Proposed Plan for Remedial Action
Naval Air Station Jacksonville
Operable Unit 1
Potential Sources of Contamination 26 and 27

Jacksonville, Florida — July 1996

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Terms that appear in **bold** within the text are defined in the glossary starting on page 18.

1. INTRODUCTION

The **Navy and Marine Corps Installation Restoration Program (NIRP)** is an ongoing environmental effort at the Naval Air Station (NAS) Jacksonville in Jacksonville, Florida (see Figure 1). Its objective is to identify and address contamination resulting from past waste disposal practices. This program follows the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**, commonly known as "Superfund." An outline of the NIRP process for NAS Jacksonville is presented on Figure 2.

In addition, the Navy, **U.S. Environmental Protection Agency (USEPA)**, and **Florida Department of Environmental Protection (FDEP)** are working together under a **Federal Facility Agreement (FFA)** at NAS Jacksonville. The FFA creates a framework for decision making in the environmental cleanup process at NAS Jacksonville. This **Proposed Plan** for **Operable Unit (OU)** 1 at NAS Jacksonville is a key element in that decision-making process.

The Proposed Plan fulfills the public participation requirements of CERCLA Section 117(a). Section 117(a) of CERCLA specifies that the lead agency (i.e., the Navy) must publish a Proposed Plan outlining the various remedial alternatives considered for the site, including the preferred alternative. The Proposed Plan is intended to be a

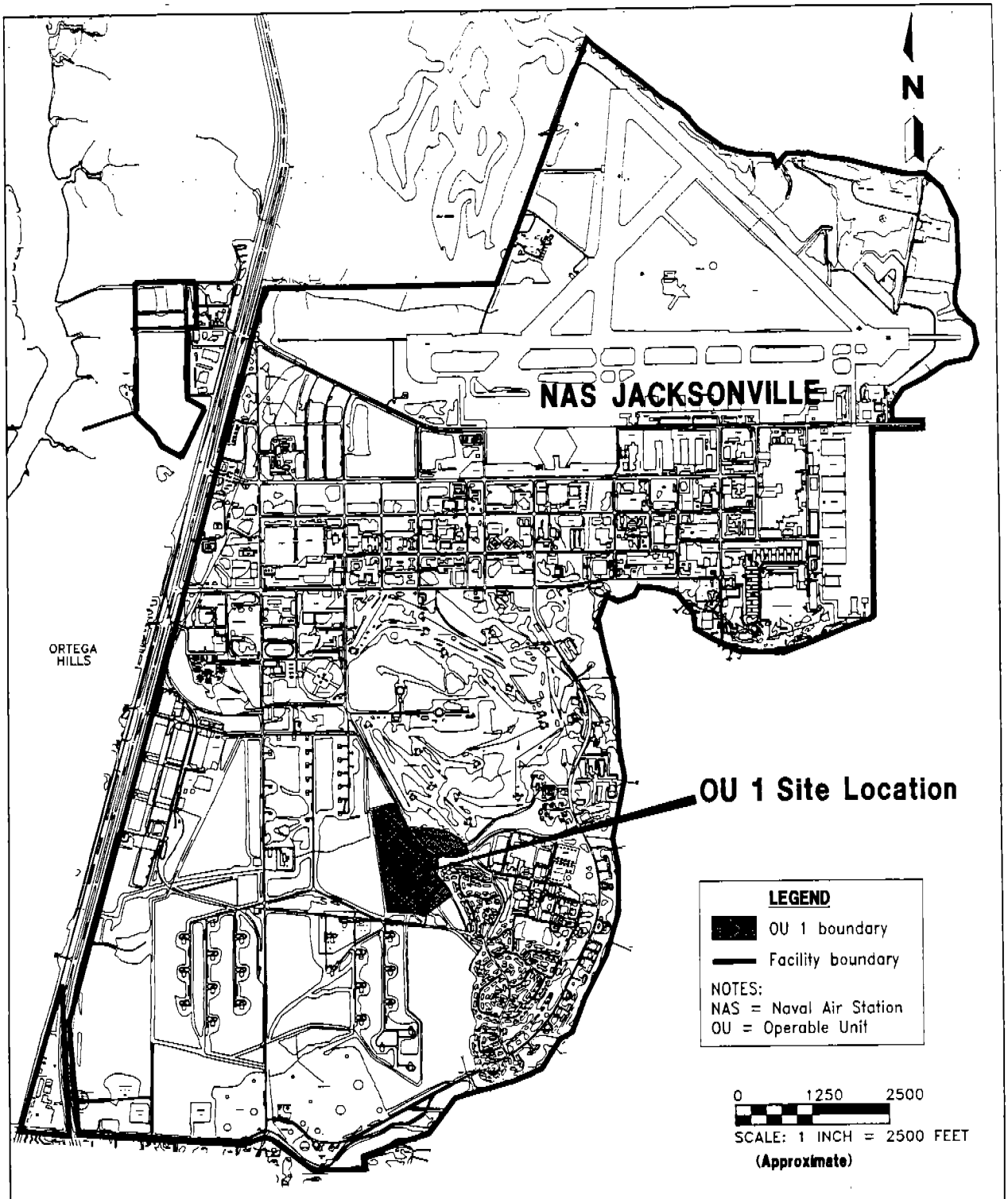

FIGURE 1
FACILITY MAP AND LOCATION OF OPERABLE UNIT 1

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PROPOSED PLAN FOR OPERABLE UNIT 1

