Record of Decision
Shoreline Site Northwest of Dry Dock #3
PEARL HARBOR NAVAL SHIPYARD AND INTERMEDIATE MAINTENANCE FACILITY, PEARL HARBOR, HAWAII

March 2010

Department of the Navy
Naval Facilities Engineering Command, Hawaii
400 Marshall Road
Pearl Harbor, HI 96860-3139

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-03-D-1837, CTO HC15

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ACRONYMS AND ABBREVIATIONS

§	Section
ACM	asbestos-containing material
ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIA	Controlled Industrial Area
DOH	Department of Health, State of Hawaii
EPA	Environmental Protection Agency, United States
FFA	Federal Facilities Agreement
HAR	Hawaii Administrative Rules
LUC	land use control
NAVFAC Hawaii	Naval Facilities Engineering Command, Hawaii
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NIRIS	Naval Installation Restoration Information Solution
no.	number
NPL	National Priorities List
PDF	portable document format
PHNC	Pearl Harbor Naval Complex
PHNSY & IMF	Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
RAB	Restoration Advisory Board
RAWP	Remedial Action Work Plan
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
TCRA	time-critical removal action
TSCA	Toxic Substances Control Act
U.S.	United States

1. Declaration

1.1 SITE NAME AND LOCATION

This Record of Decision (ROD) has been prepared by the United States (U.S.) Navy (Navy) for the Shoreline Site northwest of Dry Dock #3 (the "Shoreline Site") at the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility (PHNSY & IMF), Pearl Harbor, Hawaii (Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information System Identification HI4170090076). The Shoreline Site is located northwest of Dry Dock #3 inside the Controlled Industrial Area (CIA) of the PHNSY & IMF, which is located within the Pearl Harbor Naval Complex (PHNC) on the island of Oahu, Hawaii (Figure 1). The PHNC is listed on the National Priorities List (NPL), which identifies priorities among known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories.

This ROD has been prepared for the Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii) under the Comprehensive Long-Term Environmental Action Navy III program, contract number (no.) N62742-03-D-1837, contract task order no. HC15.

1.2 STATEMENT OF BASIS AND PURPOSE

This ROD documents for the Administrative Record the decision by the Navy and the U.S Environmental Protection Agency (EPA) that a concrete cover over exposed surface soil, land use controls (LUCs), routine inspections, and long-term management are necessary for the Shoreline Site to provide long-term protection of human health. The final remedy was chosen in accordance with the CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is supported by information contained in the Administrative Record file for the Shoreline Site. The State of Hawaii Department of Health (DOH) concurs with this decision as indicated by signatures contained in Section 1.7 of this ROD.

1.3 SITE ASSESSMENT

The selected final remedy presented in this ROD is necessary to protect human health from actual or threatened exposure to residual asbestos fibers in surface and subsurface soil at the Shoreline Site and from exposure to asbestos-containing material (ACM), such as the previously identified refractory cloth and cement kiln bricks (Ogden 1998)[1], which may be present in subsurface rubble fill of the surrounding areas. Site activities that generate dust could result in airborne asbestos fibers posing an inhalation risk to site workers (Figure 2). Construction activities involving excavation or disturbance of subsurface soil at the site could also result in a potential for worker exposure to ACM (refractory cloth) that may be present in subsurface rubble adjacent to the previous removal action portions of the Shoreline Site. Therefore, the selected remedy is required to prevent these potential exposures and to provide long-term protection of human health and the environment.

[1] Text in blue font identifies where detailed site information is available via hyperlink while viewing this ROD in portable document format (PDF). The detailed information is viewable by clicking on the blue text within the PDF. In the event of any inconsistency between the text in this ROD and the text in any of the included hyperlinks, the text in this ROD will take precedence.

1.4 DESCRIPTION OF SELECTED REMEDY

The Navy and EPA, with the concurrence of the DOH, have determined that containment of soils with residual asbestos fibers (less than 1 percent in soil by volume) using a concrete cover over exposed surface soils, LUCs, routine inspections, and long-term management are necessary after completing a time-critical removal action (TCRA) to address asbestos contamination in soil at the Shoreline Site. In 1999 and 2000, approximately 30 cubic yards of ACM and impacted soil were removed from the Shoreline Site, reducing the volume of source material. Following the soil excavation, verification soil sampling indicated that the previously established cleanup goal of <1 percent asbestos fibers was achieved. However, because residual asbestos at levels below 1 percent may still pose a potential threat to human health, primarily through the inhalation pathway (no remedial standards or guidance exist as to what constitutes safe levels of asbestos fibers in soil), a surface cover over the exposed residual contaminated soil is needed to ensure the protection of public health. The concrete surface cover will provide an effective barrier for containment of soils with any residual ACM. Periodic monitoring and maintenance at the site will include inspection of the concrete cover and asphalt paved areas to ensure their integrity. In addition, while the ACM-containing refractory cloth was not observed to be present outside the boundaries of the TCRA area, kiln bricks were observed to be present. Since the areas outside the TCRA area have not been evaluated as to the presence or absence of ACM, as a conservative measure, LUCs will be implemented in the areas surrounding the immediate vicinity of the TCRA area so as to prevent exposure to ACM which may potentially be present.

LUCs will be instituted to ensure the current industrial land use is maintained at the site, and to prohibit any unauthorized land modifications. Examples of such land modifications include activities that might disturb the proposed concrete cap or the asphalt-paved areas that contain the office trailers for Navy personnel. If activities that may expose contaminated soil must occur, the Navy will ensure proper handling and disposal of the soil. LUCs placed in Navy land use registries (e.g., Naval Installation Restoration Information Solution [NIRIS], LUC tracker) will be discussed in the Remedial Action Work Plan (RAWP). These land use controls may include land use covenants (restricting site construction activities and land use to commercial/industrial only); notice of site contamination and land use restrictions; and Navy and EPA rights of access for purposes of site inspection and further response action, if necessary. Signage will also be installed at the site that will prohibit unauthorized disturbance of soil beneath the concrete cover, asphalt paved areas, and structures to avoid exposure of the buried residual ACM.

1.5 STATUTORY DETERMINATIONS

Executive Order No. 12580 delegates authority to the Navy to conduct CERCLA environmental cleanup and remediation activities at Navy sites. Therefore, the Navy is the lead agency for the Shoreline Site at the PHNSY & IMF. The Navy and EPA, with concurrence of the DOH, have determined that a concrete cover over exposed surface soils, LUCs, routine inspections, and long-term management are necessary to address the potential threats to human health and the environment from exposure to residual asbestos fibers in soil. This decision is based on the fact that the residual asbestos fibers at the Shoreline Site may be present at levels that do not allow for unrestricted use. The final remedy selected for the Shoreline Site is protective of human health and the environment, complies with federal requirements that are applicable or relevant and appropriate, is cost-effective, and uses, to the maximum extent practicable, permanent solutions and alternative treatment technologies.

The NCP, 40 CFR § 300.430(a)(1)(iii)(A), establishes the expectation that treatment will be used to address the principal threats at a site where practicable. The previous ACM and asbestos-contaminated soil removal action did not satisfy the statutory preference for treatment. The final

remedy selected for this site also does not satisfy the statutory preference for treatment as a principal element of the remedy because capping and LUCs does not achieve reduction of toxicity, mobility, or volume through treatment. It should be noted that asbestos fibers do not dissolve in water or evaporate and are resistant to heat, fire, chemical, and biological degradation. Therefore, traditional treatment technologies are ineffective, and disposal in a landfill is typically the recommended response action for asbestos in soil.

Residual asbestos fibers in Shoreline Site soils and rubble possibly containing ACM still may be present in the immediate surrounding areas. CERCLA Section 121(c), 42 U.S.C.§ 9621(c), and the NCP, 40 CFR §300.430(f)(4)(ii), requires that remedies resulting in hazardous substances remaining on site above levels that allow for unlimited use and unrestricted exposure must be subject to review every five years to assure that human health and the environment are being protected by the remedial action being implemented. The 5-year reviews will help ensure that the cover remains in place and is properly maintained, and that the LUCs are in place, properly maintained, and effective. The Navy is responsible for performing the 5-year reviews for the Shoreline Site.

1.6 DATA CERTIFICATION CHECKLIST

Based on the evaluation of analytical data and other information, the Navy and EPA have determined that a cover over exposed surface soils and LUCs are necessary to ensure the long-term protection of human health and the environment at the Shoreline Site. The previous removal actions completed at the Shoreline Site met the removal action objectives established at the time (less than 1 percent asbestos fibers in soil), but potential unacceptable risks to human health and the environment may still remain. The selected final remedy will be protective of human health and the environment and will allow continued industrial land use at the Shoreline Site. The following information supports this conclusion and is included in Section 2, Decision Summary of this ROD (additional information can be found in the Administrative Record file for this site, which can be found in the locations noted in Section 2.3):

- Current and potential future site and resource use (Section 2.6)
- Response action objectives (Section 2.7)
- Comparative analysis of alternatives (Section 2.8)
- Principal threat waste (Section 2.9)
- Selected final remedy (Section 2.10)
- Statutory determinations (Section 2.11)
- Documentation of significant changes (Section 2.12)

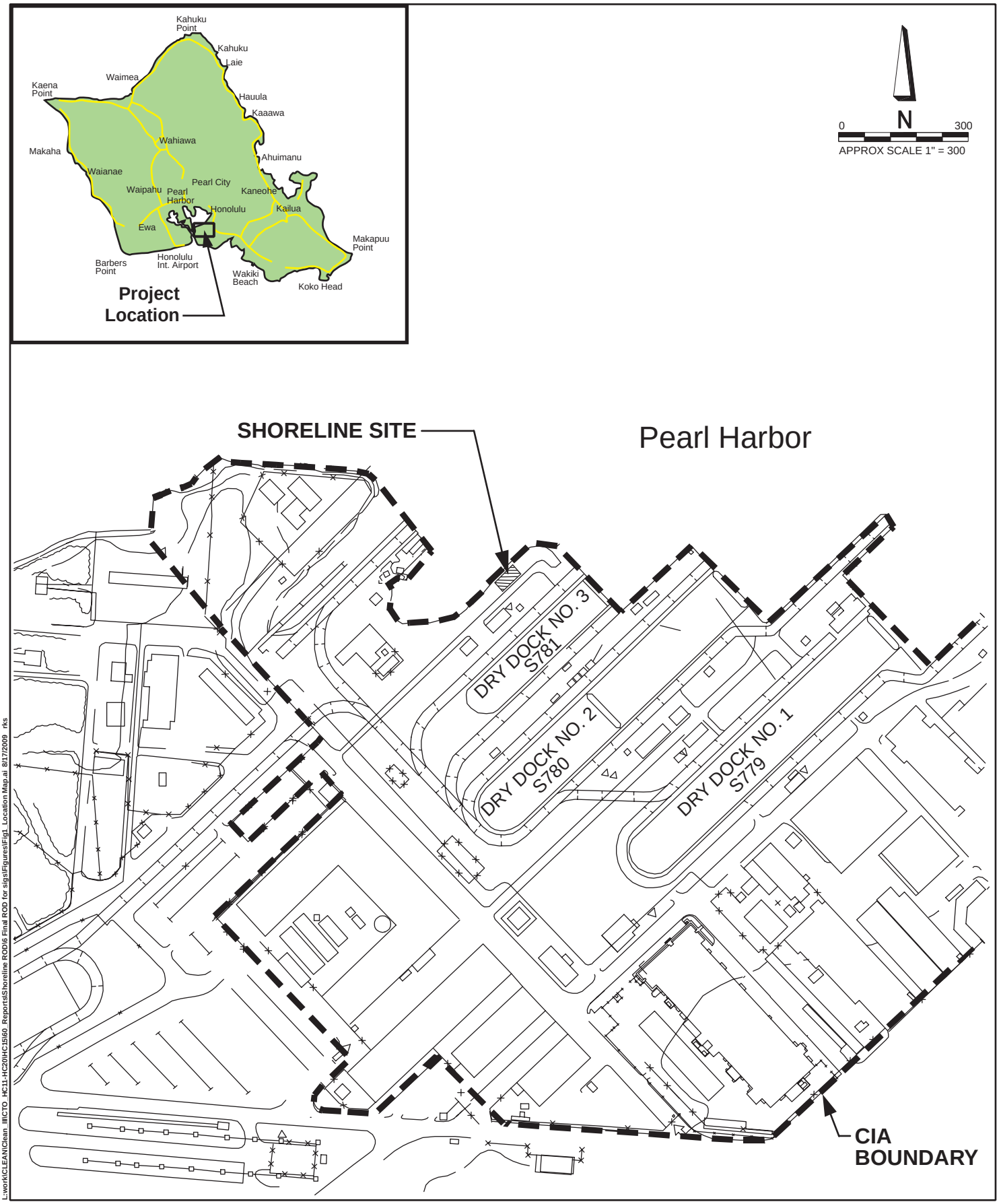

Figure 1
Location Map of Shoreline Site
Shoreline Site Northwest of Dry Dock #3
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu, Hawaii

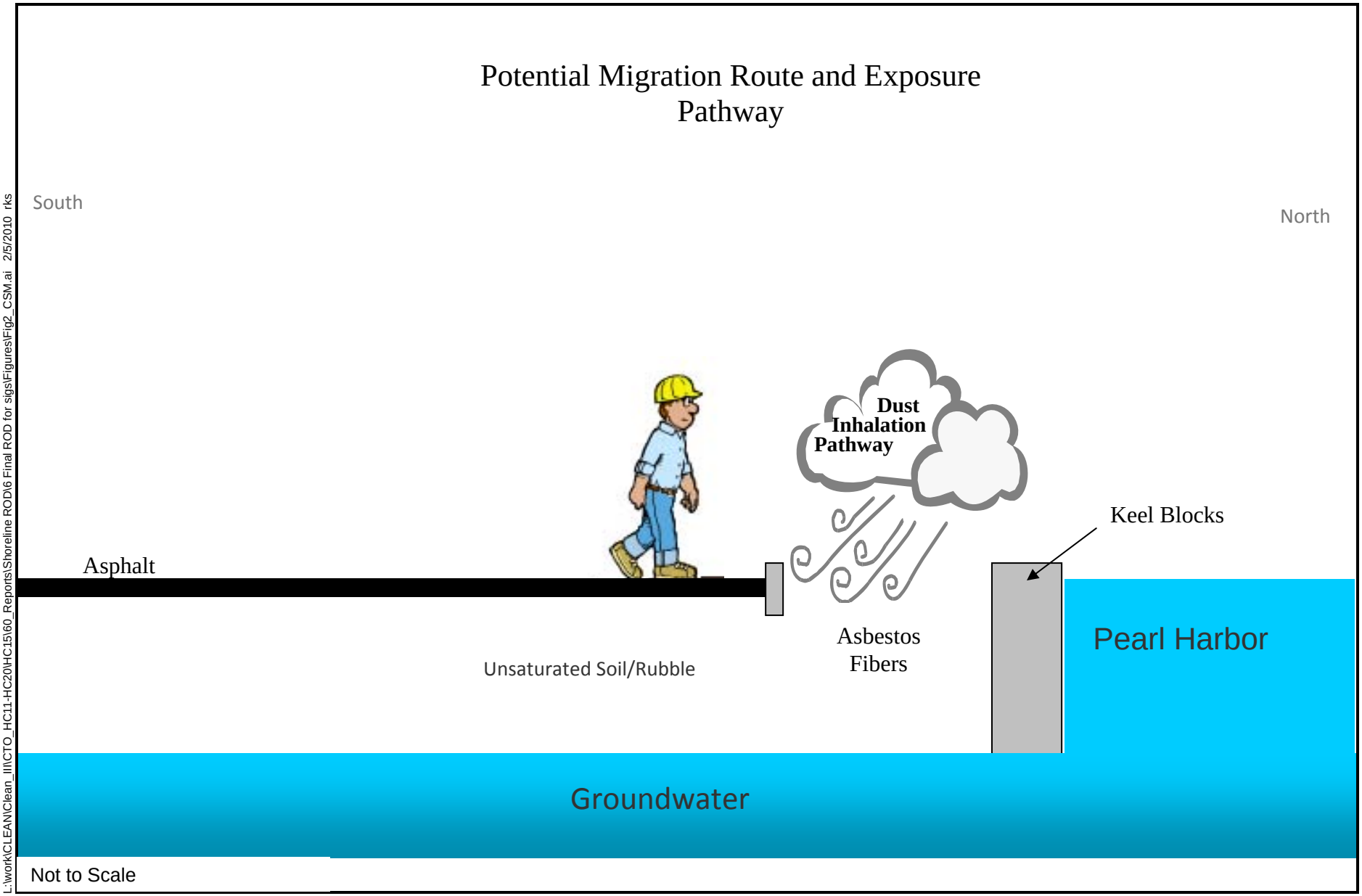

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Figure 2
Potential Migration Route and Exposure Pathway
Shoreline Site Northwest of Dry Dock #3
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu, Hawaii

1.7 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF FINAL REMEDY

The Navy and EPA, with concurrence from the DOH, have selected the remedy described in this ROD. The remedy includes installation of a concrete cover over exposed surface soil containing residual asbestos fibers, maintenance of the warning signage, concrete cover, and asphalt paved areas to ensure that the cover is in good condition, implementation of LUCs, routine inspections, and long-term management. CERCLA 5-year reviews will be necessary to ensure that the final selected remedy remains protective of human health and the environment.

Richard W. Anderson
Director
Occupational Safety, Health, and Environmental Office
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility

4/7/2010
Date

Michael Montgomery
Assistant Director, Federal Facility and Site Cleanup Branch
Superfund Division
U.S. Environmental Protection Agency, Region 9

7/2/10
Date

The State of Hawaii Department of Health concurs with the selected remedy as documented in this ROD.

Keith Kawaoka, D. Env.
Environmental Program Manager
Hazard Evaluation and Emergency Response Office
State of Hawaii, Department of Health

7-14-10
Date

2. Decision Summary

This section provides information regarding the site location and description, site history and enforcement activities, community participation, scope and role of the response action, site characterization, current and potential future site and resource use, response action objectives, comparative analysis of alternatives, principal threat waste, selected final remedy, statutory determinations, and documentation of significant changes to the original proposed remedy, which were necessary to protect human health and the environment.

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The Shoreline Site is located northwest of Dry Dock #3 inside the CIA of the PHNSY & IMF, which is located within the PHNC on the island of Oahu, Hawaii (Figure 1). The initial site boundaries consisted of a flat and narrow piece of land approximately 800-feet-long and 8-feet-wide that is elevated approximately 7- to 10-feet above the open water in the adjacent harbor. The shoreline is made up of a thin layer of coarse sand mixed with shell fragments, which overlays weathered bedrock. The site is sparsely vegetated and bordered by a paved area with office trailers to the east and south, and large, heavy concrete keel blocks and Pearl Harbor to the north and west. The site has subsequently been expanded eastward to include the paved area with office trailers (Figure 3). The size of the site is approximately 0.18 acre.

Previous investigations identified asbestos-containing cloth and asbestos fibers in soil that resulted in unacceptable risks to human health. These threats warranted a response action at the site. The Navy conducted a soil removal action at the Shoreline Site under the Navy's Environmental Restoration Program.

Executive Order 12580 authorizes the Navy to conduct environmental cleanup at Navy sites, such as the remediation activities at the Shoreline Site, with the Navy as the lead agency. The EPA and DOH have provided oversight during environmental investigations and remediation activities at the site.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 Site History

Pearl Harbor was established as a naval base for the Navy by act of Congress in 1908 to provide the United States with a permanent presence in the Pacific region. Construction of the first dry dock began in 1909, and expansions of the harbor facilities continued through the 1940s. In mid-1941, the newly formed Pacific Fleet was permanently based at Pearl Harbor.

Historical aerial photographs indicate that the Shoreline Site area of Pearl Harbor may have been used to dock Navy surface vessels during World War II. The open water adjacent to the shoreline was used formerly to test subsurface vessel detection systems. Historically, rubble (including keel blocks and asbestos-containing cloth attached to cement kiln bricks) was used as fill material to stabilize this area.

Several environmental investigations and removal actions have been conducted at the Shoreline Site. Previous actions include:

- Navy laboratory analysis of suspected ACM during late 1993
- Site Evaluation (Preliminary Assessment and Site Inspection) at the Shoreline Site from June 1994 through April 1995 (Ogden 1998)

- Additional ACM sampling in August 1997 (Ogden 1997)
- TCRA for ACM and verification sampling from August 1999 to July 2000 (Earth Tech 2001)

The initial investigations concluded that potential human health risk at the site existed because of the presence of the asbestos. Site activities that generate dust could result in airborne asbestos fibers despite the placement of a tarpaulin cover in July 1994 over the area of concern, posing an inhalation risk to site workers. Construction activities involving excavation of subsurface soil could also result in a potential for worker exposure to ACM or asbestos-containing kiln bricks that may be present in subsurface rubble adjacent to the previous removal action portions of the Shoreline Site (Figure 2).

As a result, the Navy decided to perform a TCRA of the ACM-containing soils. Due to the time-critical nature of the removal action, an engineering evaluation/cost analysis discussing removal action alternatives was not prepared for the site. Nevertheless, four removal action alternatives were developed and evaluated against the nine NCP criteria prior to recommending the removal action: (1) No Action; (2) Maintain the tarpaulin cover and implement additional engineering controls (e.g., fencing, warning signs) and institutional controls restricting future access; (3) Construct a permanent cover (e.g., concrete) over affected area and apply other engineering controls (e.g., fencing, warning signs) and institutional controls restricting future site access; and (4) Excavation and offsite disposal. An Action Memorandum dated 9 February 2001 documents the decision to undertake the TCRA (DON 2001) and the selection of Alternative 4 (excavation and offsite disposal) as the preferred action.

Subsequently, the Navy conducted the removal action in several stages between August 1999 and August 2000. The goal of the removal action was to excavate and dispose of all materials with greater than 1 percent asbestos fibers. ACM debris was identified and removed within the initial 8-foot by 2-foot site. Additional ACM debris were identified, and the excavation was expanded to a 3-foot-wide area extending approximately 50 feet along the shoreline (Figure 3). During the removal work, the Navy observed cement kiln bricks and weathered asbestos-containing cloth buried roughly 3 to 5 feet below ground surface. This buried ACM was removed by the Navy Public Works Center in July and August 2000. The extent of the excavation was initially determined based upon the presence of the ACM-containing refractory cloth, and was subsequently confirmed through the collection of soil samples for analysis of asbestos. The total volume of asbestos-contaminated cloth, attached cement kiln brick, and surrounding soil removed from the site was 30 cubic yards (DON 2000). All ACM waste was transported off island to a facility approved to receive CERCLA/Toxic Substances Control Act (TSCA) wastes. The excavation was then backfilled with clean imported fill material.

As a result of the TCRA, Alternative 1 No Action was recommended as the final remedy in the 2006 *Proposed Plan Time-Critical Removal Action at the Shoreline Site Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Oahu, Hawaii* (DON 2006). A public comment period was held, and no comments that would impact the no further action (NFA) decision were received.

Following the Proposed Plan and public comment period, EPA issued a letter (Attachment D) which raised concerns about the protectiveness of the 1 percent asbestos fibers cleanup goal. Subsequent discussions and meetings among the Navy, EPA, and DOH led to the conclusion that the proposed NFA remedy may not be protective of human health. There was also a question whether the rubble fill underlying the paved areas with office trailers located east and south of the excavation may also contain ACM. As a result of these concerns and as a conservative measure, site boundaries were expanded to include these areas (Figure 4), and the removal action alternatives were re-evaluated.

