# 3.0 FEASIBILITY STUDY CONSIDERATIONS

Generally, the purpose of a feasibility study for a contaminated sediment site is to develop and evaluate a number of alternative methods for achieving the remedial action objectives (RAOs) for the site. This process lays the groundwork for proposing and selecting a remedy for the site that best eliminates, reduces, or controls risks to human health and the environment. The feasibility study process is described in the U.S. Environmental Protection Agency's (EPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (U.S. EPA 1988a, also referred to as the "RI/FS Guidance"). The proposed plan and record of decision (ROD) process is described in the EPA's *Guide to Preparing Superfund Proposed Plans, Records of Decision, and other Remedy Selection Decision Documents* (U.S. EPA 1999a, also referred to as the "ROD Guidance"). This chapter is intended to supplement existing guidance by offering sediment-specific guidance about developing alternatives, considering the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria, identifying applicable or relevant and appropriate requirements (ARARs), estimating cost, and implementing institutional controls. Chapters 4, 5, and 6 present more detailed guidance on evaluating alternatives based on the three major approaches for sediment: monitored natural recovery (MNR), in-situ capping, and dredging (or excavation) with treatment or disposal.

Although this chapter focuses on remedial alternatives for managing contaminated sediment, project managers beginning this stage of site management should keep in mind the first step at almost every sediment site should be to implement measures to control any significant ongoing sources and to evaluate the effectiveness of those controls. Until this is done, appropriately evaluating alternatives for sediment may be difficult. However, it may be appropriate to evaluate implementation of interim sediment cleanup measures prior to completing source control to control further dispersal of sediment hot spots or reduce risks to human health and the environment due to sediment contamination.

In addition, project managers should keep in mind that flexibility is frequently important in the feasibility study process at sediment sites. Iterative or adaptive approaches to site management are likely to be appropriate at these sites. Also, project managers should consider pilot testing various approaches as part of the feasibility study process. Phasing, adaptive management, and early actions are described further in Chapter 2, Section 2.7, Phased Approaches, Adaptive Management, and Early Actions.

## 3.1 DEVELOPING REMEDIAL ALTERNATIVES FOR SEDIMENT

As described in Chapter 1, Section 1.3.1, Remedial Approaches, there are typically three major approaches that can be taken to reduce risk from contaminated sediment when source control measures are insufficient to reduce risks: MNR, in-situ capping, and sediment removal by dredging or excavation. Hybrid approaches may combine these three. A fourth approach, in-situ treatment, is currently under development and may become a viable alternative in the future, especially in combination with in-situ caps. Highlight 1-5 in Chapter 1 briefly summarizes these major approaches for sediment sites.

Project managers should consider the following steps, which build on EPA's RI/FS Guidance by adding details specific to sediment, when developing alternatives at sediment sites:

1. Develop remedial action objectives specifying the contaminants and media of interest, exposure pathways, and remediation goals that permit a range of alternatives to be

developed including each of the three major approaches (MNR, capping, and removal), and that consider state and local objectives for the site;

2. Identify estimated volumes or areas of sediment to which the approaches may be applied, taking into account the need for protectiveness as identified in the RAOs and the biological, chemical and physical characteristics of the site;

3. Develop additional detail concerning the equipment, methods, and locations to be evaluated for each alternative, including the three major approaches (e.g., potential natural recovery processes, potential cap materials and placement methods, number and types of dredges or excavators, transport methods, treatment methods, type of disposal units, general disposal location, need for monitoring and/or institutional controls);

4. Develop additional detail concerning known major constraints on each alternative, including the three major approaches at the site (e.g., need to maintain flow capacity for flood control, need to accommodate navigational dredging);

5. To the extent possible with information available at this stage of the FS, identify the time frame(s) in which the alternatives are expected to achieve cleanup levels and RAOs; and

6. Assemble the more detailed methods into a set of alternatives representing a range of options, including MNR, in-situ capping, and removal options or combination of options, as appropriate.

This process often is best done in an iterative fashion, especially at complex sites. For example, investigation into equipment and disposal options for sediment removal may lead to evaluation of a variety of time frames for achieving risk reduction goals. Typically, the number and type of remedial alternatives that a project manager develops for any site is a site-specific decision. The project manager should take into account the size, characteristics, and complexity of the site. However, due to the limited number of approaches that may be available for contaminated sediment, generally project managers should evaluate each approach carefully, including the three major approaches (MNR, in-situ capping, and removal through dredging or excavation) at every sediment site at which they might be appropriate.

### *3.1.1 Alternatives that Combine Approaches*

At sites with multiple water bodies or sections of water bodies with differing characteristics or uses, or differing levels of contamination, project managers have found that alternatives that combine a variety of approaches are frequently the most promising. In many cases, institutional controls are also part of many alternatives (see Section 3.6, Institutional Controls). The following examples illustrate how different approaches might be combined into alternatives:

- An alternative might combine a variety of dredging, transport, and disposal methods that remove differing volumes of higher-risk contaminated sediment with MNR for more widespread areas of lesser risk;

- An alternative might combine armored in-situ capping of contaminated sediment in more erodible areas, with MNR in highly depositional areas;

- An alternative might combine dredging in federal navigation channels or for areas where there is insufficient water depth to maintain navigation or flood capacity with a cap, with in-situ capping of floodplain, intertidal or under-pier areas where a more technically practicable and less costly approach is desired; and

- An alternative might combine thin-layer placement (see Chapter 4, Monitored Natural Recovery) with MNR where the natural rate of sedimentation is insufficient to bury contaminants in a reasonable time frame.

### *3.1.2 No-Action Alternative*

The NCP at Title 40 Code of Federal Regulations (40 CFR) §300.430(e)(6) provides that the no-action alternative should be considered at every site. The no action alternative should reflect the site conditions described in the baseline risk assessment and remedial investigation. This alternative may be a no-further-action alternative if some removal or remedial action has already occurred at the site, such as under another ROD.

No-action or no-further-action alternatives normally do not include any treatment, engineering controls, or institutional controls but may include monitoring. For example, at a site where risk is acceptable (e.g., because contaminant levels in surface sediment and biota are low and the site is stable), but the site contains higher levels of contamination at depth, it may be advisable to evaluate periodically the continued stability of buried contaminants. A no action alternative may include monitoring of these buried contaminants. Project managers and others should not confuse this however with MNR, where natural processes are relied upon to reduce an unacceptable risk to acceptable levels. The difference is often the increased level and frequency of monitoring included in the MNR alternative and the fact that the MNR alternative includes a cleanup level and expected time frame for achieving that level. Project managers should normally evaluate both a no action alternative and a MNR alternative at sediment sites.

If a no-action or no-further-action alternative does not meet the NCP's threshold criteria addressed in 40 CFR §300.430 (i.e., protection of human health and the environment and meeting applicable or relevant and appropriate requirements), it is not necessary to carry it though to the detailed analysis of alternatives. However, the ROD should explain why the no action alternative was dropped from the analysis. Chapter 7, Remedy Selection Considerations, includes guidance on when it may be appropriate to select a no-action alternative.