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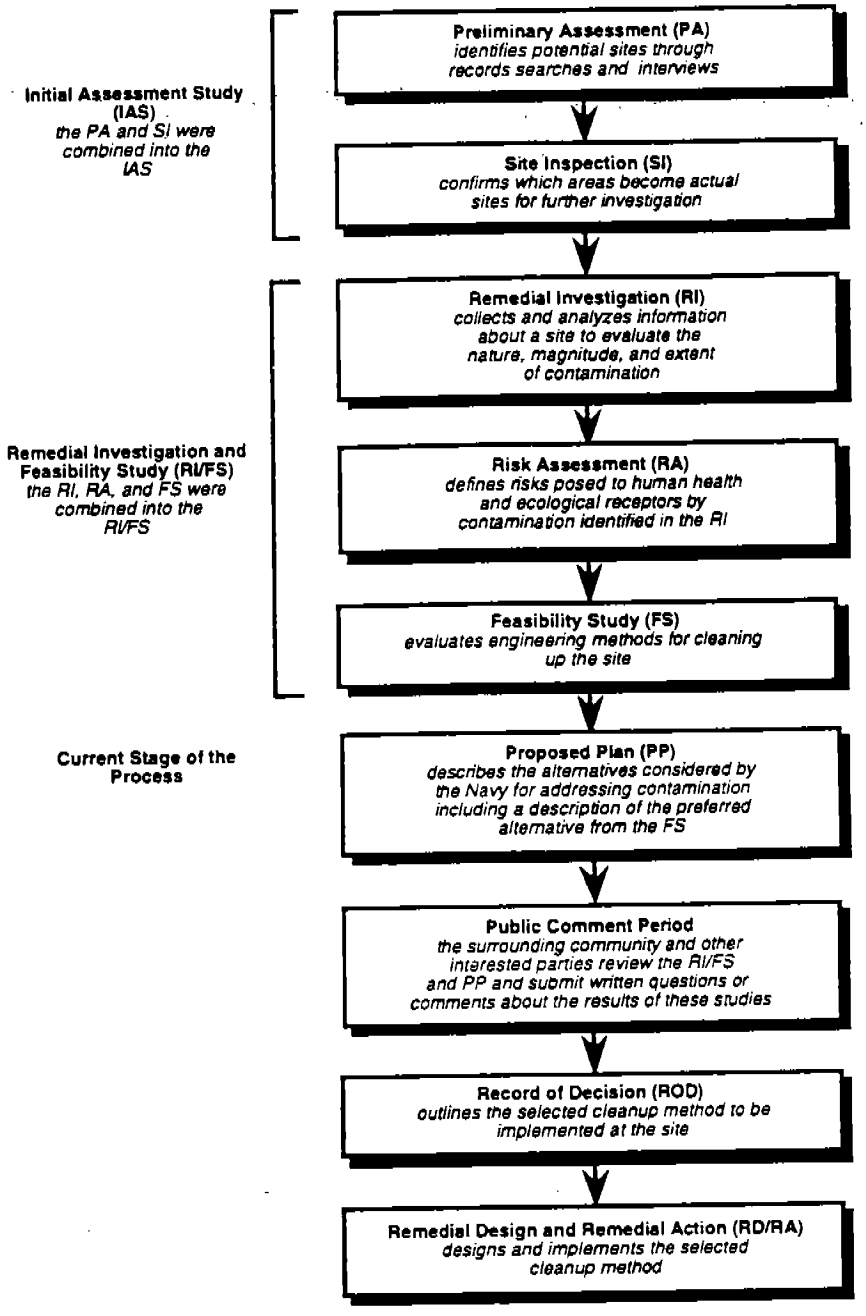

FIGURE 2
NAVAL INSTALLATION RESTORATION PROGRAM PROCESS

PROPOSED PLAN FOR OPERABLE UNIT 1

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companion document to the **Remedial Investigation and Feasibility Study** (RI/FS) report and is a required part of the **administrative record**.

Members of NAS Jacksonville and the surrounding community are encouraged to submit their comments on the Proposed Plan and on all of the alternatives developed in the RI/FS report during a public **comment period** from July 24, 1996, through September 6, 1996. An opportunity for a public meeting will be advertised in the newspaper and will be held on August 6, from 7:00 to 9:00 p.m., at the Holiday Inn in Orange Park, Florida. When the comment period ends, the Navy will summarize and respond to public comments in a **responsiveness summary**, which will be incorporated as part of the **Record of Decision (ROD)** for OU 1.

In addition to the RI/FS report, other documents for OU 1 are available for public review at the Charles D. Webb Wesconnett Branch of the Jacksonville Public Library (see *Available Information* on page 17).

The Technical Assistance Grants (TAG) Program

The TAG program is provided by the USEPA to assist community groups in hiring advisors to help them comment on oversight actions at Federal Facility sites, such as NAS Jacksonville. Only one grant is awarded per site and may be as much as $50,000. For more information on TAGs, please contact Mr. Bill Dougherty at the NAS Jacksonville Public Affairs Office at the address given in Section 6.

2. OU 1 BACKGROUND

OU 1 is located on Child Street in the south-central portion of NAS Jacksonville (see Figure 3). OU 1 is composed of **Potential Sources of Contamination (PSCs)** 26 (30 acres), the Old Main Registered Disposal Area, and 27 (less than 1 acre), the Former Transformer Storage Area (see Figure 3). Within a forested area south of OU 1, a tributary (referred to as the unnamed tributary) flows approximately 2,500 feet southward of OU 1 to the St. Johns River.

PSC 26. The land at PSC 26 was used for disposal of discarded vehicles, household and sanitary waste, liquid industrial waste such as oil and **solvents**, and demolition and construction debris. Beginning in approximately 1940, materials were sometimes burned in open pits or trenches. Pits and trenches were then covered with soil. Between 1940 and 1950, low-level radioactive wastes (consisting of paint containing radium-226 and radium-228 used to make airplane dials visible at night) were disposed of at PSC 26. Disposal of liquid wastes continued until 1978, when **light nonaqueous-phase liquid (LNAPL)** was discovered on the water table. PSC 26 was officially closed as a disposal area on January 15, 1979.

PSC 27. PSC 27 was used to store electrical transformers during an unknown period of time. Reportedly, vandalism in 1978 caused transformer oil containing **polychlorinated biphenyls (PCBs)** to spill onto the ground surface. The amount of oil spilled was unknown. At that time, the Navy removed the transformers and PCB-contaminated soil and transported them offsite for disposal.

Summary of Previous Investigations

OU 1 has undergone several phases of investigation since 1978. The Navy completed its most recent **field investigations** in May 1996. Based on the historical information available about OU 1, an innovative approach was taken to gathering information and developing cleanup alternatives for the site. This approach allowed for

- implementation of an **interim removal action (IRA)** for the LNAPL source area prior to completing the field investigation for the RI,
- implementation of a preferred technology or **presumptive remedy** for the landfill soil and debris, and
- basewide cleanup activities and risk reduction.