PEARL HARBOR

CONCRETE PILLAR

KEEL BLOCKS

EDGE OF WATER

TOP OF SLOPE

BURIED PIPE

A B C 1 2 3 4 5 6

ELECTRICAL BOX

CONCRETE CURBING

OFFICE TRAILER

OFFICE TRAILER

OFFICE TRAILER

ASPHALT PAVEMENT

EDGE OF PAVEMENT

CUSHING STREET

DRY DOCK NO. 3

LEGEND

TCRA Area

- Limit of Initial Excavation
- Limit of First Excavation Extension
- Limit of Second Excavation Extension
- Limit of Third Excavation Extension
- Limit of Fourth Excavation Extension
- Area of Surface Soil Removal (January 2000)
- 1 — Approximate Size and Location of Inspection Hole (March 2000) with ID Number
- A — Approximate Size and Location of Inspection Hole (March 2000) with ID Number

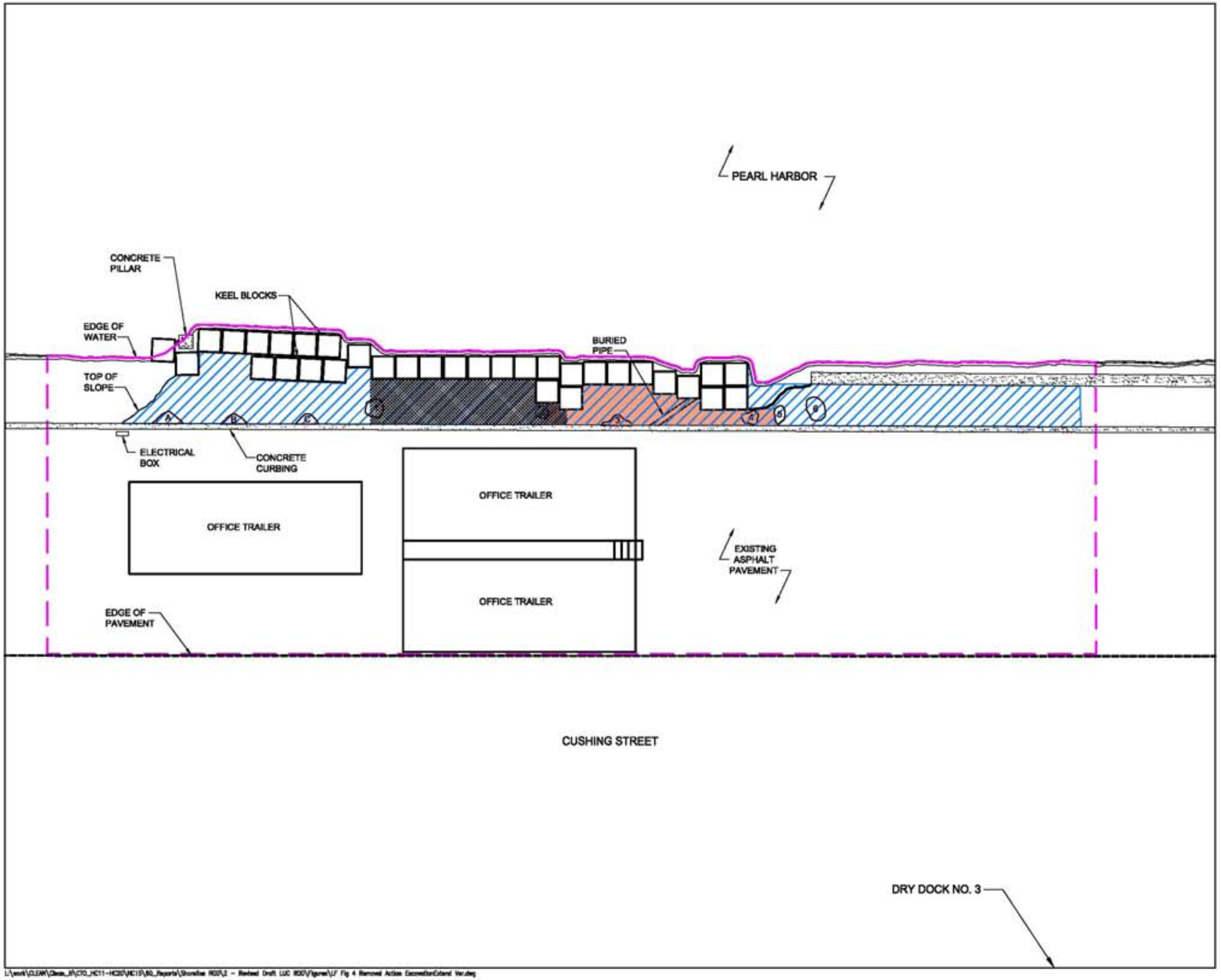
LOCATION MAP

N

0 10

SCALE 1"=10' (APPROXIMATE)

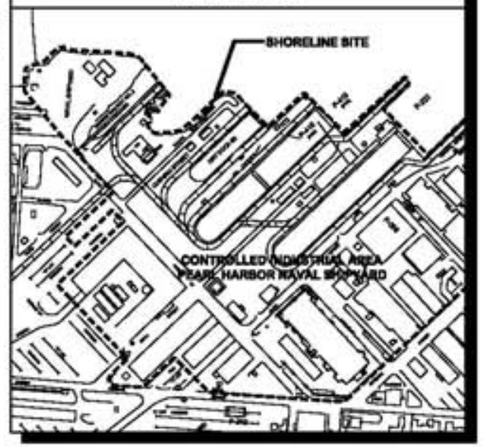
Figure 3
Limits of Removal Action Excavation
Shoreline Site Northwest of Dry Dock #3
Pearl Harbor Naval Shipyard and
Intermediate Maintenance Facility
Oahu, Hawaii



LEGEND

- TCRA AREA
- LAND USE CONTROL BOUNDARY
- UNPAVED AREA PROPOSED FOR CONCRETE COVER
- AREA OF SURFACE SOIL REMOVAL (JANUARY 2000)
- (1) APPROXIMATE SIZE AND LOCATION OF INSPECTION HOLE (MARCH 2000) WITH ID NUMBER
- (A) APPROXIMATE SIZE AND LOCATION OF INSPECTION HOLE (MARCH 2000) WITH ID NUMBER

LOCATION MAP



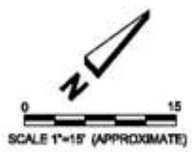


Figure 4
Proposed LUC Boundaries at the Shoreline Site
Shoreline Site Northwest of Dry Dock #3
Pearl Harbor Naval Shipyard and
Intermediate Maintenance Facility
Oahu, Hawaii

L:\work\CLEAN\Clean_III\CTO_HC11-HC20\HC15\SS_Reports\Shoreline RGT\2 - Revised Draft LUC RGD\Figures\LF Fig 4 Removal Action ExcavationExtent Ver.dwg

A final re-evaluation of the removal action alternatives, discussed in Section 2.8, has resulted in the recommendation for Alternative 3 as the preferred remedy for the Shoreline Site. Alternative 3, which was previously evaluated and determined to meet the evaluation criteria for effectiveness, implementability and cost, is deemed more protective of human health and the environment than the previously proposed NFA remedy.

2.2.2 Enforcement Activities

There have been no enforcement activities at the Shoreline Site.

2.3 COMMUNITY PARTICIPATION

Public participation in the decision process for environmental activities at the Shoreline Site has been encouraged throughout the investigation and cleanup of the site. In an effort to involve the public in the decision-making process at sites within the PHNC, a Restoration Advisory Board (RAB) composed of representatives of the Navy, EPA, DOH, and the community was established in 1994. The Navy also established contacts for the public at NAVFAC Hawaii.

Project documents, including work plans, technical reports, fact sheets, and other materials relating to the Shoreline Site investigations and removal actions, are on file in the information repository for the Shoreline Site, PHNSY & IMF, which is located at:

Pearl City Public Library
1138 Waimano Home Road
Pearl City, Hawaii 96782

Hamilton Library
University of Hawaii at Manoa
2550 McCarthy Mall
Honolulu, Hawaii 96822

Additional project information is located in the Administrative Record file at the Naval Facilities Engineering Command, Pacific. The address for the Administrative Record file is provided below:

Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Attn: NAVFAC PAC EV3
Pearl Harbor, Hawaii 96860-3134

2.4 SCOPE AND ROLE OF THE RESPONSE ACTION

The Shoreline Site is located at PHNSY & IMF, within the PHNC. PHNC is listed on the NPL, which identifies priorities among known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The Navy, EPA, and DOH, through a Federal Facilities Agreement (FFA) (DON 2004), have agreed to

- Ensure that environmental impacts associated with past and present activities conducted are thoroughly investigated and appropriate remedial actions are taken, as necessary, to protect public health, welfare, and the environment.
- Establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions in accordance with CERCLA, SARA, NCP,

Superfund guidance and policy, Resource Conservation and Recovery Act guidance and policy, and applicable State of Hawaii law.

- Facilitate cooperation, exchange of information, and participation of the Navy, EPA, and DOH.
- Ensure adequate assessment of potential injury to natural resources necessary to ensure the implementation of response actions appropriate for achieving suitable cleanup levels.

The previous cleanup activities at the Shoreline Site were designed to fulfill the objectives of the FFA for PHNC. Because the established soil cleanup goal of 1 percent asbestos is not risk-based but more a reflection of analytical detection limits, the EPA has determined that asbestos at levels below the 1 percent cleanup goal may not be protective of human health and the environment. Residual asbestos fibers in soil at any concentration may become airborne and subsequently inhaled causing potential damage to the respiratory system. For this reason, in accordance with CERCLA and the FFA, a revised remedy was required to ensure that this type of exposure to residual asbestos at the Shoreline Site does not occur.

2.5 SITE CHARACTERISTICS

The Shoreline Site is a flat 0.18-acre parcel of land bordering Pearl Harbor northwest of Dry Dock #3. Historical aerial photographs indicate that the area may have been used to dock U.S. Navy surface vessels during World War II. The sparsely vegetated site is elevated approximately 7 to 10 feet above mean sea level. A layer of uncompacted, coarse sand and fill material (coral, scrap metal, volcanic rock, concrete) overlies weathered bedrock at the site. An area of flat asphalt pavement leading to Dry Dock #3 borders the site to the east. Numerous office trailers for Navy personnel are set up on the pavement. Massive concrete keel blocks and the waters of Pearl Harbor border the site to the west.

2.5.1 Summary of Site Risks

The threat from ACM at the Shoreline Site is the potential current exposure of shipyard workers to airborne asbestos fibers. Asbestos is known to be hazardous to humans mainly by inhalation of small asbestos fibers. There are no known threats to the environment from ACM.

The potential threat to shipyard workers has been mitigated to a limited extent through the performance of the TCRA in 1999–2000 and backfilling the area found to contain ACM, which was then compacted with imported fill. However, as discussed in Section 2.2.1 above, residual ACM that may be present in subsurface rubble may pose a human health threat. Potential releases of airborne asbestos from this site, if not addressed by implementing remedial actions selected in this ROD, could endanger worker health. The recommended remedial actions would also alleviate possible human exposure to ACM through the prohibition of unsuitable (i.e., residential) redevelopment of the site in the future.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USE

The current and future use of the Shoreline Site is expected to remain as an undeveloped shoreline area adjacent to the support area for industrial activities at Dry Dock #3. Currently, the Shoreline Site is unused open space utilized by support personnel at Dry Dock #3 during break periods for various activities at Dry Dock #3. The PHNSY & IMF intend to continue this site use in the foreseeable future.

2.7 RESPONSE ACTION OBJECTIVES

The TCRA was conducted at the Shoreline Site to provide permanent long-term protection of human health and the environment from exposure to asbestos in ACM debris and in soils. The surface soil and ACM removal, and the excavation and removal of subsurface soil and ACM followed by disposal off-island at a facility approved to receive CERCLA waste, did provide long-term protection to human health and the environment. However, residual asbestos fibers below the original cleanup goal may be present in soil (such as beneath existing structures) and may still pose a risk to human health through the inhalation pathway.

The objectives of the selected final remedy are listed below, and consist of a concrete cover over exposed surface soils, LUCs, and long-term management:

- Prevent potential exposure to residual asbestos fibers in Shoreline Site soils through the installation and long-term management of a surface concrete cover.
- Prohibit the future development and use of the property for residential housing, elementary and secondary schools, child-care facilities, and playgrounds.
- Restrict excavation and construction activities within the LUC boundary to ensure that exposure to potential additional subsurface ACM debris or asbestos in soil does not occur.

The selected final remedy will be protective of human health and the environment through engineering and institutional controls, will comply with applicable or relevant and appropriate requirements (ARARs), and will achieve the response action objectives.

2.8 COMPARATIVE ANALYSIS OF ALTERNATIVES

The NCP, 40 CFR §300.430(e)(9)(iii), requires evaluation of response action alternatives by nine criteria for effectiveness, implementability, and cost. Table 1 summarizes the evaluation of the response action alternatives considered for the Shoreline Site.

Table 1: Comparative Analysis of Removal Action Alternatives with Nine Remedy Selection Criteria

Remedy Selection Criterion	Alternatives Evaluated			
	1. No Action	2. Engineering and Institutional Controls	3. Apply Concrete Cover with Engineering/ Institutional Controls	4. Excavation and Offsite Disposal
1. Overall Protection of Human Health and the Environment	Provides only short-term protection of human health for as long as the existing cover lasts. There is no known ecological threat from exposure to asbestos.	Provides short-term protection of human health but may not be effective in protecting future human health. There is no known ecological threat from exposure to asbestos.	Provides protection of human health through the use of engineered barriers. There is no known ecological threat from exposure to asbestos.	Presently, there are no remedial standards or guidance concerning asbestos fibers in soil. Complete removal of all fill material at the site would provide protection of human health with proper procedures and long-term protection of human health through source removal. There is no known ecological threat from exposure to asbestos.
2. Compliance with ARARs	Does not comply with EPA asbestos disposal regulations regarding the cover construction specifications and the use of engineering and institutional controls in 40 CFR 61.151 (a)–(c), and (e).	Does not comply with EPA asbestos disposal regulations regarding cover construction specifications in 40 CFR 61.151(a)–(c), and (e).	Complies with EPA asbestos disposal regulations in 40 CFR 61.151(a)–(c), and (e).	Complies with EPA asbestos removal regulations in 40 CFR 61.151(d), and disposal regulations in 40 CFR 61.154 (c) and (e)-(g). Remedial standards or guidance applicable to asbestos fibers in soil do not presently exist.
3. Long-Term Effectiveness and Permanence	Not effective long-term nor does it provide a permanent solution.	Provides long-term effectiveness and permanence for as long as the engineering and institutional controls are maintained.	Provides long-term effectiveness and permanence through durable engineered barriers with proper maintenance, and for as long as engineering and institutional controls are maintained.	Effectiveness of an excavation and removal alternative cannot be adequately evaluated as there are no existing remedial standards or guidance as to what constitutes safe levels of asbestos in soil.
4. Reduction of Toxicity, Mobility, and Volume through Treatment	Does not reduce toxicity, mobility, or volume through treatment.	Does not reduce toxicity, mobility, or volume through treatment.	Does not reduce toxicity, mobility, or volume through treatment.	Does not reduce toxicity, mobility, or volume through treatment.
5. Short-Term Effectiveness	Prevents exposure in the short-term through engineered barriers for only as long as the soil treatment and existing cover lasts.	Prevents exposure in the short-term through presence of the existing compacted fill cover and existing structures/ concrete pavement, combined with other engineering and institutional controls.	Uses dust suppressants while grading the surface, mitigating short-term exposure concerns. Completely effective for the portions of the site which are already covered with structures or pavement.	Uses dust-suppressants during excavation, mitigating short-term exposure concerns.
6. Implementability	Technically feasible	Technically feasible	Technically feasible	While the technology to be employed (excavation and offsite landfilling) is common, and easily implemented, as there are no existing remedial standards or guidance as to what constitutes safe levels of asbestos in soil, it is technically impracticable.
7. Cost	$0	$172,992.00	$210,120.00	$not evaluated [b]

Remedy Selection Criterion	Alternatives Evaluated			
	1. No Action	2. Engineering and Institutional Controls	3. Apply Concrete Cover with Engineering/ Institutional Controls	4. Excavation and Offsite Disposal
8. State Acceptance	Not acceptable to the state based on non-compliance with state asbestos laws.	Not acceptable due to non-compliance with relevant and appropriate federal asbestos disposal laws.	Acceptable	Acceptable [c]
9. Community Acceptance	Likely to be accepted by the community. [a]	Likely to be accepted by the community.	Likely to be accepted by the community.	Likely to be accepted by the community. [c]

[a] The Navy presented the results of the removal actions at the Shoreline Site at a RAB meeting in March 2000 and issued two fact sheets in 2000. The RAB, at that time, was in agreement with an NFA decision for the Shoreline Site. The Navy also presented the proposed NFA final remedy in the Proposed Plan at a public meeting held on 20 June 2006 at Aiea Public Library. No comments that would impact the NFA decision were received during the public meeting or during the subsequent 30-day public comment period.

[b] The cost was not evaluated because this alternative is technically impracticable (See Remedy Selection Criterion 6).

[c] If remedial standards existed with which to base a removal action, it is presumed that both the State of Hawaii and the community would find this alternative acceptable.

Four alternatives were evaluated, taking into consideration the present site conditions and prior removal actions already undertaken at the site:

1. *No action.* The no action alternative assumes that site conditions will be left in their current state. For this response alternative, the remaining soil and debris fill will be left in place. While compacted fill is in place at the site to cover the previous area of excavation, and the remainder of the site is presently paved, the presence and integrity of the protective structures will not be monitored or maintained. No additional actions, such as installation of signage or fencing, or institutional controls (e.g., restrictive land use covenants, legal notices) will be undertaken.
2. *Land use controls (engineering controls and institutional controls).* The LUC alternative includes maintenance of the existing protective structures (i.e., compacted fill cover, asphalt pavement) that currently exist at the site. In addition, institutional (legal) controls and periodic site monitoring will be implemented to ensure the continued integrity and effectiveness of these controls. Institutional (legal) controls placed in Navy land use registries will include land use covenants (restricting site construction activities and limiting land use to commercial/industrial only), notice of site contamination and land use restrictions, and Navy, EPA and DOH rights of access for purposes of site inspection and further response action, if necessary.
3. *Land use controls plus construction of a permanent cover*. The primary distinction between this alternative and Alternative 2 is the addition of a permanent concrete cover for the existing unpaved area located immediately adjacent the shoreline. This area presently resides underneath a layer of compacted fill material, and was the location of the prior removal action. This concrete cover would be monitored and maintained throughout the lifetime of the LUCs.
4. *Excavation and offsite disposal*. This alternative would address the entire Shoreline Site, including both the narrow stretch of land alongside the Pearl Harbor shoreline that had previously undergone a limited removal action, as well as areas beneath the existing structures and asphalt pavement. This removal action would involve temporary relocation of existing structures and removal of existing asphalt pavement (with subsequent replacement), soil excavation, and removal of all remaining site debris and soil containing ACM with offsite disposal at an on-island facility approved to accept CERCLA waste. However, the extent of the excavation and total volume of media to be removed is not known because there are no existing remedial standards or guidance as to what constitutes safe levels of asbestos in soil. Should an excavation be undertaken, any such areas will be backfilled with clean, on-island soil. LUCs (i.e., engineering and institutional controls), long-term monitoring, and compliance reporting will not be required.

Alternative 1 is unacceptable, as present onsite workers and future construction workers would remain exposed to ACM within site soils.

While Alternative 2 may provide some level of short-term protection, the lack of maintenance does not ensure long-term protection of human health.

Alternative 3 is acceptable, as it would involve the construction of a physical barrier against potential exposure to ACM, a barrier which would be maintained throughout the lifetime of the LUCs.

Alternative 4 is technically impracticable. Currently the levels of residual asbestos in soil in the known ACM-impacted area are unknown, and it is uncertain as to the presence of ACM in the subsurface soils beyond those in the TCRA area (e.g., beneath existing structures). While the overall

approach (excavation and offsite landfilling) is common and can be easily implemented, there are no existing remedial standards or guidance as to what constitutes safe levels of asbestos in soil. Taken together with the high costs associated with pre-removal site preparation (i.e., temporary relocation of existing structures and removal of existing asphalt pavement), Alternative 4 is technically impracticable and not a cost-effective alternative for ensuring long-term protection of human health.

2.9 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that treatment will be used to address the principal threats (i.e., source material that is highly toxic and/or highly mobile) posed by a site wherever practicable. There are no practical methods for treating low levels of asbestos fibers in soil. However, the Navy has determined that the Shoreline Site does not meet the definition of "principal threat waste" as asbestos is easily contained through engineering controls (i.e., concrete cover). Therefore, potential exposure to residual asbestos fibers at the Shoreline Site will be controlled through both institutional and engineering controls.

The EPA and others continue to study the health risks associated with low concentrations of asbestos fibers in soil. Because the actual risk to human health from residual asbestos fibers below 1 percent has not been quantified through monitoring or modeling, a conservative approach to managing risk at the Shoreline Site will be applied. The final remedy proposed in this ROD is designed to prevent potential exposure to any concentration of residual asbestos fibers through both institutional and engineering controls.

2.10 SELECTED FINAL REMEDY

2.10.1 Summary of the Rationale for the Selected Final Remedy

The selected final remedy for the Shoreline Site consists of containment (installation and maintenance of a concrete cover) for residual ACM in surface and subsurface soils coupled with LUCs. This selection is based on the following:

- The need to protect site workers and visitors from potential exposure to surface and subsurface soils containing residual levels of asbestos fibers.
- The need to control activities and land use at the Shoreline Site in the area defined as the LUC boundary to ensure the effectiveness of the selected final remedy.
- Absence of any principal threat wastes at the Shoreline Site.
- The comparative analysis of the four response action alternatives discussed in Section 2.8, which determined that the selected final remedy represents the best balance of the decision criteria (i.e., it is protective of human health and the environment, complies with ARARs, reduces contaminant mobility, and is cost-effective).

2.10.2 Description of the Selected Final Remedy

A concrete cover over exposed soils at the Shoreline Site, LUCs, regular inspections, and long-term maintenance and management of the cover are selected as the final remedy for the Shoreline Site. LUCs will be established because of the potential for additional ACM being present in subsurface rubble in areas in the vicinity of the 2000 removal action excavation area of the Shoreline Site. Although these areas are currently protective of human health (i.e., covered with asphalt and/or compacted fill), possible future construction activities have the potential for exposing subsurface ACM that may be present within the Site. Specific procedures and requirements for conducting construction activities within the Site will be presented in a RAWP, which will be prepared by the

Navy following approval of this ROD. Elements of the selected final remedy are discussed in the following sections below.

Concrete Cover. Areas of exposed soil with the potential for containing asbestos fibers will be covered with concrete to ensure that inadvertent exposure by industrial workers does not occur. The estimated extent of the soils requiring a cover is shown on Figure 4.

Other Engineering Controls. The proposed boundary of the Shoreline Site as shown on Figure 4 will be surveyed, and warning signs will be installed at the corners and at intervals along the boundary lines.

Land Use Control Performance Objectives. The following objectives will be addressed through implementation of LUCs at the Shoreline Site:

- Protect human health by eliminating the surface and subsurface exposure pathway to potentially asbestos-contaminated soil through a concrete cover.
- Maintain the integrity of the concrete cover, asphalt paved areas, and the warning signage to ensure that the cover is in good condition, is functional, and remains protective of human health.
- Limit use and development of the property to only commercial/industrial uses. Incompatible development such as residential, schools, onsite day care centers, and playgrounds will be prohibited.
- Ensure that all future site users and environmental regulators are aware that asbestos contamination may be present at the site at concentrations that may pose a risk under certain exposure scenarios and that land use restrictions are imposed on the site to protect human health and the environment.
- Require that all personnel (e.g., excavation and construction workers) who conduct activities within the LUC boundaries that may result in the disturbance of subsurface materials be properly trained in the identification, handling, testing, and disposal of ACM and ensure that documentation of this training is maintained.
- Place LUCs in Navy land use registries (e.g., NIRIS, LUC tracker).

To meet the LUC objectives, land use will be restricted to activities that are compatible with maintaining the integrity of the surface cover to ensure the long-term viability of the remedy. As there is the possibility that similar ACM could be encountered in subsurface soil and rubble adjacent to the previous cleanup areas, the boundaries of the LUCs have been extended a distance beyond the known Site. The boundaries of the LUCs were selected as representing the approximate limit of the use of fill material, which may contain the ACM. Land use activities within the LUC area boundaries will be controlled using both institutional and engineering controls designed to protect onsite workers from potential exposure should additional ACM be encountered. Workers conducting activities within the LUC area boundary that would disturb the underlying soils and rubble will be required to be properly trained and certified in the identification, handling, and disposal of ACM. Navy verification of this training and certification will be required prior to the start of any activities involving the disturbance of the cover and underlying materials.

A RAWP will be prepared to describe the implementation actions for remedial action construction and LUCs, including implementation, maintenance actions and periodic inspections. In compliance with Section 8.3 of the FFA for the Pearl Harbor Naval Complex, within 21 days of ROD signature, the Navy shall prepare and submit to EPA for review and approval, proposed deadlines for

completion of all subsequent primary documents, including the draft RAWP. Agreements to the schedule of the subsequent primary documents shall follow the stipulations cited in the FFA. LUCs will be maintained in perpetuity, or until the concentrations of hazardous substances in the soil are at levels that allow for unrestricted use and exposure through the implementation of additional remedial efforts. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. The PHNSY & IMF is expected to remain under Navy control for the foreseeable future.

Five-year reviews will be required as long as the site is deemed unsuitable for unrestricted use. The Navy will be responsible for ensuring that these controls are implemented, maintained, reported on, and enforced.

Although the Shoreline Site is anticipated to remain under Navy control, should the Navy transfer procedural responsibilities for the Site to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity.

2.10.3 Summary of the Estimated Final Remedy Costs

Current estimated present-worth costs for planning, implementation, and long-term maintenance of Alternative 3, the selected final remedy for the Shoreline Site are $410,025. This includes the planning, installation, and long-term maintenance of a concrete cover for exposed surface soils. It also includes implementation of LUCs and 5-year reviews in accordance with CERCLA requirements. Details of these estimates, which are prepared using the Remedial Action Cost Engineering and Requirements software (Attachment C), are based on the best available information regarding the anticipated scope of the remedial alternative. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

2.10.4 Expected Outcomes of the Selected Final Remedy

The selected final remedy will reduce potential future human health and ecological risks by providing a cover over soils containing residual asbestos fibers and by preventing unauthorized activities that would disturb subsurface materials that may contain ACM. This will be achieved by the installation and long-term maintenance of a concrete cover over exposed surface soil, and existing asphalt pavement within the site boundary. It will also be achieved by establishing restrictions on land use at the site, including the prohibition on the building of residential properties, schools, day-care facilities, and playgrounds. Notification of the LUCs will be placed in Navy land use registries (e.g., NIRIS, LUC tracker). In addition, exposure to potentially contaminated subsurface materials will be controlled by allowing excavation within the LUC boundary only by personnel trained in the identification, handling, testing, and disposal of asbestos.

The selected final remedy does not reduce the toxicity or volume of contamination but does reduce the mobility by maintaining a cover over soils containing asbestos fibers. The remedy will also reduce the likelihood of contaminant migration through surface runoff and wind. Asbestos fibers are not water soluble and do not move through groundwater to any appreciable extent. Thus, asbestos is not considered a groundwater contaminant, and the groundwater pathway is not a concern at the Shoreline Site.

Because contaminants will remain at the Shoreline Site, the selected final remedy will not be compatible with unrestricted use. However, the Navy plans to continue industrial use of this site with access restricted to Navy personnel and their contractors.

2.10.5 Selected Final Remedy Ongoing Activities

Several elements of the selected final remedy for the Shoreline Site will require ongoing maintenance to remain protective of human health and the environment. The physical barrier covering the surface soils and warning signs will require regular inspections and occasional maintenance to ensure that they remain effective. In addition to these maintenance items, 5-year reviews are required to certify compliance with the LUCs and to evaluate the effectiveness of the final remedy.