### *3.1.3 In-Situ Treatment and Other Innovative Alternatives*

Generally, in-situ treatment is an approach that involves the biological, chemical, or physical treatment of contaminated sediment in place. This approach is currently under development by researchers and several pilot- and full-scale applications of the more promising technologies are underway. Although significant technical limitations currently exist for many of the treatment technologies, the results of the ongoing testing may demonstrate the viability of some of these approaches in certain situations. Project managers are encouraged to track the development of in-situ treatment methods. Potential in-situ treatment methods include the following:

- *Biological Treatment:* Enhancement of microbial degradation of contaminants by the addition of materials such as oxygen, nitrate, sufate, hydrogen, nutrients, substrate (e.g., organic carbon), or microorganisms into the sediment or into a reactive cap;

- *Chemical Treatment:* The destruction of contaminants through oxidation and dechlorination processes by providing chemical reagents, such as permanganate, hydrogen peroxide, or potassium hydroxide, into the sediment or into a reactive cap; and

- *Immobilization Treatment:* Solidification, stabilization, or sequestering of contaminants by adding coal, coke breeze, Portland cement, fly ash, limestone, or other additives to the sediment for encapsulating the contaminants in a solid matrix and/or chemically altering the contaminants by converting them into a less bioavailable, less mobile, or less toxic form.

Most techniques for in-situ treatment of sediment are in the early stages of development, and few methods are currently commercially available. Experiences gained to date in experimental or small-scale applications of in-situ remedies have indicated that technical limitations to the effectiveness of available in-situ treatments continue to exist. For example, in-situ remedies relying on the addition of required substrates and nutrients, reagents, or catalysts have been developed for some contaminants, such as polychlorinated biphenyls (PCBs), but developing an effective in-situ delivery system to add and mix the needed levels of reagents to contaminated sediment is more problematic. The lack of an effective delivery system has also hindered the application of in-situ stabilization systems [National Research Council (NRC) 2001]. However, new developments may make this a more promising approach in the future.

Several EPA-funded bench and field studies in this area are underway. These include studies conducted by EPA's Superfund Innovative Technology Evaluation (SITE) program, which encouraged the development and routine use of innovative treatment, monitoring, and measurement technologies. The SITE program is in the process of completing demonstration of several in-situ treatment technologies (Highlight 3-1). More information on the SITE program is available at http://www.epa.gov/ORD/SITE/. Also, the Hazardous Substance Research Center (HSRC) - South and Southwest, is performing research about in-situ treatment and other innovative capping alternatives for contaminated sediment in the Anacostia River in Washington, DC. More information on this program is available from the HSRC Web site at http://www.hsrc.org.

**Highlight 3-1: SITE Program In-situ Treatment Technology Demonstrations**

| Site | Technology Type | Contaminant |
|---|---|---|
| Jones Island CDF (Confined Disposal Facility) | Phytoremediation | Polycyclic aromatic hydrocarbons (PAHs) and PCBs |
| Milwaukee Harbor | Phytoremediation | PAHs and PCBs |
| Whatcom Waterway, Puget Sound | Electrochemical Oxidation | Mercury and PAHs |
| Anacostia River | Multiple Reactive Caps | PAHs and PCBs |

Other sources of information about innovative approaches to contaminated sediment management include the U.S. Army Corps of Engineers' (USACE) Dredging Operations Environmental Research Program (DOER), which has contributed substantially to work in the area of risk assessment methods, fate and transport models, and dredging and capping technologies. Information on this program and on the Dredging Operations Technical Support (DOTS) program is available at http://el.erdc.usace.army.mil/dots. In addition, the Strategic Environmental Research and Development Program (SERDP) has made recent investments in contaminated sediment research. Information about these projects can be accessed from the SERDP Web site at http://www.serdp.org.

## 3.2 NCP REMEDY SELECTION CRITERIA

The NCP at 40 CFR §300.430(e)(9) establishes a framework of nine criteria for evaluating remedies. These criteria address the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and additional technical and policy considerations that are important for selecting remedial actions. Many of these criteria are also important for actions under the Resource Conservation and Recovery Act (RCRA).

The NCP at 40 CFR §300.430(e)(7) describes a method for screening potential alternatives prior to developing detailed alternatives when a number of alternatives are being considered at a site. Only the alternatives judged as the best or most promising following this screening should be retained for further development and detailed analysis. The three broad criteria for screening preliminary remedial alternatives are: 1) effectiveness; 2) implementability; and 3) cost. Although a screening level analysis may be necessary in some cases, due to the relatively limited number of approaches available for sediment, project managers generally should not screen out any of the three major approaches early in the FS.

More detailed discussions of what should be addressed under each of the nine criteria can be found in the ROD Guidance (U.S. EPA 1999a) and the RI/FS Guidance (U.S. EPA 1988a). The following provides a summary of the nine criteria (U.S. EPA 1988a). More detailed explanations related to sediment sites are cited after each criterion, as appropriate.

Threshold Criteria

- *Overall Protection of Human Health and the Environment*: This criterion is used to evaluate how the alternative as a whole achieves and maintains protection of human health and the environment; and

- *Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)*: This criterion is used to evaluate whether the alternative complies with chemical-specific, action-specific, and location-specific ARARs or if a waiver is justified. In addition to ARARs, this criterion also commonly includes whether the alternative considers other criteria, advisories, and guidance that are to be considered at the site. This criterion is discussed further with respect to contaminated sediment in Section 3.3.

Balancing Criteria

- *Long-Term Effectiveness and Permanence*: This criterion includes an evaluation of the magnitude of human health and ecological risk from untreated contaminated materials or treatment residuals remaining after remedial action has been concluded (known as residual risk), and the adequacy and reliability of controls to manage that residual risk. It also includes an assessment of the potential need to replace technical components of the alternative, such as a cap or a treatment system, and the potential risk posed by that replacement. This criterion is discussed further with respect to contaminated sediment in Section 3.4;

- *Reduction of Toxicity, Mobility, and Volume Through Treatment*: This criterion refers to the evaluation of whether treatment processes can be used, the amount of hazardous material treated, including the principal threat that can be addressed, the degree of expected reductions, the degree to which the treatment is irreversible, and the type and quantity of treatment residuals. This criterion is discussed further with respect to contaminated sediment in Chapters 4, 5, and 6 related to the individual remedies;

- *Short-Term Effectiveness*: This criterion includes an evaluation of the effects of the alternative during the construction and implementation phase until remedial objectives are met. This criterion includes an evaluation of protection of the community and workers during the remedial action, the environmental impacts of implementing the remedial action, and the expected length of time until remedial objectives are achieved. This criterion is discussed further with respect to contaminated sediment in Section 3.4;

- *Implementability*: This criterion is used to evaluate the technical feasibility of the alternative, including construction and operation, reliability, monitoring, and the ease of undertaking an additional remedial action if the remedy fails. It also considers the administrative feasibility of activities needed to coordinate with other offices and agencies, such as for obtaining permits for off-site actions, rights of way, and institutional controls, and the availability of services and materials necessary to the alternative, such as treatment, storage, and disposal facilities. This criterion is discussed further with respect to contaminated sediment in Chapters 4, 5, and 6 related to the individual remedies; and

- *Cost*: This criterion includes an evaluation of direct and indirect capital costs, including costs of treatment and disposal, annual costs of operation, maintenance, monitoring of the alternative, and the total present worth of these costs. This criterion is discussed further with respect to contaminated sediment in Section 3.5.

