

Criteria	Alternative 1 No Action	Alternative 2 Cap, Alternate Water Supply, Natural Attenuation of Ground Water	Alternative 3 In-situ Soil Vapor Extraction, Cap, Ground Water Pump and Treat	Alternative 4 In-situ Soil Vapor Extraction, In-situ Soil Stabilization, Cap, Ground Water Pump and Treat	Alternative 5 In-situ Soil Stabilization, Cap, Incineration, Ground Water Pump and Treat
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Treatment Process Used	None.	None.	Vapor extraction of soil and ground-water air stripping.	Vapor extraction, soil stabilization, and ground-water air stripping.	Incineration, soil stabilization, and ground-water air stripping.
Amount Destroyed or Treated	None.	None.	90% of volatiles in soil and 95% of volatiles in ground water removed and destroyed by carbon regeneration.	Same as Alternative 3 plus 25,000 cy of contaminated soil is stabilized (30,000 cy after stabilization).	Comparable to Alternative 4.
Reduction of Toxicity, Mobility, or Volume	None.	None.	Reduced volume and toxicity of contaminated ground water. Toxicity of soil contamination reduced.	Greater reduction of mobility of contaminants (40%) while volume increased 20% due to stabilization. Toxicity of soil contamination reduced 95%. Reduced volume and toxicity of contaminated ground water.	Greatest reduction in volume of contaminated soil (20,000 cy) and reduction in toxicity due to incineration. Mobility of lead is reduced. Reduced volume and toxicity of contaminated ground water.
Irreversible Treatment	None.	None.	Vapor extraction and air stripping are irreversible with regeneration of carbon used for air stream treatment. Some potential for continued ground- water contamination from leachate generation.	Stabilization will provide better protection against likelihood of leachate generation over Alternative 3. Other benefits similar to Alternative 3.	Completely irreversible with incineration. Air stripping with subsequent gaseous carbon treatment and regeneration is irreversible.
Type and Quantity of Residuals Remaining After Treatment	Contaminated soil remains.	None.	Contaminated soil remains in Area 1. Carbon used in air stripping requires regeneration.	No detectable residuals remain. 30,000 cy of fixed soils remain in Area 1.	Incinerated soil (20,000 cy) and fixed soils (30,000 cy) remain. Incinerated soil expected to be non-hazardous. Carbon from air strippers requires regeneration.

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SHORT-TERM EFFECTIVENESS					
Community Protection	Continued risk to community through no action. Contaminated water may reach the residents within 1-3 years.	Controllable, minor increase in dust production during cap installation. Contaminated soils remain undisturbed.	Soil would remain uncovered during vapor extraction for 3-5 years. Controllable, minor increase in dust production during cap installation.	Similar to Alternative 3. Controllable, minor increase in dust production during cap installation.	Soil would remain uncovered during incineration (about 1 year). Dust and odors released during excavation and stabilization would require controls.
Worker Protection	No risk to workers.	Protection required against dermal contact and inhalation of contaminated dust during cap construction.	Protection required against dermal contact, vapor or dust inhalation during construction and operation of vapor extraction system and air stripper.	Protection required against dermal contact, vapor, or dust inhalation during construction and operation of vapor extraction system, stabilization, and air stripper.	Protection required against dermal contact and inhalation of volatiles and particulates as a result of excavation, fixing, and incinerating TCE soil.
Environmental Impacts	Continued impact from existing conditions.	Migration of contaminants from runoff eliminated. Would be some migration of contaminant plume as part of attenuation process.	Vapor extraction may produce odors although it will meet emission standards. Would be aquifer draw-down during ground water extraction.	See Alternative 3. Stabilization may also affect air quality and produce odors.	Incineration may impact air quality, produce odors, although it will meet emission standards.
Time Until Action is Complete	Not applicable.	Cap installed in 6 months. Risk from ground water reduced within 3 months due to alternate water supply.	Soil vapor extraction complete in 3-5 years. Capping complete in 6 months. Ground-water remedial action complete in 25-40 years.	Stabilization and capping completed in 9 months. Soil vapor extraction complete in 3-5 years. Ground-water action complete in 25-40 years.	Incineration complete in 2 years. Stabilization and capping complete in 9 months. Ground-water action complete in 25-40 years.

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	No Action	Cap, Alternate Water Supply, Natural Attenuation of Ground Water	In-situ Soil Vapor Extraction, Cap, Ground Water Pump and Treat	In-situ Soil Vapor Extraction, In-situ Soil Stabilization, Cap, Ground Water Pump and Treat	In-situ Soil Stabilization, Cap, Incineration, Ground Water Pump and Treat
IMPLEMENTABILITY					
Ability to Construct and Operate	No construction or operation.	Easy to construct. Would require materials handling of about 50,000 cy of soil and clay.	More extensive than Alternate 2. Straightforward construction and operation of treatment systems, in addition to cap. Cap construction would require materials handling of 25,000 cy of soil and clay.	More extensive than Alternative 3 due to stabilization. Logistics of three treatment processes requires more effort. Otherwise similar to Alternative 3.	Incineration is complex to operate, requires large area on-site. Otherwise similar to Alternative 3.
Ease of Doing More Action if Needed	May require ROD amendment future problems arise.	Easy to extend cap. Could implement ground-water treatment if necessary. Future installation of treatment system may require cap intrusion.	Easy to extend ground-water extraction system, vapor extraction system, and cap. Would not require intrusion into cap to extend treatment systems.	Fairly complete alternative. Can increase volume of or modify all technologies easily, if needed.	Complete alternative. Can most easily handle varying volumes or concentrations.
Ability to Monitor Effectiveness	No monitoring. Failure to detect contamination means potential ingestion of contaminated ground water.	Monitoring and maintenance inspections will give notice of failure before significant exposure occurs.	Treatment systems are easily monitored to determine effectiveness. Effectiveness of cap evaluated by inspection.	Same as Alternative 2.	Same as Alternative 2.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approval necessary.	Same as Alternative 1.	More extensive approvals needed. Demonstrate compliance with air standards. Process for NPDES permit required.	Same as Alternative 3.	Most extensive. Need to demonstrate compliance with technical content of incinerator permit. Otherwise same as Alternative 3.
Availability of Equipment, Specialists, and Materials	None required.	No special equipment, material, or specialists required. Cap materials available within 20 miles.	Personnel to operate vapor extraction system are readily available. Cap materials available within 20 miles.	See Alternative 3.	Need mobile incinerator and trained operators. Need treatment plant operators. Closest source of incinerator is 500 miles from site.
Availability of Technologies	None required.	Cap technology readily available.	Vapor extraction well developed and commercially available. Will require pilot testing.	Vapor extraction and stabilization technologies well developed and commercially available. Will require pilot testing.	Incineration and stabilization technologies well developed and commercially available. Will require pilot testing.
COST					
Capital Cost	\$0	\$4,200,000	\$3,300,000	\$6,200,000	\$13,000,000
Annual O&M Cost	0	60,000	440,000	460,000	1,700,000
Present Worth Cost	0	4,800,000	7,300,000	10,200,000	16,000,000

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STATE ACCEPTANCE	Not Acceptable. Not protective of human health and environment.	Not Acceptable. Not a permanent solution.	Acceptable.	Acceptable.	Acceptable.
COMMUNITY ACCEPTANCE	Not Acceptable.	Not Acceptable.	Acceptable.	Acceptable.	Not Acceptable. Community opposed to Incineration.

6.3.11 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). The “principal threat” concept is applied to the characterization of “source materials” at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in ground water may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur.²⁰ The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria. Remedies which involve treatment of principal threat wastes likely will satisfy the statutory preference for treatment as a principal element, although this will not necessarily be true in all cases. This section of the *Decision Summary* should discuss the source materials constituting principal threats at the site and discuss how the alternatives will address them. [For definitions and examples, see Highlight 6-26 and *A Guide to Principal Threat and Low Level Threat Wastes*, OSWER 9380.3-06FS, November 1991.]

²⁰ The reasonably anticipated future land use at a site is significant in defining principal threat waste areas. Pursuant to the NCP and the 1995 land use guidance, current land use and reasonably anticipated future land use should be considered in identifying realistic exposure scenarios for estimating site risks. When the baseline risks associated with the reasonably anticipated future land use trigger action, the definition of principal threat wastes may be determined by the reasonably anticipated future land use scenario as well. For example, soil contamination that could be considered a principal threat under a residential exposure scenario might not be considered a principal threat under a non-residential exposure scenario. Although no “threshold level” of risk has been established to identify principal threat waste, a general rule of thumb is to consider as a principal threat those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the risk level that is acceptable for the current or reasonably anticipated future land use, given realistic exposure scenarios (*Rules of Thumb for Superfund Remedy Selection*, EPA 540-R-97-013, August 1997).

6.3.12 Selected Remedy

This section expands upon the details of the Selected Remedy from that which was provided in the *Description of Alternatives* section of the ROD. This section should provide the appropriate level of detail about the engineering details and estimated costs for the Selected Remedy so that the design engineer has enough information to initiate the design phase of the response action. This will minimize the likelihood of unanticipated changes to the scope and intent of the Selected Remedy. This discussion should be organized in four sections: (1) Summary of the Rationale for the Selected Remedy (2) Description of the Selected Remedy, (3) Summary of Estimated Remedy Costs, and (4) Expected Outcomes of Selected Remedy.

1) Summary of the Rationale for the Selected Remedy

This section provides a concise discussion of the principal factors upon which the remedy selection decision is based. While a number of these reasons may be reiterated in the statutory determinations (Section 6.3.13), or be based on one or more of those determinations, a discussion of the key rationale for remedy selection is a logical outgrowth of the previous summary discussion of the comparison of alternatives, and can serve as a bridge to the expanded discussion of the selected remedy and statutory determinations.

