) Remove or arrange for the removal of the discharge;

(2) Mitigate or prevent the substantial threat of the discharge; and

(3) Remove and, if necessary, destroy a vessel discharging, or threatening to discharge, by whatever means are available.

(c) In the case of a substantial threat to the public health or welfare, the OSC shall:

(1) Assess opportunities for the use of various special teams and other assistance, including the use of the services of the NSFCC, as appropriate;

(2) Request immediate activation of the RRT; and

(3) Take whatever additional response actions are deemed appropriate, including but not limited to implementation of the ACP or relevant tank vessel or facility response plan.

(d) When requested by the OSC, the lead agency or RRT shall dispatch appropriate personnel to the scene of the discharge to assist the OSC. This assistance may include technical support in the agency's areas of expertise and disseminating information to the public. The lead agency shall ensure that a contracting officer is available on scene, at the request of the OSC.

5.3.5 Enhanced activities during a spill of national significance. (a) A discharge may be classified as an SONS by the Administrator of EPA for discharges occurring in the inland zone and the Commandant of the USCG for discharges occurring in the coastal zone.

(b) For an SONS in the inland zone, the EPA Administrator may name a senior Agency official to assist the OSC in: (1) Communicating with affected parties and the public; and (2) coordinating federal, state, local, and international resources at the national level. This strategic coordination will involve, as appropriate, the NRT, RRT(s), the Governor(s) of affected state(s), and the mayor(s) or other chief executive(s) of local government(s).

(c) For an SONS in the coastal zone, the USCG Commandant may name a National Incident Commander (NIC) who will assume the role of the OSC in: (1) Communicating with affected parties and the public; and (2) coordinating federal, state, local, and international resources at the national level. This strategic coordination shall involve, as appropriate, the NRT, RRT(s), the Governor(s) of affected state(s), and the mayor(s) or other chief executive(s) of local government(s).

5.3.6 Response to worst case discharges. (a) If the investigation by the OSC shows that a discharge is a worst case discharge as defined in the ACP, or there is a substantial threat of such a discharge, the OSC shall:

(1) Notify the NSFCC;

(2) Require, where applicable, implementation of the worst case portion of an approved tank vessel or facility response plan;

(3) Implement the worst case portion of the ACP, if appropriate; and

(4) Take whatever additional response actions are deemed appropriate.

(b) Under the direction of the OSC, the NSFCC shall coordinate use of private and public personnel and equipment, including strike teams, to remove a worst case discharge and mitigate or prevent a substantial threat of such a discharge.

5.3.7 Multi-regional responses. (a) If a discharge moves from the area covered by one ACP or RCP into another area, the authority for response actions should likewise shift. If a discharge affects areas covered by two or more ACPs or RCPs, the response mechanisms of each applicable plan may be activated. In this case, response actions of all regions concerned shall be fully coordinated as detailed in the RCPs and ACPs.

(b) There shall be only one OSC at any time during the course of a response operation. Should a discharge affect two or more areas, EPA, the USCG, DOD, DOE, or other lead agency, as appropriate, shall give prime consideration to the area vulnerable to the greatest threat, in determining which agency should provide the OSC. The RRT shall designate the OSC if the RRT member agencies who have response authority within the affected areas are unable to agree on the designation. The NRT shall designate the OSC if members of one RRT or two adjacent RRTs are unable to agree on the designation.

5.3.8 Worker health and safety. (a) Response actions under the NCP shall comply with the provisions for response action worker safety and health in 29 CFR 1910.120. The national response system meets the requirements of 29 CFR 1910.120 concerning use of an incident command system.

(b) In a response action taken by a responsible party, the responsible party must assure that an occupational safety and health program consistent with 29 CFR 1910.120 is made available for the protection of workers at the response site.

(c) In a response taken under the NCP by a lead agency, an occupational safety and health program should be made available for the protection of workers at the response site, consistent with, and to the extent required by, 29 CFR 1910.120. Contracts relating to a response action under the NCP should contain assurances that the contractor at the response site will comply with this program and with any applicable provisions of the Occupational Safety and Health Act of 1970 (OSH Act) and state laws with plans approved under section 18 of the OSH Act.

(d) When a state, or political subdivision of a state, without an OSHA-approved state plan is the lead agency for response, the state or political subdivision must comply

with standards in 40 CFR part 311, promulgated by the EPA pursuant to section 126(f) of the Superfund Amendments and Reauthorization Act of 1986 (SARA).

(e) Requirements, standards, and regulations of the OSH Act and of state OSH laws not directly referenced in paragraphs (a) through (d) of this section, must be complied with where applicable. Federal OSH Act requirements include, among other things, Construction Standards (29 CFR part 1926), General Industry Standards (29 CFR part 1910), and the general duty requirement of section 5(a)(1) of the OSH Act (29 U.S.C. 654(a)(1)). No action by the lead agency with respect to response activities under the NCP constitutes an exercise of statutory authority within the meaning of section 4(b)(1) of the OSH Act. All governmental agencies and private employers are directly responsible for the health and safety of their own employees.