Modifying Criteria

- *State (Or Support Agency) Acceptance*: This criterion is used to evaluate the technical and administrative concerns of the state (or the support agency, in the case of state-lead sites) regarding the alternatives, including an assessment of the state or the support agency's position and key concerns regarding the alternative, and comments on ARARs or the proposed use of waivers. Tribal acceptance is also evaluated under this criterion.

This criterion is discussed further with respect to contaminated sediment in Chapter 1, Section 1.5; and

- Community Acceptance: This criterion includes an evaluation of the concerns of the public regarding the alternatives. It determines which component of the alternatives interested persons in the community support, have reservations about, or oppose. This criterion is discussed further with respect to contaminated sediment in Chapter 1, Section 1.6.

Additional guidance about how to apply these criteria to sediment alternatives is found throughout the guidance, as indicated above. In addition, Chapter 7, Remedy Selection Considerations, summarizes general considerations of each of the nine criteria with respect to the three major approaches.

## 3.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Pursuant to CERCLA §121(d)(4), all remedial actions at CERCLA sites must be protective of human health and the environment. In addition, on-site actions need to comply with the substantive portions of ARARs unless the ARAR is waived. ARARs may be waived only under limited circumstances. Compliance with administrative procedures, such as permits, is not required for on-site response actions. Off-site actions must comply with both substantive and administrative requirements of legally applicable laws and regulations.

Sediment cleanup levels for response actions under CERCLA are generally based on site-specific risk assessments, but are occasionally based on ARARs. Project managers may also consider non-promulgated advisories or guidance issued by federal, state, or tribal governments, frequently called TBC ("to be considered"). While TBCs may not be legally binding on their own, and, therefore, do not have the same status as ARARs, TBCs can be used as a basis for making cleanup decisions. The project manager should refer to *CERCLA Compliance with Other Laws Manual* (U.S. EPA 1988b). Also, the preamble to the final NCP (55 *Federal Register* (*FR*) 8741) states that, as a matter of policy, it is appropriate to treat Indian tribes as states for the purpose of identifying ARARs (see NCP at 40 CFR §300.515(b) for provisions dealing with tribal governments).

The process of identifying ARARs typically begins in the scoping phase of the RI/FS, continues until the ROD is finalized, and may be reexamined during the five-year review process. Identification of ARARs should be done on a site-specific basis and usually involves a two-part analysis. First, a determination of whether a given requirement is applicable should be made, and second, if it is not applicable, then a determination should be made as to whether it is relevant and appropriate. Highlight 3-2 lists some examples of potential federal, state, and tribal ARARs for sediment sites and actual and hypothetical examples of how remedial strategies have been adapted to comply with ARARs.

For more information about ARARs, the project manager should consult the *Compendium of CERCLA ARARs Fact Sheets and Directives* (U.S. EPA 1991b), and the *Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document* (U.S. EPA 1994d).

As part of the ARARs analysis, project managers, in consultation with the site attorney, should consider appropriate requirements promulgated under the Clean Water Act (CWA). As described in the examples in Highlight 3-2, federal water quality criteria as well as state-promulgated regulations including state water quality standards may be potential ARARs for surface water when water is discharged from dewatering or treatment areas or as effluent from confined disposal facilities (CDFs). Furthermore, some states may have their own promulgated sediment quality standards that may be potential ARARs for sediment.

Total maximum daily loads (TMDLs) established or approved by the EPA under the CWA are planning tools designed to reduce contributing point and nonpoint sources of pollutants in water quality limited segments (WQLS). TMDLs calculate the greatest amount of loading of a pollutant that a water body can receive without exceeding CWA water quality standards. TMDLs are usually established by the states, territories, or authorized tribes and approved by the EPA. Effluent limits in point source national pollutant discharge elimination system (NPDES) permits should be consistent with the assumptions and requirements in a wasteload allocation in an approved TMDL.

EPA-established TMDLs are not promulgated as rules, are not enforceable, and, therefore, are not ARARs. TMDLs established by states, territories or authorized Indian tribes may or may not be promulgated as rules. Therefore, TMDLs established by states, territories, or authorized Indian tribes, should be evaluated on a regulation-specific and site-specific basis. Even if a TMDL is not an ARAR, it may aid in setting protective cleanup levels and may be appropriately a TBC. Project managers should work closely with regional EPA Water program and state personnel to coordinate matters relating to TMDLs. The project manager should remember that even when a TMDL or wasteload allocation is not enforceable, the water quality standards on which they are based may be ARARs. TMDLs can also be useful in helping project managers evaluate the impacts of continuing sources, contaminant transport, and fate and effects. Similarly, Superfund's RI/FS may provide useful information and analysis to the federal and state water programs charged with developing TMDLs.

Project managers are also strongly encouraged to follow the consultation requirements of the Endangered Species Act. For on-site actions, the Endangered Species Act, Section 7, requires federal agencies to ensure that the actions they authorize, fund or carry out are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their critical habitat. By policy, EPA consults with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) where a threatened or endangered species or their habitat is or may be present. The Commencement Bay NPL (National Priorities List) site provides an example of how a remedial strategy has been adapted to comply with this act. Chinook salmon are threatened species that are found at this site during part of the year. After following EPA's policy of consulting with the NMFS, EPA decided that to avoid harming the species, some in-water remedial work would be conducted only during a window of time when juvenile salmon were not migrating through the area. Other in-water work would be performed outside of this window, using special conditions recommended by NMFS to minimize impacts to salmon.

| Highlight 3-2: Examples of Potential ARARs for Sediment Sites | | |
|---|---|---|
| **Law or Regulation** | **Description** | **Examples of How Remedial Strategies have been Adapted to Comply with ARARs** |
| | ***Potential Federal ARARs*** | |
| Clean Water Act §304<br>40 CFR part 130 | EPA publishes national recommended Ambient Water Quality Criteria (AWQC) for the protection of aquatic life and human health. CERCLA §121(d)(2) requires EPA to consider whether nationally recommended AWQC should be relevant and appropriate requirements at a site. CERCLA §121(d)(2)(B) establishes the guidelines to consider in determining when AWQC may be relevant and appropriate requirements, including consideration of the designated or potential uses of surface water, the purposes for which the criteria were developed and the latest information available. | In developing a remedy that included treatment of water following dewatering sediment, EPA determined that a revised AWQC was a relevant and appropriate criteria for discharging to the waterway. |
| Clean Water Act §404<br>33 CFR parts 320-330 and 40 CFR part 230 | Regulates the discharge of dredged or fill materials into waters of the U.S. Discharges of dredged or fill materials are not permitted unless there is no practicable alternative that would have less adverse impact on the aquatic ecosystem. Any proposed discharge must avoid, to the fullest extent practicable, adverse effects, especially on aquatic ecosystems. Unavoidable impacts must be minimized, and impacts that cannot be minimized must be mitigated. | Work at the ASARCO, Tacoma Washington, National Priorities List (NPL) site included construction of an armored cap in the inter-tidal zone. Work at the Wyckoff/Eagle Harbor, Washington, NPL site included construction of a sheet pile barrier wall to control subsurface non-aqueous phase liquid (NAPL) migration. To compensate for the loss of habitat, intertidal habitat was created in another part of these two sites.<br><br>Work at the Lavaca Bay, Texas site involved construction of a CDF with effluent discharge to the Bay. CDF effluent discharged to waters of the U.S. is defined as the discharge of dredged material under EPA and USACE regulations implementing Section 404 (40 CFR §232.2). |