The decisive factors that led to selecting the remedy should be described (*i.e.*, a description of how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria).

2) Description of the Selected Remedy

This section should expand on the description of the Selected Remedy from that which was provided in the *Description of Alternatives* (Section 6.3.9). Take the bulleted list of the major remedy components and expand, where appropriate, to an increased level of detail (*i.e.*, the level of detail one would provide to a subsequent Remedial Project Manager or PRP to implement the Remedial Design for the project).²¹ While perhaps

²¹ This section of the ROD should mention that the remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in the ROD will be documented using a technical memorandum in the Administrative Record, an ESD, or ROD amendment (in accordance with the procedures described in Chapter 7).

Highlight 6-26 : Key Definitions for Identifying Source Materials Constituting Principal Threats

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

Wastes that generally will be considered to constitute principal threats include, but are not limited to, the following:

- **Liquid source material** - waste contained in drums, lagoons or tanks, free product in the subsurface (i.e., NAPLs) containing contaminants of concern (generally excluding ground water).
- **Mobile source material** - surface soil or subsurface soil containing high concentrations of chemicals of concern that are (or potentially are) mobile due to wind entrainment, volatilization (e.g., VOCs), surface runoff, or subsurface transport.
- **Highly-toxic source material** - buried drummed non-liquid wastes, buried tanks containing non-liquid wastes, or soils containing significant concentrations of highly toxic materials.

Wastes that generally will not constitute principal threats include, but are not limited to, the following:

- **Non-mobile contaminated source material of low to moderate toxicity** - surface soil containing chemicals of concern that generally are relatively immobile in air or ground water (i.e., non-liquid, low volatility, low leachability contaminants such as high molecular weight compounds) in the specific environmental setting.
- **Low toxicity source material** - soil and subsurface soil concentrations not greatly above reference dose levels or that present an excess cancer risk near the acceptable risk range were exposure to occur.

Source: *A Guide to Principal Threat and Low Level Threat Wastes (OSWER 9380.3-06FS, November 1991)*.

more detailed, the description of remedial components provided in this section should nonetheless be consistent with initial descriptions of the alternative provided earlier in the ROD.

One specific area of the Selected Remedy that should be expanded upon is the description of the institutional control components of the remedy. Describe the institutional controls as explicitly as possible. Include performance goals (e.g., restrict access to land), the means of implementing the controls (i.e., conveyance), and the implementing entity (e.g., private party or governmental entity). If a separate institutional controls implementation document has been developed (e.g., Institutional Controls Plan), this document should be summarized in this section of the ROD as well (*Institutional Controls: A Reference Manual*, March 1998 draft).

3) Summary of the Estimated Remedy Costs

One aspect of the Selected Remedy that should be described in detail is the cost estimate for implementing the Selected Remedy. This subsection should present a more detailed estimated cost breakdown than that provided in the *Description of Alternatives* section. Although this information may also be available in the Feasibility Study, a much broader public audience is interested in what is being spent on Superfund cleanups. RODS serve as the primary data source for a host of internal and external parties interested in analyzing the costs of Superfund cleanups. Because all RODs are available to the public and are easier to obtain than large documents from the Administrative Record file for a site, it is important to present the estimated costs of the cleanup plan in as much detail as possible in the ROD.

Highlight 6-27: Tips on Writing the “Selected Remedy” Section

- Expand on the bullet list of major remedy components presented in the Description of Alternatives to give a design engineer enough information to correctly interpret the technical intent of the ROD.
- Present a clear and well annotated cost estimate summary table. The detailed cost information for the Selected Remedy is generally presented in the FS. This summary table, or the relevant information, can be copied and incorporated into a summary table similar to the one presented in Highlight 6-29.
- Present the basis and rationale for cleanup levels in a table and explain in the text where and how they will be applied during the response action.

This generally can be accomplished by presenting a one to two-page cost estimate summary table (in the same level of detail as provided in the FS). This engineering-oriented “activity-based” estimate should be determined from the major construction and annual O&M activities anticipated to implement each major component of the Selected Remedy. This estimate should include estimated capital, annual O&M, and total present worth costs; discount rate; and the number of years over which the remedy cost estimate is projected. For example, if the Selected Remedy is comprised of a soil and ground-water component, major construction and annual O&M activities and their associated unit and total cost estimates should be clearly presented in a tabular format. If more information is available, this section should NOT merely present lump sum capital, annual O&M, and total present worth cost estimates for the entire remedy. The presentation of the cost estimate should make basic assumptions clear (*i.e.*, discount rate and duration of O&M) and identify sources of uncertainty in capital and annual O&M cost estimates. An example of an “activity-based estimate” is contained in Highlight 6-29. Highlight 6-28 provides standard cost estimate disclaimer language to acknowledge the uncertainty associated with cost estimates. Tips for developing this table are provided in Highlight 6-30.²²

Additional guidance for remedy cost estimating is provided in the *Remedy Cost Estimating Procedures Manual: A Guide to Developing and Documenting Remedial Alternative Cost Estimates During the Feasibility Study* (EPA 540-R-98-045, December 4, 1998 Final Review Draft).

Highlight 6-28: Standard Cost Estimate Disclaimer Language

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

²² For response actions where a combination of several alternatives evaluated in the FS become the basis for the Selected Remedy, and hence a detailed cost estimate is not contained in the FS background materials, the services of the Army Corps of Engineers or a RACs technical support contractor should be obtained to construct a more detailed cost estimate for inclusion in the ROD.

Highlight 6-29: Example Table Format - Cost Estimate Summary for the Selected Remedy

Capital Costs for Remedy Component 1

Description	Quantity	Unit	Unit Cost	Cost
1. Mobilization/Demobilization	--	LS	--	\$11,925
2. Site Preparation				
Decommission Utilities	--	LS	--	
Perform Site Survey	3	Day	\$910.00	\$2,730
Install Temporary Construction Fencing	3,000	LF	\$5.65	\$16,950
Remove & Replace Existing Monitoring Wells	11	Well	\$3,500.00	\$38,500
3. Structural Demolition and Disposal				
Building Demolition	--	LS	--	\$195,314
Dispose of Drums w/Contaminated Materials	374	Drum	\$136.00	\$50,864
Recycle misc. Items (tires, auto tanks, pipes, etc.)	25	Ton	\$75.00	\$1,875
4. Storage Tank Removal & Reclamation	8	Tank	\$6,750.00	\$54,000
5. Water Control				
Construct Dewatering Pad	2,500	SY	\$45.17	\$112,925
Install Diversion Ditches and Berms	1,650	LF	\$3.64	\$6,006
6. Consolidation of Solids				
Temporarily Relocate Residents	160	Person	\$410.00	\$65,600
Excavation of Contaminated Soil	14,300	CY	\$15.12	\$216,216
Hydraulic Dredging of Lagoon Sediment	3,300	CY	\$3.00	\$9,900
Dewater w/Plate-Frame Filter Press	3,300	CY	\$38.75	\$127,875
Hauling	14,300	CY	\$2.25	\$32,175
Backfill Excavations w/Clean Fill	19,400	CY	\$4.69	\$90,986
Clean Topsoil & Hydro-seed	14,300	CY	\$16.00	\$228,800
7. Soil Disposal (Off-Site Landfill)	19,400	CY	\$250.00	\$4,850
8. Safety Monitoring and Sampling				
Soil Sampling and Analysis (1 sample/lot)	80	Lot	\$850.00	\$68,000
Health and Safety Expenditures (30 people @ \$60/person/day)	90	Day	\$1,800.00	\$162,000
9. Wastewater Treatment	350,000	Gallon	\$0.45	\$157,500
NAPL Disposal	10,000	Gallon	\$4.00	\$40,000
10. Facility Cover				
Place 2-foot Topsoil Layer	33,700	CY	\$16.00	\$539,200
Recontour/ Shape & Grade ACC Facility	50,550	SY	\$0.53	\$26,792
Hydroseed	450,000	SF	\$0.06	\$27,000
Subtotal				<u>\$7,134,633</u>
Contingency Allowances (15%)				\$1,070,195
Project Management and Support (10%)				\$713,463
Total Capital Cost				<u>\$8,918,291</u>

**Highlight 6-29: Example Table Format - Cost Estimate Summary for the Selected Remedy
(continued)**

Annual Operation and Maintenance Costs for Remedy Component 1

Description	Quantity	Unit	Unit Cost
1. Water Monitoring			
Sampling	15	Year	\$7,470.00
Laboratory Analysis	15	Year	\$11,240.00
2. Site Inspections/ Cover Maintenance	15	Year	\$400.00
Subtotal			<u>\$19,110.00</u>
Contingency Allowances (25%)			\$4,777.50
Project Management and Support (15%)			\$2,866.50
Total Annual O & M Cost			\$26,754.00

Summary of Present Worth Analysis

Year	Capital Cost	Annual O&M Cost	Total Cost	Discount Factor (7%)	Present Worth
0	\$8,918,291		\$8,918,291	1.000	\$8,918,291
1		\$26,754	\$26,754	0.935	\$25,015
2		\$26,754	\$26,754	0.873	\$23,356
3		\$26,754	\$26,754	0.816	\$21,831
4		\$26,754	\$26,754	0.763	\$20,413
5		\$26,754	\$26,754	0.713	\$19,076
6		\$26,754	\$26,754	0.666	\$17,818
7		\$26,754	\$26,754	0.623	\$16,668
8		\$26,754	\$26,754	0.582	\$15,571
9		\$26,754	\$26,754	0.544	\$14,554
10		\$26,754	\$26,754	0.508	\$13,591
11		\$26,754	\$26,754	0.475	\$12,708
12		\$26,754	\$26,754	0.444	\$11,879
13		\$26,754	\$26,754	0.415	\$11,103
14		\$26,754	\$26,754	0.388	\$10,381
15		\$26,754	\$26,754	0.362	\$9,685
TOTALS	<u>\$8,918,291</u>	<u>\$401,310</u>	<u>\$9,319,601</u>		<u>\$9,161,940</u>