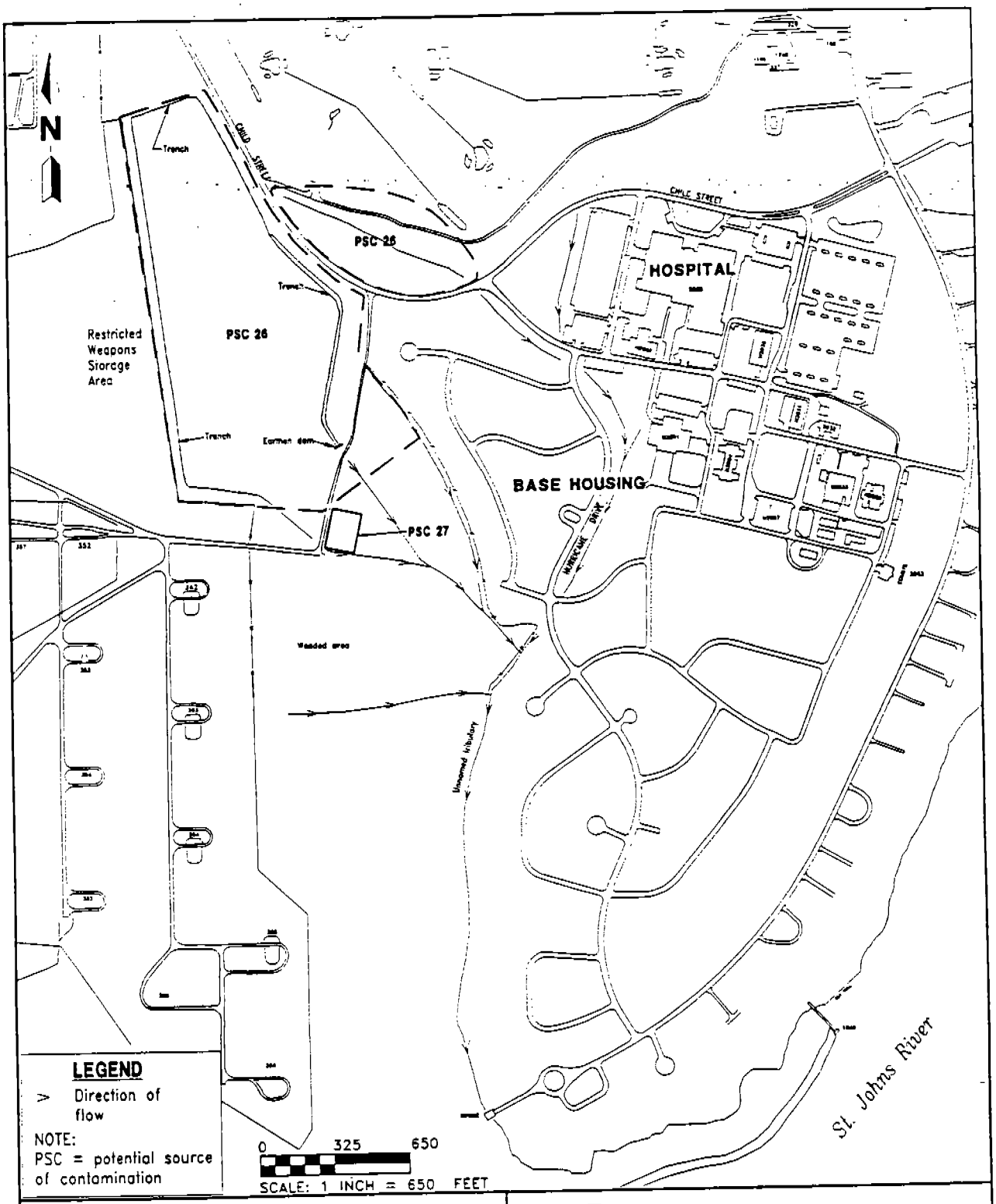

FIGURE 3
LOCATION OF OPERABLE UNIT (OU) 1 AREA, PSC 26 AND PSC 27

PROPOSED PLAN FOR OPERABLE UNIT 1

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Focused RI/FS for LNAPL

A **Focused RI/FS** was initiated by the Navy from March 1993 to April 1993 to investigate the LNAPL source area. The information gathered during this Focused RI/FS indicated LNAPL containing PCBs greater than 50 **milligrams per kilogram** were present in the **shallow surficial aquifer**. An IRA (discussed in the next section) was proposed to remove the LNAPL from the water table as specified in USEPA and FDEP regulations.

Summary of Interim Remedial Actions

In 1983, prior to implementing the IRA recommended in the Focused RI/FS, an initial LNAPL recovery system was constructed. It was operated for approximately 9 months from 1983 to 1984. **Infiltration galleries** were installed to allow the LNAPL and water to flow into a system of ditches. A **skimmer or barrier system** collected the LNAPL from the surface of the water as it flowed through these ditches. However, this system did not remove enough of the LNAPL from the water, and the water did not meet **discharge requirements**. As a result, **earthen dams** were constructed across the ditches to prevent the water from flowing from the site, and the system was shut down. The quantity of LNAPL removed during this IRA is not known.

The second LNAPL recovery system, selected in the Focused RI/FS, was constructed at OU 1 in 1994. The system consists of two gravel-filled trenches to collect water and LNAPL. **Sumps** located in the trenches contain pumps to skim LNAPL from the water surface. LNAPL is temporarily stored onsite prior to disposal offsite. This system will be used until LNAPL is removed to meet State standards (i.e., less than 0.1 inch of floating LNAPL). As a **contingent action**, the system may be upgraded if the current system is no longer removing the LNAPL effectively. All the alternatives proposed for the overall cleanup at OU 1 include continuing the LNAPL recovery.