2.11 STATUTORY DETERMINATIONS

2.11.1 Protection of Human Health and the Environment

The selected final remedy will be protective of human health and the environment by maintaining the integrity of the cover and controlling land use. Short-term exposure risks are avoided by leaving the impacted soils in place. The concrete cover over the exposed soils within the Shoreline Site will ensure that the residual ACM in the surface and subsurface soils are not disturbed, and will eliminate the inhalation pathway for onsite and offsite human and ecological receptors. The access controls and LUCs will ensure that the integrity of the cover is maintained and that unauthorized use of the site does not occur.

2.11.2 Compliance with ARARs

As required by CERCLA, SARA, and EPA policy, remedial actions are required to attain ARARs to the extent practicable. Previous removal actions at the Shoreline Site reduced asbestos fibers in soil to the standard cleanup goal of <1 percent. Although this cleanup goal was achieved, the EPA Region 9 has determined that this cleanup goal may not be protective. However, there are currently no alternative cleanup standards for asbestos in soil.

The concrete cap, signage, and LUC components of the selected final remedy are all in compliance with 40 CFR §61.151 (a)–(c) and (e) and Hawaii Administrative Rules (HAR) §11-501-13. By implementing these measures, the surface airborne asbestos pathway is eliminated by emplacement of a physical barrier between the soils with possible ACM and the ground surface, and through restriction of disturbance and removal of these soils through the physical barrier and LUCs.

Any future disposal of excavated subsurface soil would be conducted in accordance with land disposal restrictions for asbestos and requirements set forth in 40 CFR §61.151 (d) and §61.154 (c) and (e)–(g), and HAR §11-501-13 and §11-501-16.

During remedy implementation, work will adhere to relevant requirements set forth in 29 CFR §1910.1001 and §1926.1101, and HAR §12-145.1 to protect worker safety.

2.11.3 Cost Effectiveness

As shown in Section 2.8, the selected final remedy is cost-effective and represents a reasonable value for the expended public funding. Previous removal actions at the Shoreline Site significantly reduced the amount of asbestos in surface and subsurface soil. The costs of installing and maintaining a cover and for implementing and maintaining LUCs are reasonable while meeting the response action objectives and protecting human health and the environment.

2.11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected alternative represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner. Specifically, this alternative provides the best

short- and long-term effectiveness, is protective of human health and the environment, complies with ARARs, achieves response action objectives, is feasible, and reduces contaminant mobility through containment. The primary exposure pathway for asbestos is through inhalation of airborne fibers. The surface cover effectively eliminates this exposure pathway.

2.11.5 Preference for Treatment as a Principal Element

The final remedy does not satisfy the statutory preference for treatment as a principal element of the final remedy. The NCP, 40 CFR §300.430(a)(1)(iii)(A), establishes the expectation that treatment will be used to address the principal threats at a site where practicable. A principal threat waste is a source material considered to be highly toxic or mobile and cannot be contained in a reliable manner or would present a significant risk to human health and the environment should exposure occur. The Navy has determined that there are no principal threat wastes at the Shoreline Site.

2.11.6 Five-Year Review Requirement

Because soils that may contain ACM will remain at the Shoreline Site, unrestricted land use and unrestricted exposure will not be allowed. As a result, the CERCLA 5-year review requirement will apply to this site for as long as contamination posing a potential risk to human health and the environment is present.

2.12 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan identified NFA as the Navy's recommended alternative (DON 2006). The Proposed Plan was released for public comment on 11 June 2006, and a public meeting regarding the Proposed Plan was held on 20 June 2006.

The Navy received all written and verbal comments submitted by regulatory agencies on the Proposed Plan and addressed them during the public meeting on 20 June 2006 as summarized in the Responsiveness Summary (Section 3). No public comments were received.

However, in a letter dated November 2006 (Attachment D), the EPA expressed a concern over the protectiveness of the 1 percent cleanup goal used for the removal action and the determination of NFA as the final remedy. The EPA and other agencies are conducting ongoing research on health effects from exposure to asbestos fibers, and it has been determined that the previously established cleanup goal of 1 percent, which was based largely on analytical detection limits rather than being risk-based, may not be protective of human health. As a result, EPA, DOH, and Navy personnel met in January 2007 to further discuss the issue, whereby an agreement was reached that a revised remedy is required to ensure the long-term protection of human health and the environment.

Under the NCP, 40 CFR §300.430(f)(3)(ii), an alternative remedy selected after publication of the Proposed Plan that significantly changes the basic features of the remedy with respect to scope, performance, or cost does not require additional public comment if the changes could have been anticipated by the public based on the alternatives discussed in the Proposed Plan and supporting documentation in the administrative record. The change of the selected final remedy from NFA (Alternative 1) to Alternative 3, concrete cover, LUCs, routine inspections, and long-term management, constitutes a significant change. However, as presented in the Proposed Plan, the final remedy proposed in this ROD was previously evaluated and determined to meet the evaluation criteria for effectiveness, implementability, and cost. In fact, the selected final remedy is more protective of human health and the environment than the previously proposed NFA remedy. Because Alternative 3 was previously discussed in the Proposed Plan, the public could reasonably anticipate this change in the remedy and no revised Proposed Plan and additional public comment are needed. In the case of the Shoreline Site, the conclusion by the Navy and the regulatory agencies that the

previously accepted cleanup goal may not be adequately protective changes the performance goal of the NFA remedy. If the 1 percent cleanup goal for asbestos cannot be demonstrated to be protective, the NFA remedy would no longer meet the remedial action objective of protecting human health and the environment. Alternative 3 provides a cost-effective, long-term alternative that meets the remedial action objective for the Shoreline Site.

3. Responsiveness Summary

The public comment period for the Proposed Plan was held between 11 June and 11 July 2006. No written comments were received during this period; however, verbal comments were received during a public meeting for the Proposed Plan held on 20 June 2006. Responses to these verbal comments are presented in Attachment A.

3.1 COMMUNITY PREFERENCES

No community preferences were requested or identified.

3.2 INTEGRATION OF COMMENTS

The comments received and the corresponding responses to them for the Proposed Plan are integrated above. No changes to the decision were indicated in these comments.

4. References

40 Code of Federal Regulations (CFR) Part 300. *National Oil and Hazardous Substances Pollution Contingency Plan*. Available: http://ecfr.gpoacess.gov.

Department of the Navy (DON). 2000. *Time-Critical Removal Action at the Shoreline Site NW of Dry Dock #3 Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Fact Sheet No. 2*. Pearl Harbor, HI: Pacific Division, Naval Facilities Engineering Command. October.

———. 2001. *Action Memorandum. Subject: Action Memorandum for a Time-Critical Removal Action along the Shoreline Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard, Hawaii.* Pearl Harbor, HI: Pacific Division, Naval Facilities Engineering Command. 9 February.

———. 2006. *Proposed Plan, Shoreline Site Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Oahu, Hawaii*. June.

Earth Tech, Inc. 2001. *Remediation Verification Report, Time-Critical Removal Action along the Shoreline Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Oahu, Hawaii*. Pearl Harbor, HI: Pacific Division, Naval Facilities Engineering Command. August.

Ogden Environmental and Energy Services Co., Inc. (Ogden). 1997. *Letter Report, Asbestos-Containing Material Sampling of Shoreline Site, Pearl Harbor Naval Shipyard, Pearl Harbor, Hawaii*. Pearl Harbor, HI: Pacific Division, Naval Facilities Engineering Command. September.

———. 1998. *Revised Final Site Evaluation Report, Site Evaluation of Three Sites: Building 6, Transportation Yard, and Asbestos Shoreline, Naval Shipyard, Pearl Harbor, Hawaii*. Pearl Harbor, HI: Pacific Division, Naval Facilities Engineering Command. July.

Attachment A
Responsiveness Summary

Project Title: Record of Decision (ROD) for the Shoreline Site
Northwest of Dry Dock #3, Shipyard Geographic Study Area
Pearl Harbor, Hawaii
Proposed Plan Public Meeting
Date: 20 June 2006

Comment No.	Speaker	Comment
1	Steven Mow, Hawaii Department of Health	Is the Navy implementing land use controls for the paved area adjacent to the Shoreline Site?
Response: No, the Navy is not implementing land use controls for the area adjacent to the Shoreline Site. However, as a precautionary measure, the paved area adjacent to the site will be identified in the Navy's planning tool and appropriate engineering and public works departments will be notified of the potential for buried ACM and kiln bricks in this area adjacent to the Shoreline Site.		
2	Steven Mow, Hawaii Department of Health	Why was the public meeting held at the Aiea Public Library?
Response: Public and RAB meetings for sites within the Pearl Harbor Naval Complex are held throughout the surrounding community, including at Leeward Community College and other public libraries.		

Attachment B
Detailed Reference Table

Table B-1: Detailed Reference Table

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
1	Ogden 1998	Section 1.3, page 1	Revised Final Site Evaluation Report, Site Evaluation of Three Sites: Building 6, Transportation Yard, and Asbestos Shoreline, Naval Shipyard, Pearl Harbor, Hawaii, Section 1.2.4.3, page 13, Ogden, July 1998.
2	12580	Section 1.5, page 2	Presidential Executive Order 12580; 52 FR 2923, 3 CFR 1987 Comp., page 193, January 1987.
3	Section (§) 300.430(a)(1)(iii)(A)	Section 1.5, page 2	40 Code of Federal Regulations (CFR) 300. National Oil and Hazardous Substances Pollution Contingency Plan. Available: http://ecfr.gpoacess.gov.
4	Section 121(c)	Section 1.5, page 3	40 Code of Federal Regulations (CFR) 300. National Oil and Hazardous Substances Pollution Contingency Plan. Available: http://ecfr.gpoacess.gov.
5	§300.430(f)(4)(ii)	Section 1.5, page 3	40 Code of Federal Regulations (CFR) 300. National Oil and Hazardous Substances Pollution Contingency Plan. Available: http://ecfr.gpoacess.gov.
6	Executive Order 12580	Section 2.1, page 11	Presidential Executive Order 12580; 52 FR 2923, 3 CFR 1987 Comp., page 193, January 1987.
7	Ogden 1998	Section 2.2.1, page 11	Revised Final Site Evaluation Report, Site Evaluation of Three Sites: Building 6, Transportation Yard, and Asbestos Shoreline, Naval Shipyard, Pearl Harbor, Hawaii, Section 1. Ogden, July 1998.
8	Ogden 1997	Section 2.2.1, page 11	Lett er Report, Asbestos-Containing Material Sampling of Shoreline Site, Pearl Harbor Naval Shipyard, Pearl Harbor, Hawaii, Executive Summary, Ogden, September 1997.
9	Earth Tech 2001	Section 2.2.1, page 12	Remediation Verification Report, Time-Critical Removal Action along the Shoreline Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Oahu, Hawaii, Section 2, Earth Tech, August 2001.
10	Action Memorandum	Section 2.2.1, page 12	Action Memorandum. Subject: Action Memorandum for a Time-Critical Removal Action along the Shoreline Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard, Hawaii, Section III, page 4, DON, February 2001.
11	cement kiln bricks	Section 2.2.1, page 12	Photographs of cement kiln bricks from RAB presentation.
12	DON 2000	Section 2.2.1, page 12	Time-Critical Removal Action at the Shoreline Site NW of Dry Dock #3 Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Fact Sheet No. 2, DON, October 2000.
13	Proposed Plan	Section 2.2.1, page 12	Proposed Plan, Time-Critical Removal Action at the Shoreline Site Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Oahu, Hawaii. Earth Tech, June 2006.
14	40 CFR §300.430(e)(9)(iii)	Section 2.8, page 19	40 Code of Federal Regulations (CFR) 300. National Oil and Hazardous Substances Pollution Contingency Plan. Available: http://ecfr.gpoacess.gov.
15	§300.430(a)(1)(iii)(A)	Section 2.11.5, page 26	40 Code of Federal Regulations (CFR) 300. National Oil and Hazardous Substances Pollution Contingency Plan. Available: http://ecfr.gpoacess.gov.
16	Proposed Plan	Section 2.12, page 27	Proposed Plan, Time-Critical Removal Action at the Shoreline Site Northwest of Dry Dock #3, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Oahu, Hawaii. Earth Tech, June 2006.
17	§300.430(f)(3)(ii)	Section 2.12, page 27	40 Code of Federal Regulations (CFR) 300. National Oil and Hazardous Substances Pollution Contingency Plan. Available: http://ecfr.gpoacess.gov.

Attachment C
RACER Cost Estimates

Estimate Documentation Report

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Estimate Documentation Report

Site Documentation:

Site ID:	Alternative 2
Site Name:	Alternative 2 Land Use Controls
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☐
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☐
Long Term Monitoring:	☐
Site Closeout:	☐

Documentation

Description:	Alternative 2: Land Use Controls Implement Land Use Controls prevent potential exposure to asbestos fibers in soil. Five-year Reviews are also included. Selected Phase is Remedial Action Construction
Support Team:	Keith Robertson AECOM 841 Bishop Street, Suite 500 Honolulu, HI 96813 808.523.8874
References:	Figure 4 Proposed Cover Area and LUC Boundaries at the Shoreline Site Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii

Estimator Information

Estimator Name:	Mike West
Estimator Title:	Senior Cost Engineer
Agency/Org./Office:	ERA | AECOM
Business Address:	5575 DTC Parkway Suite 200 Greenwood Village, CO 80111
Telephone Number:	303-224-6777
Email Address:	Mike.West2@aecom.com

Estimate Documentation Report

Estimate Prepared Date: 09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ Date: _____

Estimated Costs:

Phase Names	Direct Cost	Marked-up Cost
Alternative 2 Remedial Action LUCs	$181,408	$182,959
Total Cost:	$181,408	$182,959
Escalation:	$82,230	$82,803
Total Site Cost:	$263,638	$265,763

Estimate Documentation Report

Phase Documentation:

Phase Type:	Remedial Action
Phase Name:	Alternative 2 Remedial Action LUCs
Description:	Implement Land Use Controls. The selected technology is Administrative Land Use Controls. The Phase start date is October 2009 (FY2010).
Approach:	In Situ
Start Date:	October, 2009
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
Five-Year Review	No	0	0

Total Marked-up Cost: $182,959

Technologies:

Estimate Documentation Report

Technology Name: Administrative Land Use Controls (# 1)
User Name: ADMINISTRATIVE LAND USE CONTROLS

Description	Default	Value	UOM
System Definition			
Required Parameters			
Rename Model		ADMINISTRATIVE LAND USE CONTROLS	n/a
Planning Documents		Yes	n/a
Planning Documents: Start Date		2010	n/a
Implementation		Yes	n/a
Implementation: Start Date		2011	n/a
Monitoring & Enforcement		Yes	n/a
Monitoring & Enforcement: Start Date		2011	n/a
Modification/Termination		Yes	n/a
Modification/Termination: Start Date		2041	n/a
Type of Site		Active Government Installation	n/a
Planning Documents			
Required Parameters			
LUC Assurance Plan (LUCAP)		Yes	n/a
LUC Assurance Plan (LUCAP): Plan Complexity		Low	n/a
LUC Implementation Plan (LUCIP)		Yes	n/a
LUC Implementation Plan (LUCIP): Number		1	EA
LUC Implementation Plan (LUCIP): Plan Complexity		Low	n/a
Long-term Stewardship (LTS) Plan		No	n/a
Memorandum of Agreements (MOA)		No	n/a
Installation (or City) Master Plan		Yes	n/a
Installation (or City) Master Plan: Plan Complexity		Low	n/a
Construction Permitting		Yes	n/a
Construction Permitting: Number		1	EA
Construction Permitting: Plan Complexity		Low	n/a
Geographic Information Systems (GIS)/Overlay Maps		No	n/a
Planning Meetings			
Required Parameters			
LUCAP: Number of Meetings		1	EA
LUCAP: Number of People		1	EA
LUCAP: Number of Days		1	EA

Estimate Documentation Report

Technology Name: Administrative Land Use Controls (# 1)
User Name: ADMINISTRATIVE LAND USE CONTROLS

Description	Default	Value	UOM
Planning Meetings			
Required Parameters			
LUCAP: Airfare Cost		0	$
LUCAP: Mileage to Meeting Site		10	MI
LUCIP: Number of Meetings		1	EA
LUCIP: Number of People		1	EA
LUCIP: Number of Days		1	EA
LUCIP: Airfare Cost		0	$
LUCIP: Mileage to Meeting Site		10	MI
Master Plan: Number of Meetings		1	EA
Master Plan: Number of People		1	EA
Master Plan: Number of Days		1	EA
Master Plan: Airfare Cost		0	$
Master Plan: Mileage to Meeting Site		10	MI
Construction Permitting: Number of Meetings		1	EA
Construction Permitting: Number of People		1	EA
Construction Permitting: Number of Days		1	EA
Construction Permitting: Airfare Cost		0	$
Construction Permitting: Mileage to Meeting Site		10	MI
Implementation			
Required Parameters			
Modify Installation (or City) Master Plan		No	n/a
Deed Notification		No	n/a
Negotiating Easements		No	n/a
Restrictive Covenants		No	n/a
Equitable Servitudes		No	n/a
Access Control Signs		Yes	n/a
Access Control Signs: Number		1	EA
Access Control Signs: Task Complexity		Low	n/a
Utility Notification Service		Yes	n/a
Access Control Signs: Number		1	EA
Access Control Signs: Task Complexity		Low	n/a

Estimate Documentation Report

Technology Name: Administrative Land Use Controls (# 1)
User Name: ADMINISTRATIVE LAND USE CONTROLS

Description	Default	Value	UOM
Implementation			
Required Parameters			
Geographic Information Systems (GIS)/Overlay Maps		No	n/a
Develop Finding of Suitablility to Transfer (FOST)		No	n/a
Monitoring & Enforcement			
Required Parameters			
Duration of Monitoring/Enforcement		30	Years
Notice Letters		No	n/a
Guard Service/Security		No	n/a
Reports & Certifications		No	n/a
Site Visits/Inspections		Yes	n/a
Site Visits/Inspections: Number		1	EA
Site Visits/Inspections: Safety Level		D	n/a
Site Visits/Inspections: Duration		1	Days
Site Visits/Inspections: Number of People		1	EA
Site Visits/Inspections: Frequency		Annually	n/a
Site Visits/Inspections: Airfare		0	$ Per Ticket
Site Visits/Inspections: Mileage		10	MI
Modify/Termination			
Required Parameters			
Document Evaluation		Yes	n/a
Document Evaluation: Number		1	EA
Document Evaluation: Plan Complexity		Low	n/a
Modify LUC Documents		Yes	n/a
Modify LUC Documents: Number		1	EA
Modify LUC Documents: Plan Complexity		Low	n/a
Amend Decision Documents		Yes	n/a
Amend Decision Documents: Number		1	EA
Amend Decision Documents: Plan Complexity		Low	n/a
Termination Letters		No	n/a

Comments: Implement Land Use Controls in FY2011 as part of Alternative 2 for the Shoreline Site, Pearl Harbor, HI. Prepare planning documents and attend planning meetings. Perform Monitoring and Enforcement of the LUCs consisting of an annual site visit by one person for one day

driving 10 miles to the site. The LUCs would be modified/terminated after 30 years in FY2041. The labor hours were modifed to reflect the typical effort for implementing LUCs at Pearl Harbor.

Estimate Documentation Report

Technology Name: Five-Year Review (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Site Complexity		Low	n/a
Document Review		Yes	n/a
Interviews		Yes	n/a
Site Inspection		Yes	n/a
Report		Yes	n/a
Travel		No	n/a
Rebound Study		No	n/a
Start Date		October-2014	n/a
No. Reviews		6	EA
Document Review			
Required Parameters			
5-Year Review Check List		Yes	n/a
Record of Decision		Yes	n/a
Remedial Action Design & Construction		No	n/a
Close-Out Report		Yes	n/a
Operations & Maintenance Manuals & Reports		No	n/a
Consent Decree or Settlement Records		Yes	n/a
Groundwater Monitoring & Reports		No	n/a
Remedial Action Required		Yes	n/a
Previous 5-Year Review Reports		Yes	n/a
Interviews			
Required Parameters			
Current and Previous Staff Management		Yes	n/a
Community Groups		No	n/a
State Contacts		Yes	n/a
Local Government Contacts		Yes	n/a
Operations & Maintenance Contractors		No	n/a
PRPs		No	n/a
Remedial Design Consultant		Yes	n/a
Site Inspection			
Required Parameters			

Estimate Documentation Report

Technology Name: Five-Year Review (# 1)

Description	Default	Value	UOM
Site Inspection			
Required Parameters			
General Site Inspection		Yes	n/a
Containment System Inspection		No	n/a
Monitoring Systems Inspection		No	n/a
Treatment Systems Inspection		No	n/a
Regulatory Compliance		Yes	n/a
Site Visit Documentation (Photos, Diagrams, etc.)		Yes	n/a
Report			
Required Parameters			
Introduction		Yes	n/a
Remedial Objectives		Yes	n/a
ARARs Review		Yes	n/a
Summary of Site Visit		Yes	n/a
Areas of Non Compliance		Yes	n/a
Technology Recommendations		Yes	n/a
Statement of Protectiveness		Yes	n/a
Next Review		Yes	n/a
Implementation Requirements		Yes	n/a

Comments: Perform 5-Year reviews as the asphalt paving Dermal Cover remedial option at the Shoreline Site Pearl Harbor Oahu, HI.

Since the remedial approach for this site is Capping, the following Tasks were deselected from this technology:

Document Review:
Remedial Action Design & Construction (Due to 0.02 Acre, size of cap, this would be very minimal)
Groundwater Monitoring Data & Reports (not applicable since there is no monitoring)

Interviews:
Community Groups (Since this project is a small portion of an active Naval facility, there is not likely to be much community involvement.
O&M Contractors
Potentially Responsible Parties (PRPs)

The labor hours were adjusted to match the typical effort requred for a 5-Year Review at Pearl Harbor.

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID:	Alternative 2
Site Name:	Alternative 2 Land Use Controls
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☐
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☐
Long Term Monitoring:	☐
Site Closeout:	☐

Documentation

Description: Alternative 2: Land Use Controls
Implement Land Use Controls prevent potential exposure to asbestos fibers in soil.
Five-year Reviews are also included.
Selected Phase is Remedial Action Construction

Support Team: Keith Robertson
AECOM
841 Bishop Street, Suite 500
Honolulu, HI 96813
808.523.8874

Phase Technology Cost Detail Report
(with Markups)

References: Figure 4
Proposed Cover Area and LUC Boundaries at the Shoreline Site
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu. Hawaii

Estimator Information

Estimator Name: Mike West
Estimator Title: Senior Cost Engineer
Agency/Org./Office: ERA | AECOM
Business Address: 5575 DTC Parkway Suite 200
Greenwood Village, CO 80111
Telephone Number: 303-224-6777
Email Address: Mike.West2@aecom.com

Estimate Prepared Date: 09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ Date: _____

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type:	Remedial Action
Phase Name:	Alternative 2 Remedial Action LUCs
Description:	Implement Land Use Controls. The selected technology is Administrative Land Use Controls. The Phase start date is October 2009 (FY2010).
Approach:	In Situ
Start Date:	October, 2009
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
Five-Year Review	No	0	0

Phase Technology Cost Detail Report
(with Markups)

Technology: ADMINISTRATIVE LAND USE CONTROLS

Element: Planning Docs

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	40.00	HR	0.00	141.00	0.00	0.00	$5,640.00	☑	☐
33220105	Project Engineer	12.00	HR	0.00	116.00	0.00	0.00	$1,392.00	☑	☐
33220106	Staff Engineer	62.00	HR	0.00	100.00	0.00	0.00	$6,200.00	☑	☐
33220110	QA/QC Officer	12.00	HR	0.00	141.00	0.00	0.00	$1,692.00	☑	☐
33220114	Word Processing/Clerical	24.00	HR	0.00	60.00	0.00	0.00	$1,440.00	☑	☐
33220115	Draftsman/CADD	24.00	HR	0.00	85.00	0.00	0.00	$2,040.00	☑	☐
33220150	Technical Editor	12.00	HR	0.00	71.00	0.00	0.00	$852.00	☑	☐
33240101	Other Direct Costs	1.00	LS	378.70	0.00	0.00	0.00	$378.70	☑	☑
					Total Element Cost			$19,634.70		

Element: Planning Meetings

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010104	Sample collection, vehicle mileage charge, car or van	20.00	MI	0.00	0.00	0.00	0.49	$9.70	☑	☐
33010202	Per Diem (per person)	4.00	DAY	249.00	0.00	0.00	0.00	$996.00	☑	☐
33220102	Project Manager	8.00	HR	0.00	141.00	0.00	0.00	$1,128.00	☑	☐
33220105	Project Engineer	2.00	HR	0.00	116.00	0.00	0.00	$232.00	☑	☐
33220110	QA/QC Officer	4.00	HR	0.00	141.00	0.00	0.00	$564.00	☑	☐
33220114	Word Processing/Clerical	4.00	HR	0.00	60.00	0.00	0.00	$240.00	☑	☐
33240101	Other Direct Costs	1.00	LS	62.34	0.00	0.00	0.00	$62.34	☑	☑
					Total Element Cost			$3,232.04		

Phase Technology Cost Detail Report
(with Markups)

Element: Implementation

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
18010412	Construction Signs	18.00	SF	45.98	0.00	0.00	0.00	$827.63	☐	☑
33220102	Project Manager	15.00	HR	0.00	141.00	0.00	0.00	$2,115.00	☑	☐
33220105	Project Engineer	30.00	HR	0.00	116.00	0.00	0.00	$3,480.00	☑	☐
33220106	Staff Engineer	45.00	HR	0.00	100.00	0.00	0.00	$4,500.00	☑	☐
33220110	QA/QC Officer	6.00	HR	0.00	141.00	0.00	0.00	$846.00	☑	☐
33220114	Word Processing/Clerical	30.00	HR	0.00	60.00	0.00	0.00	$1,800.00	☑	☐
33220115	Draftsman/CADD	16.00	HR	0.00	85.00	0.00	0.00	$1,360.00	☑	☐
33240101	Other Direct Costs	1.00	LS	288.18	0.00	0.00	0.00	$288.18	☑	☑
					Total Element Cost			$15,216.81		