Total Present Worth Cost

\$9,161,940

Notes

Unit costs are for illustration only and should not be used for cost estimating purposes. Capital cost estimates are not discounted because the construction work will be performed in the first year. O&M costs are reported as present worth estimates given a 7% discount rate for a 15 year duration. Cost estimates are based on soil volume estimates which may be refined when remedy is designed. Cost estimates are within +50 to -30% accuracy expectation. Project management and support should account for the cost of the RD and the administrative/project management costs for the RD/RA and O&M.
 LS= Lump Sum
 LF= Linear Foot
 SY= Square Yard
 CY= Cubic Yard

Highlight 6-30: Tips for Presenting Summary of Cost Estimate for Selected Remedy

- Present a summary table of the major capital and annual O&M cost elements for the Selected Remedy. This 1-2 page table should present the major construction and O&M activities required to implement each remedy component along with their associated unit and total costs. See Highlight 6-29 for an example of this format.
- Present the major cost elements in a logically organized sequence, itemized to a level of detail that is appropriate for the Selected Remedy. For example: project design, management and support, site work/preparation, sampling and analysis, treatment system costs, containment system costs, post-treatment/containment costs, annual O&M costs for treatment/containment system, and annual O&M costs for institutional controls/monitoring/five-year reviews (cost elements should be itemized below these levels if possible).
- Use footnotes to this summary table to define terminology, major assumptions, and sources of information used in developing the cost estimate.
- Identify the discount rate used for calculating total present worth costs (current OSWER policy is 7%).
- Identify the time frame over which O&M expenditures are anticipated (i.e., O&M duration or period of performance).
- If O&M activities are expected to exceed 30 years, and the cost estimate does not forecast beyond that time period, explain how the cost estimate accounts for long-term O&M costs (e.g., replacement costs are assumed as part of O&M estimate, capital costs should be recalculated after 30 years, data obtained from remedial action and 5-year reviews will be utilized to refine long-term O&M cost estimates).
- Identify major sources of uncertainty and potential cost drivers for the reader so that the information is not misinterpreted. If a sensitivity analysis was performed on the cost estimate, summarize the results.
- Qualify all cost information reported in RODs as estimates, with an accuracy expectation of +50 to -30%. These estimates are refined as the remedy is designed and implemented. Even after the remedial action is constructed, the total project cost should still be reported as an estimate due to the uncertainty associated with annual O&M expenditures.

4) Expected Outcomes of the Selected Remedy

This section should present the expected outcomes of the Selected Remedy in terms of resulting land and ground-water uses and risk reduction achieved as a result of the response action. The discussion should describe the following for each portion or media of the site (if applicable). Highlight 6-31 gives an example of the type of information that would be included in this section of the ROD.

- Available uses of land upon achieving cleanup levels. Note time frame to achieve available use (e.g., commercial or light industrial use available in three years when cleanup levels are achieved);
- Available uses of ground water upon achieving cleanup levels. Note time frame to achieve available use (e.g., restricted use for industrial purposes in TI waiver zone, drinking water use

in non-TI zone upon achieving cleanup levels in 100 years);

- Final cleanup levels for each medium (i.e., contaminant-specific remediation goals), basis for cleanup levels, and risk at cleanup levels (if appropriate).²³ See Highlight 6-32 for example table format and language (NCP §300.430(f)(5)(iii)(A));
- Anticipated socio-economic and community revitalization impacts, where such information

²³ Cleanup Levels: Final cleanup levels establish acceptable contaminant-specific exposure levels that are protective of human health and the environment. They are not formally determined until the site remedy is ready to be selected and are established in the ROD. In the ROD, it is preferable to use the term “remediation level” or “cleanup level” rather than “remediation goal” in order to make clear that the Selected Remedy establishes binding requirements (*Risk Assessment Guidance for Superfund, Volume I. Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim Final* (EPA 540-R-92-003, December 1991).

Highlight 6-31: Example Expected Outcomes for Selected Remedy

	Site Area A: Permanent Waste Management Area	Site Area B: Restricted Use	Site Area C: Unrestricted Use
Site Scenario	Exposure controlled through use of engineering and institutional controls ONLY	Exposure controlled through use of treatment, followed by containment, and/or institutional controls	Exposure controlled through use of treatment and off-site disposal of residuals (<i>i.e.</i> , nothing left on-site above health-based levels)
Summarize in Expected Outcomes Section of ROD	<ul style="list-style-type: none"> • Available uses of land and time frame (<i>e.g.</i>, long-term waste management) • Available uses of ground water and time frame (<i>e.g.</i>, restricted use in TI waiver zone, drinking water use in non-TI zone upon achieving cleanup levels in 50-70 years) • Anticipated socio-economic and community revitalization impacts • Anticipated environmental and ecological benefits 	<ul style="list-style-type: none"> • Available uses of land and time frame (<i>e.g.</i>, commercial or light industrial use available in three years) • Available uses of ground water and time frame (<i>e.g.</i>, restricted use for industrial purposes in TI waiver zone, drinking water use in non-TI zone upon achieving cleanup levels in 50-70 years) • Cleanup levels, basis, and residual risk (table) • Anticipated socio-economic and community (<i>e.g.</i>, job creation and tax revenues) revitalization impacts • Anticipated environmental and ecological benefits (<i>e.g.</i>, wetlands restoration) 	<ul style="list-style-type: none"> • Available uses of land and time frame (<i>e.g.</i>, residential redevelopment available in five years) • Available uses of ground water use and time frame (<i>e.g.</i>, unrestricted drinking water use available in 10 years) • Cleanup levels, basis, and residual risk (table) • Anticipated socio-economic and community revitalization impacts (<i>e.g.</i>, increased property values and removal of urban blight) • Anticipated environmental and ecological benefits (<i>e.g.</i>, sensitive habitat restored)

Highlight 6-32: Example Table Format - Cleanup Levels for Chemicals of Concern

Media: Soil
Site Area: Waste Area B
Available Use: Residential
Controls to Ensure Restricted Use (if applicable): N/A

Chemical of Concern ¹	Cleanup Level ²	Basis for Cleanup Level ³	Risk At Cleanup Level ⁴
Benzo(a)pyrene	0.026 mg/kg (ppm)	Risk Assessment	Cancer risk = 1×10^{-6}
4,4'-DDT	0.012 mg/kg (ppm)	Risk Assessment	Cancer risk = 1×10^{-6}
Dieldrin	0.54 mg/kg (ppm)	Risk Assessment	Cancer risk = 1×10^{-6}

Notes

- ¹ Identify Chemicals of Concern from risk assessment.
- ² Provide units of measure.
- ³ Examples include: Compliance with Federal or State ARARs (e.g., MCLs or non-zero MCLGs), health or ecological risk-based levels, and background levels. If health or ecological risk-based levels are identified as the basis, provide the cancer or noncancer risk level (e.g., 1×10^{-6} or HQ = 1) that the cleanup level will achieve.
- ⁴ Specify the carcinogenic and/or non-carcinogenic risk associated with the cleanup level. Present the exposure scenario(s) upon which cleanup levels are based in a footnote to this table (e.g., cleanup levels and residual risk information presented in this table are based on the risk associated with exposure to soil contamination through volatilization and inhalation by future on-site residents (lifetime)).

Example Language Describing Cleanup Levels for Chemicals of Concern

The purpose of this response action is to control risks posed by direct contact with soil and ground water and to minimize migration of contaminants to ground water. The results of the baseline risk assessment indicate that existing conditions at the site pose an excess lifetime cancer risk of 2.6×10^{-2} from direct contact with contaminated soils and 2.5×10^{-3} from ingestion of contaminated ground water. This risk relates to the benzo(a)pyrene, DDT, and dieldrin concentrations in soil and ground water. This remedy shall address all soils contaminated with benzo(a)pyrene in excess of 0.026 mg/kg, DDT in excess of 0.012 mg/kg and dieldrin in excess of 0.54 mg/kg, which each would correspond to an excess lifetime cancer risk of 10^{-6} . Since no Federal or State ARARs exist for soil, the action levels for soil were determined through a site-specific risk analysis. These soil cleanup levels shall also be protective at the 10^{-6} excess cancer risk level for each chemical of concern. Treatment shall be monitored to ensure that cleanup levels are achieved. The site is expected to be available for unrestricted residential land use as a result of the remedy.

is readily available and sufficiently documented (e.g., increased property values, reduced water supply costs, jobs created, increased tax revenues due to redevelopment, environmental justice concerns addressed, enhanced human uses of ecological resources); and

- Anticipated environmental and ecological benefits, where such information is readily available and sufficiently documented (e.g., restoration of sensitive ecosystems, protection of endangered species, protection of wildlife populations, wetlands restoration).

6.3.13 Statutory Determinations

The purpose of this section is to provide a brief, site-specific description of how the Selected Remedy satisfies the statutory requirements of CERCLA §121 (as required by NCP §300.430(f)(5)(ii)) and explain the five-year review requirements for the Selected Remedy. Highlight 6-33 illustrates the relationship between the nine evaluation criteria and the statutory requirements.

