Proposed Plan for the Marine Operable Unit "Ward Cove Sediment Remediation Project"

Ketchikan Pulp Company
Ketchikan, Alaska
July 1999

INTRODUCTION

This Proposed Plan presents the cleanup action proposed by the U.S. Environmental Protection Agency (EPA) for addressing contaminated marine sediments in the Marine Operable Unit of the Ketchikan Pulp Company (KPC) site. The KPC site is located approximately 5 miles north of Ketchikan, Alaska (Figure 1). EPA is requesting public comments on the information and proposed actions discussed in this plan. EPA, with input from the Alaska Department of Conservation (ADEC), will make a final remedy selection after all public comments are reviewed and considered.

The KPC site is divided into two administrative units: the Marine Operable Unit and the Uplands Operable Unit. The Marine Operable Unit includes sediments in all of Ward Cove, which is approximately 250 acres, and other marine areas as may be identified by EPA. To date, work performed in the Marine Operable Unit has generally been referred to as the "Ward Cove Sediment Remediation Project." The Uplands Operable Unit includes the pulp mill area, the wood waste and ash disposal landfill, and other land-based areas that may have been affected by pulp mill operations. The boundary between the two operable units is defined as the mean higher high tide level. The Proposed Plan for the Uplands Operable Unit was released on May 17, 1999 and is available for public comment through July 19, 1999.

This Proposed Plan summarizes the proposed remedy for the Marine Operable Unit of the KPC site. Within the Marine Operable Unit, sediments in an 87-acre area of Ward Cove have been found to pose a risk to bottom-dwelling marine animals that live in the sediments. The proposed remedy for these sediments includes: thin-layer capping of contaminated bottom sediments with clean sandy material, navigational dredging in the vicinity of KPC's main dock and upland disposal of those dredged sediments, natural recovery for those areas where capping is not practicable, requirements on certain future activities to ensure continued recovery of bottom-dwelling animals in the sediments, and long-term monitoring of the remedy.

The investigation of the Marine Operable Unit of the KPC site and the identification and analysis of cleanup alternatives are being conducted under a Clean Water Act Consent Decree between EPA and KPC. Although the KPC site is not listed on the Superfund National Priorities List (NPL), the Superfund process of investigation and alternative analysis is being followed at the

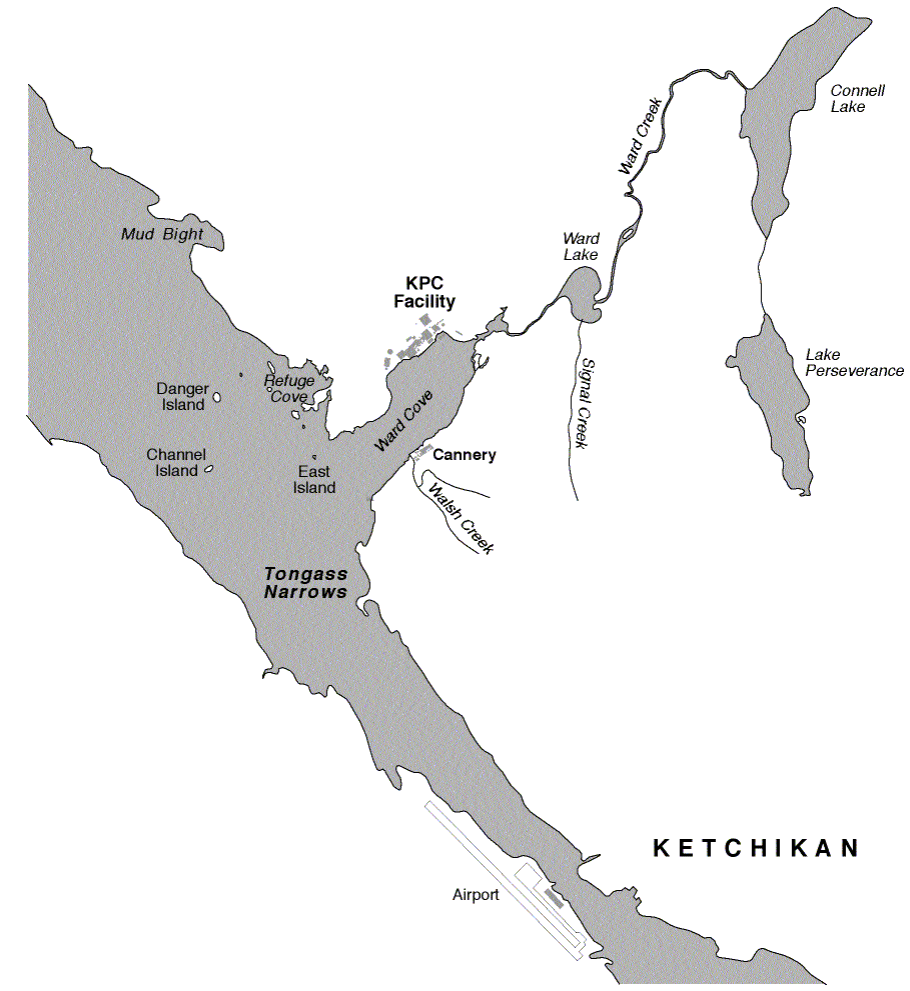

Figure 1. Location of Ward Cove and KPC facility.

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site. After consideration of comments on this proposed plan, EPA intends to document the final remedy for the Marine Operable Unit in a Superfund Record of Decision and commence negotiations with KPC to implement the subsequent cleanup activities in Ward Cove under Superfund authorities.

This Proposed Plan is being issued as part of the public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. This Proposed Plan summarizes information that can be found in greater detail in the **Detailed Technical Studies Report: Remedial Investigation and Feasibility Study** (referred to as the "RI/FS" in this plan) and other documents contained in the Information Repositories (see below for locations). Additionally, an Administrative Record, a formal collection of documents EPA relies on when making cleanup decisions, will be set up for review at the Ketchikan Public Library and at the EPA Records Center in Seattle by July 12. The public is encouraged to review these documents to gain a more comprehensive understanding of the site and the activities that have been conducted to date.