Element: Monitoring & Enforcement

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010104	Sample collection, vehicle mileage charge, car or van	10.00	MI	0.00	0.00	0.00	0.49	$4.85	☑	☐
33022038	Overnight delivery service, 1 lb package	3.00	LB	0.00	0.00	0.00	34.89	$104.68	☐	☑
33220102	Project Manager	3.00	HR	0.00	141.00	0.00	0.00	$423.00	☑	☐
33220106	Staff Engineer	10.00	HR	0.00	100.00	0.00	0.00	$1,000.00	☑	☐
33220114	Word Processing/Clerical	1.00	HR	0.00	60.00	0.00	0.00	$60.00	☑	☐
33220115	Draftsman/CADD	2.00	HR	0.00	85.00	0.00	0.00	$170.00	☑	☐
33240101	Other Direct Costs	1.00	LS	34.32	0.00	0.00	0.00	$34.32	☑	☑
					Total Element Cost			$1,796.85		

Phase Technology Cost Detail Report
(with Markups)

Element: Modification/Termination

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	30.00	HR	0.00	141.00	0.00	0.00	$4,230.00	☑	☐
33220105	Project Engineer	54.00	HR	0.00	116.00	0.00	0.00	$6,264.00	☑	☐
33220106	Staff Engineer	90.00	HR	0.00	100.00	0.00	0.00	$9,000.00	☑	☐
33220110	QA/QC Officer	13.00	HR	0.00	141.00	0.00	0.00	$1,833.00	☑	☐
33220114	Word Processing/Clerical	35.00	HR	0.00	60.00	0.00	0.00	$2,100.00	☑	☐
33220115	Draftsman/CADD	24.00	HR	0.00	85.00	0.00	0.00	$2,040.00	☑	☐
33240101	Other Direct Costs	1.00	LS	511.38	0.00	0.00	0.00	$511.38	☑	☑

Total Element Cost	$25,978.38
Total 1st Year Technology Cost	$65,858.77

Phase Technology Cost Detail Report
(with Markups)

Technology: Five-Year Review

Element: Document Review

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	8.00	HR	0.00	141.00	0.00	0.00	$1,128.00	☑	☐
33220105	Project Engineer	5.00	HR	0.00	116.00	0.00	0.00	$580.00	☑	☐
33220108	Project Scientist	4.00	HR	0.00	116.00	0.00	0.00	$464.00	☑	☐
33220109	Staff Scientist	8.00	HR	0.00	100.00	0.00	0.00	$800.00	☑	☐
					Total Element Cost			$2,972.00		

Element: Interviews

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220105	Project Engineer	9.00	HR	0.00	116.00	0.00	0.00	$1,044.00	☑	☐
					Total Element Cost			$1,044.00		

Element: Site Inspection

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	4.00	HR	0.00	141.00	0.00	0.00	$564.00	☑	☐
33220105	Project Engineer	4.00	HR	0.00	116.00	0.00	0.00	$464.00	☑	☐
33220108	Project Scientist	4.00	HR	0.00	116.00	0.00	0.00	$464.00	☑	☐
33220109	Staff Scientist	4.00	HR	0.00	100.00	0.00	0.00	$400.00	☑	☐
					Total Element Cost			$1,892.00		

Phase Technology Cost Detail Report
(with Markups)

Element: Report

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	6.00	HR	0.00	141.00	0.00	0.00	$846.00	☑	☐
33220105	Project Engineer	10.00	HR	0.00	116.00	0.00	0.00	$1,160.00	☑	☐
33220108	Project Scientist	13.00	HR	0.00	116.00	0.00	0.00	$1,508.00	☑	☐
33220109	Staff Scientist	10.00	HR	0.00	100.00	0.00	0.00	$1,000.00	☑	☐
33220114	Word Processing/Clerical	4.00	HR	0.00	60.00	0.00	0.00	$240.00	☑	☐
33220115	Draftsman/CADD	2.00	HR	0.00	85.00	0.00	0.00	$170.00	☑	☐

Total Element Cost	$4,924.00
Total 1st Year Technology Cost	$10,832.00
Total Phase Cost	$76,690.77

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID:	Alternative 3
Site Name:	Alternative 3 Permanent Cover w/ Land Use Controls
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☑
Long Term Monitoring:	☐
Site Closeout:	☐

Documentation

Description: Alternative 3: Permanent Cover with Land Use Controls
Install Dermal Cover over areas of bare ground to prevent potential exposure to asbestos fibers in soil.
Five-year Reviews are also included.

Selected Phases are Remedial Design, Remedial Action Construction and Operations and Maintenance.

Phase Technology Cost Detail Report
(with Markups)

Support Team:	Keith Robertson AECOM 841 Bishop Street, Suite 500 Honolulu, HI 96813 808.523.8874
References:	Figure 4 Proposed Cover Area and LUC Boundaries at the Shoreline Site Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii

Estimator Information

Estimator Name:	Mike West
Estimator Title:	Senior Cost Engineer
Agency/Org./Office:	ERA | AECOM
Business Address:	5575 DTC Parkway Suite 200 Greenwood Village, CO 80111
Telephone Number:	303-224-6777
Email Address:	Mike.West2@aecom.com
Estimate Prepared Date:	09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:	
Reviewer Title:	
Agency/Org./Office:	
Business Address:	
Telephone Number:	
Email Address:	
Date Reviewed:	

Reviewer Signature: _____ Date: _____

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type: Design Percent Method
Phase Name: Alternative 3 Remedial Design
Description: Accepted the recommended $10,000 minimum design cost for the In Situ Containment approach. The percentage is high due to small scale of project. Design would be performed in FY2010.

Total Capital Costs are the marked up costs for the Phase, excluding the Professional Labor Management, Administrative Land Use Controls, and Operations and Maintenance technologies. Only the first year costs are included for cost-over-time technologies.

Phase Name	Phase Date	Design Approach	Total Capital Cost	Design %	Design Costs	Design Cost Year
Alternative 3 Remedial Action Capping & LUCs	October, 2010	In Situ Containment	$5,480	182.48	$10,000	2010

Phase Technology Cost Detail Report
(with Markups)

Technology: Design Costs

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
32032001	Remedial Design Professional Labor	1.00	EA	0.00	10,000.00	0.00	0.00	$10,000.00	☐	☑

Total Element Cost	$10,000.00
Total 1st Year Technology Cost	$10,000.00
Total Phase Cost	$10,000.00

Estimate Documentation Report

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Estimate Documentation Report

Site Documentation:

Site ID:	Alternative 3
Site Name:	Alternative 3 Permanent Cover w/ Land Use Controls
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☑
Long Term Monitoring:	☐
Site Closeout:	☐

Documentation

Description:	Alternative 3: Permanent Cover with Land Use Controls Install Dermal Cover over areas of bare ground to prevent potential exposure to asbestos fibers in soil. Five-year Reviews are also included. Selected Phases are Remedial Design, Remedial Action Construction and Operations and Maintenance.
Support Team:	Keith Robertson AECOM 841 Bishop Street, Suite 500 Honolulu, HI 96813 808.523.8874
References:	Figure 4 Proposed Cover Area and LUC Boundaries at the Shoreline Site Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii

Estimator Information

Estimator Name:	Mike West
Estimator Title:	Senior Cost Engineer
Agency/Org./Office:	ERA | AECOM
Business Address:	5575 DTC Parkway Suite 200 Greenwood Village, CO 80111

Estimate Documentation Report

Telephone Number: 303-224-6777
Email Address: Mike.West2@aecom.com

Estimate Prepared Date: 09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information
Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ Date: _____

Estimated Costs:

Phase Names	Direct Cost	Marked-up Cost
Alternative 3 Remedial Design	$0	$10,000
Alternative 3 Remedial Action Capping & LUCs	$105,502	$108,790
Alternative 3 Operations and Maintenance	$98,931	$101,998
Total Cost:	$204,433	$220,788
Escalation:	$90,610	$93,139
Total Site Cost:	$295,043	$313,927

Estimate Documentation Report

Phase Documentation:

Phase Type: Design Percent Method
Phase Name: Alternative 3 Remedial Design
Description: Accepted the recommended $10,000 minimum design cost for the In Situ Containment approach. The percentage is high due to small scale of project. Design would be performed in FY2010.

Total Capital Costs are the marked up costs for the Phase, excluding the Professional Labor Management, Administrative Land Use Controls, and Operations and Maintenance technologies. Only the first year costs are included for cost-over-time technologies.

Phase Name	Phase Date	Design Approach	Total Capital Cost	Design %	Design Costs	Design Cost Year
Alternative 3 Remedial Action Capping & LUCs	October, 2010	In Situ Containment	$5,480	182.48	$10,000	2010

Total Design Cost: $10,000

Estimate Documentation Report

Phase Documentation:

Phase Type:	Remedial Action
Phase Name:	Alternative 3 Remedial Action Capping & LUCs
Description:	Installation of a Dermal Cover with the Asphalt Paving option over an area of approximately 850 SF. The selected technologies include Capping, Administrative Land Use Controls and Professional Labor Management.
Approach:	In Situ
Start Date:	October, 2010
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
Capping	Yes	100	0
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
Professional Labor Management	Yes	100	0

Total Marked-up Cost: $108,790

Technologies:

Estimate Documentation Report

Technology Name: Capping (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Cap		Dermal Cover	n/a
Acres		1.928375E-02	AC
Length		120	FT
Width		7	FT
Safety Level		D	n/a
General			
Secondary Parameters			
Side Slope of Cap	3	3	n/a
Horizontal Projection of Side Slope	5	5	FT
Horizontal Projection of Top Slope	5	5	FT
Dermal Cover			
Secondary Parameters			
Top Cover Type	Vegetation	Asphalt Paving	n/a
Soil Cover Thickness	3	3	IN
Soil Cover Borrow Source	Off-site	Off-site	n/a
Foundation Layer Thickness	12	6	IN
Foundation Layer Borrow Source	Off-site	Off-site	n/a

Comments: Install dermal cover cap over an area of 120 FT x 7 FT (840 SF). Selected the Asphalt Paving option. However, the actual cover will be concrete. A user defined assembly was added for 6" Structural Slab on Existing Prepared Grade. Changed the quantity for the asphalt assembly to zero. Since the cover will be installed over existing soil, assumed only a 6-inch foundation layer is needed.

Estimate Documentation Report

Technology Name: Administrative Land Use Controls (# 1)
User Name: ADMINISTRATIVE LAND USE CONTROLS

Description	Default	Value	UOM
System Definition			
Required Parameters			
Rename Model		ADMINISTRATIVE LAND USE CONTROLS	n/a
Planning Documents		No	n/a
Implementation		Yes	n/a
Implementation: Start Date		2011	n/a
Monitoring & Enforcement		Yes	n/a
Monitoring & Enforcement: Start Date		2011	n/a
Modification/Termination		Yes	n/a
Modification/Termination: Start Date		2041	n/a
Type of Site		Active Government Installation	n/a
Implementation			
Required Parameters			
Modify Installation (or City) Master Plan		No	n/a
Deed Notification		No	n/a
Negotiating Easements		No	n/a
Restrictive Covenants		No	n/a
Equitable Servitudes		No	n/a
Access Control Signs		Yes	n/a
Access Control Signs: Number		1	EA
Access Control Signs: Task Complexity		Low	n/a
Utility Notification Service		Yes	n/a
Access Control Signs: Number		1	EA
Access Control Signs: Task Complexity		Low	n/a
Geographic Information Systems (GIS)/Overlay Maps		No	n/a
Develop Finding of Suitablility to Transfer (FOST)		No	n/a
Monitoring & Enforcement			
Required Parameters			
Duration of Monitoring/Enforcement		30	Years
Notice Letters		No	n/a
Guard Service/Security		No	n/a
Reports & Certifications		No	n/a

Estimate Documentation Report

Technology Name: Administrative Land Use Controls (# 1)
User Name: ADMINISTRATIVE LAND USE CONTROLS

Description	Default	Value	UOM
Monitoring & Enforcement			
Required Parameters			
Site Visits/Inspections		Yes	n/a
Site Visits/Inspections: Number		1	EA
Site Visits/Inspections: Safety Level		D	n/a
Site Visits/Inspections: Duration		1	Days
Site Visits/Inspections: Number of People		1	EA
Site Visits/Inspections: Frequency		Annually	n/a
Site Visits/Inspections: Airfare		0	$ Per Ticket
Site Visits/Inspections: Mileage		10	MI
Modify/Termination			
Required Parameters			
Document Evaluation		Yes	n/a
Document Evaluation: Number		1	EA
Document Evaluation: Plan Complexity		Low	n/a
Modify LUC Documents		Yes	n/a
Modify LUC Documents: Number		1	EA
Modify LUC Documents: Plan Complexity		Low	n/a
Amend Decision Documents		Yes	n/a
Amend Decision Documents: Number		1	EA
Amend Decision Documents: Plan Complexity		Low	n/a
Termination Letters		No	n/a

Comments: Implement Land Use Controls in FY2011 as part of Alternative 3 for the Shoreline Site, Pearl Harbor, HI. Perform Monitoring and Enforcement of the LUCs consisting of an annual site visit by one person for one day driving 10 miles to the site. The LUCs would be modified/terminated after 30 years in FY2041. The labor hours were modifed to reflect the typical effort for implementing LUCs at Pearl Harbor.

Estimate Documentation Report

Technology Name: Professional Labor Management (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Markedup Construction Cost ($)		5,480	$
Percentage	20.1	20.1	%
Dollar Amount		1,101	$

Comments: Contractor oversight costs for the asphalt dermal cover installation.

Estimate Documentation Report

Phase Documentation:

Phase Type:	Operations & Maintenance
Phase Name:	Alternative 3 Operations and Maintenance
Description:	This phase estimates the costs for long-term monitoring and maintenance of the asphalt dermal cover and 5-year reviews at the Shoreline Site, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii.
Start Date:	October, 2011
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
Operations and Maintenance	Yes	100	0
Five-Year Review	No	0	0

Total Marked-up Cost: $101,998

Technologies:

Estimate Documentation Report

Technology Name: Operations and Maintenance

Description	Default	Value	UOM
Labor			
Secondary Parameters			
Operations Labor: Type		Exclude from Estimate	n/a
Professional Labor: Type		Exclude from Estimate	n/a
Analytical			
Secondary Parameters			
Wastewater/Effluent: Sampling Frequency		Exclude from Estimate	n/a
Wastewater/Effluent: Primary Analytical Template		None	n/a
Wastewater/Effluent: Secondary Analytical Template		None	n/a
Air Emissions: Sampling Frequency		Exclude from Estimate	n/a
Air Emissions: Primary Analytical Template		None	n/a
Air Emissions: Secondary Analytical Template		None	n/a
Solid Wastes: Sampling Frequency		Exclude from Estimate	n/a
Solid Wastes: Primary Analytical Template		None	n/a
Solid Wastes: Secondary Analytical Template		None	n/a
Heating Requirements			
Secondary Parameters			
Air Streams: Flow Rate		0	CFM
Air Streams: Temperature Difference		0	F
Air Streams: Months per Year		0	Month
Water Streams: Flow Rate		0	CFM
Water Streams: Temperature Difference		0	F
Water Streams: Months per Year		0	Month
Facility: Area		0	SF
Facility: Temperature Difference		0	F
Facility: Months per Year		0	Month

Comments: Perform annual inspections and asphalt replacement for the concrete paving Dermal Cover at the Shoreline Site, Pearl Harbor Oahu, HI. Included pavement sweeping to prepare the area before the concrete is placed. A Field Technican will be onsite to inspect the capped area and supervise the concrete replacement. Included a user defined assembly for 6" Structural Slab on Existing Prepared Grade.

Estimate Documentation Report

Technology Name: Five-Year Review (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Site Complexity		Low	n/a
Document Review		Yes	n/a
Interviews		Yes	n/a
Site Inspection		Yes	n/a
Report		Yes	n/a
Travel		No	n/a
Rebound Study		No	n/a
Start Date		October-2015	n/a
No. Reviews		6	EA
Document Review			
Required Parameters			
5-Year Review Check List		Yes	n/a
Record of Decision		Yes	n/a
Remedial Action Design & Construction		Yes	n/a
Close-Out Report		Yes	n/a
Operations & Maintenance Manuals & Reports		Yes	n/a
Consent Decree or Settlement Records		Yes	n/a
Groundwater Monitoring & Reports		No	n/a
Remedial Action Required		Yes	n/a
Previous 5-Year Review Reports		Yes	n/a
Interviews			
Required Parameters			
Current and Previous Staff Management		Yes	n/a
Community Groups		No	n/a
State Contacts		Yes	n/a
Local Government Contacts		Yes	n/a
Operations & Maintenance Contractors		Yes	n/a
PRPs		Yes	n/a
Remedial Design Consultant		Yes	n/a
Site Inspection			
Required Parameters			

Estimate Documentation Report

Technology Name: Five-Year Review (# 1)

Description	Default	Value	UOM
Site Inspection			
Required Parameters			
General Site Inspection		Yes	n/a
Containment System Inspection		Yes	n/a
Monitoring Systems Inspection		No	n/a
Treatment Systems Inspection		No	n/a
Regulatory Compliance		Yes	n/a
Site Visit Documentation (Photos, Diagrams, etc.)		Yes	n/a
Report			
Required Parameters			
Introduction		Yes	n/a
Remedial Objectives		Yes	n/a
ARARs Review		Yes	n/a
Summary of Site Visit		Yes	n/a
Areas of Non Compliance		Yes	n/a
Technology Recommendations		Yes	n/a
Statement of Protectiveness		Yes	n/a
Next Review		Yes	n/a
Implementation Requirements		Yes	n/a

Comments: Perform 5-Year reviews as the asphalt paving Dermal Cover remedial option at the Shoreline Site Pearl Harbor Oahu, HI.

Since the remedial approach for this site is Capping, the following Tasks were deselected from this technology:
Document Review:
Groundwater Monitoring Data & Reports (not applicable since there is no monitoring)

Interviews:
Community Groups (Since this project is a small portion of an active Naval facility, there is not likely to be much community involvement.
Potentially Responsible Parties (PRPs)

The labor hours were adjusted to match the typical effort requred for a 5-Year Review at Pearl Harbor.

Estimate Documentation Report

Technology Name: Capping (# 1) - (O&M Parameters)

Description	Default	Value	UOM
O&M Parameters			
Type of Cap		Dermal Cover	n/a
Acres		1.928375E-02	AC
Top Cover Type		Asphalt Paving	n/a

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID:	Alternative 3
Site Name:	Alternative 3 Permanent Cover w/ Land Use Controls
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☑
Long Term Monitoring:	☐
Site Closeout:	☐

Documentation

Description: Alternative 3: Permanent Cover with Land Use Controls
Install Dermal Cover over areas of bare ground to prevent potential exposure to asbestos fibers in soil.
Five-year Reviews are also included.

Selected Phases are Remedial Design, Remedial Action Construction and Operations and Maintenance.

Phase Technology Cost Detail Report
(with Markups)

Support Team:	Keith Robertson AECOM 841 Bishop Street, Suite 500 Honolulu, HI 96813 808.523.8874
References:	Figure 4 Proposed Cover Area and LUC Boundaries at the Shoreline Site Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii

Estimator Information

Estimator Name:	Mike West
Estimator Title:	Senior Cost Engineer
Agency/Org./Office:	ERA | AECOM
Business Address:	5575 DTC Parkway Suite 200 Greenwood Village, CO 80111
Telephone Number:	303-224-6777
Email Address:	Mike.West2@aecom.com
Estimate Prepared Date:	09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:	
Reviewer Title:	
Agency/Org./Office:	
Business Address:	
Telephone Number:	
Email Address:	
Date Reviewed:	

Reviewer Signature: _____ Date: _____

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type:	Operations & Maintenance
Phase Name:	Alternative 3 Operations and Maintenance
Description:	This phase estimates the costs for long-term monitoring and maintenance of the asphalt dermal cover and 5-year reviews at the Shoreline Site, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii.
Start Date:	October, 2011
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
Operations and Maintenance	Yes	100	0
Five-Year Review	No	0	0

Phase Technology Cost Detail Report
(with Markups)

Technology: Operations and Maintenance

Element: Capping

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
17040102	Pavement Sweeping, Machine	93.00	SY	0.00	0.08	0.00	0.00	$7.42	☐	☑
33220112	Field Technician	4.00	HR	0.00	100.00	0.00	0.00	$400.00	☑	☐
95010101	6" Structural Slab on Existing Prepared Grade	27.00	SF	5.52	5.57	0.02	0.00	$299.92	☑	☑

Total Element Cost	$707.35
Total 1st Year Technology Cost	$707.35

Phase Technology Cost Detail Report
(with Markups)

Technology: Five-Year Review

Element: Document Review

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	8.00	HR	0.00	141.00	0.00	0.00	$1,128.00	☑	☐
33220105	Project Engineer	9.00	HR	0.00	116.00	0.00	0.00	$1,044.00	☑	☐
33220108	Project Scientist	6.00	HR	0.00	116.00	0.00	0.00	$696.00	☑	☐
33220109	Staff Scientist	12.00	HR	0.00	100.00	0.00	0.00	$1,200.00	☑	☐
					Total Element Cost			$4,068.00		

Element: Interviews

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220105	Project Engineer	10.00	HR	0.00	116.00	0.00	0.00	$1,160.00	☑	☐
					Total Element Cost			$1,160.00		

Element: Site Inspection

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	7.00	HR	0.00	141.00	0.00	0.00	$987.00	☑	☐
33220105	Project Engineer	7.00	HR	0.00	116.00	0.00	0.00	$812.00	☑	☐
33220108	Project Scientist	7.00	HR	0.00	116.00	0.00	0.00	$812.00	☑	☐
33220109	Staff Scientist	7.00	HR	0.00	100.00	0.00	0.00	$700.00	☑	☐
					Total Element Cost			$3,311.00		

Phase Technology Cost Detail Report
(with Markups)

Element: Report

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	6.00	HR	0.00	141.00	0.00	0.00	$846.00	☑	☐
33220105	Project Engineer	10.00	HR	0.00	116.00	0.00	0.00	$1,160.00	☑	☐
33220108	Project Scientist	13.00	HR	0.00	116.00	0.00	0.00	$1,508.00	☑	☐
33220109	Staff Scientist	10.00	HR	0.00	100.00	0.00	0.00	$1,000.00	☑	☐
33220114	Word Processing/Clerical	4.00	HR	0.00	60.00	0.00	0.00	$240.00	☑	☐
33220115	Draftsman/CADD	2.00	HR	0.00	85.00	0.00	0.00	$170.00	☑	☐

Total Element Cost	$4,924.00
Total 1st Year Technology Cost	$13,463.00
Total Phase Cost	$14,170.35

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID:	Alternative 3
Site Name:	Alternative 3 Permanent Cover w/ Land Use Controls
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☑
Long Term Monitoring:	☐
Site Closeout:	☐

Documentation

Description: Alternative 3: Permanent Cover with Land Use Controls
Install Dermal Cover over areas of bare ground to prevent potential exposure to asbestos fibers in soil.
Five-year Reviews are also included.

Selected Phases are Remedial Design, Remedial Action Construction and Operations and Maintenance.