1) Protection of Human Health and the Environment

This discussion must describe how the Selected Remedy will adequately protect human health and the environment through treatment, engineering controls, and/or institutional controls (NCP §300.430(f)(5)(ii)). Specifically, the remedy should be described in terms of how the existing or potential risks posed by the site or operable unit through each pathway will be eliminated, reduced, or controlled by the response action. This discussion should also indicate that exposure levels will be reduced to protective ARAR levels or to within EPA's generally acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic risk and below the HI of 1 for non-carcinogens. Finally, this discussion should reflect that the implementation of the Selected Remedy will not pose unacceptable short-term risks or cross-media impacts. If the site presents ecological risks, then there should be a brief discussion of how the remedy provides adequate protection of the environment. See also *Risk Assessment Guidance for Superfund. Volume 1. Human Health Evaluation Manual (Part C, Risk Evaluation of Remedial Alternatives)*, Interim Final (EPA 540-R-92-004, December 1991).

2) Compliance with Applicable or Relevant and Appropriate Requirements²⁴

NCP §§300.430(f)(5)(ii)(B) and (C) require that a ROD:

- Describe the Federal and State ARARs that the remedy will attain; and
- Describe the Federal and State ARARs that the remedy will not meet, the waiver invoked, and the justification for invoking the waiver.

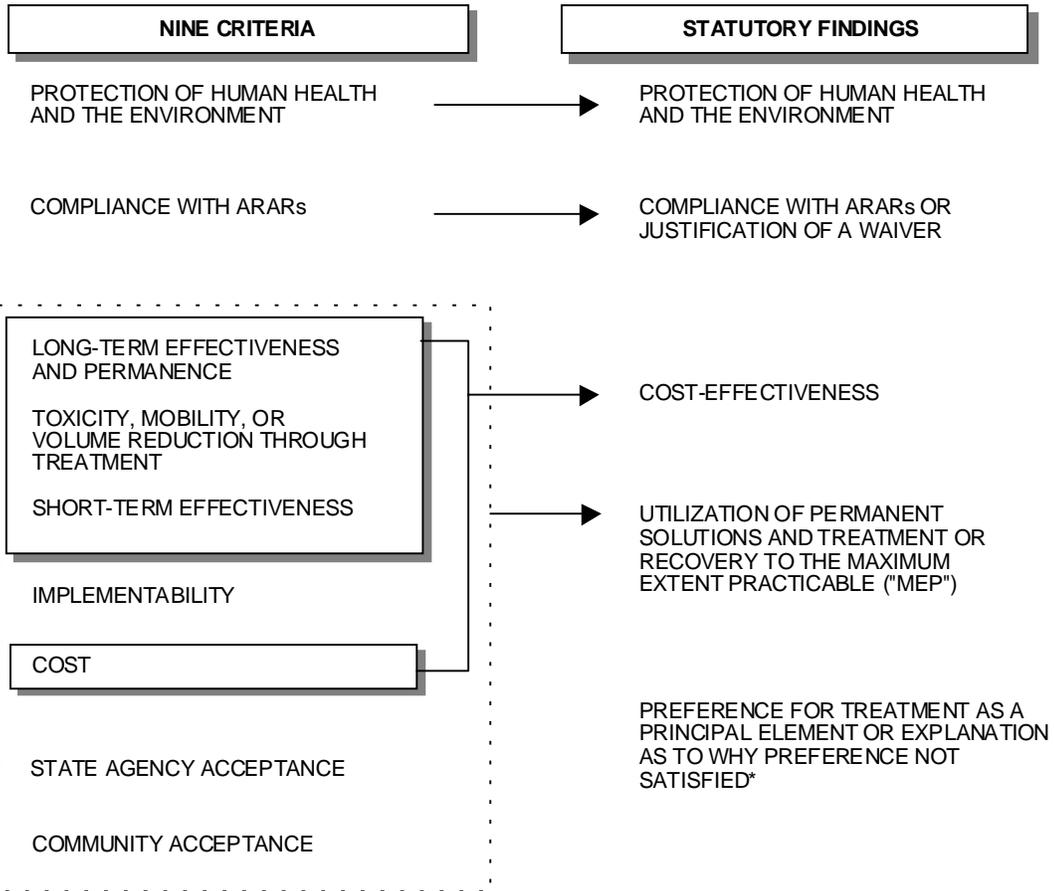
The ARARs that the Selected Remedy will attain should be listed and briefly described. Provide the regulatory citation in an appropriate level of detail. Some remedies may require a more lengthy discussion of a statute or regulation. A tabular summary should be used if appropriate. See Highlight 6-34 for an example.

This section should also describe other available information that does not constitute an ARAR (e.g., advisories, criteria, and guidance) that should be considered in the analysis if it helps to ensure protectiveness or is otherwise appropriate for use in a specific alternative. Such information is commonly referred to as TBCs (To Be Considered). Use of a TBC should be justified for the record.²⁵

²⁴ Applicable or Relevant and Appropriate Requirements (ARARs) include substantive provisions of any promulgated Federal or more stringent State environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements for a CERCLA site or action. These requirements may include regulations promulgated under the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), and other Federal or State environmental laws. *Applicable requirements* are those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. *Relevant and appropriate requirements* are requirements that, while not legally "applicable" to circumstances at a particular CERCLA site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited. (See the NCP at 40 CFR 300.5 for definitions.) Additional guidance on ARARs is provided in *CERCLA Compliance with Other Laws Manual: Parts I and II* (EPA 540-G-89-006, August 1988 and 540-G-89-009, August 1989), and the NCP preamble at 55 FR 8741-8766.

²⁵ Include policies or support documents for the TBC in the Administrative Record file, or incorporate by reference. If the validity of TBCs is challenged, justify the use in the Responsiveness Summary (see Section 6.4).

Highlight 6-33: Relationship of the Nine Criteria to the Statutory Findings



* Remedies which involve treatment of source materials constituting principal threat wastes likely will satisfy the statutory preference for treatment as a principal element, although this will not necessarily be true in all cases.

Highlight 6-34: Example Table Format - Description of ARARs for Selected Remedy

Authority	Medium ¹	Requirement	Status ²	Synopsis of Requirement ³	Action to be Taken to Attain Requirement ⁴
Federal Regulatory Requirement	Ground Water	Federal Safe Drinking Water Maximum Contaminant Levels (MCLs)	Relevant and Appropriate	MCLs have been regulated for a number of common organic and inorganic contaminants. These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for ground-water aquifers potentially used for drinking water.	The selected remedy will comply with these regulations through source control measures and monitored natural attenuation.
State Regulatory Requirement	Soil	State Hazardous Waste Management Rules	Applicable	These rules set forth the State's definitions and criteria for establishing whether waste materials are hazardous and subject to associated hazardous waste regulations. These rules identify requirements for hazardous waste generators and land disposal restrictions.	The selected remedy will comply with these requirements by identifying and properly disposing of hazardous wastes through capping the landfill with a RCRA C cap.
Federal Regulatory Requirement	Wetland	Protection of Wetlands, Executive Order 11990, 40 CFR Part 6	TBC	These requirements regulate actions that occur in wetlands and may be applicable to actions that may adversely affect wetlands.	The selected remedy will cause an unavoidable loss of wetlands. The requirements will be met through compensatory wetland mitigation.

Notes

- ¹ Identify medium (*e.g.*, soil, ground water, air, or hazardous waste).
- ² Identify status of requirement (*e.g.*, applicable, relevant and appropriate, or to be considered (TBC)).
- ³ Provide a brief synopsis of each requirement.
- ⁴ Provide a brief description of action to be taken to attain requirement.

3) Cost-Effectiveness

This discussion explains how the Selected Remedy meets the statutory requirement that all Superfund remedies be cost-effective. A cost-effective remedy in the Superfund program is one whose “costs are proportional to its overall effectiveness” (NCP §300.430(f)(1)(ii)(D)). The “overall effectiveness” of a remedial alternative is determined by evaluating the following three of the five balancing criteria used in the detailed analysis of alternatives: (1) Long-term effectiveness and permanence; (2) Reduction in toxicity, mobility and volume (TMV) through treatment; and, (3) Short-term effectiveness.

“Overall effectiveness is then compared to cost” to determine whether a remedy is cost-effective (NCP §300.430(f)(1)(ii)(D)).

Additional guidance for making cost-effectiveness determinations is found in the preamble to the NCP, which states that decision makers should compare “the cost to effectiveness of each alternative individually and . . . the cost and effectiveness of alternatives in relation to one another” (55 FR 8728).

It is important to note that more than one cleanup alternative can be cost-effective, and the Superfund program does not mandate the selection of the most cost-effective cleanup alternative. In addition, the most cost-effective remedy is not necessarily the remedy that provides the best balance of tradeoffs with respect to the remedy selection criteria nor is it necessarily the least-costly alternative that is both protective of human health and the environment and ARAR-compliant. Rather, cost-effectiveness is concerned with the reasonableness of the relationship between the effectiveness afforded by each alternative and its costs compared to other available options.

A tabular format, or cost-effectiveness matrix, can be used to summarize this determination. An example can be found in Highlight 6-35. Each row of the matrix provides detailed information needed to evaluate the cost-effectiveness of a single remedial alternative. Each column of the matrix provides detailed information about the alternatives under consideration relative to a single element of cost-effectiveness. To facilitate cost-effectiveness comparisons, the alternatives should be listed from top to bottom in order of increasing cost. The cost-effectiveness summary at the base of

the matrix is the summary of incremental differences between remedial alternatives with respect to each of the effectiveness criteria.

4) Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable (MEP)

This discussion describes the rationale for the remedy selected, explaining how the remedy provides the best balance of trade-offs among the alternatives with respect to the balancing criteria set out in NCP §300.430(f)(1)(i)(B), such that it represents the maximum extent to which permanence and treatment can be practicably utilized at this site. NCP §300.430(f)(1)(ii)(E) provides that the balancing shall emphasize the factors of “long-term effectiveness” and “reduction of toxicity, mobility or volume through treatment,” and shall consider the preference for treatment and bias against off-site disposal. The modifying criteria should also be considered in making this determination. This subsection should discuss why the selected remedy is believed to best satisfy the statutory mandates based on the evaluation criteria, compared with the other alternatives, and why it is the most appropriate solution for the site. This part of the Decision Summary needs to identify the one protective, ARAR-compliant, and cost-effective alternative that the lead agency has concluded utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for that site (*i.e.*, provides the best balance of trade-offs). The discussion in this subsection should be organized as follows:

- Explain how the Selected Remedy represents the maximum extent to which permanent solutions and treatment are practicable at this site by describing how the Selected Remedy affords the “best balance of tradeoffs” as compared to the other options.
- Highlight trade-offs among alternatives related to the five balancing and two modifying criteria, which should be discussed in the following order: (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility, or volume through treatment, (3) short-term effectiveness, (4) implementability, (5) cost, (6) State acceptance, and (7) community acceptance. Discuss which of the criteria were most decisive in the selection decision. [NOTE: To

HIGHLIGHT 6-35: Example Matrix of Cost and Effectiveness Data for Hypothetical Site: Ground Water Control Options

RELEVANT CONSIDERATIONS FOR COST-EFFECTIVENESS DETERMINATION: (Site characteristics relative to cost-effectiveness criteria;

- Contaminant plume consists approximately 4.3 million cubic feet of ground water ("00 acre feet);
- Municipal well field serving 10,000 people is located one mile downgradient from site.
- Baseline individual cancer risk for future on-site residents using ground water = 4×10^{-5}

Alternative (check box if cost-effective)	Present Worth Cost	Incremental Cost	Long-Term Effectiveness and Permanence	Reduction of TMY Through Treatment	Short-Term Effectiveness
1) No Action <input type="checkbox"/>	\$1.5,000	-----	<ul style="list-style-type: none"> • No reduction in long-term risk to human health and the environment • Baseline individual cancer risk = 4×10^{-5} 	<ul style="list-style-type: none"> • No reduction of toxicity • No reduction of mobility • No reduction of volume 	<ul style="list-style-type: none"> • No short-term risk to workers • No short-term risk to community • No short-term impact on environment • More than 500 years before remedial goals achieved through natural attenuation
2) Limited Action, including institutional controls and ground-water monitoring <input type="checkbox"/>	\$500,000	+ \$485,000	<ul style="list-style-type: none"> • No reduction in long-term risk to human health and the environment • Residual individual cancer risk = 4×10^{-5} 	<ul style="list-style-type: none"> • No reduction of toxicity • No reduction of mobility • No reduction of volume 	<ul style="list-style-type: none"> • 2 months to implement • No additional short-term risk to workers • No short-term risk to community • No short-term impact on environment • More than 500 years before remedial goals achieved through natural attenuation
3) Application of "innovative" ground-water treatment technology <input checked="" type="checkbox"/>	\$3,000,000	+ \$2,500,000	<ul style="list-style-type: none"> • Residual risk = 3×10^{-6} • Potential for remedy failure due to application of innovative technology 	<ul style="list-style-type: none"> • Reduction in toxicity • Reduction in mobility • Treatment of entire volume of contaminated ground water 	<ul style="list-style-type: none"> • 6 months to implement • No additional short-term risk to workers • No additional short-term risk to community • No additional short-term impact on environment • Potential to achieve remedial goals in approximately 15 years
4) Standard extraction and treatment <input checked="" type="checkbox"/>	\$6,000,000	+ \$3,000,000	<ul style="list-style-type: none"> • Residual risk = 3×10^{-6} • Low potential for remedy failure 	<ul style="list-style-type: none"> • No additional reduction in toxicity • No additional reduction in mobility • No additional reduction in volume 	<ul style="list-style-type: none"> • 3 months to implement • No additional short-term risk to workers • No additional short-term risk to community • No additional short-term impact on environment • Remedial goals achieved in approximately 30 years

COST-EFFECTIVENESS SUMMARY: (Summary of individual cost-effectiveness evaluations and relative cost-effectiveness determinations)

- Alternatives 1 and 2 are not considered to be cost-effective.
- While Alternatives 3 and 4 are considered to be cost-effective, Alternative 3 provides a potentially greater return on investment

Key:

- - Baseline characteristic
- - More "effective" compared to previous alternative
- - Less "effective" compared to previous alternative
- - No change compared to previous alternative

the extent the alternatives are comparable with respect to a particular criterion (*e.g.*, all options provide similar degrees of long-term effectiveness), that criterion would not be a decisive factor in the selection process].

When “containment” is found to provide the “best balance of tradeoffs” with respect to the other alternatives evaluated, the extent of treatment found to be practicable may be “no treatment.” Long-term effectiveness is achieved through monitored engineering controls. Where the Selected Remedy does not employ any treatment or resource recovery technologies, the explanation of the rationale used in the decision under this statutory finding must include the reasons for finding treatment to be impracticable.

5) Preference for Treatment as a Principal Element

In addition to the four statutory mandates discussed previously, the statutory preference for treatment as a principal element shall also be addressed. In writing the ROD, the rationale for whether or not the preference for treatment is satisfied should consider whether or not the Selected Remedy uses treatment to address the principal threats posed by the site. This discussion should summarize the source materials constituting principal threats and the treatment methods used to reduce their toxicity, mobility, or volume.²⁶ If the Selected Remedy does not satisfy the statutory preference for treatment as a principal element, this discussion must explain why it does not do so.

6) Five-Year Review Requirements

NCP §300.430(f)(4)(ii) requires a five-year review if the remedial action results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. This review evaluates whether a remedy currently is, or will be, protective of human health and the envi-

²⁶ In evaluating this statutory preference, the site manager needs to decide whether treatment selected in the ROD constitutes treatment as a major component of the remedy for that site. Remedies which involve treatment of principal threat wastes likely will satisfy the statutory preference for treatment as a principal element, although this will not necessarily be true in all cases (*e.g.*, when principal threat wastes that are treated represent only a small fraction of the wastes managed through containment). Ground-water treatment remedies also may satisfy the statutory preference, even though contaminated ground water is not considered a principal threat waste and even though principal threat source material may not be treated (*A Guide to Principal Threat and Low Level Threat Wastes* (OSWER 9380.3-06FS, November 1991)).

ronment. The ROD must state whether a five-year review is required pursuant to CERCLA §121(c) and NCP §300.430(f)(5)(iii)(C). It is also EPA’s policy to conduct five-year reviews under certain circumstances. This section of the Decision Summary should also discuss whether the site may be subject to any reviews as a matter of policy. Standard language is provided for the Declaration in Section 6.2.5. Highlight 6-36 describes the different types of five-year reviews. Highlight 6-37 provides an example of the *Statutory Determinations* section.²⁷

6.3.14 Documentation of Significant Changes

To fulfill CERCLA §117(b) and NCP §§300.430(f)(5)(iii)(B) and 300.430(f)(3)(ii)(A), the ROD must document and discuss the reasons for any significant changes made to the Selected Remedy. Changes described in this section must be limited to those that could have been reasonably anticipated by the public from the time the Proposed Plan and RI/FS Report were released for public comment to the final selection of the remedy. (See Chapter 4 for a complete discussion on pre-ROD significant changes.) Changes that could not have been anticipated require additional public comment (see Chapter 7 for details).

Documentation of significant changes that could have been reasonably anticipated by the public can be accomplished in one of two ways, depending upon the nature of the changes: (1) If the Selected Remedy involves significant change to a feature of the Preferred Alternative proposed to the public, the documentation should appear at the end of the ROD after the *Statutory Determinations* section; or (2) if the significant change entails changing from the Preferred Alternative discussed in the Proposed Plan to a different alternative, this should be documented in a section prior to the description of alternatives.

Wherever this documentation is placed, this section of the ROD should identify the Preferred Alternative from the Proposed Plan, should indicate the significant changes made, and should provide a rationale for the

²⁷ For Federal facility sites, Executive Order 12580 delegates the responsibility for conducting five-year reviews, in certain instances, to other Federal agencies, and directs that these activities be conducted consistent with CERCLA §120. CERCLA §120(a)(2) provides that the reviews be carried out consistent with the guidelines, rules, regulations, and criteria established by the EPA Administrator.

Highlight 6-36: Determinations for Five-Year Reviews

The purpose of this Section is to explain determinations for five-year reviews. The NCP states that the ROD must describe whether a five-year review is required (i.e., a “statutory review”). The ROD should also discuss whether the site is likely to undergo any discretionary policy reviews (i.e., a “policy review”). The structure and content of the five-year review is the same for both statutory and policy reviews.

Statutory Reviews

Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(C) provide the statutory and legal bases for conducting five-year reviews. If there are any hazardous substances, pollutants, or contaminants remaining at the site above levels that would allow for unlimited use and unrestricted exposure, EPA shall conduct a review of such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

EPA will conduct a statutory review of any site at which a post-SARA remedy, upon attainment of remedial action objectives and cleanup levels, will not allow for unlimited use and unrestricted exposure (i.e., where contaminants will remain on-site following remediation at concentrations above health-based levels). For example, sites at which the selected remedy ensures protectiveness through capping or institutional controls would require a statutory review. These reviews are triggered by the initiation of the remedial action. For statutory reviews, initiation of remedial action should be determined by the “actual RA on-site construction” date. See five-year review guidance for policy on timing of reviews at sites with multiple operable units.