EPA Records Center
1200 Sixth Avenue, 7th Floor
Seattle, WA
Call 206-553-4494 to arrange
a time to look at the documents.

Ketchikan Public Library
629 Dock Street
Ketchikan, AK
907-225-3331

Ketchikan ADEC Office
340 Water Street
Ketchikan, AK
Contact: Marla Trimble
907-225-6200

Juneau ADEC Office
410 Willoughby Avenue
Juneau, AK
Contact: Helen Austerman
907-465-5202

PUBLIC PARTICIPATION

Background

There has been extensive public involvement at the KPC site because of the high degree of community interest. In February 1997, a questionnaire was sent to every mailing address in Ketchikan asking individuals to identify concerns regarding the potential contaminant releases associated with the facility and the on-going environmental investigation and cleanup activities. ADEC personnel also conducted a limited number of door-to-door interviews to learn more about community concerns. Information gathered in this process was used by EPA, ADEC, and KPC to prepare a Community Involvement Plan and to help identify areas that should be studied. Also, a technical discussion group (TDG) of concerned citizens formed. KPC provided funding that the group used to hire independent consultants to assist in reviewing and understanding the complex technical documents.

At each significant stage of the investigation, EPA and KPC held public meetings. Most of these meetings were preceded by an afternoon availability session where members of the community could meet one on one with EPA and KPC project staff and consultants. In total, 12 public meeting and public availability sessions were held to discuss the uplands and Ward Cove investigations. All public comments were considered in the development of the investigation. In addition, the draft RI/FS, which supports the proposed cleanup alternative set forth in this Proposed Plan, was made available for public review and comment from August 3 through October 1, 1998. An availability session, a public meeting, and a meeting with the TDG were held to discuss this report. EPA subsequently provided a summary of public comments and responses to those comments on April 26, 1999. All comments received during the public comment period were considering when revising the RI/FS.

During the investigation, EPA and ADEC hosted an Education Workshop for interested community members, to promote a better understanding of risk assessment. The workshop covered both the assessment process and technical concepts related to assessing risks to human health and the environment.

A mailing list was created to keep interested citizens informed of activities and significant issues. The agencies created flyers and newspaper advertisements announcing the release of significant documents, meetings, and availability sessions. Several newsletters providing more in-depth information were sent out.

How You Can Participate

The public is encouraged to participate in the decision-making process by commenting on the Proposed Plan. EPA will accept written comments on this proposed plan during the public comment period from July 12, 1999 to August 10, 1999. You may meet with EPA from 3:00 p.m. to 4:30 p.m. on July 29, 1999, at the Ted Ferry Civic Center for informal discussion. You may also attend the formal public meeting from 7:00 p.m. to 9:30 p.m. on the same date and at the same location to learn about, ask questions, or provide oral comments on the Proposed Plan. Written comments should be addressed to:

Karen Keeley
U.S. Environmental Protection Agency
Region 10, ECL-111
1200 Sixth Avenue
Seattle, WA 98101

All public comments, whether provided orally at the public meeting or submitted in writing, will be considered equally by EPA prior to reaching a final decision. In addition to this plan, related project documents are available for review at four Information Repositories (see above for locations).

EPA will present responses to public comments in a document called a Responsiveness Summary. A final Record of Decision will then be prepared by EPA. The Responsiveness Summary will be part of the Record of Decision and will be available for review at the Information Repositories. Depending on public comments, the final decision may be the preferred cleanup action presented in this plan or incorporate modifications to the cleanup action.

PURPOSE AND SCOPE OF PROPOSED PLAN

This Proposed Plan includes a brief summary of the history of the KPC pulp mill, the nature and extent of sediment contamination, and the potential risks associated with detected contaminants in the sediments. In addition, this plan presents EPA's preferred remedy for the Marine Operable Unit of the KPC site. Implementation of EPA's Proposed Plans for the Uplands and Marine Operable Units is intended to remedy all potential human health and environmental risks associated with the KPC site.

SITE LOCATION AND HISTORY

KPC operated a dissolving sulfite pulp mill on the north shore of Ward Cove. The facility began operations in 1954 and discharged pulp mill effluent to Ward Cove until March 1997, when pulping operations terminated. Prior to state and federal regulations that went into effect in 1971, untreated effluent from the mill was discharged directly to the cove. Beginning in 1972, effluent was treated in an on-site wastewater treatment plant prior to discharge, and in 1980, a secondary activated sludge treatment system was installed. Historical releases of pulping by-products and log handling activities in Ward Cove resulted in a complex mixture of wood debris, byproducts of the decomposition of organic matter, and other chemicals. Since the mill closure, on-going business operations on the uplands portion of the site are limited to a sawmill. Currently, KPC owns the upland site and the majority of the bottom sediments in Ward Cove.

In terms of physical site characteristics, Ward Cove is a deep estuary, approximately 1 mile long with a maximum width of 0.5 mile. The shoreline of the cove is mostly rocky (i.e., basalt) and relatively steep. Over two-thirds of the cove is deeper than 100 feet. Sediments in the cove are subtidal (i.e., below the tide line); intertidal sediments are limited to a very small area near the mouth of Ward Creek.

Numerous environmental studies of Ward Cove have been conducted to evaluate the potential environmental effects associated with discharges from the KPC facility. Historical studies focused on water quality assessments and sediment chemistry and toxicity studies. In support of the RI/FS, comprehensive studies were conducted by KPC, with EPA oversight, in 1996 and 1997 to determine the extent to which sediments in Ward Cove may pose risks to humans and the environment and therefore potentially warrant remediation.

Results from the environmental studies were used to conduct human health and ecological risk evaluations. Human health evaluations focused on potential risks associated with contacting sediment or eating seafood from the study area. Ecological evaluations focused on the effects of sediment contaminants on animals. These evaluations consisted of sediment chemical analyses, sediment toxicity testing, and food-web assessments. Sediment toxicity testing was performed in a laboratory by exposing marine animals to sediment from the study area. Food-web assessments were performed by estimating potential risks posed by chemicals in sediment to wildlife, such as birds and mammals, that live in the study area.