5.4 Disposal

Oil recovered in cleanup operations shall be disposed of in accordance with the RCP, ACP, and any applicable laws, regulations, or requirements. RRT and ACP guidelines may identify the disposal plans to be followed during an oil spill response and may address: the sampling, testing, and classifying of recovered oil and oiled debris; the segregation and stockpiling of recovered oil and oiled debris; prior state disposal approvals and permits; and the routes; methods (e.g., recycle/reuse, on-site burning, incineration, landfilling, etc.); and sites for the disposal of collected oil, oiled debris, and animal carcasses.

5.5 Natural Resource Trustees

5.5.1 Damage assessment. (a) Upon notification or discovery of injury to, destruction of, loss of, or threat to natural resources, trustees may, pursuant to section 1006 of the OPA, take the following actions as appropriate:

(1) Conduct a preliminary survey of the area affected by the discharge to determine if trust resources under their jurisdiction are, or potentially may be, affected;

(2) Cooperate with the OSC in coordinating assessments, investigations, and planning;

(3) Carry out damage assessments; or

(4) Devise and carry out a plan for restoration, rehabilitation, replacement, or acquisition of equivalent natural resources. In assessing damages to natural resources, the federal, state, and Indian tribe trustees have the option of following the procedures for natural resource damage assessments located at 43 CFR part 11.

(b) Upon notification or discovery of injury to, destruction of, loss of, or loss of use of, natural resources, or the potential for such, resulting from a discharge of oil occurring after August 18, 1990, the trustees, pursuant

to section 1006 of the OPA, are to take the following actions:

(1) In accordance with OPA section 1006(c), determine the need for assessment of natural resource damages, collect data necessary for a potential damage assessment, and, where appropriate, assess damages to natural resources under their trusteeship; and

(2) As appropriate, and subject to the public participation requirements of OPA section 1006(c), develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent, of the natural resources under their trusteeship.

(c)(1) The trustees, consistent with procedures specified in the Fish and Wildlife and Sensitive Environments Annex to the Area Contingency Plan, shall provide timely advice on recommended actions concerning trustee resources that are potentially affected by a discharge of oil. This may include providing assistance to the OSC in identifying/recommending pre-approved response techniques and in predesignating shoreline types and areas in ACPs.

(2) The trustees shall assure, through the lead administrative trustee, that the OSC is informed of their activities regarding natural resource damage assessment that may affect response operations in order to assure coordination and minimize any interference with such operations. The trustees shall assure, through the lead administrative trustee, that all data from the natural resource damage assessment activities that may support more effective operational decisions are provided in a timely manner to the OSC.

(3) The OSC deploys federal response resources, including but not limited to aircraft, vessels, and booms to contain and remove discharged oil. When circumstances permit, the OSC shall share the use of federal response resources with the trustees, providing trustee activities do not interfere with response actions. The lead administrative trustee facilitates effective and efficient communication between the OSC and the other trustees during response operations and is responsible for applying to the OSC for non-monetary federal response resources on behalf of all trustees. The lead administrative trustee is also responsible for applying to the National Pollution Funds Center for funding for initiation of damage assessment for injuries to natural resources.

(d) The authority of federal trustees includes, but is not limited to the following actions:

(1) Requesting that the Attorney General seek compensation from the responsible parties for the damages assessed and for the costs of an assessment and of restoration planning;

(2) Participating in negotiations between the United States and potentially responsible parties (PRPs) to obtain PRP-financed

or PRP-conducted assessments and restorations for injured resources or protection for threatened resources and to agree to covenants not to sue, where appropriate; and

(3) Initiating damage assessments, as provided in OPA section 6002.

(e) Actions which may be taken by any trustee pursuant to section 311(f)(5) of the CWA or section 1006 of the OPA include, but are not limited to, any of the following:

(1) Requesting that an authorized agency issue an administrative order or pursue injunctive relief against the parties responsible for the discharge; or

(2) Requesting that the lead agency remove, or arrange for the removal of any oil from a contaminated medium pursuant to section 311 of the CWA.

5.5.2 Lead administrative trustee. The lead administrative trustee is a natural resource trustee who is designated on an incident-by-incident basis and chosen by the other trustees whose natural resources are affected by the incident. The lead administrative trustee facilitates effective and efficient communication between the OSC and the other trustees during response operations and is responsible for applying to the OSC for non-monetary federal response resources on behalf of all trustees. The lead administrative trustee is also responsible for applying to the National Pollution Funds Center for funding for initiation of damage assessment for injuries to natural resources.

5.5.3 OSC coordination. (a) The OSC shall ensure that the natural resource trustees are promptly notified in the event of any discharge of oil, to the maximum extent practicable, as provided in the Fish and Wildlife and Sensitive Environments Plan annex to the ACP for the area in which the discharge occurs. The OSC and the trustees shall coordinate assessments, evaluations, investigations, and planning with respect to appropriate removal actions. The OSC shall consult with the affected trustees on the appropriate removal action to be taken.