Policy Reviews

Policy reviews are generally triggered by construction completion. Policy reviews should be conducted at sites where: (1) a post-SARA remedial action will allow for unlimited use and unrestricted exposure after completion of the remedial action, but where attainment of remedial action objectives and cleanup levels will take longer than five years to complete; (2) pre-SARA sites at which the remedy, upon attainment of the remedial action objectives and cleanup levels, will not allow unlimited use and unrestricted exposure; and (3) NPL removal-only sites, where hazardous substances, pollutants, or contaminants are left on-site above levels that allow unlimited use and unrestricted exposure and where no remedial action has taken place. Remedies that include pump and treat systems, bioremediation, or soil vapor extraction will usually take more than five years to complete, and thus should have a policy review.

Discontinuation of Five-Year Reviews

Statutory five-year reviews may be discontinued when no hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. These reviews should be discontinued only when a five-year review report documents that the contaminants of concern are reported at acceptable levels based on an appropriate period of monitoring. Post-SARA policy five-year reviews should generally only be discontinued under the same circumstances as statutory reviews. Other policy reviews should generally only be discontinued for sites with a pre-SARA remedy or at removal-only NPL sites after at least one review is completed.

For More Information

For more detailed information regarding five-year reviews see: Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 23, 1991); Fact sheet: Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02FS1, August 1991); Supplemental Five-Year Review Guidance (OSWER Directive 9355.7-02A, July 26, 1994); and Second Supplemental Five-Year Review Guidance (OSWER Directive 9355.7-03A, December 21, 1995). An updated and consolidated version of EPA guidance on this subject is currently available as a review draft under the title “Comprehensive Five-Year Review Guidance,” (OSWER Directive 9355.7-03, April 1999). Completion is anticipated in FY00, but in advance of that date, the draft is available to EPA employees at: <http://intranet.epa.gov/oerrinet/review/index.htm>.

Highlight 6-37: Example Language - Statutory Determinations Section

Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

Protection of Human Health and the Environment

The Selected Remedy, Alternative 4, will protect human health and the environment through the treatment of TCE- contaminated soil by soil vapor extraction and stabilization of lead-contaminated soil followed by capping. By pumping and treating contaminated ground water, the Selected Remedy will also prevent the existing plume from migrating to current ground-water users and remove contamination to Federal drinking water standards.

Soil vapor extraction, stabilization, and capping the contaminated soil will eliminate the threat of exposure to the most mobile chemical of potential concern via direct contact with or ingestion of contaminated soil. The Selected Remedy will also minimize the potential for leachate generation and recontamination of ground water. The current cancer risks associated with these exposure pathways is 2.6×10^{-2} . The Selected Remedy will reduce the cancer risks from exposure to 1×10^{-6} and the Hazard Index to less than 1.0. This level falls at the lower end of EPA's target risk range of 10^{-4} to 10^{-6} . There are no short-term threats associated with the Selected Remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the Selected Remedy.

Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy of ex-situ bioremediation and capping of contaminated soils, and of pumping and treating the ground water by carbon adsorption comply with all ARARs. The ARARs are presented below and in more detail in Table ____.

Chemical, Location, and Action-Specific ARARs include the following:

- Safe Drinking Water Act MCLs (40 CFR Part 141), which specify acceptable concentration levels in ground-water that serves as a potential drinking water aquifer.
- Clean Water Act FWQC (40 CFR Part 403).
- RCRA Subtitle D requirements for landfill closure (40 CFR 264.111, Subpart G), which specify a cap with a permeability less than or equal to the permeability of any bottom liner or natural subsoils present at the site.
- 40 CFR 264.117(a)(1) Subpart G Post-Closure and Monitoring requirements for 30 years.
- Clean Air Act requirements for emissions from air stripping units.

[Note: Any State ARARs need to be listed here as well.]

Other Criteria, Advisories, or Guidance To Be Considered (TBCs) for This Remedial Action

In implementing the Selected Remedy, EPA and the State have agreed to consider a number of non-binding criteria that are TBCs. These include the guidance on designing RCRA caps, Draft RCRA Guidance Document, Landfill Design, Liner Systems and Final Cover, issued June 1982. The guidance on designing RCRA caps includes specifications to be followed in constructing and maintaining a RCRA cap.

Highlight 6-37: Example Language - Statutory Determinations Section (continued)

Cost-Effectiveness

In the lead agency's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money to be spent.

The estimated present worth cost of the Selected Remedy is \$10,200,000. Although Alternative 3 is \$2,900,000 less expensive, lead contamination is not addressed, and therefore the remedy is cost-effective. EPA believes that the Selected Remedy's additional cost for stabilization provides a significant increase in protection of human health and the environment and is cost-effective. EPA also believes that the Selected Remedy's combination of soil vapor extraction and capping will provide an overall level of protection comparable to Alternative 5 (incineration and capping) at a significantly lower cost.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering State and community acceptance.

The Selected Remedy treats the source materials constituting principal threats at the site, achieving significant reductions in TCE concentrations in soil and ground water and stabilizing lead contamination in soil. The Selected Remedy satisfies the criteria for long-term effectiveness by removing TCE contamination from soil. Stabilization of lead contaminated soil and capping will effectively reduce the mobility of and potential for direct contact with contaminants remaining on-site. The Selected Remedy does not present short-term risks different from the other treatment alternatives. There are no special implementability issues that sets the Selected Remedy apart from any of the other alternatives evaluated, other than the requirement for a test burn in the incineration alternative.

Preference for Treatment as a Principal Element

By treating the contaminated soils by soil vapor extraction and stabilization, the Selected Remedy addresses principal threats posed by the site through the use of treatment technologies. By utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

changes (e.g., arguments or new information provided in public comments).

Highlight 6-38 includes examples of the following three types of discussions that generally could be included in this section of the ROD

- A case in which no significant changes are made.
- A case in which a significant change is made that could have been reasonably anticipated based on information originally presented in the Proposed Plan, the RI/FS Report, or elsewhere in the Administrative Record file. The only procedural requirement is to discuss the change in this section of the ROD.
- A case in which a significant change is made that could not have been reasonably anticipated based on information in the RI/FS Report, the Proposed Plan, or elsewhere in the Administrative Record file.

6.4 KEY ELEMENTS OF THE RESPONSIVENESS SUMMARY

The *Responsiveness Summary*, the third component of the ROD, summarizes information about the views of the public and support agency regarding both the remedial alternatives and general concerns about the site submitted during the public comment period. It also documents in the record how public comments were integrated into the decision-making process.

To serve these purposes, the *Responsiveness Summary* should be a concise and complete summary of significant comments received from the public, including PRPs, during the public comment period required by CERCLA §117 and NCP §§300.430(f)(3)(i)(F) and 300.430(f)(5)(iii)(B). *Superfund Responsiveness Summaries (Superfund Management Review: Recommendation Number 43E)* (OSWER 9230.0-06, June 1990) provides a framework for creating responsiveness summaries that can thoroughly address the complicated legal and technical issues, and still be responsive to local communities. Based on this directive, responsiveness summaries should be organized in two sections:

- Stakeholder Issues and Lead Agency Responses: Summarize and respond concisely to major issues raised by stakeholders (e.g., community groups, support agencies, businesses, municipalities, PRPs).

- Technical and Legal Issues: Expand on technical and legal issues, if necessary.

Whenever possible, the response to a “yes” or “no” question should begin with a “yes” or “no” before providing a detailed explanation; or, if this is not possible, then a statement to that effect should be made at the beginning of that answer. Responses should be clear, accurate, and written by the RPM and/or the Community Relations Coordinator with review and concurrence by the Office of Regional Counsel (ORC). A *Responsiveness Summary* should reflect a genuine attempt to address citizen’s questions and concerns, and not simply re-assert the correctness of EPA’s determination. At the same time, the summary will be a critical document in the defense of the lead agency’s actions. For this reason, the summary should fully and completely express the lead agency’s policy, technical, and legal rationales. To ensure that commitments made in the *Responsiveness Summary* are addressed during implementation of the Remedial Action and to meet the requirements of NCP §300.430(f)(5)(iii)(B), they must also be addressed in the *Description of the Remedial Alternatives* section of the ROD.

When general policy matters are discussed in the *Responsiveness Summary*, they should be brought to management’s attention early in the ROD review process. If the lead agency determines that a point-by-point response to a set of comments is warranted, a separate comment/response document should be prepared. In this situation, a summary of these comments with the lead agency’s response should be included in the Summary as well.

Guidance on preparing Responsiveness Summaries is available in *Community Relations in Superfund: A Handbook* (EPA 540-R-92-009 January 1992) and in *Community Relations During Enforcement Activities and Development of the Administrative Record* (OSWER 9836.0-1A, November 1988). These documents detail the process of preparing the Summary and include a sample Responsiveness Summary.

6.5 RECORDS OF DECISION TO EPA HEADQUARTERS

After the ROD is issued, a copy should be sent to EPA Headquarters as soon as possible. For guidance on submitting RODs to EPA Headquarters, please see Appendix D, Records of Decision and Other Decision Documents to Headquarters.

Highlight 6-38: Examples of Changes and Documentation Requirements

Example One: No Significant Changes

The Proposed Plan for the EIO Site was released for public comment in March 1999. The Proposed Plan identified Alternative S2, ex situ bioremediation and capping, as the Preferred Alternative for soil remediation. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

Example Two: Significant Change Requiring Only Documentation in the ROD

The Proposed Plan was released for public comment in March 1999. It identified Alternative G2, pump and treat through carbon adsorption with discharge to XYZ River, as the Preferred Alternative for ground-water remediation. Alternative G3 involving discharge to a POTW, was also considered. During the public comment period, new information indicated that health and environmental levels could not be met by the carbon adsorption treatment. In addition, it was discovered that the POTW in Nameless does have the capacity to handle the additional wastewater from the EIO Site. Therefore, EPA and the State decided to select discharge to the POTW rather than discharge to the XYZ River.