| Law or Regulation | Description | Examples of How Remedial Strategies have been Adapted to Comply with ARARs |
|---|---|---|
| Resource Conservation and Recovery Act (RCRA); 40 CFR parts 260 to 268 | Dredged material may be subject to RCRA regulations if it contained a listed waste, or if it displays a hazardous waste characteristic, for example, by the Toxicity Characteristic Leaching Procedure (TCLP). Most states have been authorized in lieu of EPA to implement the RCRA program. RCRA regulations may be potentially ARARs for the storage, treatment, and disposal of the dredged material unless an exemption applies. One such exemption is if CWA 404 applies to the cleanup activity (40 CFR part 261). | The material to be dredged contains a listed pesticide formulation waste, and thus RCRA may be a applicable. However, the site is located in a state where EPA implements the RCRA program, and the on-site cleanup action will comply with substantive requirements of a 404 permit. Thus the cleanup action is exempted from RCRA. This situation is explained in the description of the selected remedy in the ROD. |
| Rivers and Harbors Act, Section 10<br>33 CFR parts 320 to 323 | Activities that could impede navigation and commerce are prohibited. Prohibits authorized obstruction or alteration of any navigable waterway. | A site with contaminated sediment has an authorized navigation depth of 30 ft. The evaluation of alternatives needs to consider the need to maintain this minimum depth when evaluating whether capping is or is not a feasible alternative for the entire site. |
| Toxic Substances Control Act (TSCA) 40 CFR part 761 | Section 6(e) of TSCA regulates PCBs from cradle to grave (i.e., from manufacture to disposal). TSCA and portions of its implementing regulations may be an ARAR for on-site response actions involving contaminated sediment.<br><br>The regulations provide several factors for determining whether PCB contaminated media is PCB remediation waste (as defined per 40 CFR §761.3), including the date of the spill, PCB concentration of material spilled, and PCB concentration currently at the site (i.e., the “as found” concentration.) In general, material meeting the definition of PCB remediation waste may be disposed of using one of the three options under 40 CFR §761.61, which includes a self-implementing option (40 CFR §761.61(a)), a performance-based option (40 CFR §761.61(b)), and a risk-based option (40 CFR §761.61(c)). Under the regulations, however, the self-implementing option cannot be used to clean up sediments in marine or freshwater ecosystems (see 40 CFR §761(a)(1)(i)). | Example: A determination was made to identify PCB remediation waste by sampling the sediments. Based on the definition of PCB remediation waste (40 CFR §761.3), as the spill occurred prior to 1978, those sediments with PCB concentrations greater than 50 ppm are considered PCB remediation wastes. The risk-based option (under 40 CFR §761.61(c)) for PCB remediation waste is selected (the self-implementing option at 40 CFR §761.61(a) is not available for sediments). A site-specific disposal plan is prepared that includes a sites specific sampling protocol as well as detailed performance standards for on-site temporary storage and off-site disposal for dredged sediments. After determining that this approach will not pose an unreasonable risk of injury to health or the environment (as specified in 40 CFR §761.61(c)), the Regional Administrator approves the plan. |

| Law or Regulation | Description | Examples of How Remedial Strategies have been Adapted to Comply with ARARs |
|---|---|---|
| | Selection of disposal options under 40 CFR §761.61 for wastes generated at a Superfund site is generally made at the regional level. The risk-based option under 40 CFR §761.61(c) may often be the most appropriate option at Superfund sites. In appropriate circumstances, the risk-based option may allow disposal of PCB remediation wastes with <50 ppm in a municipal landfill.<br><br>Substantive TSCA requirements also exist for storage and other activities involving PCB contaminated wastes. | |
| ***Potential State and Tribal ARARs*** | | |
| State Water Quality Standards Regulation | Under the CWA, states are required to designate surface water uses, and to develop water quality standards based on those uses and the AWQC. Often an applicable requirement for discharges to surface water. Where an Indian tribe has promulgated water quality standards, these may also be an applicable requirement. | A tribe has an EPA approved water quality standard regulation which designates the uses of a river to include rearing of aquatic life and other uses. Design and construction of the selected remedy, including the confined aquatic disposal facility, needs to achieve or waive the tribe's water quality standards based on that use. |
| State Hazardous Waste Regulations | Many states have been authorized by EPA to implement the RCRA Subtitle C Hazardous Waste Program in lieu of EPA. | The sediment at a site was contaminated with a listed hazardous waste. The state has been authorized for RCRA, and decided to not adopt the hazardous waste identification rule (HWIR) sediment exemption. Treatment and disposal of the dredged contaminated sediment must meet or waive the state's hazardous waste regulations. |
| State Solid Waste Regulations | Most states have regulations for the location, design, construction, operation and closure of solid waste management facilities. Potential applicable or relevant and applicable requirement for disposal of non-hazardous waste contaminated sediment. | A remedial alternative includes on-site upland disposal of dredged sediment. The feasibility study examines the state solid waste regulations and determines that a disposal facility at two of the three possible sites can be designed to meet the ARAR. The third site is eliminated from further analysis. |

| Law or Regulation | Description | Examples of How Remedial Strategies have been Adapted to Comply with ARARs |
|---|---|---|
| Total Maximum Daily Load (TMDL) Regulation | Some states have established wasteload allocations in State-promulgated and EPA-approved TMDLs. These allocations may be an applicable or a relevant and appropriate requirement, where promulgated by the state as an enforceable regulation. Non-promulgated TMDLs may be a TBC. | A remedial dredging alternative includes an expected temporary increase in total suspended solids in the water body and residual contamination that provides a small continuing load to the water body. EPA consulted with the state TMDL program to determine whether TMDLs are a potential ARAR or TBC and how they interact with the alternative. |
| National Pollutant Discharge Elimination System (NPDES) Permit Regulations | Under the CWA, many states have been delegated the authority for the NPDES permit program. These regulations generally regulate discharges, including monitoring requirements and effluent discharge limitations for point sources. Where a remedy has a point discharge that is on-site, the substantive requirements may be an applicable regulation. | A Superfund remedy includes ground water remediation with discharge of the water to surface water. EPA consulted with the state NPDES permit program to determine water treatment standards prior the discharge. |

Project managers are also strongly encouraged to follow the consultation requirements of the National Historic Preservation Act, Section 106 (36 CFR part 800). Section 106 requires federal agencies to consider the effects of their actions on historic properties that are on or are eligible for listing on the National Register of Historic Places. Compliance generally includes conducting a preliminary survey to determine the presence of significant resources, including among others, historic, prehistoric, archeological, architectural, engineering or cultural resources. If significant resources are found, generally a documentation package is prepared for review and comment by the State or Tribal Historic Preservation Office and appropriate mitigation is included in site plans. Examples of how remedial strategies have been adapted to comply with this Act include the Pine Street Canal Site in Vermont, where mitigation for damages related to capping sunken barges and other historic features included study and artifact collection by a local maritime museum related to a historic sunken barge of similar type in nearby Lake Champlain. In addition, at the Fox River PCB (polychlorinated biphenyl) site in Wisconsin, historic and prehistoric artifacts will be protected during nearby site activities and a potential shipwreck site will either be avoided during dredging or a diver study employed for further examination.