(b) The trustees will provide timely advice concerning recommended actions with regard to trustee resources that are potentially affected. This may include providing assistance to the OSC in identifying/recommending pre-approved response techniques, and in pre-designating shoreline types and areas in ACPs.

(c) The trustees also will assure that the OSC is informed of their activities regarding natural resource damage assessment that may affect response operations.

5.5.4 Dissemination of information. (a) When an incident occurs, it is imperative to give the public prompt, accurate information on the nature of the incident and the actions underway to mitigate the damage. OSCs and community relations personnel should ensure that all appropriate public and private interests are kept informed and that their

concerns are considered throughout a response. They should coordinate with available public affairs/community relations resources to carry out this responsibility by establishing, as appropriate, a Joint Information Center bringing together resources from federal and state agencies and the responsible party.

(b) An on-scene news office may be established to coordinate media relations and to issue official federal information on an incident. Whenever possible, it will be headed by a representative of the lead agency. The OSC determines the location of the on-scene news office, but every effort should be made to locate it near the scene of the incident. If a participating agency believes public interest warrants the issuance of statements and an on-scene news office has not been established, the affected agency should recommend its establishment. All federal news releases or statements by participating agencies should be cleared through the OSC. Information dissemination relating to natural resource damage assessment activities shall be coordinated through the lead administrative trustee. The designated lead administrative trustee may assist the OSC by disseminating information on issues relating to damage assessment activities. Following termination of the removal activity, information dissemination on damage assessment activities shall be through the lead administrative trustee.

5.5.5 Responsibilities of trustees. (a) Where there are multiple trustees, because of coexisting or contiguous natural resources or concurrent jurisdictions, they should coordinate and cooperate in carrying out these responsibilities.

(b) Trustees are responsible for designating to the RRTs and the Area Committees, for inclusion in the RCP and the ACP, appropriate contacts to receive notifications from the OSCs of discharges.

(c)(1) Upon notification or discovery of injury to, destruction of, loss of, or threat to natural resources, trustees may, pursuant to section 311(f)(5) of the CWA, take the following or other actions as appropriate:

(A) Conduct a preliminary survey of the area affected by the discharge or release to determine if trust resources under their jurisdiction are, or potentially may be, affected;

(B) Cooperate with the OSC in coordinating assessments, investigations, and planning;

(C) Carry out damage assessments; or

(D) Devise and carry out a plan for restoration, rehabilitation, replacement, or acquisition of equivalent natural resources. In assessing damages to natural resources, the federal, state, and Indian tribe trustees have the option of following the procedures for natural resource damage assessments located at 43 CFR part 11.

(2) Upon notification or discovery of injury to, destruction of, loss of, or loss of use of, natural resources, or the potential for such, resulting from a discharge of oil occurring after August 18, 1990, the trustees, pursuant to section 1006 of the OPA, are to take the following actions:

(A) In accordance with OPA section 1006(c), determine the need for assessment of natural resource damages, collect data necessary for a potential damage assessment, and, where appropriate, assess damages to natural resources under their trusteeship; and

(B) As appropriate, and subject to the public participation requirements of OPA section 1006(c), develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent, of the natural resources under their trusteeship;

(3)(A) The trustees, consistent with procedures specified in the Fish and Wildlife and Sensitive Environments Annex to the Area Contingency Plan, shall provide timely advice on recommended actions concerning trustee resources that are potentially affected by a discharge of oil. This may include providing assistance to the OSC in identifying/recommending pre-approved response techniques and in redesignating shoreline types and areas in ACPs.

(B) The trustees shall assure, through the lead administrative trustee, that the OSC is informed of their activities regarding natural resource damage assessment that may affect response operations in order to assure coordination and minimize any interference with such operations. The trustees shall assure, through the lead administrative trustee, that all data from the natural resource damage assessment activities that may support more effective operational decisions are provided in a timely manner to the OSC.

(C) When circumstances permit, the OSC shall share the use of federal response resources (including but not limited to aircraft, vessels, and booms to contain and remove discharged oil) with the trustees, providing trustee activities do not interfere with response actions. The lead administrative trustee facilitates effective and efficient communication between the OSC and the other trustees during response operations and is responsible for applying to the OSC for non-monetary federal response resources on behalf of all trustees. The lead administrative trustee also is responsible for applying to the National Pollution Funds Center for funding for initiation of damage assessment for injuries to natural resources.

(d) The authority of federal trustees includes, but is not limited to the following actions:

(1) Requesting that the Attorney General seek compensation from the responsible parties for the damages assessed and for the costs of an assessment and of restoration planning; and

(2) Initiating damage assessments, as provided in OPA section 6002.

(e) Actions which may be taken by any trustee pursuant to section 1006 of the OPA include, but are not limited to, any of the following:

(1) Requesting that an authorized agency issue an administrative order or pursue injunctive relief against the parties responsible for the discharge or release; or

(2) Requesting that the lead agency remove, or arrange for the removal of, or provide for remedial action with respect to, any oil from a contaminated medium pursuant to section 311 of CWA.