Example Three: Significant Change Requiring a New Public Comment Period

A Proposed Plan for the EIO Site was released for public comment in March 1999. The Plan identified Alternative S2, ex situ bioremediation and capping, as the Preferred Alternative for remediation. During the public comment period, the results of remedial activities at another site with contamination problems similar to those at the EIO Site indicated that an alternative treatment technology, low temperature thermal desorption (LTTD), could be used successfully on chemical(s) of potential concern similar to those at the EIO Site. Based on a comparison of the LTTD alternative to the other alternatives using the nine evaluation criteria, it was determined that LTTD represents the best balance of tradeoffs of all the options. The nine criteria analysis indicated that while LTTD was comparable to ex-situ bioremediation, fewer short-term risks would be associated with the low temperature thermal desorption alternative than with the ex-situ bioremediation alternative. The information supporting this determination is available in the Administrative Record file.

As a result of this new information, EPA decided to propose LTTD as the new Preferred Alternative for soil remediation at the EIO Site. The Tennessee Department of Environment and Conservation concurred with this decision. In compliance with statutory requirements for ensuring the public has the opportunity to comment on major remedy selection decisions, a new Proposed Plan was prepared presenting low temperature thermal desorption as the Preferred Alternative. The second Plan was made available to the public in July 1999. No significant comments were received during the second public comment period, and no significant changes were made to the proposed remedy.

Highlight 6-39: Management Review Checklist: Twelve Questions to be Addressed by a ROD

1. **Treatment/Containment:** Does the ROD identify the source materials constituting principal threats (e.g., liquid waste contained in drums, mobile source materials, highly toxic source materials)? If principal threat wastes are not going to be treated, does the ROD explicitly state why not? Is the amount of material to be treated or contained estimated for each component of the Selected Remedy? Does the ROD adequately address the statutory preference for treatment as a principal element?
2. **Remedial Action Objectives:** Does the ROD clearly state the objectives of the remedial action?
 - a. Examples of remedial action objectives for ground water remedies include the following:
 - To restore the aquifer to drinking water quality in 30 years.
 - To prevent any exposure to the contaminated ground water by implementing institutional controls.
 - To prevent the contaminated plume from reaching an uncontaminated aquifer.
 - To stop the plume migration off-site.
 - b. Examples of remedial action objectives for source control remedies include the following:
 - To clean the site up to levels that allow for unrestricted use.
 - To clean the site to levels that allow only for recreational or industrial use.
 - To contain the waste in place and use institutional/engineering controls to prevent any site use other than as a waste management unit.
 - To remove as much contamination as possible in order to improve the effectiveness and efficiency of the ground-water remedy.
3. **Land and Ground-water Uses:** Does the ROD identify: (1) current land use, (2) reasonably anticipated future land use, (3) current ground-water use, and (4) potential future ground-water use? Are they the same as those used in estimating the baseline risks?
4. **Human Health Risks:** Does the ROD clearly present the cancer and non-cancer baseline risks for each chemical of concern (COC) to which there may be exposure and the total aggregate risk based on the reasonably anticipated future land use and/or potential future ground-water use?
5. **Ecological Risks:** Does the ROD include a discussion of whether or not there are ecological risks from site releases? If there are unacceptable ecological risks, is the basis for this determination clear and does the ROD explain how the remedy will achieve protection of ecological resources?
6. **Chemicals of Concern:** Does the Selected Remedy address all Chemicals of Concern posing unacceptable risk according to the risk assessment section of the ROD (i.e., explain how the Selected Remedy will achieve protection of human health and the environment)?
7. **Remedy Selection Rationale:** Does the ROD clearly describe why the Selected Remedy is preferred over the other alternatives (i.e., describe how the Selected Remedy provides the best "balance of tradeoffs" with respect to the balancing and modifying criteria)?
8. **Cleanup Levels:** Are the Chemical of Concern cleanup levels, their basis (i.e., human- or ecological-risk or ARAR), the risk at each Chemical of Concern cleanup level (if applicable), and the medium addressed, described for each component of the Selected Remedy?
9. **Institutional Controls:** If the Selected Remedy includes institutional controls, does the ROD describe the specific types of controls and the entity that will be responsible for implementing them and maintaining their effectiveness?
10. **Description of Selected Remedy:** Is the Selected Remedy described consistently (e.g., same technology components, contaminants and medium addressed) in the following three sections of the ROD: (1) Declaration, (2) Description of Alternatives, and (3) Selected Remedy?
11. **Summary of Remedy Cost Estimate:** Are all of the following estimated for the Selected Remedy: (1) capital costs; (2) annual operations and maintenance (O&M) costs; (3) duration of O&M cost estimate; (4) discount rate (%); (5) total discounted O&M costs (should take into account annual O&M costs, duration, and discount rate); and (6) Total Present Worth cost (sum of estimated capital costs and discounted O&M costs)?
12. **Remedy Changes:** If the ROD, ROD Amendment, or ESD addresses a change in a previously Selected Remedy, does the decision document give the reasons for the change?

RECOMMENDED OUTLINE AND CHECKLIST FOR A RECORD OF DECISION

**[See Highlight 6-39 for Management Review Checklist:
Twelve Questions to be Addressed by a ROD]**

PART 1: THE DECLARATION

The Declaration functions as the abstract and formal authorizing signature page for the ROD.

A. Site Name and Location

B. Statement of Basis and Purpose

- Certify the factual and legal basis for the Selected Remedy [see Highlight 6-2 for standard language].

C. Assessment of Site

- Certify that the site poses a threat to public health, welfare, or the environment [see Highlight 6-3 for standard language].

D. Description of Selected Remedy

- Describe the major components of the Selected Remedy in a bullet fashion.
- Describe the scope and role of this operable unit within the overall site management strategy.
- Describe how this operable unit addresses principal threats and other contamination at the site (*i.e.*, what is being treated, what is being contained, and what is the rationale for each).

E. Statutory Determinations

- Describe how the Selected Remedy satisfies the statutory requirements of CERCLA §121 and the regulatory requirements of the NCP.
- Discuss the applicability of the five-year review requirements [see Highlight 6-4 for standard language].

F. Data Certification Checklist

The Declaration should certify that the following information is included in the ROD (or provide a brief explanation for why this information is not included):

- Chemicals of concern (COCs) and their respective concentrations.
- Baseline risk represented by the chemicals of concern.
- Cleanup levels established for chemicals of concern and the basis for these levels.
- How source materials constituting principal threats will be addressed.

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD.
- Potential land and ground water use that will be available at the site as a result of the Selected Remedy.
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factor(s) that led to selecting the remedy (*i.e.*, describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

G. Authorizing Signatures

[See Highlight 6-6 for notes on ROD authorizing signatures.]

PART 2: THE DECISION SUMMARY

The Decision Summary identifies the Selected Remedy, explains how the remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the Administrative Record file that supports the remedy selection decision.

A. Site Name, Location, and Brief Description

- Name and location.
- National Superfund database identification number (*e.g.*, CERCLIS).
- Lead and support agencies (*e.g.*, EPA, State, Federal facility).
- Source of cleanup monies (*e.g.*, Fund-financed, PRP-financed).
- Site type (*e.g.*, landfill, industrial facility).
- Brief site description.

B. Site History and Enforcement Activities

- History of site activities that led to the current problems.

- History of Federal, State, and local site investigations and removal and remedial actions conducted under CERCLA or other authorities.
- History of CERCLA enforcement activities at the site (*e.g.*, results of PRP searches, issuances of special notices to PRPs).

C. Community Participation

- Describe how the public participation requirements in CERCLA and the NCP were met in the remedy selection process (*e.g.*, community relations plans, fact sheets, public notices, public meetings, public comment periods, Technical Assistance Grant, Community Advisory Group).
- Describe other community outreach and involvement efforts [see Highlight 6-7 for an example].
- Describe efforts to solicit views on the reasonably anticipated future land uses and potential future beneficial uses of ground water.

D. Scope and Role of Operable Unit or Response Action

- The planned sequence of actions.
- The scope of problems those actions will address.
- The authorities under which each action will be/has been implemented (*e.g.*, removal, remedial, State).

[See Highlights 6-8 and 6-9 for tips on writing the Scope and Role section when there is more than one operable unit, and for an example.]

E. Site Characteristics

(Include maps, a site plan, or other graphical presentations, as appropriate.)

- Describe the Conceptual Site Model (CSM) on which the risk assessment and response action are based [see Highlight 6-10 for an example].
- Provide an overview of the site, including the following:
 - Size of site (*e.g.*, acres).
 - Geographical and topographical information (*e.g.*, surface waters, flood plains, wetlands).
 - Surface and subsurface features (*e.g.*, number and volume of tanks, lagoons, structures, and drums on the site).
 - Areas of archaeological or historical importance.
- Describe the sampling strategy (*e.g.* which media were investigated, what sampling approach was

used, over what area, when was the sampling performed).