Extensive investigations were also completed at the Uplands Operable Unit. As part of those investigations, the potential for releases of contaminants from the uplands site to Ward Cove sediments was investigated. EPA concludes there are no further actions necessary to control contaminant releases from uplands to the cove.

Summary of Site Contamination

As part of site investigations, chemicals of *potential* concern (CoPCs) are identified. These CoPCs then undergo further study to assess whether any of them are actually chemicals of concern (CoCs).

In Ward Cove sediments, there were three categories of chemicals of potential concern (CoPCs):

1) CoPCs for human health risks associated with food-web bioaccumulation
2) CoPCs for ecological risks associated with sediment toxicity
3) CoPCs for ecological risks associated with food-web bioaccumulation.

The following CoPCs were initially identified:

Substances Associated with Organic Matter and Organic Matter Degradation—Total organic carbon (TOC), ammonia, sulfide, biochemical oxygen demand (BOD), chemical oxygen demand (COD), phenol, and 4-methylphenol

Metals—Arsenic, cadmium, mercury, and zinc

Organic Compounds—Polycyclic aromatic hydrocarbons and polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (referred to collectively as chlorinated dioxins/furans).

Based on a rigorous evaluation of their potential risk to human health and ecological receptors, and the results of those risk evaluations (described in more detail below), many of these CoPCs were screened out after the 1996 sampling effort and were not further evaluated in 1997.

In 1997, the CoPCs that were retained and evaluated included ammonia, sulfide, phenol, and 4-methylphenol. TOC, BOD, and COD were also included as CoPCs; however, they were not

considered problem chemicals or causative agents for toxicity. They were included as CoPCs because they are general indicators of elevated levels of organic matter, which can be harmful to bottom-dwelling marine animals.

The concentrations of most of the CoPCs throughout large portions of the cove exceed the concentrations found in Moser Bay, a nearby site used as a "background" reference point. The highest concentrations of many of the CoPCs were found near the KPC facility and the fish cannery (see cannery location in Figure 1). There are differences from year to year in the distributions of some, but not all, CoPCs. The greatest differences occur for those CoPCs that may be susceptible to seasonal changes in biological activity (e.g., ammonia, 4-methylphenol). Concentrations of CoPCs in Ward Cove intertidal sediments were negligible.

Visual observations of deep sediment cores collected in Ward Cove and the associated chemical data indicate that impacts to sediment from activities at the KPC facility, including historical releases of pulping by-products and log handling activities, have resulted in a black, organic-rich layer of sediment that is distinct from native sediments. This layer of sediment is concentrated near the head of the cove offshore of the KPC facility and along the north shore, and generally ranges in thickness from 3 to 10 feet. This layer is distinguished from native sediment by higher concentrations of TOC, BOD, COD, ammonia, sulfide, phenol, and 4-methylphenol.

SUMMARY OF SITE RISKS

Human Health Risk Assessment

Conclusion -- A human health risk assessment was conducted to identify potential risks posed by chemicals detected in sediments or seafood (e.g., fish, shellfish, other edible marine invertebrates) from Ward Cove. No chemicals of concern were identified for human health. Thus, sediments in Ward Cove do not pose unacceptable risk to humans.

Analysis -- In the human health risk assessment, eating seafood that may contain chemicals bioaccumulated from sediments in Ward Cove was identified as the only complete exposure pathway for people. The chemicals that were evaluated included arsenic, cadmium, mercury, zinc, phenol, 4-methylphenol, chlorinated dioxins/furans, and polyaromatic hydrocarbons. Subsistence-level consumption rates were used to evaluate risks for all hypothetical current or future site users. Direct contact with sediments in Ward Cove is unlikely because of the depth of the water overlying affected sediments and the cold climate. While recreational use of the lower portion of Ward Creek could result in contact with sediments, transport of site-related CoPCs to this area is not expected. Thus, direct human contact with CoPCs in sediments is unlikely. However, to provide a worst-case analysis, this pathway was evaluated in the RI/FS.

Potential human health risks associated with chemicals in Cove sediments were evaluated using both estimated and measured concentrations of chemicals in seafood. Estimated concentrations

were based on application of Biota-Sediment Accumulation Factors to maximum sediment chemical concentrations. Measured concentrations were based on chemical concentrations measured in seafood tissue (mussels, crabs, clams, and finfish) collected by previous investigators in Ward Cove. Estimated concentrations were consistently higher than measured concentrations. Both estimated and measured tissue concentrations were conservatively used to determine whether any chemicals detected in Cove sediments pose a potential risk to human health.

The level of acceptable risk considered by EPA and Alaska is consistent with EPA's NCP-designated acceptable risk range of 1 in 10,000 to 1 in 1,000,000 (i.e., 10^{-4} to 10^{-6}). This risk range means that an individual could face a 1 in ten thousand to a 1 in a million additional risk of developing cancer (over a lifetime) related to site-specific exposure conditions evaluated. In the RI/FS, risk-based concentrations were calculated using a target risk level of 1 in 100,000 (i.e., 10^{-5}), which is more conservative than the lower end of EPA's acceptable risk range for Superfund sites. Thus, use of this target risk level incorporates a measure of protection for exposure to carcinogens at the site. Non-cancer risks are evaluated using a hazard index. If a hazard index is less than 1, non-cancer effects are not expected from contaminant exposures at a site. A hazard index of greater than 1 may indicate a potential adverse health effect from chemical exposure.

Ecological Evaluation

The ecological evaluation of Ward Cove sediments consisted of an *assessment of sediment toxicity* throughout the cove and a *food-web assessment* to estimate risks of CoPCs in sediments to representative birds and mammals at the top of the Ward Cove food web, as discussed below. Surface sediments were collected from 44 different stations in Ward Cove for these assessments. Surface sediments (i.e., the top 10 cm) were collected and analyzed because bottom-dwelling organisms (e.g., worms, clams), known as the "benthic community," live only in these upper sediments; benthic organisms do not live in the deeper sediments.