5.6 Oil spill liability trust fund.

5.6.1 *Funding.* (a) The OSLTF is available under certain circumstances to fund removal of oil performed under section 311 of the CWA. Those circumstances and the procedures for accessing the OSLTF are described in 33 CFR subchapter M. The responsible party is liable for costs of federal removal and damages in accordance with section 311(f) of the CWA, section 1002 of the OPA, and other federal laws.

(b) Response actions other than removal, such as scientific investigations not in support of removal actions or law enforcement, shall be provided by the agency with legal responsibility for those specific actions.

(c) The funding of a response to a discharge from a federally owned, operated, or supervised facility or vessel is the responsibility of the owning, operating, or supervising agency if it is a responsible party.

(d) The following agencies have funds available for certain discharge removal actions:

(1) DOD has two specific sources of funds that may be applicable to an oil discharge under appropriate circumstances. This does not consider military resources that might be made available under specific conditions.

(i) Funds required for removal of a sunken vessel or similar obstruction of navigation are available to the Corps of Engineers through Civil Works Appropriations, Operations and Maintenance, General.

(ii) The U.S. Navy (USN) may conduct salvage operations contingent on defense operational commitments, when funded by the requesting agency. Such funding may be requested on a direct cite basis.

(2) Pursuant to Title I of the OPA, the state or states affected by a discharge of oil may act where necessary to remove such discharge. Pursuant to 33 CFR subchapter M, states may be reimbursed from the OSLTF for the reasonable costs incurred in such a removal.

5.6.2 *Claims.* (a) Claims are authorized to be presented to the OSLTF under section 1013 of the OPA of 1990, for certain uncompensated removal costs or uncompensated damages resulting from the discharge, or

substantial threat of discharge, of oil from a vessel or facility into or upon the navigable waters, adjoining shorelines, or exclusive economic zone of the United States.

(b) Anyone desiring to file a claim against the OSLTF may obtain general information on the procedure for filing a claim from the Director, National Pollution Funds Center, Suite 1000, 4200 Wilson Boulevard, Arlington, Virginia, 22203-1804, (703) 235-4756.

5.7 Documentation and Cost Recovery.

(a) All OSLTF users need to collect and maintain documentation to support all actions taken under the CWA. In general, documentation shall be sufficient to support full cost recovery for resources utilized and shall identify the source and circumstances of the incident, the responsible party or parties, and impacts and potential impacts to public health and welfare and the environment. Documentation procedures are contained in 33 CFR subchapter M.

(b) When appropriate, documentation shall also be collected for scientific understanding of the environment and for research and development of improved response methods and technology. Funding for these actions is restricted by section 6002 of the OPA.

(c) As requested by the NRT or RRT, the OSC shall submit to the NRT or RRT a complete report on the removal operation and the actions taken. The OSC report shall record the situation as it developed, the actions taken, the resources committed, and the problems encountered. The RRT shall review the OSC report with its comments or recommendations within 30 days after the RRT has received the OSC report.

(d) OSCs shall ensure the necessary collection and safeguarding of information, samples, and reports. Samples and information shall be gathered expeditiously during the response to ensure an accurate record of the impacts incurred. Documentation materials shall be made available to the trustees of affected natural resources. The OSC shall make available to the trustees of affected natural resources information and documentation in the OSC's possession that can assist the trustees in the determination of actual or potential natural resource injuries.

(e) Information and reports obtained by the EPA or USCG OSC shall be transmitted to the appropriate offices responsible for follow-up actions.

5.8 National response priorities

(a) Safety of human life must be given the top priority during every response action. This includes any search and rescue efforts in the general proximity of the discharge and the insurance of safety of response personnel.

(b) Stabilizing the situation to preclude the event from worsening is the next pri-

ority. All efforts must be focused on saving a vessel that has been involved in a grounding, collision, fire, or explosion, so that it does not compound the problem. Comparable measures should be taken to stabilize a situation involving a facility, pipeline, or other source of pollution. Stabilizing the situation includes securing the source of the spill and/or removing the remaining oil from the container (vessel, tank, or pipeline) to prevent additional oil spillage, to reduce the need for follow-up response action, and to minimize adverse impact to the environment.

(c) The response must use all necessary containment and removal tactics in a coordinated manner to ensure a timely, effective response that minimizes adverse impact to the environment.

(d) All parts of this national response strategy should be addressed concurrently, but safety and stabilization are the highest priorities. The OSC should not delay containment and removal decisions unnecessarily and should take actions to minimize adverse impact to the environment that begin as soon as a discharge occurs, as well as actions to minimize further adverse environmental impact from additional discharges.

(e) The priorities set forth in this section are broad in nature, and should not be interpreted to preclude the consideration of other priorities that may arise on a site-specific basis.