Phase Technology Cost Detail Report
(with Markups)

Support Team:	Keith Robertson AECOM 841 Bishop Street, Suite 500 Honolulu, HI 96813 808.523.8874
References:	Figure 4 Proposed Cover Area and LUC Boundaries at the Shoreline Site Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii

Estimator Information

Estimator Name:	Mike West
Estimator Title:	Senior Cost Engineer
Agency/Org./Office:	ERA | AECOM
Business Address:	5575 DTC Parkway Suite 200 Greenwood Village, CO 80111
Telephone Number:	303-224-6777
Email Address:	Mike.West2@aecom.com
Estimate Prepared Date:	09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:	
Reviewer Title:	
Agency/Org./Office:	
Business Address:	
Telephone Number:	
Email Address:	
Date Reviewed:	

Reviewer Signature: _____ Date: _____

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type:	Remedial Action
Phase Name:	Alternative 3 Remedial Action Capping & LUCs
Description:	Installation of a Dermal Cover with the Asphalt Paving option over an area of approximately 850 SF. The selected technologies include Capping, Administrative Land Use Controls and Professional Labor Management.
Approach:	In Situ
Start Date:	October, 2010
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
Capping	Yes	100	0
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
Professional Labor Management	Yes	100	0

Phase Technology Cost Detail Report
(with Markups)

Technology: Capping

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	20.00	CY	17.50	2.52	2.31	0.03	$447.26	☐	☑
95010101	6" Structural Slab on Existing Prepared Grade	840.00	SF	2.98	3.01	0.01	0.00	$5,032.92	☑	☑

Total Element Cost	$5,480.18
Total 1st Year Technology Cost	$5,480.18

Phase Technology Cost Detail Report
(with Markups)

Technology: ADMINISTRATIVE LAND USE CONTROLS

Element: Implementation

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
18010412	Construction Signs	18.00	SF	45.98	0.00	0.00	0.00	$827.63	☐	☑
33220102	Project Manager	40.00	HR	0.00	141.00	0.00	0.00	$5,640.00	☑	☐
33220105	Project Engineer	134.00	HR	0.00	116.00	0.00	0.00	$15,544.00	☑	☐
33220106	Staff Engineer	70.00	HR	0.00	100.00	0.00	0.00	$7,000.00	☑	☐
33220110	QA/QC Officer	6.00	HR	0.00	141.00	0.00	0.00	$846.00	☑	☐
33220114	Word Processing/Clerical	30.00	HR	0.00	60.00	0.00	0.00	$1,800.00	☑	☐
33220115	Draftsman/CADD	16.00	HR	0.00	85.00	0.00	0.00	$1,360.00	☑	☐
33220150	Technical Editor	8.00	HR	0.00	71.00	0.00	0.00	$568.00	☑	☐
33240101	Other Direct Costs	1.00	LS	698.81	0.00	0.00	0.00	$698.81	☑	☑
					Total Element Cost			$34,284.44		

Element: Monitoring & Enforcement

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010104	Sample collection, vehicle mileage charge, car or van	10.00	MI	0.00	0.00	0.00	0.49	$4.85	☑	☐
33022038	Overnight delivery service, 1 lb package	3.00	LB	0.00	0.00	0.00	34.89	$104.68	☐	☑
33220102	Project Manager	3.00	HR	0.00	141.00	0.00	0.00	$423.00	☑	☐
33220106	Staff Engineer	10.00	HR	0.00	100.00	0.00	0.00	$1,000.00	☑	☐
33220114	Word Processing/Clerical	1.00	HR	0.00	60.00	0.00	0.00	$60.00	☑	☐
33220115	Draftsman/CADD	2.00	HR	0.00	85.00	0.00	0.00	$170.00	☑	☐

Phase Technology Cost Detail Report
(with Markups)

Element: Monitoring & Enforcement

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33240101	Other Direct Costs	1.00	LS	34.81	0.00	0.00	0.00	$34.81	☑	☑

Total Element Cost $1,797.34

Element: Modification/Termination

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	20.00	HR	0.00	141.00	0.00	0.00	$2,820.00	☑	☐
33220105	Project Engineer	40.00	HR	0.00	116.00	0.00	0.00	$4,640.00	☑	☐
33220106	Staff Engineer	25.00	HR	0.00	100.00	0.00	0.00	$2,500.00	☑	☐
33220110	QA/QC Officer	8.00	HR	0.00	141.00	0.00	0.00	$1,128.00	☑	☐
33220114	Word Processing/Clerical	12.00	HR	0.00	60.00	0.00	0.00	$720.00	☑	☐
33220115	Draftsman/CADD	16.00	HR	0.00	85.00	0.00	0.00	$1,360.00	☑	☐
33220150	Technical Editor	8.00	HR	0.00	71.00	0.00	0.00	$568.00	☑	☐
33240101	Other Direct Costs	1.00	LS	267.59	0.00	0.00	0.00	$267.59	☑	☑

Total Element Cost $14,003.59

Total 1st Year Technology Cost $50,085.37

Phase Technology Cost Detail Report
(with Markups)

Technology: Professional Labor Management

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220149	Lump Sum Percentage Labor Cost	1.00	LS	0.00	1,101.00	0.00	0.00	$1,101.00	☑	☐

Total Element Cost	$1,101.00
Total 1st Year Technology Cost	$1,101.00
Total Phase Cost	$56,666.55

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID:	Alternative 4
Site Name:	Alternative 4 Excavation with On Island Disposal
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☐
Long Term Monitoring:	☐
Site Closeout:	☑

Documentation

Description: Alternative 4: Excavation with On Island Disposal
Excavate entire area known to contain asbestos fibers in soil.

Selected Phases are Remedial Design, Remedial Action Construction and Site Closeout

Support Team: Keith Robertson
AECOM
841 Bishop Street, Suite 500
Honolulu, HI 96813
808.523.8874

Phase Technology Cost Detail Report
(with Markups)

References: Figure 3
Limits of Removal Action Excavation Shoreline Site Northwest of Dry Dock #3
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu. Hawaii

Figure 4
Proposed Cover Area and LUC Boundaries at the Shoreline Site
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu. Hawaii

Estimator Information

Estimator Name: Mike West
Estimator Title: Senior Cost Engineer
Agency/Org./Office: ERA | AECOM
Business Address: 5575 DTC Parkway Suite 200
Greenwood Village, CO 80111
Telephone Number: 303-224-6777
Email Address: Mike.West2@aecom.com

Estimate Prepared Date: 09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ Date: _____

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type: Design Percent Method
Phase Name: Alternative 4 Remedial Design
Description: HC 15 Shoreline Site - Alternative 4 Remedial Design. Selected the Ex Situ: Removal/Off-site Treatment or Disposal approach. Design would be performed in FY2010.

Total Capital Costs are the marked up costs for the Phase, excluding the Professional Labor Management, Administrative Land Use Controls, and Operations and Maintenance technologies. Only the first year costs are included for cost-over-time technologies.

Phase Name	Phase Date	Design Approach	Total Capital Cost	Design %	Design Costs	Design Cost Year
Alternative 4 Remedial Action Excavation	October, 2010	Ex Situ Removal - Off-site Treatment or Disposal	$676,396	3.00	$20,292	2010

Phase Technology Cost Detail Report
(with Markups)

Technology: Design Costs

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
32032001	Remedial Design Professional Labor	1.00	EA	0.00	20,292.00	0.00	0.00	$20,292.00	☐	☑

Total Element Cost	$20,292.00
Total 1st Year Technology Cost	$20,292.00
Total Phase Cost	$20,292.00

Estimate Documentation Report

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Estimate Documentation Report

Site Documentation:

Site ID:	Alternative 4
Site Name:	Alternative 4 Excavation with On Island Disposal
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☐
Long Term Monitoring:	☐
Site Closeout:	☑

Documentation

Description:	Alternative 4: Excavation with On Island Disposal Excavate entire area known to contain asbestos fibers in soil. Selected Phases are Remedial Design, Remedial Action Construction and Site Closeout
Support Team:	Keith Robertson AECOM 841 Bishop Street, Suite 500 Honolulu, HI 96813 808.523.8874
References:	Figure 3 Limits of Removal Action Excavation Shoreline Site Northwest of Dry Dock #3 Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii Figure 4 Proposed Cover Area and LUC Boundaries at the Shoreline Site Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility Oahu. Hawaii

Estimator Information

Estimator Name:	Mike West
Estimator Title:	Senior Cost Engineer
Agency/Org./Office:	ERA | AECOM

Estimate Documentation Report

Business Address: 5575 DTC Parkway Suite 200
Greenwood Village, CO 80111
Telephone Number: 303-224-6777
Email Address: Mike.West2@aecom.com

Estimate Prepared Date: 09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information
Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ Date: _____

Estimated Costs:

Phase Names	Direct Cost	Marked-up Cost
Alternative 4 Remedial Design	$0	$20,292
Alternative 4 Remedial Action Excavation	$643,711	$801,454
Alternative 4 Site Closeout	$17,410	$17,410
Total Cost:	$661,121	$839,156
Escalation:	$44,626	$56,197
Total Site Cost:	$705,746	$895,353

Estimate Documentation Report

Phase Documentation:

Phase Type: Design Percent Method
Phase Name: Alternative 4 Remedial Design
Description: HC 15 Shoreline Site - Alternative 4 Remedial Design. Selected the Ex Situ: Removal/Off-site Treatment or Disposal approach. Design would be performed in FY2010.

Total Capital Costs are the marked up costs for the Phase, excluding the Professional Labor Management, Administrative Land Use Controls, and Operations and Maintenance technologies. Only the first year costs are included for cost-over-time technologies.

Phase Name	Phase Date	Design Approach	Total Capital Cost	Design %	Design Costs	Design Cost Year
Alternative 4 Remedial Action Excavation	October, 2010	Ex Situ Removal - Off-site Treatment or Disposal	$676,396	3.00	$20,292	2010

Total Design Cost: $20,292

Estimate Documentation Report

Phase Documentation:

Phase Type:	Remedial Action
Phase Name:	Alternative 4 Remedial Action Excavation
Description:	HC 15 Shoreline Site - Alternative 4 Excavation of asbestos containing soil. The selected technologies include User Defined Estimate, Decontamination Facilities, Excavation, Residual Waste Management and Professional Labor Management. Three (3) office trailers will be relocated. A temporary decon pad will be setup. 2,300 CY of soil containing asbestos will be excavated. Excavated soil, PPE and decon water will be transported to appropriate facilities for disposal and/or treatment. The asphalt from the excavation area will be taken of a recycling facility. Oversight of all work will be performed. The phase start date is October 2010 (FY2011)
Approach:	Ex Situ
Start Date:	October, 2010
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
RELOCATE OFFICE TRAILERS	Yes	100	0
Decontamination Facilities	Yes	100	0
Excavation	Yes	100	0
Residual Waste Management	Yes	100	0
Load and Haul	Yes	100	0
Professional Labor Management	Yes	100	0

Total Marked-up Cost: $801,454

Technologies:

Estimate Documentation Report

Technology Name: User Defined Estimate (# 1)
User Name: RELOCATE OFFICE TRAILERS

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		RELOCATE OFFICE TRAILERS	n/a
WBS Type		HTRW	n/a
Selected WBS		331.21.01	n/a
Safety Level		D	n/a

Comments: Three office trailers located at hte SHoreline Site will be relocated during excavation of the asbestos containing soil.

Technology Name: Decontamination Facilities (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
New Decontamination Facility Pad Construction		Yes	n/a
Equipment Rating		Medium Equipment Rating	n/a
Equipment Decontamination Operations		Yes	n/a
Equipment Decontamination Operations: Duration		1	weeks
Personnel Decontamination Trailers		Yes	n/a
Personnel Decontamination Trailers: Average Crew Size		3	per shift
Personnel Decontamination Trailers: Duration		1	weeks
Safety Level		D	n/a
Decon Pad			
Secondary Parameters			
Area of Decontamination Pad	800	800	SF
Use Flexible Membrane Liner	Yes	Yes	n/a
Percentage of Time Decontamination Pad in Use	25	25	%
Work Shifts			
Secondary Parameters			
Equipment Decontamination		One Shift per Day	n/a
Personnel Decontamination		One Shift per Day	n/a

Comments: Setup a temporary decontamination pad and a personnel decontamination trailer. The pad and trailer will be utilized for about one week during excavation of the shoreline area.

Estimate Documentation Report

Technology Name: Excavation (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Estimating Method		Volume / Depth	n/a
Volume		2,300	CY
Depth		8	FT
Soil Type		Sand-Silt/Sand-Clay Mixture	n/a
Safety Level		D	n/a
Excavation			
Secondary Parameters			
Existing Cover	Soil/Gravel	Asphalt	n/a
Replacement Cover	Soil/Seeding	Asphalt	n/a
Sidewall Protection	Side Sloping	Trench Box	n/a
% of Excavated Material To Be Used as Backfill	0	0	%
Source of Additional Fill	Off Site	Off Site	n/a
Backfill Hauling Distance (one way)	10	20	MI
Dewatering Required	No	No	n/a
Analytical			
Secondary Parameters			
Primary Analytical Template	System Soil - Asbestos	System Soil - Asbestos	n/a
Secondary Analytical Template	None	None	n/a
Number of Sampling Points/Locations	18	18	EA
Number of Composites Submitted to Lab	5	5	EA
Turnaround Time	Standard (21 Days)	Standard (21 Days)	n/a
Submit Data Electronically	Yes	Yes	n/a
Data Package / QC	Stage 1	Stage 2b	n/a
Lab Data Review	Stage 1	Stage 2b	n/a
Sampling Reports	Abbreviated	Standard	n/a

Comments: Exacavate soil with asbestos containing material. Selected the Volume/Depth estimating method based on 2,300 CY of soil and 8-FT exacavation depth. The existing cover is asphalt, which will be replaced after backfilling the excavation.

Estimate Documentation Report

Technology Name: Residual Waste Management (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Safety Level		D	n/a
Non-Rad Disposal			
Required Parameters			
Waste Type / Condition		Non-Hazardous Bulk Liquid	n/a
Total Quantity		3,000	GAL
Transportation Type		Truck	n/a
Truck Distance (One-way)		20	Miles
Waste Type / Condition		Non-Hazardous Drums	n/a
Total Quantity		1	Drums
Transportation Type		Truck	n/a
Truck Distance (One-way)		21	Miles
Waste Type / Condition		Hazardous Bulk Solid	n/a
Total Quantity		2,990	CY
Stabilization		No	n/a
Transportation Type		Truck	n/a
Truck Distance (One-way)		21	Miles

Comments: This technology estimates the costs for transport and disposal of the following waste streams:
3,000 gallons of non-hazardous bulk liquid from the decontamination pad
One (1) drum of personal protective equipment (PPE)
2,990 CY of hazardous excavated soil

Assumed that the decon pad water would be taken to a commercial wastewater treatment facility approximately 20 miles from Pearl Harbor.

Assumed that the drummed PPE and bulk soil would be transported the PVT landfill (87-2020 Farrington Hwy, Waianae, HI 96792) approximately 25 miles from Pearl Harbor. Adjusted the assembly costs based on the published disposal fees from PVT.
Special Waste Disposal $90 per ton plus $90 per load handling ($180 min)
Add general excise tax (GET 4.712%) to above fee schedule.

Estimate Documentation Report

Technology Name: Load and Haul (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Truck Type		Highway	n/a
Volume		144	CY
One-way Haul Distance		15	MI
Dump Charge		15	$/CY
Safety Level		D	n/a

Comments: Transport 144 CY of asphalt to the Grace-Pacific facility 15 miles from the Pearl Harbor Shoreline Site. Entered a dump charge of $15/CY as a recycling fee.

Technology Name: Professional Labor Management (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Markedup Construction Cost ($)		665,201	$
Percentage	18.8	18.8	%
Dollar Amount		125,058	$

Comments: The Professional Labor Management technology uses a percentage method to calculate management labor costs incurred by the project. Professional Labor Management includes activities that are not accounted for within the Field Overhead/G&A, Overhead, or Owner's Cost factors of the phase mark-up template. The activities encompassed by this technology are for costs generally incurred during the removal/interim action and remedial action phases of the environmental remediation process. The technology uses the Marked-up Construction Cost ($) to calculate a default percentage for contractor professional labor costs.

Estimate Documentation Report

Phase Documentation:

Phase Type:	Site Closeout
Phase Name:	Alternative 4 Site Closeout
Description:	HC 15 Shoreline Site - Alternative 4 Site Closeout Prepare Site Close-Out Work Plans, Close-Out Reports and Decision Documents
Start Date:	January, 2011
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
Site Close-Out Documentation	Yes	100	0

Total Marked-up Cost: $17,410

Technologies:

Estimate Documentation Report

Technology Name: Site Close-Out Documentation (# 1)

Description	Default	Value	UOM
System Definition			
Required Parameters			
Meetings		Yes	n/a
Work Plans and Reports		Yes	n/a
Documents		No	n/a
Site Close-Out Complexity		Low	n/a
Meetings			
Required Parameters			
Kick Off/Scoping Meetings		Yes	n/a
Kick Off/Scoping Meetings: Number of Meetings	1	1	EA
Kick Off/Scoping Meetings: Travel		No	n/a
Review Meetings		Yes	n/a
Review Meetings: Number of Meetings	1	1	EA
Review Meetings: Travel		No	n/a
Regulatory Review Meetings		Yes	n/a
Regulatory Review Meetings: Number of Meetings	1	1	EA
Regulatory Review Meetings: Travel		No	n/a
Work Plans & Reports			
Required Parameters			
Work Plans		Yes	n/a
Draft Work Plan		Yes	n/a
Final Work Plan		Yes	n/a
Reports		Yes	n/a
Draft Close-Out Report		Yes	n/a
Draft Final Close-Out Report		Yes	n/a
Final Close-Out Report		Yes	n/a
Progress Reports		Yes	n/a
Project Duration	8	8	months

Comments:

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID:	Alternative 4
Site Name:	Alternative 4 Excavation with On Island Disposal
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☐
Long Term Monitoring:	☐
Site Closeout:	☑

Documentation

Description: Alternative 4: Excavation with On Island Disposal
Excavate entire area known to contain asbestos fibers in soil.

Selected Phases are Remedial Design, Remedial Action Construction and Site Closeout

Support Team: Keith Robertson
AECOM
841 Bishop Street, Suite 500
Honolulu, HI 96813
808.523.8874

Phase Technology Cost Detail Report
(with Markups)

References: Figure 3
Limits of Removal Action Excavation Shoreline Site Northwest of Dry Dock #3
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu. Hawaii

Figure 4
Proposed Cover Area and LUC Boundaries at the Shoreline Site
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu. Hawaii

Estimator Information

Estimator Name: Mike West
Estimator Title: Senior Cost Engineer
Agency/Org./Office: ERA | AECOM
Business Address: 5575 DTC Parkway Suite 200
Greenwood Village, CO 80111
Telephone Number: 303-224-6777
Email Address: Mike.West2@aecom.com

Estimate Prepared Date: 09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ Date: _____

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type:	Remedial Action
Phase Name:	Alternative 4 Remedial Action Excavation
Description:	HC 15 Shoreline Site - Alternative 4 Excavation of asbestos containing soil. The selected technologies include User Defined Estimate, Decontamination Facilities, Excavation, Residual Waste Management and Professional Labor Management. Three (3) office trailers will be relocated. A temporary decon pad will be setup. 2,300 CY of soil containing asbestos will be excavated. Excavated soil, PPE and decon water will be transported to appropriate facilities for disposal and/or treatment. The asphalt from the excavation area will be taken of a recycling facility. Oversight of all work will be performed. The phase start date is October 2010 (FY2011)
Approach:	Ex Situ
Start Date:	October, 2010
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
RELOCATE OFFICE TRAILERS	Yes	100	0
Decontamination Facilities	Yes	100	0
Excavation	Yes	100	0
Residual Waste Management	Yes	100	0
Load and Haul	Yes	100	0
Professional Labor Management	Yes	100	0

Phase Technology Cost Detail Report
(with Markups)

Technology: RELOCATE OFFICE TRAILERS

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
95010102	Mobilize/demobilize office trailer	3.00	EA	0.00	0.00	0.00	1,012.99	$3,038.96	☑	☑

Total Element Cost	$3,038.96
Total 1st Year Technology Cost	$3,038.96

Phase Technology Cost Detail Report
(with Markups)

Technology: Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
17030109	Pad Subgrade Preparation	35.56	CY	0.00	13.46	3.89	0.00	$617.01	☐	☑
17030257	Cat 215, 1.0 CY, Soil, Shallow, Trenching, Excludes Sheeting, Excludes Dewatering	1.78	BCY	0.00	1.90	0.84	0.00	$4.88	☐	☑
17030501	Compaction, subgrade, 18" wide, 8" lifts, walk behind, vibrating plate	35.56	ECY	0.00	6.08	0.42	0.00	$231.36	☐	☑
17030510	Dry Roll Gravel, Steel Roller	106.67	SY	0.00	2.04	0.75	0.00	$298.21	☐	☑
18010102	Gravel, Delivered & Dumped	14.81	CY	58.34	10.36	10.92	0.00	$1,179.29	☐	☑
18010103	Gravel (90%) & Sand Base (10%), with Calcium Chloride 3/4 - 1 Lb/CY	14.81	CY	8.32	0.75	0.74	0.00	$145.27	☐	☑
18010203	Asphalt Curb 8" W x 6" H	120.00	LF	2.28	4.29	0.79	0.00	$883.45	☐	☑
18010310	Prime Coat	88.89	SY	1.00	0.09	0.04	0.00	$100.23	☐	☑
18010312	Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	19.33	TON	119.60	18.07	5.11	0.00	$2,759.89	☐	☑
18020203	26" x 26", 5' Deep Area Drain with Grate	1.00	EA	3,250.52	5,143.65	95.26	0.00	$8,489.42	☐	☑
19020313	5' x 5' x 5' Reinforced Concrete Sump	1.00	EA	4,065.62	8,430.00	156.31	0.00	$12,651.93	☐	☑
19020604	12" x 12" CIP Concrete In-Ground Trench Drain with Metal Grate	20.00	LF	132.72	165.59	0.95	0.00	$5,985.21	☐	☑

Phase Technology Cost Detail Report
(with Markups)

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
19040604	1,500 Gallon Steel Sump, Aboveground with Supports & Fittings, Excludes Foundation, Pumps, Piping	1.00	EA	10,418.32	1,299.71	0.00	0.00	$11,718.03	☐	☑
33080503	Polymeric Liner Anchor Trench, 3' x 1.5'	144.00	LF	0.09	5.12	0.89	0.00	$879.10	☐	☑
33080532	Geotextile Fabric, Non-Woven 80 Mil	106.67	SY	2.08	2.15	0.07	0.00	$458.83	☐	☑
33080571	40 Mil Polymeric Liner, High-density Polyethylene	960.00	SF	0.97	0.53	0.05	0.00	$1,490.68	☐	☑
33170818	Spray washers, cold water, electric, 1800 psi, 5 GPM, 5 HP, rent/month	1.00	MO	0.00	0.00	0.00	2,278.14	$2,278.14	☐	☑
33170822	8' x 36' Decontamination Trailer with 2 Showers, Fans	1.00	MO	0.00	0.00	0.00	5,056.36	$5,056.36	☐	☑
33170823	Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	10.00	HR	0.00	174.17	0.00	77.23	$2,514.06	☐	☑
33199921	DOT steel drums, 55 gal., open, 17C	1.00	EA	263.93	0.00	0.00	0.00	$263.93	☐	☑
33220112	Field Technician	30.00	HR	0.00	100.00	0.00	0.00	$3,000.00	☑	☐
33231306	High Sump Level Switch for Avoiding Overflow	1.00	EA	605.65	0.00	0.00	0.00	$605.65	☐	☑
33260623	(2 1/2", 4") PVC Double-wall Piping, with Fittings	30.00	LF	81.26	81.68	0.00	0.00	$4,888.10	☐	☑
33290401	Pump, pedestal sump, single stage, 25 GPM, 1 H.P., 1-1/2" discharge	1.00	EA	7,084.46	1,564.13	0.00	0.00	$8,648.59	☐	☑

Phase Technology Cost Detail Report
(with Markups)

Total Element Cost	$75,147.61
Total 1st Year Technology Cost	$75,147.61

Phase Technology Cost Detail Report
(with Markups)

Technology: Excavation

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
17020201	Demolish Bituminous Road with Power Equipment	144.00	CY	0.00	53.43	18.55	0.00	$10,364.18	☐	☑
17020416	12 CY Dump Truck Haul/Hour	286.00	HR	0.00	151.56	110.22	0.00	$74,870.15	☐	☑
17030263	Trench Box, 10' x 20', Daily Rental	3.00	DAY	0.00	0.00	0.00	533.42	$1,600.25	☐	☑
17030277	Excavate and load, bank measure, medium material, 2 C.Y. bucket, hydraulic excavator	2,300.00	BCY	0.00	2.44	1.75	0.00	$9,646.51	☐	☑
17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	2,990.00	CY	17.50	2.52	2.31	0.03	$66,866.08	☐	☑
18020301	Asphalt Pavement - 10" Subgrade, 9" Base, 1 1/2" Topping	863.00	SY	18.04	4.69	3.29	0.00	$22,455.21	☐	☑
33020401	Disposable Materials per Sample	18.00	EA	23.66	0.00	0.00	0.00	$425.91	☐	☑
33021779	Asbestos in Bulk Solids/Soils (Identification by PLM)	5.00	EA	0.00	0.00	0.00	51.03	$255.17	☐	☑
33220102	Project Manager	5.00	HR	0.00	141.00	0.00	0.00	$705.00	☑	☐
33220108	Project Scientist	7.00	HR	0.00	116.00	0.00	0.00	$812.00	☑	☐
33220110	QA/QC Officer	1.00	HR	0.00	141.00	0.00	0.00	$141.00	☑	☐
33220112	Field Technician	2.00	HR	0.00	100.00	0.00	0.00	$200.00	☑	☐
33220114	Word Processing/Clerical	2.00	HR	0.00	60.00	0.00	0.00	$120.00	☑	☐
33220115	Draftsman/CADD	2.00	HR	0.00	85.00	0.00	0.00	$170.00	☑	☐

Phase Technology Cost Detail Report
(with Markups)

Total Element Cost	$188,631.47
Total 1st Year Technology Cost	$188,631.47

Phase Technology Cost Detail Report
(with Markups)

Technology: Residual Waste Management

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33190101	Liquid Loading Into 5,000 Gallon Bulk Tank Truck	1.00	EA	0.00	1,256.10	807.90	0.00	$2,064.00	☐	☑
33190102	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	2,990.00	BCY	2.64	2.87	1.01	0.00	$19,484.12	☐	☑
33190103	Load Drums on Disposal Vehicle	1.00	EA	0.00	14.30	4.05	0.00	$18.35	☐	☑
33190108	Tanker Pumping Equipment to Load Liquid	1.00	HR	0.00	0.00	0.00	146.69	$146.69	☐	☑
33190204	Transport 55 Gallon Drums of Hazardous Waste, Max 80 drums (per Mile)	21.00	MI	0.00	0.00	0.00	4.05	$84.95	☐	☑
33190205	Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	3,507.00	MI	0.00	0.00	0.00	3.89	$13,640.50	☐	☑
33190207	Transport Bulk Liquid/Sludge Hazardous Waste, Maximum 5,000 Gallon (per Mile)	20.00	MI	0.00	0.00	0.00	4.05	$80.90	☐	☑
33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	3.00	EA	0.00	0.00	0.00	1,022.38	$3,067.15	☐	☑
33190350	State Disposal Tax (Non-Hazardous, Non-leaking Drums)	1.00	EA	0.00	0.00	0.00	10.17	$10.17	☑	☑
33190361	State Disposal Tax (Hazardous Bulk Solid, Without Stabilization)	2,991.00	CY	0.00	0.00	0.00	5.37	$16,059.95	☑	☑

Phase Technology Cost Detail Report
(with Markups)

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33197205	Landfill Nonhazardous Solid Waste, 55 Gallon Drum	1.00	EA	0.00	0.00	0.00	107.89	$107.89	☑	☑
33197263	Commercial RCRA landfills, bulk waste, solid, based on 2,000 lb/CY	2,990.00	TON	0.00	0.00	0.00	107.89	$322,597.08	☑	☑
33197274	Commercial RCRA landfills, regional outline, liquid, non-hazardous	3,000.00	GAL	0.00	0.00	0.00	1.98	$5,934.28	☐	☑
95010103	Per load handling fee	168.00	EA	0.00	0.00	0.00	107.89	$18,125.86	☑	☑

Total Element Cost	$401,421.89
Total 1st Year Technology Cost	$401,421.89

Phase Technology Cost Detail Report
(with Markups)

Technology: Load and Haul

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
17020401	Dump Charges	144.00	EA	22.48	0.00	0.00	0.00	$3,236.76	☑	☑
17030220	910, 1.25 CY, Wheel Loader	3.00	HR	0.00	163.06	80.59	0.00	$730.96	☐	☑
17030285	12 CY, Dump Truck	16.00	HR	0.00	151.56	110.22	0.00	$4,188.54	☐	☑

Total Element Cost	$8,156.26
Total 1st Year Technology Cost	$8,156.26

Phase Technology Cost Detail Report
(with Markups)

Technology: Professional Labor Management

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220149	Lump Sum Percentage Labor Cost	1.00	LS	0.00	125,058.00	0.00	0.00	$125,058.00	☑	☐

Total Element Cost	$125,058.00
Total 1st Year Technology Cost	$125,058.00
Total Phase Cost	$801,454.19

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.0.2
Database Location: C:\RACER DBs\HC15 Pearl Harbor Shoreline Site\RACER Pearl Harbor.mdb

Folder:

Folder Name: CTO HC15

Project:

Project ID: Pearl Harbor Naval Shipyard
Project Name: Pearl Harbor Naval Shipyard
Project Category: None

Location

State / Country: HAWAII
City: PEARL HARBOR

Location Modifier	Default	User
	1.854	1.854

Options

Database: Modified System
Cost Database Date: 2008
Report Option: Fiscal

Description: Estimate for a proposed cover and Land Use Controls at Pearl Harbor Naval Shipyard, HI.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID:	Alternative 4
Site Name:	Alternative 4 Excavation with On Island Disposal
Site Type:	None

Media/Waste Type

Primary:	Soil
Secondary:	N/A

Contaminant

Primary:	Asbestos
Secondary:	None

Phase Names

Pre-Study:	☐
Study:	☐
Design:	☑
Removal/Interim Action:	☐
Remedial Action:	☑
Operations & Maintenance:	☐
Long Term Monitoring:	☐
Site Closeout:	☑

Documentation

Description: Alternative 4: Excavation with On Island Disposal
Excavate entire area known to contain asbestos fibers in soil.