Sediment Toxicity Assessment

Conclusion -- Sediment contamination in certain portions of Ward Cove poses a risk to bottom-dwelling animals (i.e., the benthic community) that live in the sediments. The chemicals of concern (CoCs) identified for sediment toxicity are ammonia, sulfide, and 4-methylphenol.

Analysis -- The primary objective of the sediment toxicity assessment was to identify any potential areas in Ward Cove that may pose a risk to organisms that live within the surface sediments of the cove. The sediment toxicity assessment was based primarily on the evaluation of the following types of information collected at individual stations: 1) concentrations of CoPCs in Ward Cove surface sediments in comparison to sediment quality values; and, 2) results of surface sediment toxicity tests performed in a laboratory by exposing four different marine animal species to sediment from the bottom of Ward Cove.

Results of the sediment toxicity assessment included:

- Most stations at which CoPCs exceeded their respective sediment quality values were located offshore from the KPC facility and downcurrent from the KPC facility along the northern shoreline of Ward Cove. Exceedances were also found offshore from the fish cannery on the southern shoreline of the cove.

- Most exceedances of sediment quality values at the stations sampled in Ward Cove were for ammonia and 4-methylphenol. Although sediment quality values were not available for sulfide, specialized laboratory tests suggest that this chemical may contribute to the observed sediment toxicity. There are no "hot spots" of contamination (i.e., there is not a small portion of the area that contains most of the problem sediments), rather the contaminants are dispersed among 87 acres of sediments.

- Sediment toxicity was found in selected portions of the cove for two of the four marine animals (which were used as "indicator species") used to evaluate sediments.

As occurs in most natural environments, bottom-dwelling animals in the sediments in Ward Cove serve as a food source to larger invertebrates and fishes. Thus, if the toxicity of sediments affects the numbers or types of bottom-dwelling animals living in the sediments, then those changes in the structure of the benthic community may alter the feeding strategies of larger invertebrates and fish. Although this pathway was not directly evaluated in the RI/FS, it is recognized that sediment toxicity to benthic communities may affect the wider marine community.

Food-Web Assessment

Conclusion -- No chemicals of concern were identified for the food-web assessment. Thus, sediments in Ward Cove do not pose unacceptable risks to wildlife.

Analysis -- Food-web models were used to evaluate whether chemicals in the sediments of Ward Cove pose a potential risk of adverse effects to key ecological receptors in Ward Cove. Mammals evaluated were the harbor seal and river otter. Seabirds evaluated were the marbled murrelet and pelagic cormorant. These species were selected because their habitat-use characteristics suggest that they have the highest potential for exposure to *bioaccumulative chemicals* in Ward Cove. Bioaccumulative chemicals are those that can build up in tissues of organisms and can be passed to other organisms through the food chain. Risks were evaluated using the maximum and mean chemical concentrations found in Cove sediments and food-web models based on conservative, but realistic assumptions.

The bioaccumulative CoPCs evaluated in the food-web assessment were total mercury and chlorinated dioxins/furans, as well as other chemicals found in sediments at concentrations greater than reference conditions (i.e., arsenic, cadmium, zinc, and polyaromatic hydrocarbons).

Ammonia, sulfide, and 4-methylphenol are not bioaccumulative.

Exposure models indicate that no risks of harmful effects result from exposure to CoPCs through the food web for mammals or birds in Ward Cove. In addition, a model used to evaluate potential effects on early life stages of fish indicates that concentrations of chlorinated dioxins/furans in Ward Cove sediments are not adversely impacting fish.

AREA OF CONCERN

Based on results of the RI/FS, sediment contamination in certain portions of Ward Cove poses a risk to bottom-dwelling animals (i.e., the benthic community) living in the sediments. Sediment toxicity is believed to be from substances that are generated in place as a result of degradation of organic matter in the soft sediments. These substances are sulfide, ammonia, and 4-methylphenol.

The Area of Concern represents that area and/or volume of sediment within the Marine Operable Unit where cleanup may be warranted for protection of the benthic community. The boundaries of the Area of Concern were delineated using a weight-of-evidence approach recommended by EPA for evaluation of contaminated sediments, and is based on exceedances of sediment quality values at individual sampling stations. Because potential risks associated with human health and ecological food-web assessments were found to be acceptable, results of those studies were not used to delineate the Area of Concern.

Using this approach, 24 stations were designated as being part of a spatially contiguous Area of Concern of approximately 87 acres (Figure 2) out of the approximately 250 acres within Ward Cove. Within this Area of Concern, the total volume of organic-rich sediment, assuming an average thickness of 6 feet, is approximately 840,000 cubic yards.

[INSERT FIGURE 2]

REMEDIAL ACTION OBJECTIVES

Based on results of the KPC Marine Operable Unit investigations, sediments in Ward Cove have been found to pose a risk to bottom-dwelling marine animals (i.e., benthic communities) in the environment. Given the impact to benthic communities, the remedial action objectives (RAOs) for remediation of sediments within the Area of Concern are to:

- Reduce toxicity of surface sediments to benthic communities in Ward Cove.
- Enhance recolonization of benthic organisms that live in the surface sediments to support a healthy community of marine animals on the bottom of Ward Cove.
- Provide a community of benthic organisms that serves as an abundant food source to larger invertebrates and fishes in Ward Cove.

SUMMARY OF REMEDIAL ALTERNATIVES

In the RI/FS, potential remedial technologies were screened to identify those most appropriate for cleanup of sediments within the Area of Concern in Ward Cove. In general, the cleanup evaluation for contaminated sediments included leaving sediments in place to recovery naturally (termed "natural recovery"), leaving sediments in place and capping the sediments with clean sandy material (termed "capping"), removing sediments by dredging and disposing of the dredged materials (termed "dredging with disposal"), and treating sediments either in place or in an upland facility. If sediments were to be dredged, they could be disposed of in various ways. The range of disposal options that were considered included upland disposal (in an appropriate landfill), near-shore disposal (in a constructed facility along the shoreline), and confined aquatic disposal (which includes placement of dredged material in a submerged, aquatic site followed by capping of the dredged material with clean material).