Summary of Basewide Cleanup Actions

As part of ongoing basewide risk management activities, radioactive materials similar to those previously disposed of at OU 1 and that exhibited similar characteristics to the landfill material were consolidated and disposed of in a designated area within the landfill boundary. This material consisted of nonregulated, low-level radium-contaminated soils excavated at PSC 13, PSC 18, and from the landfill area north of Child Street.

RI/FS for OU 1

The goal of the most recent field investigation, presented in the RI/FS report, was to collect information to assess the nature, extent, and magnitude of contamination in the remaining **environmental media** at PSCs 26 and 27. Based on the nature and extent of contamination, various cleanup methods, or **alternatives**, were identified.

Based on the history of PSCs 26 and 27, suspected contaminants at OU 1 included **volatile organic compounds (VOCs)**, **semivolatile organic compounds (SVOCs)**, **pesticides** and PCBs, **inorganics**, **radionuclides**, and LNAPL. The field activities were completed to gather information on both the physical characteristics and the amount of contamination in soil, groundwater, surface water, and sediment at OU 1. The major components of the field investigation included the following:

- a **geophysical survey**;
- a **radiological survey**;
- installation of **monitoring wells**; and
- **chemical** and **physical analysis** of surface (i.e., less than 1 foot deep) and subsurface (i.e., more than 1 foot deep) soil, groundwater, surface water, and sediment samples.

Details on each of these activities are described in the RI/FS report.

As described in the RI/FS, the results of the field program indicated there were various compounds present in all media. The following contaminants were found in each medium:

- Soil and debris within the landfill - The landfill soil and debris were not fully characterized during the RI, as the presump-

tive remedy had already been selected for this medium. However, the radiological survey indicated radionuclides, consisting of **nonregulated, low-level radium**-contaminated soils, were identified in the surface soils.

- Surface water in the unnamed tributary - VOCs, SVOCs, pesticides, PCBs, and inorganic compounds were detected, but not extensively.

- Sediment in the unnamed tributary - VOCs, SVOCs, pesticides, PCBs, **dioxins** and **furans**, radionuclides, and inorganic compounds were detected in the ditch around the landfill and in the unnamed tributary.

- Groundwater - VOCs were detected in the groundwater underlying the landfill area and the western portion of the golf course and base housing.

- Air - **Air quality** at OU 1 was similar to the general air quality at the base.

A **risk assessment** was also completed as part of the RI/FS for OU 1. The goal of the risk assessment was to evaluate the contaminants detected in the field program (listed above) and identify those contaminants that may pose an **unacceptable risk** to human health or **ecological receptors**. For each medium, the risk assessment also calculated cleanup levels that would protect humans and ecological receptors.

The risk assessment was divided into two parts, a human health risk assessment and an ecological risk assessment. The human health risk assessment included the following:

- evaluating the contaminants identified during the field program to select **chemicals of potential concern** for human health,

- assessing the ways humans could come in contact with those chemicals of potential concern (both currently and in the future),

- evaluating the possible effects of being exposed to the chemicals of potential concern, and

- estimating the overall risk posed to human health by the chemicals of potential concern in OU 1 media.

The components of the ecological risk assessment were the same as for the human health risk assessment.

The major conclusions of the human health and ecological risk assessment are as follows:

- Radiological activity in the landfill boundary was higher than the activity in the surrounding area. This activity within the landfill is primarily the result of low-level, radium-contaminated soil.

- LNAPL is present in the area of OU 1 located north of Child Street and outside the landfill boundary.

- Contaminants in some media may pose an unacceptable risk to human health or ecological receptors. These are as follows:

  Surface soil outside of the landfill: SVOCs, PCBs, and inorganics.

  Groundwater: low levels of VOCs.

  Sediment: pesticides, PCBs, and inorganics.

- Contaminants in subsurface soil and surface water are not believed to pose an unacceptable risk to human health or ecological receptors.

3. REMEDIAL ACTION OBJECTIVES FOR OU 1

Based on the most recent investigation, risk assessment, and evaluation of regulations that may be either **applicable or relevant and appropriate requirements (ARARs)** for this site, **remedial action objectives (RAOs)** were established for OU 1. The RI/FS report develops the RAOs and presents the reasons for their selection. A brief summary of the RAOs is presented in Table 1.

RAOs were not established for subsurface soil at OU 1 because no contaminants were found to cause unacceptable risk to human or ecological receptors.

Table 1
Remedial Action Objectives for OU 1

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Landfill soil and debris	PCBs Inorganics Radionuclides	Reduce exposure to contaminants in the landfill. Prevent contaminants on the surface of the landfill from washing off the site. Control **leachate** generation from the additional material placed on the landfill.
LNAPL	Presence of LNAPL (containing PCBs and PAHs)	Remove LNAPL if greater than 0.1 inch from the water table.
Soil outside landfill	SVOCs PCBs Inorganics	Reduce human and ecological exposure to contaminants in the soil. Reduce the potential for humans or ecological receptors to swallow contaminants in the soil.
Groundwater	Low-level VOCs	Reduce the potential for humans to ingest or breathe in contaminants found in the groundwater.
Surface water in unnamed tributary	None	Reduce the potential for humans and ecological receptors to come in contact with contaminants in the surface water that are the result of contamination in the sediment and groundwater.
Sediment in unnamed tributary	Pesticides PCBs Inorganics	Reduce human and ecological exposure to contaminants in the sediment. Reduce the potential for humans or ecological receptors to swallow contaminants in the sediment.

Notes: OU = operable unit.
PCB = polychlorinated biphenyl.
LNAPL = light nonaqueous-phase liquid.
PAH = polynuclear aromatic hydrocarbon.
SVOC = semivolatile organic compound.
VOC = volatile organic compound.

Therefore, in Table 1 and for the remainder of this Proposed Plan, the word "soil" will be used in two ways:

a) "landfill soil" is surface soil located within the boundary of the landfill and

b) "soil" is surface soil outside of the landfill limits.

Technologies for each medium that would achieve the RAOs were then identified and compared to one another based on cost, effectiveness, and ease of construction or implementation. A subset of technologies was then chosen for incorporation into alternatives for remedial action.