Project managers should also be aware of Executive Orders such as those covered by the *Statement of Procedures on Floodplain Management and Wetland Protections* (Appendix A of 40 CFR part 6). Although not ARARs, the Agency normally follows Executive Orders as a matter of policy. The Statement of Procedures cited above sets forth EPA policy and guidance for carrying out Executive Orders 11988 and 11990, which were written in furtherance of the National Environmental Policy Act (NEPA) and other environmental statutes. Executive Order 11988 concerns floodplain management and the evaluation by federal agencies of the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. Executive Order 11990 concerns protection of wetlands and the avoidance by federal agencies, to the extent possible, of the adverse impacts associated with the destruction or loss of wetlands if a practical alternative exists. OSWER Directive 9280.0-03, *Considering Wetlands at CERCLA Sites* (U.S. EPA 1994e), contains further guidance on addressing this Executive Order.

Examples of ways in which remedial strategies for sediment have been adapted in light of these Executive Orders as a matter of policy include the following:

- EPA determined that capping above grade would be an inappropriate alternative for remediating contaminated sediment in a small river, as the increased bottom elevation would increase the risk of flooding. Instead, the final EPA remedy called for dredging contaminated sediment and capping back to the existing grade; and

- EPA selected a route that avoided the wetland and would minimize the potential for effects on the floodplain, after evaluating possible alignments for the access road to the contaminated sediment site. During design of the access road, additional features were incorporated to further minimize any indirect impact on the floodplain.

## 3.4 EFFECTIVENESS AND PERMANENCE OF SEDIMENT ALTERNATIVES

Two NCP balancing criteria for which project managers of sediment sites may find additional guidance helpful are those related to short-term effectiveness, and long-term effectiveness and permanence. Each is described in more detail below, as it relates to evaluation of contaminated sediment alternatives. The NCP describes the assessment of short-term effectiveness as follows 40 CFR §300.430(e)(9)(iii)(E)):

> The short-term impacts of alternatives shall be assessed considering the following:
>
> (1) Short-term risks that might be posed to the community during implementation of an alternative;
>
> (2) Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures;
>
> (3) Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and
>
> (4) Time until protection is achieved.

For contaminated sediment alternatives, short-term risks to the community and workers may include those that may occur during dredging or capping operations or during the first few years of a MNR remedy. For a sediment remedy involving bioaccumulative contaminants, short-term impacts may include those due to continued human or ecological exposure to contaminants currently in the food chain. For a MNR alternative, these impacts may also be frequently due to continued human and ecological exposure to contaminants in surface sediment. For in-situ capping, short-term impacts may be due to factors such as contaminant releases during capping or accidents during transport or placement of cap material. For dredging or excavation, short-term impacts may include those due to contaminant releases during sediment removal, transport, treatment, or disposal or accidents during construction and operation of facilities. Short-term impacts to the benthic community as a result of capping or dredging should also be considered. Additional possible short-term impacts are presented in Highlight 7-3, Examples of Some Key Differences Between Remedial Approaches for Contaminated Sediment.

The time needed until protection is achieved can be difficult to assess at sediment sites, especially where bioaccumulative contaminants are present. Generally, for sites where risk is due to contaminants in the food chain, time to achieve protection can be estimated using models. These models may have significant uncertainty, but may be useful for predicting whether or not there are significant differences between time to achieve protection using different alternatives. When comparing time to achieve protection from MNR to that for active remedies such as capping and dredging, it is generally important to include the time for design and implementation of the active remedies in the analysis.

The NCP describes the assessment of long-term effectiveness and permanence as follows (40 CFR §300.430(e)(9)(iii)(C)):

> Alternatives shall be assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. Factors that shall be considered, as appropriate, include the following:
>
> (1) Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals should be

considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate; and

(2) Adequacy and reliability of controls such as containment systems and institutional controls that are necessary to manage treatment residuals and untreated waste. This factor addresses in particular the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to repair or replace technical components of the alternative, such as a cap, a slurry wall, or a treatment system; and the potential exposure pathways and risks posed should the remedial action need replacement.

For contaminated sediment alternatives, residual risk generally may be considered to be the risk remaining after completion of dredging, capping, or MNR. In their evaluation of residual risk, project managers should consider the volume, toxicity, mobility, and bioavailability of the remaining contaminants, as well as their propensity to bioaccumulate. The adequacy and reliability of controls used to manage post-remediation sediment residuals or untreated contamination that remains in the sediment should also be considered. Where institutional controls such as fish consumption advisories are one of the controls used to manage residual risk, project managers should assess their expected effectiveness and whether resulting exposures are expected to be within protective levels. Developing answers to the following questions may help the project manager in evaluating the long-term effectiveness and permanence of alternatives:

- What is the likelihood that the planned cap, dredging approach, or MNR will meet the cleanup levels and RAOs?

- What is the level of human health and/or ecological risk remaining after implementation?

- What is the expected pattern of risk reduction over time for the various alternatives and what uncertainties are associated with that pattern?

- How much of the risk is due to the area that was remediated versus unremediated areas of contamination?

- What type and degree of long-term operation and maintenance (O&M) will be required?

- What are the requirements for long-term monitoring?

- What is the potential need for replacing or modifying the technical components of the alternative?

- What is the magnitude of risk should the remedy fail? and

- What is the degree of confidence that there are adequate controls to identify and prevent remedy failure?

It is important to remember that each of the three major approaches may be capable of reaching acceptable levels of both short-term effectiveness and long-term effectiveness and permanence, and that site-specific characteristics should be reviewed during the alternatives evaluation to ensure that the selected alternative will be effective in that environment. Project managers should evaluate and compare the effectiveness of in-situ (capping and MNR) and ex-situ (dredging) alternatives under the conditions present at the site. There should not be necessarily a presumption that removal of contaminated sediments from a water body will be necessarily more effective or permanent than capping or MNR. Likewise, without sufficient evaluation there should not be a presumption that capping or MNR will be effective or permanent. What constitutes an acceptable level of effectiveness and permanence is a site-specific decision that should also consider each of the other NCP remedy selection criteria. Each of the major approaches for sediment has its own remedy-specific considerations under these criteria, which are summarized below. Some aspects are discussed in more detail in the following remedy-specific chapters.

<u>Monitored Natural Recovery</u>

For a MNR remedy, the risk present at the time of remedy selection should decrease with time as natural processes progress. The level of risk reduction afforded by this remedy generally depends on what cleanup levels the natural processes are expected to be able to achieve in a reasonable time frame and the level of contamination which may continue to enter the system from any uncontrolled sources.