6.0 Response coordination

6.1 *Nongovernmental participation.* (a) Industry groups, academic organizations, and others are encouraged to commit resources for response operations. Specific commitments should be listed in the RCP and ACP. Those entities required to develop tank vessel and facility response plans under CWA section 311(j) must be able to respond to a worst case discharge to the maximum extent practicable, and should commit sufficient resources to implement other aspects of those plans.

(b) The technical and scientific information generated by the local community, along with information from federal, state, and local governments, should be used to assist the OSC in devising response strategies where effective standard techniques are unavailable. Such information and strategies will be incorporated into the ACP, as appropriate. The SSC may act as liaison between the OSC and such interested organizations.

(c) ACPs shall establish procedures to allow for well organized, worthwhile, and safe use of volunteers, including compliance with requirements regarding worker health and safety. ACPs should provide for the direction of volunteers by the OSC or by other federal, state, or local officials knowledgeable in contingency operations and capable of providing leadership. ACPs also should

identify specific areas in which volunteers can be used, such as beach surveillance, logistical support, and bird and wildlife treatment. Unless specifically requested by the OSC, volunteers generally should not be used for physical removal or remedial activities. If, in the judgment of the OSC, dangerous conditions exist, volunteers shall be restricted from on-scene operations.

(d) Nongovernmental participation must be in compliance with the requirements of subpart H of the NCP if any recovery of costs will be sought.

6.2 Natural resource trustees.

6.2.1 Federal agencies. (a) The President is required to designate in the NCP those federal officials who are to act on behalf of the public as trustees for natural resources. These designated federal officials shall act pursuant to section 1006 of the OPA. "Natural resources" means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled (hereinafter referred to as "managed or controlled") by the United States, including the resources of the exclusive economic zone.

(b) The following individuals shall be the designated trustee(s) for general categories of natural resources, including their supporting ecosystems. They are authorized to act pursuant to section 1006 of the OPA when there is injury to, destruction of, loss of, or threat to natural resources, including their supporting ecosystems as a result of a discharge of oil. Notwithstanding the other designations in this section, the Secretaries of Commerce and the Interior shall act as trustees of those resources subject to their respective management or control.

(1) The Secretary of Commerce shall act as trustee for natural resources managed or controlled by DOC and for natural resources managed or controlled by other federal agencies and that are found in, under, or using waters navigable by deep draft vessels, tidally influenced waters or waters of the contiguous zone, the exclusive economic zone, and the outer continental shelf. However, before the Secretary takes an action with respect to an affected resource under the management or control of another federal agency, he shall, whenever practicable, seek to obtain concurrence of that other federal agency. Examples of the Secretary's trusteeship include the following natural resources and their supporting ecosystems: marine fishery resources; anadromous fish; endangered species and marine mammals; and the resources of National Marine Sanctuaries and National Estuarine Research Reserves.

(2) The Secretary of the Interior shall act as trustee for natural resources managed or controlled by DOI. Examples of the Sec-

retary's trusteeship include the following natural resources and their supporting ecosystems: migratory birds; anadromous fish; endangered species and marine mammals; federally owned minerals; and certain federally managed water resources. The Secretary of the Interior shall also be trustee for those natural resources for which an Indian tribe would otherwise act as trustee in those cases where the United States acts on behalf of the Indian tribe.

(3) Secretary for the land managing agency. For natural resources located on, over, or under land administered by the United States, the trustee shall be the head of the department in which the land managing agency is found. The trustees for the principal federal land managing agencies are the Secretaries of DOI, USDA, DOD, and DOE.

(4) Head of Authorized Agencies. For natural resources located within the United States but not otherwise described in this section, the trustee is the head of the federal agency or agencies authorized to manage or control those resources.

6.2.2 State. (a) State trustees shall act on behalf of the public as trustees for natural resources, including their supporting ecosystems, within the boundary of a state or belonging to, managed by, controlled by, or appertaining to such state. For the purposes of section 6.1, the definition of the term "state" does not include Indian tribes.

(b) The Governor of a state is encouraged to designate a lead state trustee to coordinate all state trustee responsibilities with other trustee agencies and with response activities of the RRT and OSC. The state's lead trustee would designate a representative to serve as a contact with the OSC. This individual should have ready access to appropriate state officials with environmental protection, emergency response, and natural resource responsibilities. The EPA Administrator or USCG Commandant or their designees may appoint the lead state trustee as a member of the Area Committee. Response strategies should be coordinated between the state and other trustees and the OSC for specific natural resource locations in an inland or coastal zone, and should be included in the Fish and Wildlife and Sensitive Environments Plan annex of the ACP.

6.2.3 Indian tribes. The tribal chairmen (or heads of the governing bodies) of Indian tribes, as defined in section 1.5, or a person designated by the tribal officials, shall act on behalf of the Indian tribes as trustees for the natural resources, including their supporting ecosystems, belonging to, managed by, controlled by, or appertaining to such Indian tribe, or held in trust for the benefit of such Indian tribe, or belonging to a member of such Indian tribe, if such resources are subject to a trust restriction on alienation. When the tribal chairman or head of the tribal governing body designates another

person as trustee, the tribal chairman or head of the tribal governing body shall notify the President of such designation.