4. SUMMARY OF ALTERNATIVES

Five cleanup alternatives are being considered for OU 1. These cleanup alternatives were developed by the U.S. Navy, the USEPA, and the FDEP. The selected alternative is intended to be a final cleanup action. However, alternatives may include contingent actions that can be taken if the actions already implemented cannot effectively meet RAOs.

The five alternatives developed for OU 1 are as follows:

Alternative 1: **Capping/covering, intrinsic bioremediation** of groundwater.

Alternative 2: Capping/covering, intrinsic bioremediation with selected groundwater removal, and a contingent action for collecting the surface water in the unnamed tributary.

Alternative 3: Capping/covering, soil and sediment **excavation**, intrinsic bioremediation of groundwater, and a contingent action for collecting the surface water in the tributary and **enhanced bioremediation**.

Alternative 4: Capping/covering, soil and sediment excavation, and enhanced bioremediation of groundwater.

Alternative 5: Capping/covering, soil and sediment excavation, **pump-and-treat** groundwater.

Common Elements of Alternatives

The USEPA, FDEP, and the Navy have agreed that the presumptive remedy for landfills, consisting of a cap/cover system, will be constructed over the landfill soil and debris as part of the remedial action at OU 1. Therefore, all of the alternatives include this common remedy for landfill sites. A cap/cover will act as a shield for radionuclides present in the landfill, prevent exposure to other contaminants, and reduce the potential for leachate generation from additional material placed on the landfill.

Every alternative proposes to continue the LNAPL removal described previously. The passive removal will be evaluated **quarterly** to determine if the removal is complete or if the system should be upgraded to an active mode. In addition, every alternative proposes restricting access to groundwater and surface water, sampling groundwater and surface water quarterly, and reviewing the site every 5 years to determine if the remediation is going as planned. These are typical actions for sites with contaminated groundwater.

Alternatives 3 through 5 propose excavation of **hot spots** of contaminated soil and sediment to provide additional reduction of unacceptable risks associated with these media. These **spoils** would be consolidated within the landfill and covered with the cap/cover.

Other alternatives also share similarities:

- Alternatives 1, 2, and 3 propose to treat groundwater primarily via intrinsic bioremediation.

- Alternative 4 proposes to treat groundwater via enhanced bioremediation while Alternative 3 proposes enhanced bioremediation as a contingent action.

- Alternatives 2 and 3 include a contingent action for tributary water collection.

- Alternatives 2 and 5 propose to pump, treat, and **discharge** groundwater.

The major activities included in each alternative are shown in Table 2.

Alternative 1: Capping/Covering, Intrinsic Bioremediation of Groundwater

Estimated cost: $4.5 million
Estimated duration: 30 years

Landfill Soil and Debris. The soil and debris within the landfill would be capped/covered. The proposed cap/cover consists of

- a 30-**mil geomembrane** laid over the radionuclide-contaminated soil and debris, including the additional materials placed on the landfill (to prevent water from infiltrating through this material);

- an 18-inch layer of soil placed over the geomembrane and on the remainder of the landfill (the thickness of this layer may change slightly during design to ensure proper grading and radionuclide shielding); and

- a 6-inch layer of soil to promote the growth of small plants and grass that will absorb rainwater and reduce surface runoff.

LNAPL. LNAPL collection and offsite disposal would continue as planned during the IRA. This includes upgrading to an active system, if required, to meet RAOs.

Sediment. Warning signs would be posted near the unnamed tributary to reduce exposure and limit access to its sediments.

Groundwater. Alternative 1 relies on intrinsic bioremediation, working directly with other processes and technologies, to treat the low-level VOCs in groundwater. Based on samples collected during the field program, the bacteria naturally present in the subsurface are breaking down the more complex VOCs, such as **trichloroethene (TCE)**, into less complex VOCs, such as **dichloroethene (DCE)** and **vinyl chloride**. This breakdown process occurs most readily under **anaerobic conditions**, similar to the subsurface conditions at OU 1.

In addition to **biodegradation**, **natural flushing** is also working to reduce the VOCs in groundwater. By removing sources of groundwater contamination, such as the LNAPL removal described above, uncontaminated water will **infiltrate** and mix with the VOCs in the groundwater. As the uncontaminated water mixes with the contaminated groundwater, the concentrations will be reduced as the groundwater moves away from the source. By allowing natural flushing to continue, biodegradation can work more effectively. In turn, any VOCs not completely biodegraded will be naturally flushed.

As this cycle of biodegradation and flushing continues to reduce the concentrations of VOCs, the groundwater moves away from the original sources. As described in the RI/FS, some of the groundwater moves toward, and eventually becomes part of, the surface water in the unnamed tributary. Sampling data from recent and past field programs indicate the concentrations of VOCs in the surface water have not significantly increased with time. Based on the **model** presented in the RI/FS, intrinsic bioremediation is expected to reduce VOCs before **breakthrough** in the unnamed tributary occurs.

This alternative also proposes a monitoring program for groundwater and surface water. The purpose of this monitoring program is to collect samples and evaluate the progress of the cleanup action. This program would consist of sampling quarterly from selected wells and locations within the unnamed tributary. Samples would be analyzed for VOCs and other compounds that are used to evaluate the rate of biodegradation of contaminants. Additionally, access to groundwater would be restricted during the cleanup period. The institutional controls for sediment would use the existing fences and warning signs to limit access to the sediment and surface water.