Selected Phases are Remedial Design, Remedial Action Construction and Site Closeout

Support Team: Keith Robertson
AECOM
841 Bishop Street, Suite 500
Honolulu, HI 96813
808.523.8874

Phase Technology Cost Detail Report
(with Markups)

References: Figure 3
Limits of Removal Action Excavation Shoreline Site Northwest of Dry Dock #3
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu. Hawaii

Figure 4
Proposed Cover Area and LUC Boundaries at the Shoreline Site
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Oahu. Hawaii

Estimator Information

Estimator Name: Mike West
Estimator Title: Senior Cost Engineer
Agency/Org./Office: ERA | AECOM
Business Address: 5575 DTC Parkway Suite 200
Greenwood Village, CO 80111
Telephone Number: 303-224-6777
Email Address: Mike.West2@aecom.com

Estimate Prepared Date: 09/09/2009

Estimator Signature: _____ Date: _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ Date: _____

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type:	Site Closeout
Phase Name:	Alternative 4 Site Closeout
Description:	HC 15 Shoreline Site - Alternative 4 Site Closeout Prepare Site Close-Out Work Plans, Close-Out Reports and Decision Documents
Start Date:	January, 2011
Labor Rate Group:	Navy CLEAN Labor Rates
Analysis Rate Group:	System Analysis Rate
Phase Markups:	System Defaults

Technology Markups	Markup	% Prime	% Sub.
Site Close-Out Documentation	Yes	100	0

Phase Technology Cost Detail Report
(with Markups)

Technology: Site Close-Out Documentation

Element: Meetings

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220102	Project Manager	14.00	HR	0.00	141.00	0.00	0.00	$1,974.00	☑	☐
33220106	Staff Engineer	13.00	HR	0.00	100.00	0.00	0.00	$1,300.00	☑	☐
33220114	Word Processing/Clerical	5.00	HR	0.00	60.00	0.00	0.00	$300.00	☑	☐
33220115	Draftsman/CADD	1.00	HR	0.00	85.00	0.00	0.00	$85.00	☑	☐

Total Element Cost $3,659.00

Element: Work Plans & Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220101	Senior Project Manager	7.00	HR	0.00	148.00	0.00	0.00	$1,036.00	☑	☐
33220102	Project Manager	61.00	HR	0.00	141.00	0.00	0.00	$8,601.00	☑	☐
33220105	Project Engineer	4.00	HR	0.00	116.00	0.00	0.00	$464.00	☑	☐
33220109	Staff Scientist	2.00	HR	0.00	100.00	0.00	0.00	$200.00	☑	☐
33220114	Word Processing/Clerical	49.00	HR	0.00	60.00	0.00	0.00	$2,940.00	☑	☐
33220115	Draftsman/CADD	6.00	HR	0.00	85.00	0.00	0.00	$510.00	☑	☐

Total Element Cost $13,751.00

Total 1st Year Technology Cost $17,410.00

Total Phase Cost $17,410.00

Attachment D
EPA Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

1 November 2006

Ms. Janice Fukumoto
Naval Facilities Engineering Command, Hawaii (EV)
400 Marshall Road (Building X-11)
Pearl Harbor, Hawaii 96860-3139

RE: Draft Final Record of Decision Shoreline Site Northwest of Dry Dock #3 Shipyard Geographic Study Area, Pearl Harbor, Hawaii

Dear Ms. Fukumoto:

The purpose of this letter is to convey the U.S. Environmental Protection Agency's (EPA) program recommendation to achieve a Record of Decision (ROD) for the Shoreline Site Northwest of Dry Dock #3, Shipyard Geographic Study Area, Pearl Harbor, Hawaii (DD#3). As you are aware, the DD3# was addressed in a Navy removal action to the standard practice of using less than 1 percent asbestos found on site. The draft final DD#3 ROD selects no further action (NFA) for the site and 5 year reviews under CERCLA Section 121 (c) is not applicable.

Our experience with other asbestos sites has led to EPA OSWER Memorandum 9345.4-05 *Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups* dated August 10, 2004. The OSWER Memorandum states EPA has concluded the 1 percent threshold for asbestos in soil/debris as a cleanup level may not be protective of human health and the environment. The 1 percent threshold was used in the National Emissions Standards for Hazardous Air Pollutants (NESHAP) in 1973 and has been carried over to other federal regulations governing asbestos. The use of the 1 percent threshold is related to the analytical method detection limits of the phase contrast microscopy and is not a risk based value.

Currently, there is no risk assessment methodology or a risk based remediation goal for asbestos. In addition, there is no reliable methodology to detect asbestos in soil below 1 percent. To be protective of human health and the environment under the current circumstances the DD#3 ROD should be changed to an Institutional Control (IC) ROD and the site should be subject to CERCLA 5 year reviews. The ROD should include the paved parking lot area built on rubble debris which may contain asbestos and kiln brick.

EPA is concerned with the potential air pathway exposure to workers from wind blown dust from the unpaved removal action area of the site. The excavation boundary for the removal action was determined by surface soil sampling using the 1 percent threshold. Potentially, surface soil outside the excavation boundary may contain asbestos at or below 1 percent. This potential air pathway should be addressed as soon as practicable. The action to prevent the air pathway exposure should be included as part of the IC ROD for the site.

The ROD for the DD#3 should follow *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Documents*, EPA 540-R-98-301, July 1999 (ROD Guidance). EPA recommends the Navy incorporate Section 6.3.14 *Documentation of Significant Changes* of the ROD Guidance into the DD#3 ROD. In making this recommendation, EPA considered the site specific circumstances of the DD#3 site as well as public comments on the Proposed Plan for DD#3. EPA's recommendation will help the Navy maintain program continuity of the administrative record file and achieve a ROD for the DD#3 site.

The Navy submission of the DD#3 IC ROD for regulatory review should also include two companion documents. The two documents are the IC checklist that was previously provided to the Navy and an estimate of the volume of the area to be included under the IC. I have enclosed the *Measure and Calculations for Volume of Contaminated Medium Addressed with Respect to the Superfund and RCRA Corrective Action Programs* from EPA's Office of Enforcement and Compliance Assurance as guidance for national consistency. The information provided by the Navy will be entered into a national tracking database, an EPA requirement under the Government Performance and Results Act (GPRA).

If you have any questions, please give me a call at (415) 972-3032.

Sincerely,

Lewis Mitani
Remedial Project Manager

Enclosure

CC: Ms. Carolyn Orita (EVCO)
Mr. Michael Miyasaka, DOH
Mr. Rich Howard, TLI

MEMORANDUM

SUBJECT: Metholodolgy for Estimating Superfund and RCRA Corrective Actions Environmental Benefits at Federal Facilities

FROM: David Kling, Director
Federal Facilities Enforcement Office
Office of Enforcement and Compliance Assurance

James Woolford, Director
Federal Facility Restoration and Reuse Office
Office of Solid Waste and Emergency Response

TO: Waste Division Directors, Regions I-X
Regional Counsels, Regions I-X

We want the public and stakeholders to know the tremendous work the Regions are doing in the Federal facilities Superfund and RCRA corrective action arena. That's why reporting your work through Agency information systems is important. In November 2003, the Office of Enforcement and Compliance Assurance issued guidance on reporting environmental benefits, "Measure and Calculations for Volume of Contaminated Medium Addressed with Respect to the Superfund and RCRA Corrective Action Programs." Data for this effort are reported through the Integrated Compliance Information System (ICIS). ICIS is the database of record for tracking federal enforcement actions and the environmental benefits they occasion.

The guidance document, attached, provides background information on the measure, describes the rationale for the new volume-of-contaminated medium basis for the measure, and identifies the methodologies that should be used to estimate the volume of contaminated media addressed for various Superfund and RCRA corrective/response actions. These data are reported for private facilities at the signing of a remedial design/remedial action consent decree, a non-existent milestone for our program. To this end, we have determined that signing of the Record of Decision (ROD) is the appropriate time to report on the amount of pollutants reduced.

Because EPA historically has not calculated and reported this information, this guidance will help the Regions provide this information at the signing of each ROD. Such information informs the public of our cleanup accomplishments at Federal facilities and is also a measure against which the importance of our program will be judged. The regions should begin reporting these data based on the methodology outlined in the guidance in FY 2005.

Should you have any concerns or questions, please contact Sally M. Dalzell at (202) 564-2583 or Joshua Barber at (703) 603-0265.

Attachment

cc: Michael Stahl
Susan Bromm
Joshua Barber, FFRRO
Federal Facilities Leadership Council
Federal Facility Program Managers, Regions I-X

Measure and Calculations for Volume of Contaminated Medium Addressed

With Respect to the Superfund And RCRA Corrective Action Programs

As Tracked by the
Office of Enforcement and Compliance Assurance

November 2003

1. Purpose

The purpose of this document is to provide guidance for the implementation of a Volume of Contaminated Medium Addressed measure in ICIS for Superfund and RCRA Corrective Action enforcement actions. In July 2003, the Office of Compliance requested comments on a proposal to develop a nationally consistent methodology for estimating pollutant reductions resulting from Superfund and RCRA Corrective Action enforcement actions. Generally, all the regions were supportive of a methodology based on the total volume of contaminated media addressed.

This document provides a brief background on the measure, describes the new volume-of-contaminated medium basis for the measure, identifies the methodologies that should be used to estimate the Volume of Contaminated Medium Addressed (VCMA) for various Superfund response actions and RCRA corrective actions.

2. Background

The estimated amount of pollutant reduced is one of the program performance measures employed by the EPA Office of Enforcement and Compliance Assurance (OECA) for media programs. The intent of this measure is to estimate how much pollutant will be reduced as a result of an enforcement action. Pollutant reduction data are tracked with other enforcement data in the ICIS database, which is independent of the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) database used by the Office of Superfund Remediation and Technology Innovation (OSRTI). The pollutant reduction field in ICIS addresses an enforcement-based measure under the Government Performance and Results Act (GPRA).

Historically, the Superfund and RCRA Corrective Action programs have had problems reporting pollutant reduction values. Nationally, there is a varying degree of accuracy and completeness with which the information is reported on the Case Conclusion Data Sheet (CCDS). While overall CCDS reporting improvements have occurred recently for the Superfund and RCRA Corrective Action programs, data quality improvements are needed in two major areas: (1)

appropriate reporting of estimated pollutant reduction amounts for enforcement actions that involve remediation, treatment, and/or removal; and 2) use of adequate pollutant calculation technique consisting of standard units of measure. Inconsistent reporting in past years revealed that some Regions were attempting to report the amount of pure contaminant (e.g. pollutant) reduced while others were reporting the amount of contaminated medium (e.g. pollutant and soil). This problem was further compounded by:

- the use of differing methods for calculating the measure among regions, and between site projects;
- difficulty in making the estimates based on the methodologies proposed;
- confusion among regions as to how to address the measure in particular situations, and
- the use of differing units of measure (e.g. pounds, gallons) requiring conversion to a common unit of measure in order to summarize the data for GPRA reporting.

A workgroup was formed to examine the causes for concern and to suggest how the pollutant reduction measure and/or the procedures for reporting it could be modified to improve the completeness, quality and consistency of the data. The group sought to find alternative approaches that would be more appropriate to Superfund and RCRA Corrective Action, and lead to data that is more complete and consistent from region to region.

3. Changing the Basis for the Pollutant Reduction Measure

3.1 Considerations for an Effective Measure for Superfund and RCRA Corrective Action

In modifying the approach from a measure of pollutants reduced to volume of contaminated medium addressed, the following important characteristics were considered:

- Superfund and RCRA Corrective Action cleanups most-often address contaminants already in the environment. The characteristics of the media that are contaminated can be just as important as the characteristics and quantity of the contaminant itself. An effective measure of pollutants reduced in the Superfund and RCRA Corrective Action context therefore ideally reflects an amount of actual environment that no longer poses a health risk due to contamination.
- Pollutant reduction data from the Superfund program is tracked in multiple databases. The pollutant reduction measure should be consistent with the requirements for pollutant tracking in WasteLAN (CERCLIS).
- The technical calculation used for the measure should result in a value that reasonably represents the basis of the measure (e.g. if the basis of the measure is volume of medium, then a calculation should be available that results in a representative value for the actual volume of medium).

- The measure should be easy to understand.

- The measure should be clear and fairly easy for EPA staff to derive from data readily available from routine field investigations at the time that the Case Conclusion Data Sheet is to be filled out.

3.2 The Former Concept of Mass-of-Contaminant as a Basis for the Measure

The mass of contaminant removed or reduced was previously used at times to measure pollutant reduction data in Superfund and RCRA Corrective Action enforcement matters and is currently the basis of this measure for enforcement matters under other environmental statutes. The measure typically refers to the actual mass of the contaminant (for instance, benzene or trichloroethylene) that is removed, destroyed, or prevented from entering the environment due to a particular enforcement action. It does *not* refer to the mass of *medium* (soil, vapor, water, etc.) but to the mass of the contaminant *within* a medium or *before entering* a medium. An example might be that as a result of an air enforcement action compelling stack scrubber technology, EPA has prevented 5000 tons of NOx emissions from entering the atmosphere. In Superfund and RCRA Corrective Action cases, a mass-based indicator typically would imply measuring and summing the total mass of contaminant present in soil, water, vapor, non-aqueous phase liquids (NAPL), sediment, etc. that will be removed or addressed by a response or corrective action. Wider adoption of this method was considered as a primary method and decided against in development of this guidance.

3.3 A Mass-of-Contaminant-Based Measure Is Not The Best Option For Remediation Programs

A mass-of-contaminant based measure generally does not meet the criteria outlined in 3.1 above as well as a volume-of-medium approach. First, remedies at Superfund sites and RCRA Corrective Action facilities/sites typically address complexities associated with contaminated media, not merely the contaminating chemicals themselves. Contaminants are often found in the environment in more than one medium (soil, water, air, fractured rock) and in multiple inter-related phases (as vapor, stuck to soil (sorbed phase), dissolved in water, or as pure undissolved liquid (non-aqueous phase liquid, or NAPL). Although the total mass of contaminant at a site is divided among these media and phases, the mass-based measure was not designed to address these complexities. It is exceedingly difficult and often impossible to measure the total site contaminant mass. In situations where it may be possible, doing so requires technically complex measurements that are not generally needed or acquired in the Superfund or RCRA investigation and cleanup process. Thus, measuring contaminant mass that has already entered the environment is often difficult and frequently cannot be achieved with readily available data (See Appendix A).

Second, the calculations that had been tried for calculating contaminant mass did not provide representative values for mass (see Appendix A). Third, a measure based on contaminant mass is not a good indicator of the remediation achieved. Mass does not reflect the size of the problem, nor the nature of the environment in which the contaminant is situated. Lastly, a

measure based on contaminant mass is significantly different than Superfund measures required for CERCLIS, which measure pollutant reduction based on volume. Those wishing more discussion on the difficulties associated with the mass-based approach to pollutant reduction should consult Appendix A.

3.4 The Concept of Volume of Contaminated Medium as a Basis for the Measure

Given the difficulties associated with calculating and using contaminant mass as a basis for pollutant reduction, particularly in situations where contaminants have already entered the environment and reside in one more environmental media, ***volume of contaminated medium addressed*** will be used as the basis for the measure for Superfund and RCRA Corrective Action enforcement actions. Under this basis, the focus of the measure is on estimating the physical space (volume) that EPA's selected response or corrective action will address in order to achieve protection of human health and the environment. This basis does not require that the person calculating the measure be able to separate the amount of mass inside each of many separate media (water, stuck to soil, etc.) and among many contaminant phases (e,g, solid, liquid, gas). The volume-based measure is much easier to calculate with readily available information, and easier to understand. Finally, the volume-based approach is more consistent with the measures and indicators used in CERCLIS, which are volume-based and not mass-based.

It is recognized that no single indicator can provide all the information about a Superfund or RCRA facility/site, and this measure is no exception. The amount of volume addressed by a response or corrective action does not indicate, for instance, the degree of total risk reduction, or whether the response or corrective action permanently destroyed, converted the form, or contained the contaminant. Nor does it reflect the cost. These should not be viewed as shortcomings of the measure, but rather as identifying needs for other measures to tell the full story of Superfund and RCRA Corrective Action accomplishments. As such while the volume-of-contaminated medium basis has limitations, it is preferable in comparison to the mass-of-contaminant-based measure.

4. Calculating the Volume of Contaminated Medium Addressed Measure

While the basis for this measure has been modified to address the most-common situations that arise at Superfund sites and RCRA Corrective Action facilities/sites (e.g. groundwater contamination, soil contamination) there are circumstances that differ from these. Also volume of contaminated medium could be interpreted several different ways. Because of these factors, fairly specific rules are needed for how to use and calculate the measure. At the same time, one of the objectives of this change to the measure is to make it easier to calculate with available information. To this end, an attempt has been made to be precise about the definition of the volume itself while not being overly prescriptive in defining how the volume is calculated, particularly when there may be several legitimate ways of calculating the volume depending on the situation in the field. For example, a project manager may have several different ways that legitimately allow for an estimate of the volume of soil addressed by a removal action (e.g. number of filled trucks that drove out the gate times the volume of each truck, or the known depth times the area of the soil contamination). The best method will depend on the specifics of the site and the data that are available to that project manager.

The following provides the definition of the measure, general guidance elements, and then guidance specific to particular types of Superfund response actions and RCRA corrective actions.

4.1 General Definition

Under this guidance, "Volume of Contaminated Medium Addressed" refers to:

> ***The volume of environmental medium that is subject to the Superfund response action or RCRA corrective action, such that, at the conclusion of the action, human health and the environment are protected in accordance with the statutory mandate for Superfund or RCRA Corrective Action.***

The focus is on the physical space that is addressed by the response or corrective action. As an example, for soil and groundwater remedies, the volume of medium measures the volume of soil or aquifer subject to the response or corrective action. In the case of soil contamination, the volume of contaminated medium is the volume of soil subject to removal or treatment. In the case of groundwater contamination, the volume of contaminated medium is the volume of physical aquifer (not water, but entire formation) that will be addressed by the response or corrective action. These are further elaborated in the sections that follow.

4.2 General Questions and Answers About Calculating the Measure

This section provides important guidance on general questions pertaining to when and how the measure is calculated. The next section provides guidance specific to each response action category.

When and with what data is the measure calculated?

- For Superfund remedial actions, at the time an enforcement document is finalized (e.g. issuance of a unilateral order or corrective action order, signing of an agreement on consent or consent decree) using data available from the remedial investigation, feasibility study, and/or record of decision (or any other relevant data).

- For Superfund non-time critical removal actions, at the time an enforcement document is finalized using data available from the engineering evaluation/cost analysis, and/or the action memorandum (or any other relevant data).

- For Superfund time-critical removal actions, at the time an enforcement document is finalized using data available from the action memorandum (or any other relevant data). Sometimes few data are available for such cases at the time of the action memorandum. If insufficient data exist for an estimate at the time of the action memorandum, the value for the measure should be entered at the soonest practical time after the settlement as data are available to calculate the measure; with the caveat that the best available value for the measure should always be entered in the same fiscal year in which the enforcement document is finalized.

- For RCRA corrective actions, at the time an enforcement document is finalized using data available from RCRA inspections or corrective action investigations.

Over what time period is the measure calculated?

The volume of contaminated medium measure includes the total volume of medium anticipated (as of the enforcement action or settlement necessitating the CCDS) to be addressed by the response action *at its completion*. As an example, if a Superfund record of decision requires cleanup of the groundwater plume to MCLs, then the total volume of aquifer presently above MCLs is what is reported; this is what will be addressed at the completion of the cleanup.

This is a change from the previous requirement to report the first year's worth of pollutant reduction data once the response action or corrective active had been fully implemented.

How is the measure addressed if there are multiple response actions under the same enforcement action?

The calculation of the Volume of Contaminated Medium Addressed measure is to be made on a *response-action specific (or corrective action-specific) basis*. For each different physical response or corrective action among the protocols discussed below, the CCDS will accept one estimate for the measure. For example, if there is a groundwater cleanup and a soil removal under the same enforcement action, each will have its own measure value.

How is the measure addressed if there is a response action or corrective action for Non-aqueous Phase Liquid (NAPL) <u>within</u> a groundwater cleanup?
Many sites may have a groundwater cleanup such as pump-and-treat, within which is a small subset volume in which NAPL is being recovered; for instance, by steam-injection. In such cases, NAPL recovery is one response (or corrective) action and groundwater cleanup is another, so both are reported with separate values for the measure. Even though the volume of the NAPL recovery resides entirely within the volume for the groundwater cleanup, the purpose, application, contaminant-phase targeted, cleanup technology, and cleanup goals of the former differ entirely from the latter; so both are counted.

Is the measure to be calculated for enforcement cases securing investigation work?
No. The Volume-of-Medium Addressed Measure is only calculated in association with settlements that secure physical response action or corrective action work.

Is the measure to be calculated for institutional controls?
No estimate of the measure should be provided for institutional control remedies or the portions of remedies that may involve solely institutional controls. Such cases do not directly and physically address contaminants, and determining a volume to associate with such controls would be difficult to do in any consistent way.

Is the measure to be calculated for cash-out settlements?
No estimate of the measure should be provided for cash-out settlements or for the portions of settlements which are cash-outs. Such cases do not directly and physically address contaminants, and determining a volume to associate with the cash proceeds would be difficult to do in any consistent way.

Is the measure to be calculated for containment remedies?
Yes. Containment is a critical tool to EPA for addressing contamination. The situation-specific protocols below (Section 4.3) provide methods for calculating the measure in containment situations.

Is the measure to be calculated for monitored-natural-attenuation (MNA) remedies or other "passive" remedies?
Yes. MNA remedies are not the same as no-action remedies. When MNA is employed, biodegradation is relied upon as a physical process to achieve remedial goals. The situation-specific protocols below (Section 4.3) provide methods for calculating the measure in MNA situations. It is noted also that MNA can be used either for containment or for reduction in the size of the contaminated groundwater plume. So, MNA is not synonymous with containment, either.

Is the measure to be calculated for true no-action remedies?
No. No action remedies, by definition, are a determination that no physical cleanup action will be taken, no natural process will be relied upon, and no cleanup standards will be applied. Therefore, there is no volume of contaminated medium addressed to report.

What if the response action addresses only part of the contamination?
The measure is only to report the volume of medium that is addressed by the action. The excess volume is not counted in the measure.

What is a "Point of Entry Control Remedy" and how does it apply to the measure?
Some Superfund response actions and RCRA corrective actions do not focus on cleaning up a medium that is already contaminated to a particular goal, but rather, focus on keeping a certain amount of contaminants from entering a medium. In such a case, the medium is indirectly positively affected, but the objective of the response action is not to attain a particular standard for the medium, but rather a standard for how much to keep *out* of the medium. It is not appropriate to count the volume of the entire medium, and other methods are needed for the measure. Examples of these are mining drainage diversion and mining waste drainage treatment remedies, and vapor intrusion remedies.

4.3 Response Action-Specific Protocols for Calculating the Measure

This section contains a table that provides a summary of measures and methodologies for estimating volume of contaminated medium addressed in various cleanup situations that are common to Superfund and RCRA Corrective Action. If more than one of these situations occurs at the same site, separate estimates should be made for each.

In order to maintain brevity, in this section the term "response action" is intended to mean "Superfund response action or RCRA corrective action," unless otherwise specified.