Residual risk following MNR and permanence for a MNR alternative frequently are related to the stability of the sediment bed, or the chance that clean sediment overlying buried contaminants may be eroded to such an extent that unacceptable risk is created. Residual risk for an MNR remedy may also be related to the chance that ground water flow, bioturbation, or other mechanisms may move buried contaminants to the surface where they could cause unacceptable human or ecological exposure, even in otherwise stable, non-erosional sediment. Whether erosion, ground water flow, or other processes cause unacceptable risk depends on the rate of exposure due to those processes. For example, erosion of some portions of a sediment bed, or some movement of contaminants through bioturbation, may not create an unacceptable risk; therefore, it is important to review such factors on a site-specific basis. Evaluating the adequacy of controls for these risks in an MNR remedy may include evaluating the ability of the monitoring plan to detect significant sediment erosion or contaminant movement, and evaluating the adequacy of any institutional controls that are relied upon to control erosion (e.g., dam or breakwater maintenance agreements).

<u>In-Situ Capping</u>

For an in-situ capping remedy, risk due to direct exposure to contaminated sediment in the capped area generally decreases rapidly, although risks may remain from uncapped areas. The level of risk reduction associated with this remedy generally depends on the action level selected for capping (i.e., what level of contamination will remain outside the capped area) and the level of contamination that may continue to enter the system from any uncontrolled sources. Residual risk, after the cap is in place, usually is related to the following: 1) likelihood of cap erosion or disruption exposing contaminants; 2) likelihood of contaminants migrating through the cap; and 3) risks from contaminants remaining in uncapped areas. Like MNR, whether cap erosion or contaminant migration through a cap cause unacceptable risk depends on depends on the rate of exposure due to those processes. An evaluation of long-term effectiveness and permanence for capping also should include an evaluation of the ability to monitor the effectiveness of the cap and to replace or replenish components of the cap through time before any significant contaminant releases occur.

Dredging or Excavation

For a dredging or excavation remedy, risks within the site itself may initially increase due to increased exposure to contaminants released into the surface water during sediment removal, but this increase should be temporary and localized. After this time, risk should decrease. The speed of the decrease and the level of long-term risk reduction associated with this remedy generally depends on the action level and/or cleanup levels selected for sediment removal (i.e., what level of contamination will remain outside of the dredged/excavated area), the level of residual contamination in the area after dredging, and the level of contamination that may continue to enter the system from any uncontrolled sources.

Residual risk, after the dredging or excavation is complete, is usually related to the following: 1) risk from contaminated sediment left behind outside of the dredged or excavated areas and from contaminated sediment resuspended and transported by dredging; 2) residual contamination left in place after dredging (an estimate of the likely post-dredging/post-backfilling surficial contamination levels should be developed); and 3) risk posed by untreated contaminants and treatment residuals at their disposal location. Similar to capping, the long-term effectiveness evaluation should include the need to replace technical components of the remedy after remedial action is completed. For dredging or excavation, this usually focuses on technical components of any on-site disposal units and the need to replenish backfill material in the dredged areas if backfill was used.

Project managers should recognize that all approaches for remediating sediment leave some contaminants in place after remedial actions are completed, whether buried beneath a natural sediment layer or engineered cap, left near the surface or mixed with backfill as residuals following dredging or excavation, or as low levels of contamination outside of areas that were capped or dredged. All of these residual contaminants are affected by a variety of natural processes that can disperse, contain or sequester them. As described above and in the three remedy-specific chapters of this guidance that follow, MNR, in-situ capping, and sediment removal, each may be capable of achieving acceptable levels of effectiveness and permanence. Site-specific site characteristics should be reviewed to ensure that the selected alternative will provide adequate short-term and long-term effectiveness at a particular site.

## 3.5 COST

Developing accurate cost estimates generally is an essential part of evaluating alternatives. It is also appropriate at many sites, and can be especially useful at large sites, to include the relative cost of achieving different cleanup levels. This typically is an important part of evaluating the cost-effectiveness of a range of protective alternatives which may, for example, be associated with different fish consumption rates or different levels of ecological protection.

Guidance on preparing cost estimates and the general role of cost in remedial alternative selection is discussed in *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (U.S. EPA and USACE 2000). The general elements of a cost estimate include capital costs, annual and periodic O&M costs, and net present value (U.S. EPA and USACE 2000). A cost estimate prepared as part of the CERCLA cleanup process should not include potential claims for natural resource damages or potential restoration credits, but may include costs for mitigation of habitat lost or impaired by the remedial action, where appropriate.

### 3.5.1 Capital Costs

Capital costs generally are those expenditures needed to construct a remedial action (U.S. EPA and USACE 2000). Capital costs include only those expenditures initially incurred to implement a remedial alternative and major capital expenditures in future years. Capital cost elements that may be important at sediment sites include those listed in Highlight 3-3. As indicated in the Highlight, capital costs may include construction monitoring and environmental monitoring before, during and immediately following the remedial action. Monitoring beyond that point should be considered part of O&M.

**Highlight 3-3: Examples of Categories of Capital Costs for Sediment Remediation**

| Categories | Capital Costs |
|---|---|
| General (may apply to several or all remedial approaches) | • Mobilization/demobilization<br>• Site preparation (e.g., fencing, roads, utilities)<br>• Construction monitoring, sampling, testing, and analysis before, during, and immediately following construction (e.g., bathymetric surveys)<br>• Environmental monitoring before, during, and immediately following construction (e.g., water quality monitoring)<br>• Debris and/or structure (e.g., piers, pilings) removal and disposal<br>• Project management and support throughout construction, including preparation of remedial action documentation and construction submittals<br>• Engineering needs during construction (not pre-construction design)<br>• Post-construction habitat restoration (e.g., plantings)<br>• Pilot studies<br>• General contingency<br>• Indirect costs<br>• Implementation of institutional controls |
| Monitored Natural Recovery | • Monitoring and reporting prior to attainment of cleanup levels |
| In-situ Capping | • Cap materials<br>– Material costs<br>– Equipment and labor costs<br>– Cost of mitigation if required under CWA §404<br>• Transport, storage, and placement of cap materials<br>– Barge/tug lease costs<br>– Stockpiling of cap material<br>– Land use cost |

| Categories | Capital Costs |
|---|---|
| Dredging or Excavation | • Dredging or excavation equipment and labor costs<br>• Engineering controls to protect water quality (e.g., silt curtains)<br>• Site decontamination for support facilities (e.g., truck wash, dewatering area)<br>• Sediment isolation for excavation (e.g., sheetpile, earthen dams)<br>• Construction of dewatering area/temporary storage of dredged material<br>• Transporting sediment to treatment or disposal site<br>– Barge/tug lease costs<br>– Pipeline costs<br>• Land acquisition costs for construction easements or relocating utilities |
| Pretreatment/Treatment | • Land acquisition costs<br>• Construction of pretreatment/treatment/storage buildings<br>• Treatment of sediment<br>• Treatment and discharge of water from dewatering process<br>• Engineering controls to protect water quality (e.g., process water and storm water runoff controls)<br>• Disposal of treatment residuals |
| In-Water Contained Aquatic Disposal, In-Water or Upland Confined Disposal Facilities | • Land acquisition or use costs<br>• Construction of disposal site and any associated disposal costs<br>– Demolition of existing facilities<br>– Excavation to support berm<br>– Equipment and labor costs<br>• Berm construction<br>– Imported materials for berm<br>– Equipment costs<br>• Capping disposal site<br>– Cap materials<br>– Equipment and labor costs<br>• Engineering controls to protect water quality<br>• Cost of mitigation if required under CWA §404 |

| Categories | Capital Costs |
|---|---|
| Upland Landfill Disposal | • Land acquisition costs<br>• Construction costs<br>• Transportation costs<br>• Tipping fees for regional landfill |

The basis for a cost estimate may include a variety of sources, including cost curves, generic unit costs, vendor information, standard cost estimating guides, and similar estimates, as modified for the specific site. Where site-specific costs are available from pilot studies or removal actions, they are likely to be the best source of realistic cost information. Where this is not available, actual costs from similar projects implemented at other sites is frequently the next best source of costs.