The cleanup status of OU 1 would be reviewed every 5 years to assess whether intrinsic bioremediation is still appropriate or if additional

Table 2
Remedial Alternatives Evaluated for OU 1

Alternative	Description of Key Components
Alternative 1: Capping/covering, intrinsic bioremediation of groundwater.	Capping/covering of landfill soil and debris. Continued collection and offsite transport of LNAPL. Upgrade the system, if required to meet RAOs. Intrinsic bioremediation of groundwater. **Institutional controls** for sediment. Groundwater **access restrictions**, monitoring, and 5-year reviews.
Alternative 2: Capping/covering, intrinsic bioremediation with hot spot removal, and a contingent action for collecting the surface water in the unnamed tributary.	Capping/covering of landfill soil and debris. Continued collection and offsite transport of LNAPL. Upgrade the system, if required to meet RAOs. Intrinsic bioremediation of groundwater. Pump, treat, and discharge the most contaminated groundwater. Institutional controls for sediment. Groundwater access restrictions, monitoring, and 5-year reviews. A contingent action for collecting the surface water in the tributary.
Alternative 3: Capping/covering, soil and sediment excavation, intrinsic bioremediation of groundwater, and *contingent actions for tributary collection* and enhanced bioremediation.	Consolidation and capping of excavated soil and sediment, and landfill soil and debris. Continued collection and offsite transport of LNAPL. Upgrade the system, if required to meet RAOs. Intrinsic bioremediation of groundwater. Groundwater access restrictions, monitoring, and 5-year reviews. A contingent action for collecting the surface water in the tributary. Enhanced bioremediation, if the results of the first 5-year monitoring indicates RAOs for groundwater will not be met within 30 years.
Alternative 4: Capping/covering, soil and sediment excavation, enhanced bioremediation of groundwater.	Consolidation and capping of excavated soil and sediment, and landfill soil and debris. Continued collection and offsite transport of LNAPL. Upgrade the system, if required to meet RAOs. Enhanced bioremediation of groundwater. Groundwater access restrictions, monitoring, and 5-year reviews.
Alternative 5: Capping/covering, soil and sediment excavation, pump-and-treat groundwater.	Consolidation and capping of excavated soil and sediment, and landfill soil and debris. Continued collection and offsite transport of LNAPL. Upgrade the system, if required to meet RAOs. Collection, treatment, and discharge of groundwater. Groundwater access restrictions, monitoring, and 5-year reviews.

Notes: OU = operable unit.
LNAPL = light nonaqueous-phase liquid.
RAOs = remedial action objectives.

actions are needed. If data from the first 5 years of monitoring indicate intrinsic bioremediation will not restore the groundwater to allowable levels (**maximum contaminant levels [MCLs]**) within 30 years, or if the data indicate a breakthrough of high concentrations of VOCs in the unnamed tributary is likely to occur, additional actions may be needed. An amendment to the Record of Decision would be required to implement the additional action.

Alternative 2: Capping/Covering, Intrinsic Bioremediation with Hot Spot Removal and a Contingent Action for Collecting the Surface Water in the Unnamed Tributary.

Estimated cost:	$5.1 million
with contingency:	$5.5 million
Estimated duration:	30 years

Landfill Soil and Debris. Soil and debris within the landfill would be capped/covered as described for Alternative 1.

LNAPL. LNAPL collection would continue as described in Alternative 1.

Sediment. Warning signs would be posted and access restrictions would be obtained as described in Alternative 1.

Groundwater. This alternative combines two treatment methods for groundwater. Similar to Alternative 1, this alternative would rely on intrinsic bioremediation to treat the VOCs in groundwater to meet RAOs. In addition, this alternative proposes the installation of three **extraction wells** to collect selected groundwater with the highest concentrations of VOCs. Once collected, the groundwater would be treated by the system described below and discharged to the unnamed tributary, which feeds the St. Johns River.

Although not detected above background concentrations, extracted groundwater would require removal of inorganics, radionuclides, and low levels of organics before discharging to the unnamed tributary. **National Pollution Discharge Elimination System (NPDES) limits** or **State of Florida Surface Water Quality Criteria** have been established by the USEPA and FDEP listing concentrations to which these contaminants require treatment. To achieve these limits, the groundwater would be treated by the following methods:

1. A chemical would be mixed with groundwater to cause dissolved inorganics to **precipitate** into solid particles.

2. A **polymer** would then be added to **coagulate** radionuclides and solids into clumps of larger particles. Once the polymer is fully blended with the water, the liquid would be mixed slowly to cause the clumps of enlarged particles to **flocculate** into groups that settle easily.

3. The flocculated particles would be allowed to settle to the bottom of a tank, where they would be removed and disposed of offsite.

4. **Clarified** groundwater would be pumped from the settling tank and would be passed through a vessel containing **granular activated carbon (GAC)**, which would remove trace levels of organics.

5. Groundwater would then be discharged to the unnamed tributary. The discharge would be sampled and analyzed periodically to ensure that the treatment system is working effectively.

The treatment scheme can be modified if sampling results indicate that the discharge exceeds NPDES limits or State of Florida Surface Water Quality Criteria. The RI/FS report contains a description of potential modifications.

As with Alternative 1, the access restrictions would be obtained, the groundwater and surface water monitoring program would implemented, and the cleanup status would be reviewed every 5 years.

Unlike Alternative 1, this alternative proposed a contingent action for collecting the surface water in the unnamed tributary. As described in the addendum to the RI/FS report, if an evaluation of the data collected during quarterly monitoring indicates there is a potential for contaminant levels in the unnamed tributary to increase above NPDES

requirements or State of Florida Surface Water Quality Criteria for two consecutive quarters, tributary collection will be initiated. The collection system will consist of a series of **well points** placed along the tributary's bank to collect the groundwater before it reaches the tributary. The collected water will be treated by the previously described onsite treatment system, and then will be discharged.

Alternative 3: Capping/Covering, Soil and Sediment Excavation, Intrinsic Bioremediation

Estimated cost:	$4.2 million
with contingencies:	$7.3 million
Estimated duration:	30 years

Landfill Soil and Debris. Soil and debris within the landfill would be capped as described for Alternative 1.

LNAPL. LNAPL collection would continue as described in Alternative 1.

Soil and Sediment. Select areas, or hot spots, of contaminated soil and sediment would be excavated. These soils would be placed within the landfill and covered with the cap. Sediment would be drained of excess water prior to placement in the landfill. This water will be disposed of properly.

Groundwater. As with Alterative 1, the primary treatment technology for groundwater is intrinsic bioremediation. As with Alternative 2, this alternative also proposes a contingent action for collecting the surface water in the unnamed tributary with onsite treatment and discharge, if surface water cannot meet the NPDES requirements. Groundwater and surface water monitoring, access restrictions, and 5-year reviews would be the same as described for Alternative 1.