6.2.4 Foreign trustees. Pursuant to section 1006 of the OPA, foreign trustees shall act on behalf of the head of a foreign government as trustees for natural resources belonging to, managed by, controlled by, or appertaining to such foreign government.

6.3 Federal agencies.

(a) Federal agencies listed in this appendix have duties established by statute, executive order, or Presidential directive which may apply to federal response actions following, or in prevention of, the discharge of oil. Some of these agencies also have duties relating to the restoration, rehabilitation, replacement, or acquisition of equivalent natural resources injured or lost as a result of such discharge. The NRT, RRT, and Area Committee organizational structure, and the NCP, RCPs, and ACPs provide for agencies to coordinate with each other in carrying out these duties.

(b) Federal agencies may be called upon by an OSC during response planning and implementation to provide assistance in their respective areas of expertise, consistent with the agencies' capabilities and authorities.

(c) In addition to their general responsibilities, federal agencies should:

(1) Make necessary information available to the Secretary of the NRT, RRTs, Area Committees, and OSCs;

(2) Provide representatives to the NRT and RRTs and otherwise assist RRTs and OSCs, as necessary, in formulating RCPs and ACPs; and

(3) Inform the NRT, RRTs, and Area Committees consistent with national security considerations, of changes in the availability of resources that would affect the operations implemented under the NCP.

(d) All federal agencies must report discharges of oil, as required in 40 CFR part 110, from vessels or facilities under their jurisdiction or control to the NRC.

6.4 Other Federal agencies.

6.4.1 Department of Commerce. (a) The DOC, through NOAA, provides scientific support for response and contingency planning in coastal and marine areas, including assessments of the hazards that may be involved, predictions of movement and dispersion of oil through trajectory modeling, and information on the sensitivity of coastal environments to oil and associated cleanup and mitigation methods; provides expertise on living marine resources and their habitats, including endangered species, marine mammals and National Marine Sanctuary ecosystems; and provides information on actual and predicted meteorological, hydrological, ice, and oceanographic conditions for ma-

rine, coastal, and inland waters, and tide and circulation data for coastal and territorial waters and for the Great Lakes. In addition to this expertise, NOAA provides SSCs in the coastal zone, as described under section 3.3.3 of this appendix, Special teams.

6.4.2 Department of Justice. The DOJ can provide expert advice on complicated legal questions arising from discharges, and federal agency responses. In addition, the DOJ represents the federal government, including its agencies, in litigation relating to such discharges. Other legal issues or questions shall be directed to the federal agency counsel for the agency providing the OSC for the response.

6.4.3 Department of Defense. The DOD has responsibility to take all action necessary with respect to discharges where either the discharge is on, or the sole source of a discharge is from, any facility or vessel under the jurisdiction, custody, or control of DOD. In addition to those capabilities provided by SUPSALV, DOD may also, consistent with its operational requirements and upon request of the OSC, provide locally deployed USN oil spill response equipment and provide assistance to other federal agencies upon request. The following two branches of DOD have particularly relevant expertise:

(a) The United States Army Corps of Engineers has specialized equipment and personnel for maintaining navigation channels, for removing navigation obstructions, for accomplishing structural repairs, and for performing maintenance to hydropower electric generating equipment. The Corps can also provide design services, perform construction, and provide contract writing and contract administrative services for other federal agencies.

(b) The U.S. Navy Supervisor of Salvage (SUPSLAV) is the branch of the service within DOD most knowledgeable and experienced in ship salvage, shipboard damage control, and diving. The USN has an extensive array of specialized equipment and personnel available for use in these areas as well as specialized containment, collection, and removal equipment specifically designed for salvage-related and open-sea pollution incidents.

6.4.4 Department of Health and Human Services. (a) The HHS assists with the assessment, preservation, and protection of human health and helps ensure the availability of essential human services. HHS provides technical and nontechnical assistance in the form of advice, guidance, and resources to other federal agencies as well as state and local governments.

(b) The principal HHS response comes from the U.S. Public Health Service and is coordinated from the Office of the Assistant Secretary for Health, and various Public Health Service regional offices. Within the Public Health Service, the primary response to a

hazardous materials emergency comes from the Agency for Toxic Substances and Disease Registry (ATSDR) and the Centers for Disease Control (CDC). Both ATSDR and CDC have a 24-hour emergency response capability wherein scientific and technical personnel are available to provide technical assistance to the lead federal agency and state and local response agencies on human health threat assessment and analysis, and exposure prevention and mitigation. Such assistance is used for situations requiring evacuation of affected areas, human exposure to hazardous materials, and technical advice on mitigation and prevention. CDC takes the lead during petroleum releases regulated under the CWA and OPA while ATSDR takes the lead during chemical releases under CERCLA. Both agencies are mutually supportive.

(c) Other Public Health Service agencies involved in support during hazardous materials incidents either directly or through ATSDR/CDC include the Food and Drug Administration, the Health Resources and Services Administration, the Indian Health Service, and the National Institutes of Health.