Of these four general technologies, treatment was not considered a practicable alternative for Ward Cove sediments (see further discussion below). Thus, the remedial options that remained after screening (i.e., capping, dredging, and natural recovery) were formulated into the six alternatives that are presented below. The alternatives are numbered to correspond with the designations in the RI/FS report.

Alternative A1 - No Action. Superfund requires that the "no action" alternative be included to establish a baseline for comparison among alternatives. Under this alternative, EPA would take no action to prevent or reduce exposure to contaminants.

Alternative A2 - Natural Recovery; monitoring. This alternative depends on natural processes (e.g., sediment accumulation, mixing, chemical degradation and diffusion, benthic community succession) to achieve Remedial Action Objectives. Long-term monitoring to confirm recovery

is an important component of this alternative.

Alternative B - Thin cap; dredge 12,300 cy with upland disposal; natural recovery; monitoring. This alternative includes thin-layer capping of approximately 40 acres; dredging 12,300 cubic yards (cy) from 3 to 6 acres near the main dock with upland disposal (at either the KPC landfill for Option B1 or at an approved off-site landfill for Option B2); dredging is proposed to depths of -50 feet mean lower low water (MLLW) at the western end of the dock and to -24 feet MLLW at the eastern end of the dock; thin-layer capping of the dredged area unless native sediments are reached; natural recovery where capping is not practicable; and long-term monitoring**.**

Alternative C - Thin cap; dredge 80,000 cy with confined aquatic disposal; natural recovery; monitoring. This alternative includes thin-layer capping of approximately 34 acres; dredging 80,000 cy (up to 9 ft deep over approximately 7 to 8 acres) with confined aquatic disposal in Site 2 (located on the eastern shoreline of Ward Cove, directly east of the main KPC dock); thin-layer capping of the dredged area unless native sediments are reached; natural recovery where capping is not practicable; and long-term monitoring.

Alternative D - Thin cap; dredge 175,000 cy with disposal in nearshore confined disposal facility; natural recovery; monitoring. This alternative includes thin-layer capping of approximately 34 acres; dredging 175,000 cy (up to 9 ft deep over approximately 12 to 14 acres) with disposal in a nearshore confined disposal facility at Site 2 (located on the eastern shoreline of Ward Cove, directly east of the main KPC dock); thin-layer capping of the dredged area unless native sediments are reached; natural recovery where capping is not practicable; and long-term monitoring.

Alternative E - Thin cap; dredge 155,000 cy with disposal in nearshore confined disposal facility; natural recovery; monitoring. This alternative includes thin-layer capping of approximately 27 acres; dredging 155,000 cy (up to 9 ft deep over approximately 10 to 12 acres) with disposal in a nearshore confined disposal facility at Site 1 (located in the northern portion of the Area of Concern near KPC's log lift and main dock); thin-layer capping of the dredged area unless native sediments reached; natural recovery where capping is not practicable; and long-term monitoring.

Alternatives B through E include requirements on certain future activities to ensure continued recovery of bottom-dwelling animals in the sediments. Costs for each alternative (except "no action") are shown in Table 1, and are presented as total present worth (1999). Costs shown for the operation and maintenance category represent long-term monitoring costs, and are estimated based on 10 yrs of monitoring.

Table 1. Cost estimates for Remedial Alternatives

Alt.	Estimated Capital Cost	Estimated Operation and Maintenance Cost	Estimated "In-water" Cleanup Time (a)	Estimated Time to Meet Remedial Action Objectives
A2	$0	$450,000	0 months	8 to more than 20 yrs
B	$4,010,000(b) $5,180,000(c)	$450,000	6 months	Active Remediation - Less than 10 yrs; Natural Recovery - 8 to more than 20 yrs
C	$16,440,000	$450,000	Over 1 yr	Same as Alternative B
D	$32,300,000	$450,000	Over 1 yr	Same as Alternative B
E	$29,280,000	$450,000	Over 1 yr	Same as Alternative B

(a) "In-water" refers to the time period that construction-related activities occur in the field (e.g., barges are placing capping material).
(b) Disposal of dredged material at KPC landfill.
(c) Disposal of dredged material at Washington state landfill.

Common Elements for Alternatives

Thin-layer capping would be accomplished by slowly and gently distributing a thin layer (e.g., 12 inches) of clean sandy material on existing sediments. The purpose of thin capping is to provide suitable habitat for bottom-dwelling animals, which live in the top 4 inches of bottom sediments. Animals will be able to colonize in this newly-placed clean sandy material rather than trying to inhabit the existing toxic sediments. In general, the contaminated sediments that remain buried beneath a 6 to 12 inch cap of new material will be too deep for animals to live in. Thin-layer capping would reduce surface sediment toxicity to benthic organisms, enhance recolonization of surface sediments by benthic organisms (e.g., worms, clams), and provide an abundant benthic community that serves as a food source to larger invertebrates and fishes. As described in more detail in the RI/FS, there are other capping approaches that could be used to place clean sandy material on the bottom of Ward Cove. For example, the cap material could be placed as a series of mounds that extend out of the soft sediments (this type of placement is referred to as "island mounding").

Thin-layer capping is particularly suitable for the type of sediment present in Ward Cove, which has high water content and low compressive strength, and which does not contain persistent chemicals that are highly toxic or that have the potential to bioaccumulate to levels of concern in animals. It is important to understand that because human health and food-web ecological risks at this site were found to be within acceptable regulatory limits, it is not necessary for the cap to

provide complete physical isolation of the contaminated sediment from the marine environment.