Unlike the previous two alternatives, this alternative proposes a contingent action to enhance bioremediation. If an evaluation of the data collected during the first 5 years of monitoring indicates groundwater will not meet the RAOs within 30 years, this contingent action would be implemented.

If enacted, the contingent action would consist of infiltration of a carbon source and nutrients (**nitrogen** and **phosphorus**) into the soil to stimulate bacterial growth. Typically, bacteria use the carbon and nutrients for growth and reproduction, and the thriving bacterial community would degrade organics in groundwater faster than if these stimulants were not added.

Carbon and nutrients would be mixed with clean water and infiltrated into the ground using a series of trenches placed across OU 1. The trenches would be filled in with coarse sand to allow the nutrient-rich liquid to trickle into the surrounding soil and move naturally with contaminated groundwater. The amount of carbon and nutrients added would be adjusted based on groundwater monitoring results.

Alternative 4: Capping/Covering, Soil and Sediment Excavation, Enhanced Bioremediation of Groundwater

Estimated cost:	$5.8 million
Estimated duration:	12 years

Landfill Soil and Debris. Soil and debris within the landfill would be capped as described for Alternative 1.

LNAPL. LNAPL collection would continue as described in Alternative 1.

Soil and Sediment. These media would be excavated and placed in the landfill as described for Alternative 3.

Groundwater. Similar to the previous alternatives, Alternative 4 would rely on natural bacteria to biodegrade organic contaminants. This alternative proposes the addition of carbon and nutrients to enhance the bioremediation as part of the initial base action. The components for enhancing the bioremediation are the same as those proposed for the contingent action for Alternative 3. Groundwater and surface water monitoring, access restrictions, and 5-year reviews would be the same as described for Alternative 1.

Alternative 5: Capping/Covering, Soil and Sediment Excavation, Pump-and-Treat Groundwater

Estimated cost:	$10.2 million
Estimated duration:	14 years

Landfill Soil and Debris. Soil and debris within the landfill would be capped as described for Alternative 1.

LNAPL. LNAPL collection would continue as described in Alternative 1.

Soil and Sediment. These media would be excavated and placed in the landfill as described for Alternative 3.

Groundwater. This alternative would provide collection, treatment, and discharge of groundwater. Groundwater would be collected from two trenches installed at OU 1, with a combined estimated flow rate of approximately 110 gallons per minute (gpm). The extracted groundwater will be treated onsite and discharged to the unnamed tributary, as described in Alternative 2.

Groundwater and surface water monitoring, access restrictions, and 5-year reviews would be the same as described for Alternative 1.

5. EVALUATION OF THE ALTERNATIVES AND THE PREFERRED ALTERNATIVE

In selecting the preferred alternative, nine criteria were used to evaluate each of the alternatives developed during the RI/FS. The first seven are technical criteria based on protecting human health and the environment, cost, and construction and engineering issues. The final three criteria are based on acceptance by the USEPA, the FDEP, and the community. To date, the USEPA and FDEP have concurred with selection of the preferred alternative.

These nine criteria are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. An explanation of the criteria is provided in Table 3.

All the alternatives were developed to meet the threshold criteria. Therefore, the major tradeoffs among alternatives (such as cost, ease of implementation, etc.) are compared using the primary balancing criteria. Finally, the modifying criteria will be considered after public review and after USEPA and FDEP concurrence is received on this Proposed Plan.

Evaluation of Alternatives for OU 1

The preferred alternative for cleanup at OU 1 is Alternative 3. This selection summarizes the evaluation of the preferred alternative against the nine criteria. It notes how this alternative compares to the other alternatives under consideration for OU 1.

Threshold Criteria

Overall Protection of Human Health and the Environment. Each of the alternatives reduces the risks for both human health and ecological receptors to within acceptable limits. This is accomplished primarily by capping/covering the landfill. In addition, each of the alternatives will eventually reduce the contaminants found in groundwater to the MCLs. Alternatives 3 through 5 may be more protective of human health and the environment than Alternatives 1 and 2 because Alternatives 3 through 5 propose removing the contaminated soil and sediment outside the landfill.

Compliance with ARARs. As proposed, each of the alternatives is protective of human health and the environment and will eventually meet ARARs. The cap/cover proposed by each alternative will meet the appropriate parts of the landfill closure regulations, the presumptive remedy, and RAOs immediately upon construction.

Additionally, Alternatives 3 through 5 will meet the cleanup levels for soil and sediment outside the landfill immediately upon excavation. The action levels of the remaining environmental media in all alternatives will be met, but at varying rates. Alternatives 2 and 3 include additional protection by including a contingent action for collecting surface water in the unnamed tributary if the discharge requirements cannot be met.

Table 3
Explanation of Evaluation Criteria

Criterion	Description
Threshold	**Overall Protection of Human Health and the Environment.** This criterion evaluates the degree to which each alternative eliminates, reduces, or controls potential risks to human health and the environment through treatment, engineering methods, or access restrictions. **Compliance with State and Federal ARARs.** Alternatives are evaluated for compliance with environmental protection regulations determined to be applicable or relevant and appropriate to site conditions.
Primary Balancing	**Long-Term Effectiveness.** Alternatives are evaluated on their ability to maintain reliable protection of human health and the environment after implementation. **Reduction of Contaminant Toxicity, Mobility, and Volume.** Alternatives are evaluated on how they reduce the harmful nature of the contaminants, ability of contaminants to move through the environment, and the amount of contamination. **Short-Term Effectiveness.** The length of time needed to implement each alternative is considered. In addition, the health risks to workers and nearby residents from the construction activities required to implement the alternative are considered. **Implementability.** The ease of construction as well as the amount of coordination required for each alternative is considered. This includes the availability of necessary goods and services. **Cost.** The benefits of implementing a particular alternative are weighed against the cost of implementation.
Modifying	**U.S. Environmental Protection Agency (USEPA) and Florida Department of Environmental Protection (FDEP) Acceptance.** The Navy requests USEPA and FDEP comments on the RI/FS report and the Proposed Plan as part of the FFA. The final RI/FS report and the Proposed Plan, which are placed in the Information Repository, represent a consensus by the Navy, USEPA, and FDEP. **Community Acceptance.** The public is given the opportunity to comment on the selected remedy. The Navy then evaluates and responds to these comments.