Substantial amounts of historical cost data for some components of sediment remediation (e.g., removal, transport, disposal, and residue management) may be available from other project managers. EPA's Office of Superfund Remediation and Technology Innovation (OSRTI) can help project managers locate sites where a similar approach has been implemented. Additionally, the project manager may find it useful to refer to the ARCS program's remediation guidance document (U.S. EPA 1994d) for a discussion on the general elements of cost estimates for sediment sites. This document provides examples of percentages for general costs and site-specific costs for both in-situ and ex-situ remedies. Also, many of the local district USACE offices have extensive experience with dredging and in-water construction and may be an additional source of good cost information.

### 3.5.2 Operation and Maintenance (O&M) Costs

O&M costs are generally those post-construction costs necessary to ensure or verify the continued effectiveness of a remedial action (U.S. EPA and USACE 2000). These costs may be annual or periodic (e.g., once only, or once every five years). It is important to note that short-term O&M costs generally are incurred as part of the remedial action phase of a project, while long-term O&M costs or long-term cap maintenance generally are part of the O&M phase of a project (U.S. EPA and USACE 2000). At Fund-lead sites, it can be very important to differentiate these two cost categories because CERCLA has specific requirements addressing payment for long-term O&M [CERCLA §104(c))(3)), see Section 3.5.4, State Cost Share]. Some examples of categories that are generally considered short-term O&M at sediment sites include the following:

- Operation of sediment or water treatment facilities during the remedial action;
- Monitoring, sampling, testing, analysis, and reporting during the remedial action (some may be considered capital costs, see Section 3.5.1 above);
- Maintenance of in-situ cap or on-site disposal site during the shake-down period (e.g., one year);
- Maintenance of engineering site controls during shake-down period (e.g., one year);

- Cost overrun contingency; and

- Project management and support.

Some examples of categories that are generally considered long-term O&M at sediment sites include the following:

- Maintenance and monitoring of institutional controls;

- Long-term monitoring, sampling, testing, analysis, and reporting;

- Long-term maintenance of in-situ cap or on-site disposal unit; and

- Long-term maintenance of engineering site controls.

Additional issues related to long-term monitoring and maintenance of all three remedial approaches (MNR, capping, and dredging or excavation) are discussed in Chapter 8 of this guidance.

### *3.5.3 Net Present Value*

The NCP also provides that an analysis of remedy net present value, or present worth, should be used [NCP §300.430(e)(9)(iii)(G)]. A net present value analysis should be used to compare expenditures occurring over different time periods. This standard methodology allows for a cost comparison of different alternatives having capital, O&M, and monitoring costs that would be incurred in different time periods on the basis of a single cost figure for each alternative. In general, the period of analysis should be equivalent to the project duration, resulting in a complete life cycle cost estimate for implementing the remedial alternative. Past EPA guidance recommended the general use of a 30-year period of analysis for estimating present value costs (U.S. EPA 1988a). Although this may be appropriate in some circumstances, the blanket use of a 30-year period is no longer recommended. Site-specific justification should be provided for the period of analysis selected, especially when the project duration (i.e., time period required for design, construction, O&M, and closeout) exceeds the selected period of analysis (U.S. EPA and USACE 2000).

For sediment approaches that leave significant quantities of contaminated sediment in place, such as in-situ capping or MNR based on natural burial, the actual monitoring period is likely to be longer than 30 years, although project managers are encouraged not to assume that monitoring in perpetuity will be necessary at every site. This is discussed further in Chapter 8, Remedial Action and Long-Term Monitoring.

The discount rate that should be used for this analysis is established by the Office of Management and Budget (OMB). Based on current Agency policy, as reflected in the NCP preamble (55 *FR* 8722) and the OSWER Directive 9355.3-20, *Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis* (U.S. EPA 1993b), a seven percent discount rate should be used in estimating the present worth value for potential alternatives. This figure could be revised in the future, and project managers should use the current figure contained in an update of the OMB Circular. Project managers should be aware that this rate may not be the same as rates that various potentially responsible parties (PRPs) or federal facilities use for similar analyses. The project manager should refer to *A Guide to*

*Developing and Documenting Cost Estimates for the Feasibility Study* (U.S. EPA and USACE 2000) for more information.

### 3.5.4 State Cost Share

At Fund-lead sites, generally the state is responsible under CERCLA for ten percent of remedial action costs and 100 percent of long-term O&M costs (see also 40 CFR §300.510(b) and (c)). Other requirements may apply if the facility was publicly operated at the time of disposal of hazardous substances and for federal facilities. Where O&M costs are significantly different between alternatives, this may add to differences of opinion about preferred alternatives. For the discussion to be based on the best available information, it is especially important that cost estimates be as accurate as possible, including costs of long-term O&M.

After a joint EPA/state inspection of an implemented Fund-financed remedial action, EPA may share, for a period of up to one year, in the cost of the operation of the remedial action to ensure that the remedy is operational and functional (40 CFR §300.510(c)(2)). For sediment sites, this may arise at sites involving in-situ caps and on-site disposal facilities.

The RAOs at sediment sites typically address sediment and biota, but remedies may also include surface water restoration as a goal of the remedial action. The NCP specifies the following in 40 CFR §300.510(c)(2):

> In the case of the restoration of ground or surface water, EPA shall share in the cost of the state's operation of ground or surface water restoration remedial actions as specified in 40 CFR §300.435(f)(3).

The NCP at 40 CFR §300.435(f)(3) specifies that:

> For Fund-financed remedial actions involving treatment or other measures to restore ground- or surface-water quality to the level that assures protection of human health and the environment, the operation of such treatment or other measures for a period of up to 10 years after the remedy becomes operational and functional will be considered part of the remedial action. Activities required to maintain the effectiveness of such treatment or other measures following the 10-year period, or after remedial action is complete, whichever is earlier, shall be considered O&M.

In 40 CFR §300.435(f)(3) and (4), the NCP also addresses when a restoration activity can be considered administratively "complete" for purposes of federal funding and discusses several actions that are excluded from consideration under this provision.

Where a sediment site includes surface water restoration as a goal, the project manager should consult with their Office of Regional Counsel to determine how these provisions may apply to their site.