For most alternatives, dredging of sediments in the vicinity of KPC's main dock is considered because it is believed that a cap could not be placed in this portion of the Area of Concern without affecting potential future navigation. The remedial alternatives considered different dredging volumes based on various navigational scenarios that considered dredging different areas and different depths offshore of the main dock at the KPC facility. The alternatives also considered different upland and in-water disposal options for the dredged materials. There are few potential disposal sites in Ward Cove for dredged sediment because of the geographic characteristics and limited size of the cove. In part, the different dredging volumes were also evaluated to illustrate capacity limitations of disposal sites and the very high unit costs involved in dredging and confining Ward Cove sediments.

Natural recovery is an integral component of EPA's national sediment management strategy, and is a critical component of the remedial alternatives evaluated for this site. The estimates of recovery provided here are regarded as the best practicable, given available data and a reasonable approach to natural recovery modelling. Natural recovery would be the selected remedy for those portions of the Area of Concern where capping (or island mounding) is impracticable or will not be performed. As set forth in the RI/FS, capping or island mounding is not considered practicable for those areas of the Area of Concern that are too steep (estimated to be areas with slopes greater than 25 percent), are too deep (estimated to be areas that are greater than 120 feet deep), or have a very-high density of aged sunken logs (as defined in the RI/FS). Additionally, a field study will be performed as part of future remedial design activities in Ward Cove to determine the maximum thickness of existing soft sediments that can be practicably capped (e.g., to determine whether capping material will "sink" into soft-bottom sediments).

Long-term monitoring would be required to evaluate changes in environmental conditions after active cleanup or natural recovery to ensure that the selected remedy is effective and that it remains protective of the environment.

For Alternatives B through E, reasonable restrictions or conditions on future activities that may adversely affect the continued recovery of the benthic community in the sediments will be implemented until RAOs are attained. As an example, activities, such as dredging projects, that may erode or displace large portions of the cap (thus exposing non-native sediments and adversely affecting the continued recovery of the benthic community in the sediments) will be required to replace the cap in exposed areas. It is expected that these restrictions will have minimal impact on development activities in the cove.

Aged sunken logs will be removed only from areas proposed for dredging. Sunken logs will not be removed from other areas because they do not pose a toxic risk to human health, and based on information available to EPA, aged sunken logs do not pose a known or suspected toxic risk to the environment.

EVALUATION OF REMEDIAL ALTERNATIVES

This section evaluates the different cleanup alternatives in accordance with the nine criteria from EPA's Superfund program. The detailed analysis of alternatives is in the RI/FS.

1. Overall Protection of Human Health and the Environment

Determines whether a remedial action eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Sediments in Ward Cove do not pose a risk to human health. Accordingly, alternatives are evaluated only on whether they protect the environment. All of the alternatives, except the "no action" alternative, would provide adequate protection of the environment by eliminating, reducing, or controlling risk through one or more of the following: capping, removal (i.e., dredging), and natural recovery. All alternatives, except the "no action" alternative, include long-term monitoring of the remedial alternative.

The "no action" alternative is typically used as a baseline for comparison of other alternatives. Because the "no action" alternative is not protective of the environment, it was eliminated from consideration under the remaining eight criteria.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Evaluates whether a remedial alternative meets state and federal environmental laws and regulations that pertain to the site or whether a waiver is justified.

All alternatives comply with federal and state ARARs.

There are no promulgated federal or Alaska cleanup standards for marine sediments. For the sediment toxicity assessment, the "sediment quality values" that were used to determine which areas of Ward Cove required remediation are based on the results of sediment toxicity tests and bulk chemistry data for surface sediments, portions of the State of Washington's sediment management standards (which are the only existing sediment standards in the U.S.), and site-specific sediment quality values that were developed for Ward Cove for selected chemicals using methods consistent with those used to develop the Washington State sediment management standards. Although neither Alaska nor EPA have a requirement or policy that the Washington State approach must be followed for contaminated sediment projects, portions of the State of Washington's sediment management standards were used for this site because they are considered environmentally protective and they have received extensive scientific and public review. Further, they have some natural applicability to the marine waters of Ward Cove because they are considered protective of Puget Sound, Washington marine species, many of which are found in southeast Alaska, including Ward Cove.

For the alternatives that involve dredging of sediments, the dredging itself would comply with turbidity requirements (or conditions for waivers) under Alaska's water quality standards, 18 AAC 70.020. For the alternatives that include disposal of dredged sediments, such sediments would be disposed in landfills that comply with state requirements for solid waste landfills, e.g., 18 AAC 60.300, or applicable off-site disposal requirements.

3. Long-Term Effectiveness and Permanence

Considers the ability of a remedial alternative to maintain protection of human health and the environment over time and the reliability of such protection.

The long-term effectiveness of cleanup in Ward Cove is measured by the existence of healthy benthic communities (e.g., worms and clams) in surface sediments. After contaminated sediments are capped, the existing benthic community will likely be eliminated through burial; however, the newly-placed clean sandy material will provide suitable habitat for recolonization by benthic animals. The toxic effects from the existing contaminated sediments are not expected to impact the new benthic communities; given the types of contaminants at this site, some mixing of contaminated and newly-placed sediments is not necessarily considered an unacceptable effect. Capping will not be effective in areas of Ward Cove where the cap materials are not expected to stay in place (e.g., areas that are too steep or too deep).

Dredging is necessary near the existing KPC dock in order to maintain navigational depths in Ward Cove. Because different dredging volumes were based on various navigational scenarios (i.e., dredging volumes were not risk-based), and because dredged areas will be capped after dredging (unless native sediments are reached), the degree of long-term effectiveness is similar among the different alternatives with various dredging options. In regards to the different options for disposal of dredged material (i.e., upland, near-shore confined disposal, and confined aquatic disposal), the effectiveness of upland and near-shore confined disposal facilities would be easier to inspect, monitor, and maintain than a confined aquatic disposal facility.