The following response action categories are covered in this section:

1. Soils (including mine tailings) Response Actions
2. Groundwater Hydraulic Response Actions
3. Landfill Response Actions
4. Soil Vapor Extraction Response Actions
5. Vapor Intrusion (Point of Entry Control) Response Actions
6. Non-Aqueous Phase Liquid (NAPL) Recovery Response Actions
7. Sediment Response Actions
8. Surface Water Response Actions
9. Mine Drainage Diversion and Treatment (Point of Entry Control) Response Actions
10. Container (e.g. Drum) and Large Debris Removal

These categories will address a large percentage of Superfund response and RCRA corrective actions. However, because the number of possible actions is so varied and extensive, occasionally there will be situations that do not fit into one of these categories. In such cases, consultation with the Office of Compliance is strongly recommended. Such consultations will enable us to develop consistent approaches for these less common actions.

1. Soils Response Actions

What is included: (Examples)	What is not included: (Examples)
Actions addressing soil, fine-grained buried debris such as fine foundry slag, crushed aggregate, mine tailings, excavation under surface impoundments and RCRA units; including excavation with treatment followed by replacement or disposal, in-situ treatment, capping, soil containment, stabilization	Aqueous sediments, landfills, drum removals, large-scale debris, NAPL (see later categories)
Target of this measure category: Physical volume of soil, fine debris, or tailings that are being addressed (treated, removed, capped, stabilized) by the response action	**Units for reporting this measure:** Cubic yards Useful conversion factors: 1 cubic yard = 27 cubic feet 1 cubic foot = 0.037 cubic yards 1 acre = 4840 square yards

Methodology for calculating the measure:

Use available data on the physical extent (area and depth) of soil within which the contamination resides, determine what subset of this soil will be excavated, treated, stabilized, or otherwise addressed, and report the volume of this soil. This may be a simple length times width times depth calculation, or another 3-dimensional volume-of-solid calculation (e.g. formula for cone, sphere), and/or the volume may need to be broken into subvolumes that are then added together. If soil has already been excavated and placed in rail cars or trucks, it is permissible to calculate the volume based on the volume of each rail car or truck times the number of cars or trucks. If soil is excavated and passed through a batch treatment unit, it is permissible to calculate the number of batches times the volume of the unit. (See explanations and notes, below).

Additional methodology elements for special cases:

If the soils are capped, calculate the volume of contaminated soil physically beneath the cap, based on the best information available.

Explanations and notes:

(1) After soils are excavated, they often occupy a larger volume in the truck than they did in the ground. This is referred to as a swell factor, and is typically on the order of a few tens of percent. However, this difference is relatively small compared to the margins of error for this type of measurement. Therefore, it is permissible to measure the volume either in-situ or after excavation, whichever is more readily available based on the situation at the site.

(2) Note that the method specifies defining the physical extent of the soil within which the contamination resides, as opposed to the extent of "contaminated soil." This is intentional. There is no way to have perfect knowledge of contamination at every point in a block of soil. There may be, therefore, small areas within the block that are not contaminated. As there is no way to segregate these discontinuous chunks of uncontaminated soil from the rest, the entire block needs remediating. Hence, the volume of the entire block is reported.

2. Groundwater Response Actions

What is included: (Examples)	**What is not included: (Examples)**
Actions affecting cleanup of the various phases and media in a groundwater system by removing, destroying or containing contaminants in the dissolved and sorbed phase from below the water table, including pump-and-treat, monitored natural attenuation/ biodegradation, reactor trenches, in-situ groundwater treatment, hydraulic containment of NAPL (not NAPL recovery itself - see Category 6; see also Explanations and Notes, No. 2, below)	The volume of water extracted and treated (*see notes, below), non-aqueous phase liquid *recovery* (see Category 6; see also Explanations and Notes No. 2, below)
Target of this measure category: Physical volume of aquifer formation, including matrix, water, and contaminant (*not* just the water) that is contaminated above ROD cleanup standards and will be subject to the response action.	**Units for reporting this measure:** *Thousands* of Cubic Yards ($1000 \cdot yd^3$) Useful conversion factors: 1 cubic yard = 27 cubic feet 1 cubic foot = 0.037 cubic yards 1 acre = 4840 square yards 1 square mile = 3,097,600 square yards 1 square mile•foot = 1,032,533 cubic yards 1 cubic mile = 5,451,776,000 cubic yards

Methodology for calculating the measure:

1. Assemble a contaminant icoconcentration contour map ("plume map") for each hydrostratigraphic unit (aquifer layer), and collect the information available on the thickness of each unit.

2. For each unit, calculate either: (1) the physical area which lies within the icoconcentration contour defining the ROD cleanup standard the system will achieve, or (2) the area which will be treated or addressed by the groundwater treatment system or response action in that unit. These two calculations should provide similar results.

3. For each unit, multiply the area derived in (2) by the average thickness of that unit to get a volume for that unit (see Explanations and Notes No. 2, this category, below).

4. Add the volumes derived in (3) for each of the units involved to get a total volume.

5. Convert the volume to cubic yards and divide by 1000 to get the reporting volume in 1000s of cubic yards.

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2. Groundwater Response Actions

Continued...

Additional methodology elements for special cases:

(1) In groundwater containment remedies using either pump-and-treat or biodegradation, calculate the volume of aquifer formation that is being contained (so that contaminants cannot escape the containment zone)

(2) If the thickness of an aquifer unit varies by more than 50% across the area in question, do not use the average thickness, but divide the volume of affected aquifer up into smaller subvolumes such that the variation in thickness within each subvolume is less than 50%. Then, (a) run the calculation for each of the subvolumes, (b) add the subvolumes together to get a total volume for that one hydrostratigraphic unit, and finally, (c) add all the unit volumes to get the total reported volume.

(3) If pump-and-treat will be used for part of the cleanup and monitored natural attenuation will be used for another part, and both processes will attain the ROD standards, then report the volume as the sum of the volumes being treated by each both process.

Explanations and notes:

(1) This method does not calculate the volume of water pumped and treated. Make sure that you are calculating the total volume of actual aquifer formation (not just water) that is contaminated above treatment standards and will be addressed by the system. Note that aquifer porosity is not pertinent to the calculation, because the goal is to clean the entire aquifer system of contamination, not merely the water in the formation.

(2) There is a critical difference between NAPL hydraulic containment and NAPL recovery. The former actually contains the water *around* the NAPL to keep dissolved contaminants from escaping. It is a groundwater response action in that it addresses *dissolved* phase contaminants. This type of response action falls in this category. The latter, NAPL recovery, involves removing pure NAPL from the ground in the residual phase. This is addressed in Category 6.

3. Landfill Response Actions

What is included: (Examples)	What is not included: (Examples)
Actions addressing landfills, dumps, waste piles, contents of impoundments	
Target of this measure category: Physical volume of soil, waste or debris that is being addressed (treated, removed, capped, stabilized) by the response action	**Units for reporting this measure:** Cubic yards Useful conversion factors: 1 cubic yard = 27 cubic feet 1 cubic foot = 0.037 cubic yards 1 acre = 4840 square yards

Methodology for calculating the measure:

Use available data on the physical extent (area and depth) of the landfill within which the contamination resides, determine what subset of this waste will be excavated, treated, stabilized, or otherwise addressed, and report the volume of this waste. This may be a simple length times width times depth calculation, or another 3-dimensional volume-of-solid calculation (e.g. formula for cone, sphere), and/or the volume may need to be broken into subvolumes that are then added together.

The most common type of landfill response action is a landfill cap. For this case, calculate the volume of waste physically beneath the cap, based on the best information available. If contaminated waste does not extend below a certain depth and this depth is known, do not count the volume of waste below this depth. Otherwise, if contamination may extend to the bottom of the landfill, report the volume of the landfill (to the bottom) that lies under the cap.

Additional methodology elements for special cases:

1) If waste has already been excavated and placed in rail cars or trucks, one may calculate the volume based on the volume of each rail car or truck times the number of cars or trucks. Or, if excavated and passed through a batch treatment unit, one may calculate the number of batches times the volume of the unit (see explanations and notes, this category, below).

(2) If the landfill is capped and there is soil contamination in the native material under the landfill, this volume of soil is also addressed by the cap and may be included as a soil volume under Category 1, above.

(3) If the landfill is excavated and there is soil contamination in the native material under the landfill, this latter volume of soil may be included as a soil volume under Category 1, above.

Explanations and Notes:

(1) After wastes are excavated, they may occupy a larger volume in the truck than they did in the ground. However, this difference is relatively small compared to the margins of error for this type of measurement. It, therefore, is permissible to measure the volume either in-situ or after excavation (in landfill excavation cases), whichever is more readily available based on the situation at the site.

(2) Note that the method specifies defining the physical extent of the waste within which the contamination resides, as opposed to the extent of "contaminated waste." This is intentional. There is no way to have perfect knowledge of contamination at every point in a volume of waste. There may be, therefore, small areas within the block that are not even contaminated. As there is no way to segregate these discontinuous chunks of uncontaminated waste from the rest, the entire block needs remediating. Hence, the volume of the entire block is reported.

4. Soil Vapor Extraction (SVE) Response Actions

What is included: (Examples)	**What is not included: (Examples)**
Actions where soil vapor extraction is employed to reduce soil concentrations within soils (or shift residual phase contaminants to the vapor phase for removal) above or at the water table.	Actions where soil vapor extraction is employed *solely* to control vapor intrusion, i.e. with no cleanup goals for the soils but merely the goal of keeping vapors out of a building or other structure; also, where landfill gas collection (see vapor intrusion remedies, next section) is employed.
Target for this measure category: Total physical volume of soil that will be subject to reduction in concentrations due to SVE; volume of soil subject to vacuum to achieve vapor recovery with SVE.	**Units for reporting this measure:** Cubic yards Useful conversion factors: 1 cubic yard = 27 cubic feet 1 cubic foot = 0.037 cubic yards 1 acre = 4840 square yards

Methodology for calculating the measure:

Use available data on the physical extent (area and depth) of contaminated soil which the ROD or action memorandum requires be cleaned by SVE. This may be a simple length times width times depth calculation, or another 3-dimensional volume-of-solid calculation (e.g. formula for cone, sphere), and/or the volume may need to be broken into subvolumes that are then added together.

Alternately, calculate the summed volumes of the spheres of effective pneumatic influence of the planned SVE extraction wells that will be required in order to meet ROD requirements and achieve protection of human health and environment. Do not include volumes of contamination that will not be subject to the implementation of SVE and/or do not lie at concentrations above ROD-based standards.

5. Vapor Intrusion Response Actions (Point of Entry Control)

What is included: (Examples)	**What is not included: (Examples)**
Actions where a technology is employed *solely* to control vapor intrusion, i.e. with no cleanup goals for the soils but merely the goal of keeping vapors out of a building or other structure; also, landfill gas collection - pulling gas collecting under a landfill cap to prevent escape from the cap, with no associated cleanup target for the waste in the landfill	Actions where SVE is employed to evoke a reduction in the concentration of contaminant in the soil, not merely to control escape or entry into another medium (see Category 4, above).
Target for this measure category: Physical volume of air/vapor which will be diverted or treated by the vapor intrusion control system over its expected lifetime.	**Units for reporting this measure:** Cubic feet of soil vapor Useful conversion factors: 1 meter = 1.093 yards 1 cubic meter = 1.31 cubic yards 1 cubic meter = 35.31 cubic feet 1 cubic meter/sec = 35.31 cubic feet/sec 1 cubic yard = 27 cubic feet 1 year = 31,536,000 seconds

Methodology for calculating the measure:

1. Calculate the expected average volumetric flow rate of the system over the duration the system is expected to run (this may be expressed in cubic feet per second (cfs).

2. Estimate the duration of time the system is expected to run (often expressed in months or years).

3. After converting units to be consistent (convert years to seconds or vice versa, for instance), multiply the result from (1) by the result from (2) to get total cubic feet of soil vapor that will be diverted or treated.

There may be significant uncertainty in the duration of the system as well as the average flow rate, particularly if the duration of the system is expected to be very long or is listed as "indefinite." Best professional judgement will be necessary in these cases.

Explanations and notes:

In the case of residential vapor intrusion, a system runs to collect vapors and keep them from entering, for instance, a house. In landfill gas collection systems, a system removes collected gas and keeps it from entering the atmosphere, or pressing out and entering buildings. These systems do not clean the air in a house, the atmosphere, or the soil, per se, but prevent vapors from entering these. In these cases, it is not appropriate to claim a volume of house or atmosphere or soil cleaned because the goal of the response action or corrective action is not to clean an environmental medium but rather to prevent contamination from entering a medium. Therefore, it is more appropriate to fall back on a volume of air/vapor prevented from entering, for example, the house, or the atmosphere.

6. Non-Aqueous Phase Liquid (NAPL) Recovery Response Actions

What is included: (Examples)	What is not included: (Examples)
Actions which are aimed at recovery of contaminant residing in the *residual* phase (NAPL). Examples include excavation of NAPL-impacted soil, NAPL recovery extraction wells, NAPL flushing and recovery, steam injection with vapor and liquid recovery, electrical resistance heating with vapor recovery, oxidant or alcohol injection with liquid recovery, bioremediation of NAPL-impacted soils.	Groundwater actions that hydraulically contain water around the NAPL but do not seek to directly recover residual NAPL (See notes below; see also Category 2 above on groundwater response actions)
Target for this measure category: The physical volume of formation impacted with NAPL that will be subject to the recovery technology. The physical volume of the zone in which NAPL is known to occur and in which a response action will be applied to address it.	**Units for reporting this measure:** Cubic yards Useful conversion factors: 1 cubic yard = 27 cubic feet 1 cubic foot = 0.037 cubic yards 1 acre = 4840 square yards

Methodology for calculating the measure:

1. From the best available information, identify the 3-dimensional zone at the site inside which NAPL occurs and to which the selected NAPL recovery technology will be applied. There is often extreme heterogeneity in NAPL distribution - the goal is to identify the smallest boundary within which it is reasonably known that the NAPL, where it occurs, lies inside the boundary, and within which the NAPL recovery technology will be applied. Do not count NAPL volume outside the area to which the recovery system will apply.

2. Calculate the volume of the zone in (1) either as a simple area times depth calculation, or as the sum of multiple subvolumes that are then added together.

3. If there are large-scale discrete and disjoint NAPL areas within the site that will be subject to the NAPL recovery technology (i.e. where no NAPL recovery will occur between such discrete areas), calculate a volume for each such area separately and sum the volumes for each of the areas to come up with a total volume.

Additional methodology elements for special cases:
A cap over a NAPL-impacted area should be calculated as a cap over impacted soils per Category 1 above.

CONTINUED...

6. Non-Aqueous Phase Liquid (NAPL) Recovery Response Actions

Continued...

Explanations and notes:

(1) It is exceedingly difficult, and often impossible, to identify all locations within a block of ground at a site in which NAPL resides at a site. NAPL is typically distributed in a very heterogeneous way - it may vary from pure product to clean soil and back over very small distances of a few feet or less. It is not practical to determine the exact distribution of NAPL on a micro-scale or to apply NAPL remedies to exactly the micro-areas where NAPL occurs but not where NAPL does not occur. Rather, the response action must be applied to an overall area within which it is known that the NAPL occurs. This is the volume that should be reported. It is noted, however, that disjointed NAPL areas on a large scale should be computed as distinct volumes that are then summed.

(2) Actions that hydraulically remove water (e.g. pump and treat) from a zone around NAPL are often referred to as "NAPL containment" remedies. However, there is danger in this terminology because such remedies are actually dissolved phase remedies and need to be contrasted with remedies that actually recover NAPL in the residual phase. If the goal of the response action or corrective action is the physical removal of NAPL from the ground, use this category. If the goal of the response action or corrective action is containing contaminants dissolved in water around the NAPL from escaping, use the Groundwater Response Action Category No. 2, above.

(3) If the volume impacted NAPL lies entirely within the volume being counted for a hydraulic groundwater cleanup (such as within the capture zone of a pump and treat system), the NAPL volume still should be counted because NAPL recovery and groundwater pump and treat are focused on two different phases of contaminant, usually require entirely separate feasibility study analyses, and are two distinct response actions. A groundwater hydraulic response action achieves a different set of environmental conditions than does NAPL recovery. As the measure is response-action based, it is appropriate to report both volumes, even though one lies within the other in physical space.

(4) The method does not call for calculating the volume of NAPL itself - rather, the volume of NAPL-impacted formation, which will include soil, NAPL, soil moisture, etc.

7. Sediments Response Actions

What is included: (Examples)	What is not included: (Examples)
Actions addressing sediments along streams, rivers, lakes, drainage pathways, drainage conveyances (sewers), wetlands, shorelines, and waterway dredge materials. Includes excavation with treatment and replacement or disposal, in-situ treatment, capping, soil containment, stabilization	Landfills, general soils (see Category 1 and Category 3)
Target for this measure category: Physical volume of sediments to be addressed by the response action	**Units for reporting this measure:** Cubic yards Useful conversion factors: 1 mile = 5280 feet = 1760 yards 1 cubic yard = 27 cubic feet 1 cubic foot = 0.037 cubic yards 1 acre = 4840 square yards

Methodology for calculating the measure:

Use available data on the physical extent (area and depth) of sediments that are affected by contamination *and* that will be subject to the response action (excavated, treated, capped, etc.).

1. For rivers, streams, shorelines, drainages, and drainage conveyances, determine the average downstream cross-sectional area of the sediment that will be subject to the response action - in general, in the plane perpendicular to the water body. If necessary, divide the sediment into several reaches such that the variation in cross-sectional area within each reach is small.

2. Calculate the length of the overall reach of sediment that will be subject to the response action. If multiple reaches are being used, calculate the length of each reach (typically parallel to the water body).

3. Multiply the area by the average-cross sectional area to determine a volume of sediment material. If multiple reaches are being used, calculate a volume for each reach and sum them for a total volume.

Alternately, if sediment has already been excavated and placed in rail cars or trucks, it is permissible to calculate the volume based on the volume of each rail car or truck times the number of cars or trucks. If sediment is excavated and passed through a batch treatment unit, it is permissible to calculate the number of batches times the volume of the unit.

Additional methodology elements for special cases:

For lake bottoms, wetlands, and dredge materials, the above method may not be appropriate. Use the best available knowledge of the depth and surface areal dimensions of the sediment to determine a volume for the sediment. Subdivide the volume and sum the subvolumes as necessary for a more reasonable estimate.

If soil lying under the sediment is contaminated and will be subject to the response action, a separate volume estimate for the soil can be made using Category 1 above.

Explanations and notes:

See notes from Category 1 regarding swell factor.

8. Surface Water Response Actions

What is included: (Examples)	What is not included: (Examples)
Actions aimed at reducing concentrations of contaminants or containing contaminants in surface water bodies, including lakes, rivers, streams, lagoons, ponds, water in wetlands, ocean	Groundwater, sediments, mine drainage diversion and/or treatment remedies
Target for this measure category: Physical volume of water, in-situ, within the surface water body that is contaminated *and* that will be addressed (contained or reduced in concentration) by the response action.	**Units for reporting this measure:** Gallons Useful conversion factors: 1 cubic yard (liquid) = 201.97 gallons (U.S.) 1 cubic foot (liquid) = 7.47 gallons (U.S.) 1 acre-foot = 325852 gallons (U.S.)

Methodology for calculating the measure:
Because of the wide variety of surface water bodies, there is no single calculation that will address all of them. The volume of the surface water body that is contaminated and will be addressed should be targeted and reported.

Additional methodology elements for special cases:
If soil or sediment lying under the water is contaminated and will be subject to a response action, a separate volume estimate for the soil or sediment can be made using Category 1 and/or Category 7 above.

Explanations and notes:

Water within the water body that is not contaminated should not be reported, nor should water that is contaminated but will not be addressed by the response action. For example, if a certain amount of ocean or lake water will be infused with microorganisms that will biodegrade a contaminant as they fall through the water column, only the volume of water in the area being treated would be reported, not the volume of the entire ocean or lake.

Alternately, if the entire water body is contaminated, and treating a particular area will result in an attending decrease in the contaminant concentration for the entire water body, then the volume of the entire water body may be reported.

9. Mine Drainage Diversion and/or Treatment Response Actions (Point of Entry Control)

What is included: (Examples)

Actions that water draining from a mine will be diverted from its natural course so as to keep the drainage from entering a surface water body; or, where such drainage is intercepted and treated prior to being released into the surface water body. Such actions are implemented *solely* to limit drainage at its point of entry into the surface water body. There are no cleanup goals for the surface water body itself.

What is not included: (Examples)

Actions that result in direct treatment to a surface water body (see Category No. 8); actions that result in direct removal or treatment of mine tailings; actions that contain cleanup requirements for the mine materials themselves, as opposed to preventing drainage from such materials from entering a surface water body.

Target for this measure category:

Physical volume of drainage water that will be diverted or treated by the mine drainage diversion and/or treatment system over its expected lifetime.

Units for reporting this measure:

Gallons

Useful conversion factors:
1 meter = 1.093 yards
1 cubic meter = 1.31 cubic yards
1 cubic meter = 35.31 cubic feet
1 cubic meter/sec = 35.31 cubic feet/sec
1 cubic yard = 27 cubic feet
1 year = 31,536,000 seconds
1 cubic yard (liquid) = 201.97 gallons (U.S.)
1 cubic foot (liquid) = 7.47 gallons (U.S.)
1 acre-foot = 325852 gallons (U.S.)

Methodology for calculating the measure:

1. Calculate the expected average volumetric flow rate of the system over the duration the system is expected to run (this may be expressed in cubic feet per second (cfs)).

2. Estimate the duration of time the system is expected to run (often expressed in months or years).

3. After converting units to be consistent (convert years to seconds or vice versa, for instance), multiply the result from (1) by the result from (2) to get total cubic feet of water that will be diverted or treated.

There may be significant uncertainty in the duration of the system as well as the average flow rate, particularly if the duration of the system is expected to be very long or is listed as "indefinite." Best professional judgement will be necessary in these cases.

Explanations and notes:

In the case of mine drainage diversion or treatment systems, the system collects (and either treats or diverts) water contaminated with metals an and minerals leaching out of the mine that would otherwise drain into a surface water body. These systems do not clean the surface water body (e.g. a stream or river) directly but prevent drainage from entering.. In these cases, it is not appropriate to claim the volume of the stream, nor is it appropriate to claim the volume of all the mining waste inside the mountain. Neither of these is the target of the response action. It is therefore more appropriate to use the volume of water prevented from entering the surface water medium.

10. Container (e.g. Drum Removal) and Large Debris Response Actions	
What is included: (Examples) Drum and other container removal, as-is or after lab pack; excavation and disposal or stabilization of large-scale objects, including uncrushed footings, pipes, tanks, etc.	**What is not included: (Examples)** Fine slag material or soils, crushed aggregate, waste in landfills, sediments
Target for this measure category: Volume of material removed in containers; volume of large-scale material removed and/or stabilized or disposed	**Units for reporting this measure:** Cubic yards Useful conversion factors: 1 cubic yard (liquid) = 201.97 gallons (U.S.) 1 cubic foot (liquid) = 7.48 gallons (U.S.) 55 gallons (U.S.) = 0.272 cubic yards (liquid) 55 gallons (U.S.) = 7.35 cubic feet (liquid)
Methodology for calculating the measure: For each drum or container removed or addressed, count the volume of the container and sum all containers. For small numbers of large-scale objects, estimate the volume of each object removed and sum the volumes for all objects. If objects are numerous, the volumes for bulk shipment from manifests or billings can be used.	
Explanations and notes: Where drums are involved, it is not necessary to open every drum and determine what portion of the drum is full (which could pose a danger to workers and impose needless costs to the operation); instead, each drum may be counted as a volume of 55 gallons (or whatever capacity the drum has). If, however, drums have been opened in the course of the action and records kept of actual volume of material inside each, then the more accurate volume data should be used in the estimate.	

APPENDIX A
Problems In Using Mass-of-Contaminant as the Basis for the Pollutant-Amount-Reduced Measure for Superfund

The Mass-of-Contaminant Concept

The mass of contaminant removed or reduced is a measure used for various environmental programs. The measure typically refers to the actual mass of the contaminant (for instance, benzene or trichloroethylene) that is removed, destroyed, or prevented from entering the environment due to a program, regulation, intervention, or technology. It does *not* refer to the mass of *medium* (soil, water, etc.) but to the mass of the contaminant *within* a medium or *before entering* a medium. An example might be saying that stack scrubber technology has prevented 5000 tons of NOx emissions from entering the atmosphere in the last year. In Superfund, a mass-based indicator would imply estimating the total mass of contaminant present in soil, water, vapor, NAPL, sediment, etc. that will be removed or addressed by a response action.

How is Superfund Different with Respect to Pollutant Amount Reduced?

Many (not all) EPA environmental programs address contaminant being emitted at the source, and have indicators consistent with this. Often, there is a focus on preventing contaminants from entering the environment in the first place. Air programs may look at limiting the mass of contaminant discharged into the air through a stack. Water programs may look at limiting the mass of contaminant allowed to be discharged into a lake. To say that the Agency has prevented 5000 tons of NOx emissions from entering the atmosphere, or 50,000 pounds of copper from entering a lake, is almost visually compelling. Other programs focus on environmental concentrations *after* contaminants enter the environment, such as reducing the concentrations of MTBE in a lake. But these often focus on a single medium and contaminant phase. For instance, the concentration reduction in a lake involves water as the medium and the contaminant is in the dissolved phase.