(d) Statutory authority for HHS/National Institutes for Environmental Health Sciences (NIEHS) involvement in hazardous materials accident prevention is non-regulatory in nature and focused on two primary areas for preventing community and worker exposure to hazardous materials releases: (1) worker safety training and (2) basic research activities. Under section 126 of the SARA, NIEHS is given statutory authority for supporting development of curricula and model training programs for waste workers and chemical emergency responders. Under section 118(b) of the Hazardous Materials Transportation and Uniform Safety Act, NIEHS also administers the Hazmat Employee Training Program to prepare curricula and training for hazardous materials transportation workers. In the basic research arena, NIEHS is authorized under section 311 of SARA to conduct a hazardous substance basic research and training program to evaluate toxic effects and assess human health risks from accidental releases of hazardous materials. Under Title IX, section 901(h) of the Clean Air Act Amendments, NIEHS also is authorized to conduct basic research on air pollutants, as well as train physicians in environmental health. Federal research and training in hazardous materials release prevention represents an important non-regulatory activity and supplements ongoing private sector programs.

6.4.5 *Department of the Interior.* The DOI may be contacted through Regional Environmental Officers, who are the designated members of RRTs. Department land managers have jurisdiction over the national park system, national wildlife refuges and

fish hatcheries, the public lands, and certain water projects in western states. In addition, bureaus and offices have relevant expertise as follows:

(a) United States Fish and Wildlife Service and other Bureaus: Anadromous and certain other fishes and wildlife, including endangered and threatened species, migratory birds, and certain marine mammals; waters and wetlands; and effects on natural resources.

(b) The National Biological Survey performs research in support of biological resource management; inventories, monitors, and reports on the status and trends in the Nation's biotic resources; and transfers the information gained in research and monitoring to resource managers and others concerned with the care, use, and conservation of the Nation's natural resources. The National Biological Survey has laboratory/research facilities.

(c) Geological Survey: Geology, hydrology (ground water and surface water), and natural hazards.

(d) Bureau of Land Management: Minerals, soils, vegetation, wildlife, habitat, archaeology, and wilderness.

(e) Minerals Management Service: Oversight of offshore oil and gas exploration and production facilities and associated pipeline facilities under the Outer Continental Shelf Lands Act and the CWA; oil spill response technology research; and establishing oil discharge contingency planning requirements for offshore facilities.

(f) Bureau of Mines: Analysis and identification of inorganic hazardous substances and technical expertise in metals and metallurgy relevant to site cleanup.

(g) Office of Surface Mining: Coal mine wastes and land reclamation.

(h) National Park Service: General biological, natural, and cultural resource managers to evaluate, measure, monitor, and contain threats to park system lands and resources; archaeological and historical expertise in protection, preservation, evaluation, impact mitigation, and restoration of cultural resources; emergency personnel.

(i) Bureau of Reclamation: Operation and maintenance of water projects in the West; engineering and hydrology; and reservoirs.

(j) Bureau of Indian Affairs: Coordination of activities affecting Indian lands; assistance in identifying Indian tribal government officials.

(k) Office of Territorial Affairs: Assistance in implementing the NCP in American Samoa, Guam, the Pacific Island Governments, the Northern Mariana Islands, and the Virgin Islands.

6.4.6 *Department of Justice.* The DOJ can provide expert advice on complicated legal questions arising from discharges, and federal agency responses. In addition, the DOJ represents the federal government, including

its agencies, in litigation relating to such discharges. Other legal issues or questions shall be directed to the federal agency counsel for the agency providing the OSC for the response.

6.4.7 Department of Labor. The DOL, through OSHA and the states operating plans approved under section 18 of the OSH Act, has authority to conduct safety and health inspections of hazardous waste sites to assure that employees are being protected and to determine if the site is in compliance with:

(a) Safety and health standards and regulations promulgated by OSHA (or the states) in accordance with section 126 of SARA and all other applicable standards; and

(b) Regulations promulgated under the OSH Act and its general duty clause. OSHA inspections may be self-generated, consistent with its program operations and objectives, or may be conducted in response to requests from EPA or another lead agency, or in response to accidents or employee complaints. On request, OSHA shall provide advice and consultation to EPA and other NRT/RRT agencies as well as to the OSC regarding hazards to persons engaged in response activities. OSHA may also take any other action necessary to assure that employees are properly protected at such response activities. Any questions about occupational safety and health at these sites may be referred to the OSHA Regional Office.

6.4.8 Federal Emergency Management Agency. FEMA provides guidance, policy and program advice, and technical assistance in hazardous materials, chemical, and radiological emergency preparedness activities (including planning, training, and exercising). FEMA's primary point of contact for administering financial and technical assistance to state and local governments to support their efforts to develop and maintain an effective emergency management and response capability is the Preparedness, Training, and Exercises Directorate.