The least degree of long-term effectiveness is provided by natural recovery. Natural recovery takes a longer period of time (most likely 8 to more than 20 years) to become an effective cleanup solution in Ward Cove. Natural recovery works over time through a combination of natural processes -- e.g., sediment accumulation, mixing, chemical degradation and diffusion, benthic community succession -- where sediments are added to the existing layer and toxic effects diminish on their own. Benthic communities gradually inhabit the natural recovery areas as they become less toxic. Numerical modeling of quantifiable natural recovery processes indicates that recovery of the benthic community may take 8 to more than 20 years. The lower end of this range (i.e., 8 years) is based on the recovery of sulfide, which has been suggested to be the major cause of sediment toxicity in most areas of the cove (based on specialized toxicity tests). Evaluations of the results of case studies and empirical documentation of natural recovery suggest that benthic communities, in organically-rich environments such as Ward Cove, may recover within 10 years. In consideration of the numerical modeling results and the case study

evaluations, recovery of benthic communities in Ward Cove may occur within approximately 10 years. For this reason, long-term monitoring costs were estimated based on 10 years of monitoring.

All alternatives include long-term monitoring. The effectiveness and reliability of the selected alternative will be evaluated over time, and will be revisited at 5-year intervals to evaluate whether the response action remains protective of public health and the environment.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Evaluates a remedial alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of residual contamination remaining.

None of the alternatives proposes treatment of sediment for the primary purpose of reducing toxicity, mobility, or volume. Treatment technologies were considered, but were screened out of further consideration because there are currently no effective technologies for treating this type of contaminated sediment in place, and removal of contaminated sediments from the cove followed by upland treatment is not practicable because it would require significant material handling (e.g., removal, de-watering, transport, treatment of sediments and water, disposal of residual sludges after treatment) and extreme cost, over $100s of millions.

5. Short-Term Effectiveness

Considers the length of time needed to implement a remedial alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

Capping and navigational dredging could be completed and attain RAOs in about 10 years. Natural recovery is estimated to take 8 to more than 20 years to be an effective solution throughout Ward Cove. Capping is expected to achieve a more advanced stage of benthic recolonization over a shorter period of time, as compared to natural recovery, because clean sandy material will be available on the surface of the sediments.

Existing benthic communities would likely be eliminated by capping and dredging but communities are expected to recolonize quickly once clean sandy material is placed on the bottom of the cove. Because active cleanup would not occur in natural recovery areas, existing communities would not be eliminated.

Dredging or capping would also impact water quality (e.g., through the resuspension of clean or contaminated sediments). These impacts can be minimized by using available construction techniques and monitoring to contain to the extent practicable the resuspension of contaminants. Dredging or capping would also need to consider in-water regulatory restrictions based on fish protection (e.g., "fish windows"), and may temporarily disrupt water-dependent uses. The

potential for short-term impacts to water quality increase with the volume of sediments to be dredged.

Overall, capping combined with the most limited amount of navigational dredging has the greatest degree of short-term effectiveness.

Given that the source of the capping material will be from an upland source (e.g., a quarry), there are no environmental impacts associated with obtaining the cap material. None of the remedial alternatives are expected to adversely affect the remediation workers or the public.

6. Implementability

Considers the technical and administrative feasibility of implementing a remedial alternative, such as relative availability of goods and services. This criterion also considers whether the technology has been used successfully at other similar sites.

All remedial alternatives are implementable and have been used at other sites. However, there are uncertainties associated with implementing these alternatives at this site. Natural recovery (Alternative A2) and capping alternatives are the most easily implemented. Alternatives that involve extensive dredging (Alternatives C, D, and E) are the most difficult to implement because of the high water content and very soft, fine-grained nature of the site sediments.

For capping activities, a pilot study would be necessary to identify appropriate placement methods and limitations (e.g., areas where sediment is too soft to cap). For dredging, equipment type and de-watering concerns would require further evaluation. For disposal of dredged materials, landfill capacity is very limited in the Ketchikan area; therefore, some dredged material could be transported to Washington State for disposal. Constructing a confined aquatic disposal (CAD) site or near-shore confined disposal facility (NCDF) for dredged materials would be more difficult to implement than capping because of the high water content and very soft, fine-grained nature of the sediments. Capping the CAD would be difficult because of the low compressive strength and high water content of the sediments, and for both the CAD and NCDF implementation would need to be coordinated with future development.

7. Cost

Includes estimated capital and operation and maintenance costs.

Cost estimates are expected to be accurate within a range of +50 to -30 percent (see Table 1). Current estimates indicate that the natural recovery alternative is least costly, and thin capping combined with dredging and near-shore confined disposal of dredged material is the most costly. The incremental costs for Alternatives C, D, and E (compared to B) are disproportionate to their incremental environmental benefits.

8. State/Support Agency Acceptance

Considers whether the State supports EPA's analyses and recommendations of the RI/FS and the Proposed Plan.

The State of Alaska supports the preferred alternative as a reasonable alternative for Ward Cove.

9. Community Acceptance

Considers whether the local community agrees with the EPA's analyses and recommendations of the RI/FS and the Proposed Plan.

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the ROD for the site.

PREFERRED ALTERNATIVE

The preferred alternative for the Marine Operable Unit of the KPC site is Alternative B (see Figure 2) and includes the following elements:

- Placement of a thin layer cap of clean sandy material (approximately 12 inches thick) where practicable within the 87-acre Area of Concern. Thin-layer capping is estimated to be practicable for approximately 40 acres, but a pilot study will be performed to confirm cap design and construction issues, including:

  - Best placement method for the cap material (e.g., split hull barge, clamshell dredge)

  - Maximum water depth for capping (approximately 120 feet)

  - Maximum slope for capping (approximately 25 percent)

  - Maximum thickness of existing soft sediments that can be practicably capped (e.g., to determine whether capping material will "sink" into soft-bottom sediments). If thin-layer capping is proven infeasible or ineffective during the pilot study, the cap material could be placed as a series of mounds that extend out of the soft sediments (this type of placement is referred to as "island mounding"). If implemented, it is estimated that "island mounding" may only be practicable for approximately 21 acres.