- Describe known or suspected sources of contamination.
- Describe types of contamination and the affected media, including the following:
 - Types and characteristics of COCs (*e.g.*, toxic, mobile, carcinogenic, non-carcinogenic).
 - Quantity/volume of waste that needs to be addressed.
 - Concentrations of COCs in each medium.
 - RCRA hazardous wastes and affected media.
- Describe location of contamination and known or potential routes of migration, including the following:
 - Lateral and vertical extent of contamination.
 - Current and potential future surface and subsurface routes of human or environmental exposure.
 - Likelihood for migration of COCs from current location or to other media.
 - Human and ecological populations that could be affected.
- For sites with ground-water contamination, describe the following:
 - Aquifer(s) affected or threatened by site contamination, types of geologic materials, approximate depths, whether aquifer is confined or unconfined.
 - Ground-water flow directions within each aquifer and between aquifers and ground-water discharge locations (*e.g.*, surface waters, wetlands, other aquifers).
 - Interconnection between surface contamination (*e.g.*, soils, sediments/surface water) and ground-water contamination.
 - Confirmed or suspected presence and location of non-aqueous phase liquids.
 - If ground-water models were used to define the fate and transport of COCs, identify the model used and major model assumptions.
- Note other site-specific factors that may affect response actions at the site.

F. Current and Potential Future Land and Water Uses

Land Uses

- Current on-site land uses.
- Current adjacent/surrounding land uses.
- Reasonably anticipated future land uses and basis for future use assumptions (e.g., zoning maps, nearby development, 20-year development plans, dialogue with local land use planning officials and citizens, reuse assessment).

Ground-Water and Surface Water Uses

- Current ground-water and surface water uses.
- Potential beneficial ground-water and surface water uses (e.g., potential drinking water, irrigation) and basis for future use assumptions (e.g., Comprehensive State Ground Water Protection Plan, promulgated State classification, EPA ground-water classification guidelines).
- If beneficial use is potential drinking water source, identify the approximate time frame of projected future drinking water use (e.g., ground-water aquifer not currently used as a drinking water source but expected to be utilized in 30 - 50 years).
- Location of anticipate use in relation to location and anticipated migration of contamination.

G. Summary of Site Risks

- For human health risks:
 - Identify the concentrations of COCs in each medium [see Highlight 6-15 for example table format].
 - Summarize the results of the exposure assessment.
 - Summarize the results of the toxicity assessment for the COCs [see Highlights 6-16A and 6-16B for example table formats].
 - Summarize the risk characterization for both current and potential future land use scenarios and identify major assumptions and sources of uncertainty [see Highlight 6-17 for example language and Highlights 6-18A and 6-18B for example table formats].
- For ecological risks:
 - Identify the concentrations of COCs in each medium [see Highlight 6-19 for an example table format].
 - Summarize the results of the exposure assessment [see Highlight 6-20 for an example table format].

- Summarize the results of the ecological effects assessment.
- Summarize the results of the ecological risk characterization and identify major assumptions and sources of uncertainty [see Highlight 6-21 for an example table format].

- Clearly present the basis for taking the response action at the conclusion of this section [see standard language in Highlight 6-12].

H. Remedial Action Objectives

- Present a clear statement of the specific RAOs for the operable unit or site (e.g., treatment of contaminated soils above health-based action levels, restoration of ground-water plume to drinking water levels, and containment of DNAPL source areas) and reference a list or table of the individual performance standards.
- Discuss the basis and rationale for RAOs (e.g., current and reasonably anticipated future land use and potential beneficial ground-water use).
- Explain how the RAOs address risks identified in the risk assessment (e.g., how will the risks driving the need for action be addressed by the response action?).

I. Description of Alternatives

The objective of this section is to provide a brief understanding of the remedial alternatives developed for the site.

Remedy Components

Provide a bulleted list of the major components of each alternative, including but not limited to:

- Treatment technologies and materials they will be used to address (e.g., principal threats).
- Containment components of remedy (e.g., engineering controls, cap, hydraulic barriers) and materials they will be used to address (e.g., low concentration source materials, treatment residuals).
- Institutional controls (and entity responsible for implementing and maintaining them).
- Operations and Maintenance (O&M) activities required to maintain the integrity of the remedy (e.g., cap maintenance).
- Monitoring requirements.

[See Highlight 6-22 for examples of remedy components.]

Common Elements and Distinguishing Features of Each Alternative

Describe common elements and distinguishing features unique to each response option. Examples of these elements include:

- Key ARARs (or ARAR waivers) associated with each alternative (*e.g.*, action- and/or location-specific ARARs, including the control of air, emissions from ground-water treatment units, manifesting of hazardous waste, and regulating solid waste landfills).
- Long-term reliability of remedy (potential for remedy failure/replacement costs).
- Quantity of untreated waste and treatment residuals to be disposed off-site or managed on-site in a containment system and degree of residual contamination remaining in such waste.
- Estimated time required for design and construction (*i.e.*, implementation time frame).
- Estimated time to reach cleanup levels (*i.e.*, time of operation, period of performance).
- Estimated capital, annual O&M, and total present worth costs, discount rate, and the number of years over which the remedy cost estimate is projected.
- Describe uses of presumptive remedies and/or innovative technologies.

Expected Outcomes of Each Alternative

- Available land uses upon achieving performance standards. Note time frame to achieve performance standards (*e.g.*, commercial or light industrial use available in three years when cleanup levels are achieved).
- Available ground water uses upon achieving performance standards. Note time frame to achieve performance standards (*e.g.*, restricted use for industrial purposes in TI waiver zone, drinking water use in non-TI zone upon achieving cleanup levels in 50-70 years).
- Other impacts or benefits associated with each alternative.

J. Comparative Analysis of Alternatives

- Compare the relative performance of each alternative against the others with respect to the nine evaluation criteria (summarize in a table if appropriate).

[See Highlight 6-23 for tips on presenting the comparative analysis of alternatives, Highlight 6-24 for example text, and Highlight 6-25 for an example table format.]

K. Principal Threat Wastes

- Identify the source materials constituting principal threats at the site and discuss how the alternatives will address them.

Note: The *Statutory Determinations* section of the ROD should explain whether or not the Selected Remedy satisfies the statutory preference for remedies employing treatment that reduces toxicity, mobility, or volume as a principal element. By indicating whether the principal threats will be addressed by the alternatives, this section of the *Decision Summary* should provide the basis for that statutory determination.

[See Highlight 6-26 for key definitions.]

L. Selected Remedy

Summary of the Rationale for the Selected Remedy

- Provide a concise discussion of the key factors for remedy selection.

Detailed Description of the Selected Remedy

- Expand on the description of the Selected Remedy from that which was provided in the *Description of Alternatives* section and provide a brief overview of the RAO's and performance standards.

[See Highlight 6-27 for tips on writing the "Selected Remedy" section]

Cost Estimate for the Selected Remedy

- Present a detailed, activity-based breakdown of the estimated costs associated with implementing and maintaining the remedy (include estimated capital, annual O&M, and total present worth costs discount rate and the number of years over which the remedy cost estimate is projected).

[See Highlight 6-28 for standard language, Highlight 6-29 for an example table format, and Highlight 6-30 for tips on presenting the cost estimate summary.]

Estimated Outcomes of Selected Remedy

- Available land use(s) upon achieving cleanup levels. Note time frame to achieve available use (*e.g.*, commercial or light industrial use available in 3 years when cleanup levels are achieved).
- Available ground-water use(s) upon achieving cleanup levels. Note time frame to achieve available use (*e.g.*, restricted use for industrial purposes in TI waiver zone, drinking water use in non-TI zone upon achieving cleanup levels in 50-70 years).
- Final cleanup levels for each medium (*i.e.*, contaminant specific cleanup levels), basis for cleanup levels, and risk at cleanup levels (if appropriate)

[see Highlight 6-32 for an example table format].

- Anticipated socio-economic and community revitalization impacts (e.g., increased property values, reduced water supply costs, jobs created, increased tax revenues due to redevelopment, environmental justice concerns addressed, enhanced human uses of ecological resources).
- Anticipated environmental and ecological benefits (e.g., restoration of sensitive ecosystems, protection of endangered species, protection of wildlife populations, wetlands restoration).

[See Highlight 6-31 for examples of expected outcomes.]

M. Statutory Determinations

- Explain how the remedy satisfies the requirements of §121 of CERCLA to:
 - Protect human health and the environment.
 - Comply with ARARs, or justify a waiver [see Highlight 6-34 for an example table format].
 - Be cost-effective [see Highlight 6-35 for an example matrix].
 - Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable (i.e., explain why the Selected Remedy represents the best option).
 - Satisfy the preference for treatment as a principal element, or justify not meeting this preference [see Highlight 6-33 for an illustration of the relationship between statutory determinations and the nine criteria].
- Explain five-year review requirements for the Selected Remedy [see Highlight 6-36 for information regarding five-year reviews].

[See Highlight 6-37 for example language for the statutory determinations section.]

N. Documentation of Significant Changes from Preferred Alternative of Proposed Plan

If there are significant changes in the Selected Remedy from the Preferred Alternative:

- Discuss the Preferred Alternative originally presented in the Proposed Plan.
- Describe the significant changes in the Selected Remedy.
- Explain the rationale for the changes and how they could have been reasonably anticipated based on information presented in the Proposed Plan or the Administrative Record file.

[See Highlight 6-38 for examples of changes and documentation requirements.]

PART 3: RESPONSIVENESS SUMMARY

The Responsiveness Summary serves the dual purposes of: (1) presenting stakeholder concerns about the site and preferences regarding the remedial alternatives; and (2) explaining how those concerns were addressed and the preferences were factored into the remedy selection process. This discussion should cross-reference sections of the *Decision Summary* that demonstrate how issues raised by the community have been addressed.

A. Stakeholder Issues and Lead Agency Responses

- Summarize and respond concisely to issues raised by stakeholders.

B. Technical and Legal Issues

- Expand on technical and legal issues, if necessary.