6.4.9 Department of Energy. The DOE generally provides designated OSCs that are responsible for taking all response actions with respect to releases where either the release is on, or the sole source of the release is from, any facility or vessel under its jurisdiction, custody, or control, including vessels bareboat-chartered and operated. In addition, under the FRERP, DOE provides advice and assistance to other OSCs/RPMs for emergency actions essential for the control of immediate radiological hazards. Incidents that qualify for DOE radiological advice and assistance are those believed to involve source, by-product, or special nuclear material or other ionizing radiation sources, including radium, and other naturally occurring radionuclides, as well as particle accelerators. Assistance is available through di-

rect contact with the appropriate DOE Radiological Assistance Program Regional Office.

6.4.10 Department of State. The DOS will lead in the development of international joint contingency plans. It will also help to coordinate an international response when discharges or releases cross international boundaries or involve foreign flag vessels. Additionally, DOS will coordinate requests for assistance from foreign governments and U.S. proposals for conducting research at incidents that occur in waters of other countries.

6.4.11 General Services Administration. The GSA provides logistic and telecommunications support to federal agencies. During an emergency situation, GSA quickly responds to aid state and local governments as directed by other Federal Agencies. The type of support provided might include leasing and furnishing office space, setting up telecommunications and transportation services, and advisory assistance.

6.4.12 Department of Transportation. DOT provides response expertise pertaining to transportation of oil by all modes of transportation. DOT, through RSPA, establishes oil discharge contingency planning requirements for pipelines, transport by rail and containers or bulk transport of oil.

6.5 States and local participation in response.

(a) Each state Governor is requested to designate one state office/representative to represent the state on the appropriate RRT. The state's office/representative may participate fully in all activities of the appropriate RRT. Each state Governor is also requested to designate a lead state agency that shall direct state-lead response operations. This agency is responsible for designating the OSC for state-lead response actions, and coordinating/communicating with any other state agencies, as appropriate. Local governments are invited to participate in activities on the appropriate RRT as may be provided by state law or arranged by the state's representative. Indian tribes wishing to participate should assign one person or office to represent the tribal government on the appropriate RRT.

(b) Appropriate state and local officials (including Indian tribes) shall participate as part of the response structure as provided in the ACP.

(c) In addition to meeting the requirements for local emergency plans under SARA section 303, state and local government agencies are encouraged to include contingency planning for responses, consistent with the NCP, RCP, and ACP in all emergency and disaster planning.

(d) For facilities not addressed under the CWA for oil discharges, states are encouraged to undertake response actions themselves or to use their authorities to compel

potentially responsible parties to undertake response actions.

(e) Because state and local public safety organizations would normally be the first government representatives at the scene of a discharge or release, they are expected to initiate public safety measures that are necessary to protect the public health and welfare and that are consistent with containment and cleanup requirements in the NCP, and are responsible for directing evacuations pursuant to existing state or local procedures.

[59 FR 47473, Sept. 15, 1994, as amended at 80 FR 37121, June 29, 2015; 83 FR 5209, Feb. 6, 2018]

PART 302—DESIGNATION, REPORTABLE QUANTITIES, AND NOTIFICATION

Sec.

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AUTHORITY: 42 U.S.C. 9602, 9603, and 9604; 33 U.S.C. 1321 and 1361.

SOURCE: 50 FR 13474, Apr. 4, 1985, unless otherwise noted.

§ 302.1 Applicability.

This regulation designates under section 102(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (“the Act”) those substances in the statutes referred to in section 101(14) of the Act, identifies reportable quantities for these substances, and sets forth the notification requirements for releases of these substances. This regulation also sets forth reportable quantities for hazardous substances designated under section 311(b)(2)(A) of the Clean Water Act.

§ 302.2 [Reserved]

§ 302.3 Definitions.

As used in this part, all terms shall have the meaning set forth below:

The Act, CERCLA, or Superfund means the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Pub. L. 96-510);

Administrator means the Administrator of the United States Environmental Protection Agency (“EPA”);

Animal waste means feces, urine, or other excrement, digestive emission, urea, or similar substances emitted by animals (including any form of livestock, poultry, or fish). The term “animal waste” includes animal waste that is mixed or commingled with bedding, compost, feed, soil, or any other material typically found with such waste.

Consumer product shall have the meaning stated in 15 U.S.C. 2052;

Environment means (1) the navigable waters, the waters of the contiguous zone, and the ocean waters of which the natural resources are under the exclusive management authority of the United States under the Fishery Conservation and Management Act of 1976, and (2) any other surface water, ground water, drinking water supply, land surface or subsurface strata, or ambient air within the United States or under the jurisdiction of the United States;

Facility means (1) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft, or (2) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any vessel;

Farm means a site or area (including associated structures) that—

(1) Is used for—

(i) The production of a crop; or

(ii) The raising or selling of animals (including any form of livestock, poultry, or fish); and

(2) Under normal conditions, produces during a farm year any agricultural products with a total value equal to not less than \$1,000.

Hazardous substance means any substance designated pursuant to 40 CFR part 302;

Hazardous waste shall have the meaning provided in 40 CFR 261.3;

Navigable waters means the waters of the United States, including the territorial seas.