- Areas that will not be capped include:

  - An area near the sawmill log lift where maintenance dredging generally occurs on an annual basis.

- An 8-acre area with a very high-density of sunken logs in the center of Ward Cove.

- Navigational dredging of approximately 12,300 cubic yards of sediments near the existing main KPC dock (an estimated area of approximately 3 to 6 acres). Dredging is recommended to support navigational needs, primarily because a cap could not be placed in this area without constraining potential future navigation.

  - Dredging is proposed to depths of -50 feet mean lower low water (MLLW) at the western end of the dock and to -24 feet MLLW at the eastern end of the dock. These depths were chosen in consideration of the maximum draft of vessels that may utilize the marine infrastructure at the site.

  - Sunken logs in this area will be removed.

  - After dredging, a thin-layer cap will be placed in dredged areas unless native sediments are reached during dredging.

- Disposal of dredged sediment in an upland landfill that is authorized to accept the material. Any logs from the dredged areas will also be disposed in an authorized landfill unless they can be otherwise used in a manner (e.g., hog fuel) that is acceptable to the regulatory agencies.

- Areas where capping is impracticable (e.g., too steep or too deep) or will not be performed will be designated as natural recovery areas. At this time, natural recovery is estimated for approximately 47 acres.

- Long-term monitoring in capped areas and in natural recovery areas to determine whether RAOs are being attained. The long-term effectiveness of cleanup in Ward Cove is measured by the existence of healthy benthic communities in the sediments.

- Until RAOs are attained, reasonable restrictions or conditions on future activities that may adversely affect the continued recovery of the benthic community in the sediments will be implemented. As an example, a dredging project that may erode or displace large portions of the cap (thus exposing non-native sediments and adversely affecting the continued recovery of the benthic community in the sediments) will be required to replace the cap.

With proper planning, the preferred alternative could be integrated with on-going and future development plans for Ward Cove.

Best Balance of Tradeoffs

The preferred alternative represents the best balance of tradeoffs under the nine evaluation

criteria. Because the contaminated sediments in Ward Cove do not pose unacceptable risks to human health or to wildlife, the key concern is how well the preferred alternative addresses risks to benthic communities living in the sediments.

Removal of all contaminated sediments within the Area of Concern was considered but rejected early in EPA's evaluation. There is a large volume of sediments in Ward Cove but they are of relatively low toxicity. Disposal of all contaminated sediments would be problematic given the few disposal options. The cost would be several hundreds of millions of dollars. Because there are other reasonable alternatives that address the risk posed by the sediments, removal of all problem sediments is not reasonable, practicable, or cost-effective.

Placement of a thin-layer cap, or dredging and removal of contaminated sediments followed by capping, provides suitable habitat for benthic communities. A thin layer cap, however, is much less expensive and poses far fewer implementation difficulties associated with disposal of tens or hundreds of thousands of cubic yards of sediments. At this site, EPA believes that dredging is only necessary and cost-effective in areas where dredging is necessary to accommodate navigational depths. In such areas, placing a thin layer cap after dredging will provide habitat for benthic communities.

In areas where placement of a thin cap is impracticable (e.g., areas that are too steep or too deep) or cannot be performed (e.g., sediments are too soft), reliance on natural recovery is reasonable. EPA expects that such areas will become suitable habitat for benthic communities through natural processes of decay of toxic materials and additions of sediments. The "tradeoff" is that these natural processes are estimated to take 8 to more than 20 years to provide recovery of healthy benthic communities.

This alternative is particularly suitable for the type of problem sediment present in Ward Cove, which has limited toxicity and does not contain persistent chemicals that are highly toxic or that have the potential to bioaccumulate. The applicability of thin capping is limited by physical constraints within Ward Cove (i.e., steep slopes along portions of the shoreline) and by the physical properties of Ward Cove sediments (i.e., where the soft, organic rich layer is thick).

Sunken logs will only be removed in areas where dredging is performed. Sunken logs in and of themselves are not toxic and do not pose a threat to human health or the environment. EPA did not find a correlation between areas with a high density of sunken logs and sediment toxicity in Ward Cove. Because the logs are not located in nearshore or intertidal habitat that is important as juvenile fish habitat or feeding areas and because the logs are not likely to impact navigation, EPA concludes that removal of sunken logs from the 8-acre high-density area -- estimated to cost over $1 million -- is neither practicable nor cost-effective.

Based on information currently available, EPA believes that the preferred alternative provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. EPA expects the preferred alternative to satisfy the statutory requirement in CERCLA Section

121(b) to: 1) be protective of human health and the environment; 2) comply with ARARs (or justify a waiver); 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) justify not meeting the preference for treatment as a principal element of the remedy.

DEFINITIONS

Benthic community - Animals (e.g., worms, clams) living in the bottom sediments of a water body.

Bioaccumulative Chemicals - Chemicals that can build up in tissues of animals and can be passed to other organisms through the food chain.

Dredging - Removal or excavation of bottom sediments from a water body.

Island mounding - Placement of clean sandy material as a series of mounds that extend out of the soft contaminated bottom sediments.

Natural recovery - Natural recovery allows for contaminated sediments to remain in place and to recover over time through a combination of natural processes -- e.g., sediment accumulation, mixing, chemical degradation and diffusion, benthic community succession -- where sediments are added to the existing layer and toxic effects diminish on their own.

Protection of human health and the environment - Protection of people, wildlife (e.g., birds, mammals) and marine animals (including bottom-dwelling animals in sediments) from short-term and long-term risks by eliminating, reducing or controlling exposure to hazardous or toxic substances, pollutants or contaminants released into air, land or water.

Sediment quality values - In general, values are chemical concentrations in sediments and sediment toxicity test endpoints that are considered protective of benthic communities in sediments.

Sediment Toxicity - Sediments that may pose a risk to animals that live in the sediments.

Thin-layer capping - Placement of clean sandy material on top of contaminated sediments.