The Superfund program (and in large measure, the RCRA corrective action program) primarily addresses contamination that has already entered the environment. In addition, it more often must confront and overcome complexities and issues associated with contaminated ***media***, not merely the contaminating chemicals themselves. Superfund contaminants may enter the environment over years or decades. They are usually found in the environment in more than one medium (soil, water, air, fractured rock) and in multiple inter-related ***phases*** (as vapor, stuck to soil (sorbed phase), dissolved in water (dissolved phase, such as what sugar does when mixed into water), or as pure undissolved liquid (non-aqueous phase liquid, or NAPL - like salad oil in water). The total mass of contaminant at a site is divided among these media and phases. There is often great spacial heterogeneity (i.e. variability) in the distribution of the contaminant mass. Soil concentrations may vary by a factor of many thousands of times, for instance, within a foot

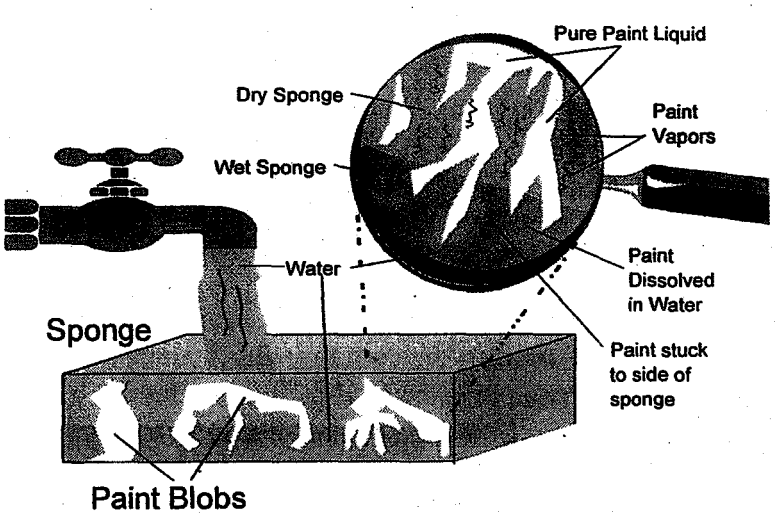


Figure A1

of soil, in contrast to the concentration of a contaminant in the water of a lake, which varies much more slowly over distance if it varies at all.

Not only is the mass of the contaminant more difficult to calculate when split among these various forms, but the specific circumstances and challenges presented by the environment in which we find the contaminant drive the necessity to remove it (e.g., the hypothetical health risks, if any, posed to the public) and the feasability and cost of doing so.

Here is an analogy to illustrate the various media and phases in a Superfund context. Many Superfund sites have groundwater contamination. Contrary to simple conception, the generic term "groundwater" does not refer to a single phase or medium but rather to many phases and media at the same time. Consider "groundwater" as the soaked part of a partially-soaked sponge with paint blobs in it. The sponge material is analogous to soil, the paint is analogous to sorbed contaminant or NAPL, and the water is analogous to the groundwater itself. Some of the mass of the paint dissolves in the water, some mass is in fumes in the dry part of the sponge and some mass is stuck to the sponge material. The sponge as a whole is analogous to the part of the aquifer that requires the response action. One can begin to see the complexity in trying to ascertain how much mass of contaminant is present in all of these forms within this "simple" sponge.

The Superfund program *does* use calculations associated with relative contaminant mass and mass removal rates in some cleanup evaluations. However, the focus usually is not on the *total* mass but on *cleaning the sponge*. And, often the total mass cannot even be calculated.

The following are a series of issues and problems associated with using mass-of-contaminant as the basis for the Pollutant Amount Reduced measure at the most common situations found at Superfund sites; for example, soil contamination, groundwater contamination, etc.

Technical Errors in Ad-hoc Methods That Have Been Used So Far to Satisfy Pollutant Amount Reduced

Calculating mass within multiple media at a Superfund site is more complex than it seems. In an attempt to satisfy the Pollutant Amount Reduced measure, methods have been used at various times to estimate contaminant mass. These efforts have contained serious technical errors that result in erroneous and misleading values for the measure. Two examples are presented for purposes of discussion.

(1) Contaminant mass for soil removals has been calculated by taking the volume of the soil removed and multiplying by an average soil density. This results in an estimate of the mass of *soil* removed, not the mass of *contaminant within the soil* that was removed. While the former is easier to calculate, it is not the quantity the measure purports to report, and so provides misleading information.

(2) In another suggested method, contaminant mass removed is calculated by taking the *difference* in dissolved groundwater concentrations between the beginning and end of a groundwater treatment action. The method applies a formula that uses the average flow rate of the system over the time that the system operates. In this method, the amount of ***change*** in the groundwater concentration leads mathematically to an estimate of mass removed. The greater the change in concentration, the more mass removed.

While this method may work for a single medium such as a lake, it does not work for groundwater. This is because the concentration of contaminant in the dissolved phase (groundwater concentration) is not merely dependent on the removal of mass by the treatment system. It is also dependent on the transfer of mass from other phases *into* the dissolved phase. For instance, contaminants can be released from soils (the sorbed phase) and redissolved in the groundwater. Or, they can be dissolved out of NAPL (residual phase) and back into the groundwater.

As a thought experiment, consider the case where nearby NAPL continues to dissolve into the groundwater as water is removed and treated by a cleanup system. In this case there is likely to be ***no*** change at all in the groundwater concentration, despite vigorous pumping. The calculation would indicate that there is no mass being removed ($C_{before} - C_{after} = 0$). Yet very large amounts of dissolved mass are being removed by the treatment system. The system is effective, but the measure says nothing is happening. Clearly, the measure defined in this way does not properly provide contaminant mass removed.

The aforementioned problem with the method is not limited to NAPL cases. Virtually all groundwater sites have some degree of sorbed contamination. Contaminants desorb into the groundwater (dissolve) during the treatment. The degree to which they do so will depend on the physical characteristics of the aquifer and the contaminant. The more desorption, the less reduction in concentration in the groundwater (dissolved phase) even though significant mass is being removed by the system. The desorption factor will vary from site to site. The conclusion is that the difference in concentration does not provide for an meaningful measure of the mass removed in a trans-phase, multi-medium environment. An estimate contaminant mass made by this method could be anywhere from a small percentage to a factor of thousands of times off, and is therefore meaningless.

Problems with Calculating Mass - Phases and Media are Missed

A straw method considered for discussion by OECA in estimating contaminant mass removed at Superfund sites, based on program staff input, involves using samples from one particular phase or medium. For instance, for soil cleanups, the original Pollutant Amount Reduced method suggested the use of soil concentrations as a means of arriving at the total mass of contamination in the soil. Setting aside for the moment the problems with determining a single mass from a wide range of concentrations measured in the soil, there is a more primary problem. Soil sampling only measures the concentration of contaminant in the sorbed phase (stuck to the soil). But there can also be (and often is) contaminant mass in soil vapor, dissolved in soil moisture, and in the residual phase (pure product, or non-aqueous phase liquid). Soil concentrations do not represent all of the forms of contaminant mass in the soil, thereby resulting in under-reporting of the environmental benefits. A similar problem exists for groundwater calculations; dissolved phase groundwater samples do not represent all phases (and therefore do not represent all mass) in the groundwater.

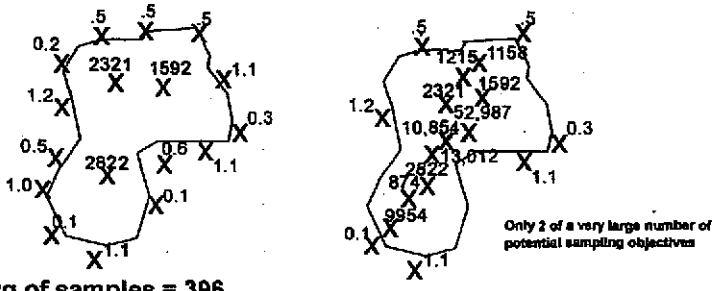
Obtaining concentration terms for all of these phases would require either: 1) performing sampling of all the phases; e.g. soil gas sampling, soil sampling, NAPL reconnaissance, groundwater sampling, at *every* site, or 2) trying to mathematically derive some of these values based on a few measured values of certain parameters. This latter approach would require using a set of equations called partitioning relationships. Either of these methods, in most cases, would represent work and expenditure significantly beyond what would otherwise be done at the site, solely for the purpose of obtaining a value for the Pollutant Amount Reduced measure.

It is also noted that at Superfund sites where NAPL is present, it can represent the vast majority of the contaminant mass at the site. Yet, determining the distribution of NAPL saturation in the ground is often virtually impossible to achieve. Said more simply, finding all of the NAPL and how much NAPL is present can be one of the most challenging problems with addressing it. Estimating the mass of NAPL would require knowing this distribution at all points within the site. In short, at NAPL sites the greatest uncertainty as to total contaminant mass applies to the phase likely to contain the most mass!

Problems with Calculating Mass - Averaging the Samples One Happens to Have on Hand

The methods considered originally for estimating contaminant mass removed at Superfund sites involve taking an *average* of the concentrations from environmental samples and applying it to the volume of material removed in order to get the mass. While this may seem like common sense, it is a flawed approach. Any set of values can be averaged; however, will that average be the average of concentrations in the medium being sampled? The answer is no, unless the samples were collected as a result of a competent sampling scheme *with the specific sampling objective of finding the average*. Sampling results are entirely dependent on the objectives for which they were collected, and the technical competency of the approach used to meet that objective (e.g. number of samples, spacing and distribution of samples, etc.).

Soil Example: ***Same contamination, 2 different sampling objectives***
Neither objective is to find the "average concentration"
Same number of samples in each case



Avg of samples = 396
Inside proven unacceptable, focus is on delineating the boundary of the contamination

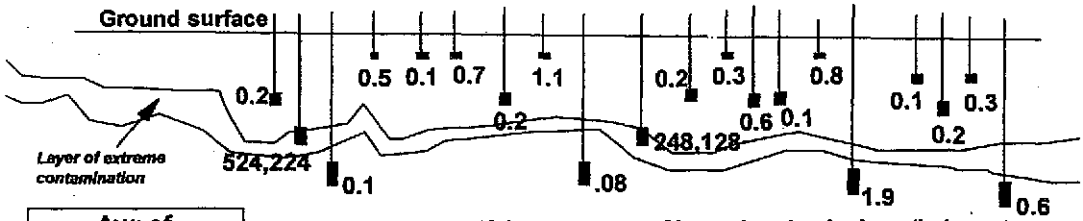
Avg of samples = 5,693
Focus is on a central band of contamination likely to have the highest contamination, as well as boundary, to some degree.

One case has an average 15 times the other.
Neither case represents the true average of soil concentrations (for a mass calc)!!!!
Still, each case meets the objectives for the data needed for the investigation;
average concentration simply was not one of those needs.

Figure A2

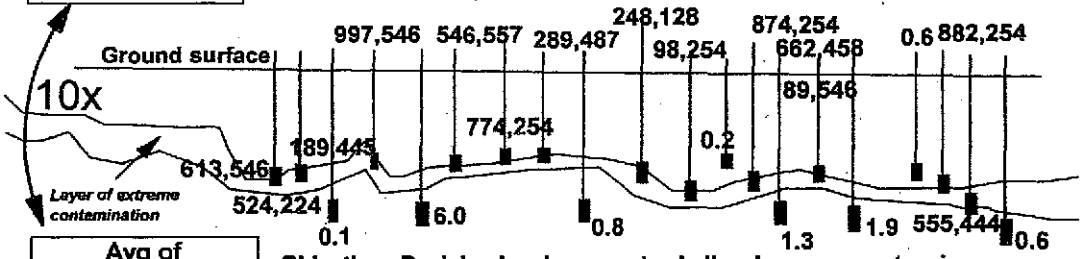
Soil Example: ***DEPTH Profile -- Same contamination, 2 different sampling objectives***
Neither objective is to find the "average concentration"
Neither case provides the true average that would allow for a mass calculation

Same number of samples in each case



Avg of Samples = 38,618

Objective: After identifying presence of layer, bracket it above/below so that we can target it for removal. Check shallower layers for risk purpose



Avg of Samples = 367,270

Objective: Decision has been made shallow layers are not an issue. Site-specific factors require very precise definition of layer.

Figure A3

The Superfund program does not typically collect samples with the objective of determining the average concentration. For example, once elevated levels are identified, many more samples may be collected with the purpose of finding the outer limits of the contamination. This may allow the Agency to target the soil that needs to be removed, and be sufficient for remedial purposes. The number of possible objectives is virtually endless and depends on the needs (data quality objectives) determined at the time of the investigation. One cannot merely take the average of the samples one has on hand and conclude that it represents the average concentration in the medium. To illustrate, consider Figures 2 and 3.

Figure B2 is shown in plane view. Two different sampling objectives and hence, two sample layouts are shown for the same site with the same contamination. Both cases contain the same number of samples. In the first case, the focus is on ensuring that the high levels are surrounded once they are identified. In the second case, the objective is to evaluate thoroughly the highest levels at the site with minimal evaluation of the limits of contamination. The averages of the samples in these two cases differ by a factor of 15 (and so would the masses calculated by the initial straw method).

Figure B3 is shown in cutaway view. In this case, there is a stringer, or layer, of very high contamination that winds through the soil. In the first case, the objective is to bracket the layer. In the second case, the objective is more precise sampling in the layer itself. The averages differ by a factor of about 10 (and so would the masses calculated by the straw method).

Even more important, none of these cases was designed to find a *true* average for the soil; doing so may well have required far more samples. Depending on the site-specific situation, the true average could be far greater than the differences shown here - perhaps hundreds of times different.

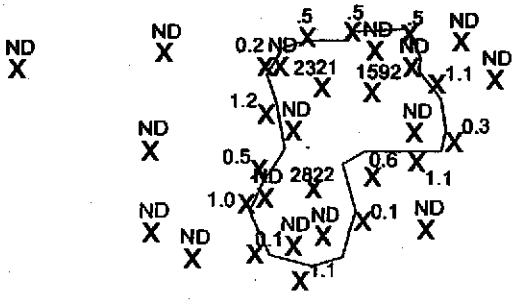
With groundwater, the same type of problems exist. Groundwater monitoring wells are typically placed to determine the extent of the groundwater contamination, to evaluate whether contamination has entered a particular area, or for contouring water levels and water quality concentrations. None of these objectives is related to the "average concentration" of water in the groundwater plume. While the average of concentrations from the wells at a site can certainly be calculated, it will have little relation to the average concentration of contaminants in the plume. Hence, a contaminant mass calculated from it will have little technical meaning.

Problems with Calculating Mass - Averaging and Non-Detects

An additional problem that arises with mass of contaminant calculations that use averaging of data is what to do with non-detect values. Again, depending on the sampling objectives, the number of samples in which no contaminant is detected will vary. The number of such samples could potentially be high. One can use conventional ways of treating this issue, such as applying one-half the detection limit to ND values, or ignoring them altogether. But each of these would have significant impacts on the average and resulting mass calculation. See Figure B4.

Soil Example: Different ways of using ND values
Which NDs do you want to count?

Assume quantification limit is 0.1 for 20 ND samples, and 50 for 13 ND samples due to matrix interference



Avg of samples not counting ND Samples = 396

Avg of samples counting ND Samples as Zero = 204
Avg of samples counting ND Samples as 1/2 QL = 213

One ND method has an average about double the other.
Neither case represents the true average of soil concentrations **!!!!**

Figure A4

Contaminant Mass is a Poor Indicator of Superfund Performance

Contaminant mass is not a particularly compelling or useful indicator of remediation achieved. For instance, 100 pounds of TCE can contaminate an aquifer for significant distances in all directions - say 500,000 acre-feet of water. Drinking groundwater within that entire area would be unsafe. At the same time, the same 100 pounds of TCE concentrated in a 10-foot cube area of dirt by the corner of a barn is a far different problem. The former is far more onerous to people, disruptive of health and economic activity, harder and more complicated to clean up, longer to clean up (50 years versus 1 day, for instance) than the latter, and would take almost incomparably greater time and resources on the part of the Superfund program.

In other words, the same mass of contaminant can present wholesale and vastly different environmental problems. Mass does not reflect the size of the problem, nor the nature of the environment in which the contaminant is situated - which gives rise to how hard and expensive it is to recover it. The public may be confounded by the question, "why did it take $25,000 to clean up 100 pounds of TCE here, and $25,000,000 to clean up 100 pounds of TCE over there? Likewise, Congress may wonder why only 100 *pounds* of TCE was cleaned up for $25,000,000 in Superfund whereas the Air Program prevented 100 *tons* of NO_x emissions out of the atmosphere for the same cost. The answer lies in the fact that mere mass does not convey the potential threat from the contaminant, which may be high regardless of mass, nor the cost required to remove the threat. As in earlier discussions, the context of the contaminant mass within a *medium* makes a great difference.

Mass Reduction in Most Superfund Situations is Difficult to Understand

The notion of mass reduction is easy for the average person to grasp for an action such as a removal of drums ("50 tons of liquids were removed") or in the case of keeping mass from entering a medium in the first place ("7000 tons of metals were kept from entering the stream"). Ironically, in these cases, mass reduction is actually easier to calculate. However, most Superfund sites involve soil and/or groundwater contamination. In such cases, it is very difficult for the average person to grasp how the mass of contaminant is distributed in the ground (e.g. the "sponge" discussion given earlier). For instance, that 500 pounds of a chemical is spread over a five-mile area; that some of it is stuck to soil, some is dissolved in water, some is vapor, some of the ground is contaminated, some of it isn't...these are lost on the public, generally, unless they are carefully explained. In such cases, by way of simplifying, the mind leaves mass of contaminant and starts focusing on the medium. In other words, not how much contaminant mass is in the soil, but *how much soil is out there that needs cleaning*? Per the earlier analogy discussion, the focus in on cleaning the sponge, and a easier question to grasp is "how much sponge did we clean?" For this reason, the mass of contaminant is difficult to understand, whereas amount-of-medium parameters are easier for the public to understand (see section 4).

Summary: Contaminant Mass-Based Pollutant Amount Reduced Measure Has Resulted in Inconsistent Data and Poor Compliance

Due in part to all of the foregoing, the originally-proposed mass-of-contaminant based Pollutant Amount Reduced measure has resulted in inconsistent data and poor compliance. Attempts to make better mass estimates would require onerous and complex increases in RPM workloads, including extra work solely to derive the measure. In many situations, the total mass may be unobtainable with current methods (such as at sites where NAPL is present). The Pollutant Amount Reduced definition and method tends to be confusing in real world Superfund situations, leaving project staff scratching their heads trying to come up with individual ways of calculating the mass. This makes the data prone to inconsistencies, and results in poor regional compliance with the measure. At the same time, the measure is a poor indicator of Superfund performance, and is not consistent with the way Superfund makes decisions. It is also difficult for the public to understand in most instances.

A better basis for the Pollutant Amount Reduced measure was therefore sought.

Attachment E
EPA LUC ROD Checklist

EPA Region 9

FEDERAL FACILITY LAND USE CONTROL ROD CHECKLIST

Cross-Checked Against Navy Record of Decision

EPA LUC ROD Checklist Item	Checklist Item Location in Shoreline Site LUC ROD
1. Map/Figure showing boundaries of the land use controls	Figure 4
2. Document risk exposure assumptions and reasonably anticipated land uses, as well as any known prohibited uses which might not be obvious based on the reasonably anticipated land uses. (For example, where "unrestricted industrial" use is anticipated, list prohibited uses such as onsite company day-care centers, recreation areas, etc.)	1.3 – Site Assessment 1.4 – Description of Selected Remedy 2.6 – Current and Potential Future Site and Resource Use 2.9 – Principal Threat Waste 2.10.4 – Expected Outcomes of the Selected Final Remedy 2.11.1 – Protection of Human Health and the Environment
3. Describe the risks necessitating the LUCs.	1.3 – Site Assessment 2.9 – Principal Threat Waste
4. State the LUC performance objectives.	1.4 – Description of Selected Remedy 2.4 – Scope and Role of the Revised Remedy 2.7 – Response Action Objectives 2.10.2 – Description of the Selected Final Remedy
5. Generally describe the LUC (restriction), the logic for its selection and any related deed restrictions/notifications	1.4 – Description of Selected Remedy 2.4 – Scope and Role of the Revised Remedy 2.10.2 – Description of the Selected Final Remedy
6. Duration language: "Land Use Controls will be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and exposure."	1.4 – Description of Selected Remedy 2.6 – Current and Potential Future Site and Resource Use 2.10.2 – Description of the Selected Final Remedy
7. Include language that the Navy is responsible for implementing, maintaining, reporting on, and enforcing the land use controls. This may be modified to include another party should the site-specific circumstances warrant it.	2.6 – Current and Potential Future Site and Resource Use 2.10.2 – Description of the Selected Final Remedy
8. Where someone else will or the military service plans that someone else will ultimately be implementing, maintaining, reporting on, and enforcing land use controls, the following language should be included: "Although the [military service] may later transfer [has transferred] these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the [military service] shall retain ultimate responsibility for remedy integrity."	While the Shoreline Site is anticipated to remain under Navy control, the following language has been added to Section 2.10.2: "Although the Shoreline Site is anticipated to remain under Navy control, should the Navy transfer procedural responsibilities for the Site to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity."

EPA LUC ROD Checklist Item	Checklist Item Location in Shoreline Site LUC ROD
9. Refer to the remedial design (RD) or remedial action work plan (RAWP) for the implementation actions. Because this is a new idea (i.e., including the LUC implementation actions in either or both of these two primary documents), to ensure that the requirement is clear and enforceable, we developed the following language where it makes sense: "A LUC Remedial Design will be prepared as the land use component of the Remedial Design. Within 90 days of ROD signature, the [military service] shall prepare and submit to EPA for review and approval a LUC remedial design that shall contain implementation and maintenance actions, including periodic inspections." Another option is to refer to the enforceable schedule in the IAG for the RD or RAWP."	The following has been added as the second-to-last paragraph of Section 2.10.2 – Description of the Selected Final Remedy: "A RAWP will be prepared to describe the implementation actions for remedial action construction and LUCs, including implementation, maintenance actions and periodic inspections. In compliance with Section 8.3 of the FFA for the Pearl Harbor Naval Complex, within 21 days of ROD signature, the Navy shall prepare and submit to EPA for review and approval, proposed deadlines for completion of all subsequent primary documents, including the draft RAWP. Agreements to the schedule of the subsequent primary documents shall follow the stipulations cited in the FFA. LUCs will be maintained in perpetuity, or until the concentrations of hazardous substances in the soil are at levels that allow for unrestricted use and exposure through the implementation of additional remedial efforts. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. The PHNSY & IMF is expected to remain under Navy control for the foreseeable future.
To Be Addressed in the Remedial Action Work Plan	
10. Commitment by military service to address any situation that may interfere with the effectiveness of LUC: "Any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs will be addressed by the Navy as soon as practicable, but in no case will the process be initiated later than 10 days after the Navy becomes aware of the breach."	
11. Commitment by military service to notify EPA of and address any situation that may interfere with the effectiveness of LUC: "The Navy will notify EPA and DOH as soon a practicable but no longer than ten days after discovery of any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs The Navy will notify EPA and DOH regarding how the Navy has addressed or will address the breach within 10 days of sending EPA and DOH notification of the breach."	
12. Notification to EPA and the state regarding land use changes: <u>For a closing base:</u> "Prior to seeking approval from the EPA and DOH the recipient of the property must notify and obtain approval from the Navy of any proposals for a land use change at a site inconsistent with the use restrictions and assumptions described in this ROD Amendment." <u>For an active base:</u> "The Navy shall notify EPA and state 45 days in advance of any proposed land use changes that are inconsistent with land use control objectives or the selected remedy."	

EPA LUC ROD Checklist Item	Checklist Item Location in Shoreline Site LUC ROD
13. Notification regarding transfers and federal-to-federal transfers: "The Navy will provide notice to EPA and DOH at least six (6) months prior to any transfer or sale of [OUs at issue] so that EPA and DOH can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for the facility to notify EPA and DOH at least six months prior to any transfer or sale, then the facility will notify EPA and DOH as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to ICs. In addition to the land transfer notice and discussion provisions above, the Navy further agrees to provide EPA and DOH with similar notice, within the same time frames, as to federal-to-federal transfer of property. The Navy shall provide a copy of executed deed or transfer assembly to EPA and DOH."	
14. Concurrence language: "The Navy shall not modify or terminate Land Use Controls, implementation actions, or modify land use without approval by EPA and DOH. The Navy shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs."	
15. Monitoring and reporting language: "Monitoring of the environmental use restrictions and controls will be conducted regularly by the Navy. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to the EPA and DOH. The monitoring reports will be used in preparation of the Five Year Review to evaluate the effectiveness of the remedy. The Five Year Review, submitted to the regulatory agencies by the Navy, will evaluate the status of the ICs and how any IC deficiencies or inconsistent uses have been addressed. It will address whether the use restrictions and controls referenced above were communicated in the deed(s), whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed with such restrictions and controls."	
16. A comprehensive list of LUCs. If the description of the LUCs in #5 above is comprehensive, it could substitute for #16's listing of LUCs.	
17. For active facilities, a description of the internal procedures for implementing the LUCs (e.g., orders, instructions, Base Master Plan) and a commitment by the Navy to notify EPA and DOH in advance of any changes to the internal procedures that would affect the LUCs.	
18. Other property transfer language: a. "Deed Restrictions: "Each transfer of fee title from the United States will include a CERCLA 120(h)(3) covenant which will have a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and objectives. The environmental restrictions are included in a section of the CERCLA 120(h)(3) covenant that the United States is required to include in the deed for any property that has had hazardous substances stored for one year or more, known to have been released or disposed of on the property. Each deed will also contain a reservation of access to the property for the Navy, USEPA, and DOH, and their respective officials, agents, employees, contractors, and subcontractors for purposes consistent with the Navy's Installation Restoration Program ("IRP") or the Federal Facility Agreement ("FFA"). The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by the Navy." b. "Lease Restrictions: " During the time between the adoption of this ROD and deeding of the property, equivalent restrictions are	

EPA LUC ROD Checklist Item	Checklist Item Location in Shoreline Site LUC ROD
being implemented by lease terms, which are no less restrictive than the use restrictions and controls described above, in this ROD. These lease terms shall remain in place until the property is transferred by deed, at which time they will be superseded by the institutional controls described in this ROD." c. "Notice: "Concurrent with the transfer of fee title from the Navy to transferee, information regarding the environmental use restrictions and controls will be communicated in writing to the property owners and to appropriate state and local agencies to ensure such agencies can factor such conditions into their oversight and decision-making activities regarding the property."	
19. Ensure that the document adequately describes pre-transfer LUCs, not just post-transfer LUCs.	