## 3.6 INSTITUTIONAL CONTROLS

The term "institutional control" (IC) generally refers to non-engineering measures intended to affect human activities in such a way as to prevent or reduce exposure to hazardous substances, often by limiting land or resource use. ICs can be used at all stages of the remedial process to reduce exposure to contamination. Chapter 7, Remedy Selection Considerations, offers guidance on when it may be appropriate to select a remedy that includes institutional controls at sediment sites and considerations regarding their effectiveness and enforceability. For more detailed information on ICs in general, refer to OSWER Directive 9355.0-74FS-P, *Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups* (U.S. EPA 2000f) and Federal Facilities Restoration and Reuse Office (FFRRO) guidance, *Institutional Controls and Transfer of Real Property under CERCLA Section 120 (h)(3)(A), (B), or (C)* (U.S. EPA 2000g).

As explained in the site managers guide cited above (U.S. EPA 2000f), the following are the four general categories of ICs:

- Governmental controls;
- Proprietary controls;
- Enforcement and permit tools with IC components; and
- Information devices.

Usually, governmental controls (e.g., bans on harvesting fish or shellfish) are implemented and enforced by the state or local government. Proprietary controls (often referred to as "deed restrictions"), such as easements or covenants, typically involve legal instruments placed in the chain of title of the site or property. Where enforcement tools are used to implement ICs, they may include provisions of CERCLA Unilateral Administrative Orders (UAOs), Administrative Orders on Consent (AOCs), or Consent Decrees (CD). Information devices are designed to provide information or notification to the public. The three most common types of ICs at sediment sites include fish consumption advisories and commercial fishing bans, waterway use restrictions, and land use restriction/structure maintenance agreements. Each of these ICs is discussed in more detail below.

<u>Fish Consumption Advisories and Fishing Bans</u>

Fish consumption advisories are informational devices that are frequently already in place and incorporated into sediment site remedies. Commercial fishing bans are government controls that ban commercial fishing for specific species or sizes of fish or shellfish. Usually, state departments of health are the governmental entities that establishes these advisories and bans. Frequently, fish consumption advisories and fishing bans are in place before a site is listed on the NPL, but if not, it could be necessary for the state to issue or revise them in conjunction with an early or interim action, or the final remedial action. An advisory usually consists of informing the public that they should not consume fish from an area, or consume no more than a specified number of fish meals over a specific period of time from a particular area. Sensitive sub-populations or subsistence fishers may be subject to more stringent advisories. Advisories can be publicized through signs at popular fishing locations, pamphlets, or other educational outreach materials and programs. Information should be provided in appropriate languages to meet the needs of the impacted communities. However, project managers should be aware that consumption advisories are not enforceable controls and their effectiveness can be extremely variable. This is discussed further in Chapter 7, Remedy Selection Considerations.

Waterway Use Restrictions

For any alternative where subsurface contamination remains in place (e.g., capping, MNR, or an in-water confined disposal site), waterway use restrictions may be necessary to ensure the integrity of the alternative. Examples include restricting boat traffic in an area to establish a no-wake zone, or prohibiting anchoring of vessels. In considering boating restrictions, it is important to determine who can enforce the restrictions, and under what authority and how effective such enforcement has been in the past. In addition, a restriction on easements for installing utilities, such as fiber optic cables, can be an important mechanism to help ensure the overall protectiveness of a remedy. It may also be necessary to evaluate remedial alternatives that involve changing the navigation status of a waterway. For a federally authorized navigation channel, deauthorization or reauthorization of the channel to a different width and/or depth configuration would be required and should be fully investigated before selecting the remedy. The state may also have additional authority to change harbor lines or the navigation status of a waterway.

Federal deauthorization can be a lengthy process that requires a formal request to the USACE, an opportunity for users of the waterway to comment, and, ultimately, deauthorization by Congress. By comparison, for those waterways or portions of waterways the USACE has placed in “caretaker” status (i.e., not actively maintained), channel reauthorization to widths and depths consistent with local requirements (e.g., to support continued recreational use) can be completed relatively quickly. Proposed channel modifications/reauthorizations are typically processed by congressional conferees and may be incorporated into the Water Resources Development Act (WRDA) or other equivalent legislative vehicles.

In designing caps to be placed within federal navigational channels, horizontal and vertical offsets, developed by the USACE based on considerations of normal dredging accuracy and overdepth allowances, can provide a factor of safety to protect the surface of the cap from potential damage during potential future maintenance dredging activities.

Land Use Restrictions and Structure Maintenance Agreements

Where contamination remains in place, it may be necessary for the project manager to work with private parties, state land management agencies, or local governments to implement use restrictions on nearshore areas and adjacent upland properties. For example, construction of boat ramps, retaining walls, or marina development can expose subsurface contamination and compromise the long-term effectiveness of a remedy. Where contaminated sediment exceeding cleanup levels is identified in proximity to utility crossings or other infrastructure and temporary or permanent relocation of utilities in support of a dredging remedy may not be feasible or practical, capping may be desirable even though temporary cap disruption may be necessary periodically.

Ownership of aquatic lands varies by state and locality. In many cases, nearshore areas can be privately owned out to the end of piers. For private property owners, more traditional ICs, such as proprietary controls or enforcement tools with IC components, can be considered. Potentially, some of these restrictions can be implemented through agencies who permit construction activities in the aquatic environment. Several federal, state, and local laws place restrictions on and may require permits or substantive requirements documents to be obtained for dredging, filling, or other construction activities in the aquatic environment. These include Section 404 of the Clean Water Act, Title 33 United States Code

(U.S.C.) Section 1344, and Sections 9 and 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. 401 and 403. It may also be possible to implement some ICs through coordination with existing permitting processes. Harbor Master Plans, state-designated port areas, and local authorities may also function to restrict certain uses. In addition, long-term maintenance of structures such as dams or breakwaters may be a necessary component of some sediment remedies. Where this is the case, it is important that project managers clarify how this maintenance is part of the remedy and who is responsible for the remedy. Where maintenance decisions may change through time, contingencies may be needed for additional actions.

Highlight 3-4 summarizes some important points to remember about feasibility studies at sediment sites.

**Highlight 3-4: Some Key Points to Remember about Feasibility Studies for Sediment**

- Generally, project managers should implement and then evaluate the effectiveness of major source control actions before finalizing the evaluation of alternatives for sediment

- Generally, project managers should evaluate each of the three major approaches: MNR, in-situ capping, and removal through dredging or excavation, at every sediment site

- At sites with multiple water bodies or sections of water bodies with different characteristics or uses, alternatives that combine a variety of remedial approaches are frequently the most promising

- MNR, in-situ capping, and sediment removal may each be capable of achieving acceptable levels of long-term effectiveness and permanence; site-specific site characteristics should be reviewed to ensure that the selected alternative will be effective at a particular site

- Accurate cost estimates, including long-term O&M costs and, where appropriate, materials handling, transport, and disposal costs, are very important to a good comparison of alternatives; a Actual costs from pilot projects at a site and at similar, completed sediment sites are among the best cost resources

- Institutional controls can be used at all stages of the remedial process to reduce exposure to contamination; project managers should consider the effectiveness and enforce ability of controls used at the site and evaluate their role in risk reduction

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