Notes: ARAR = applicable or relevant and appropriate requirement.
RI/FS = remedial investigation and feasibility study.
FFA = Federal Facility Agreement.

Primary Balancing Criteria

Long-Term Effectiveness. All of the alternatives are roughly equal in long-term effectiveness. The landfill cap/cover would be designed as a permanent radioactive shield. It would require periodic inspection and maintenance to ensure that it is working as designed.

Groundwater treatment proposed by each alternative is permanent. Alternatives 3 (with contingencies) and 4 would create subsurface conditions that allow bacteria to continue to break down organics over a long period of time. Alternatives 1, 2, and 3 (without contingencies) would do this also at a much slower rate as these alternatives rely on natural conditions in the aquifer. Alternatives 2 and 5 could potentially create new risk by generating radioactive sludges from the onsite treatment unit.

Alternatives 3 through 5 include excavation of soils and sediments to permanently eliminate any possible exposure. Alternatives 1 and 2 rely on natural processes such as flushing, scouring, and erosion to eventually eliminate possible exposure to sediments.

Short-Term Effectiveness. For all the alternatives, the landfill cap/cover provides a shield for radionuclides, prevents exposure to other contaminants, and reduces infiltration through the additional material within a short period of time. Alternatives 1, 2, and 3 would be least effective in the short run because they take the longest time to achieve cleanup levels for groundwater as they rely on intrinsic bioremediation. Alternatives 3 (with contingencies) and 4 are slightly more effective in the short term because they would create an environment in which bacteria can break down organics in groundwater more quickly than natural conditions would allow. By implementing an active pump-and-treat system, Alternative 5 is as effective in the short term as Alternative 3 (with contingencies) or Alterative 4.

Implementability. The implementability of an alternative is based on technical feasibility, administrative feasibility, and the availability of goods and services. A cap/cover proposed by all alternatives would be relatively easy to construct and maintain. To implement the remaining portions of the alternatives, the level of coordination increases for each alternative. Alternatives 3 through 5 include sediment excavations that may require the surface water in the tributary to be collected and managed during the excavation. The trenches proposed in the contingency for Alternative 3 and in Alternative 4 would be relatively easy to install and maintain, but may require some temporary relocation of residents during construction. The onsite treatment system proposed by Alternatives 2 and 5 would require maintenance and monitoring.

Reduction of Toxicity, Mobility, or Volume of Contaminants. All of the alternatives offer reduction of **mobility** of landfill contaminants by proposing construction of a landfill cap. However, the **toxicity** of landfill contaminants would remain unchanged. Soil and sediment excavation, offered by Alternatives 3 through 5, reduces the mobility of contaminants in those media because they would be capped within the landfill. The toxicity of groundwater is reduced through groundwater treatment.

All alternatives will eventually reduce the toxicity of the groundwater to the same level. Alternatives 2 and 5 reduce the mobility and volume of contaminated groundwater by pumping it out and treating it. Alternative 3 (with contingencies) and Alternative 4 do not reduce the mobility of groundwater but actually depend on the mobility of groundwater to carry the nutrients into the groundwater for enhancing the bioremediation. Alternative 1 offers the least reduction in mobility of all the alternatives.

Cost. The relative costs for the proposed alternatives ranged from $3.8 million to $10.2 million. Alternative 1 has the lowest cost, followed by Alternatives 3, 2, 4, and 5, respectively. As noted in the description of the alternatives, the contingent actions proposed by Alternatives 2 and 3, if implemented, increase the costs of those alternatives.

Modifying Criteria

State and Federal Acceptance. The FDEP and USEPA have concurred with the Navy's selection of Alternative 3 as the preferred alternative.

Community Acceptance. Community acceptance of the preferred alternative will be evaluated after the public comment period ends, and will be addressed in the Responsiveness Summary prepared for the ROD.

Summary of the Preferred Alternative

In summation, Alternative 3 was selected as the preferred alternative by USEPA, FDEP, and the Navy. It offers the best balance among three components of remedial action: risk reduction, cleanup time, and cost. Additionally, because the in-place bioremediation of groundwater is highly site specific, 5 years of monitoring the effectiveness of intrinsic bioremediation would aid in designing an enhanced bioremediation system, if the contingent action is required.

6. UPCOMING RELATED COMMUNITY PARTICIPATION ACTIVITIES

Public Comment Period

The public comment period for the RI/FS report and the Proposed Plan is the next step in selecting a remedial action for OU 1 at NAS Jacksonville. A public comment period will be held from July 24, 1996, to September 6, 1996, to accept comments on the RI/FS report and the Proposed Plan from NAS Jacksonville, the surrounding community, and other interested parties. During this period, interested parties may submit written comments to the NAS Jacksonville Public Affairs Office at the address listed below. Comments must be postmarked no later than 3:00 p.m., September 6, 1996. Based on public comments or new information, the Navy may modify the preferred alternative or choose another one of the alternatives developed during the RI/FS.

Preparation of the ROD

Following the public comment period, the Navy will prepare and sign an ROD for OU 1, NAS Jacksonville. This ROD requires concurrence from both the USEPA and FDEP. The ROD will describe the remedial action selected for the site and will include a Responsiveness Summary, which will contain the Navy's responses to comments received during the public comment period. After the engineering and designs for the selected alternative are complete, remedial action will begin at OU 1.

Ongoing Informational Updates

NAS Jacksonville will keep the local community informed through the **Restoration Advisory Board (RAB)** about new developments at OU 1, and at the base as a whole, by preparing fact sheets and distributing them to individuals on the mailing list (see *Mailing List Additions*) and through press releases.

Available Information

Copies of the documents prepared by the Navy during its investigation and study of OU 1, including the RI/FS report and the Proposed Plan, are available for review at the following **information repository**:

Charles D. Webb, Wesconnett Branch
Jacksonville Public Library
6887 103rd Street
Jacksonville, Florida 32210
Phone: (904) 778-7305

For further information on OU 1 or any other **Installation Restoration program** activities at NAS Jacksonville, please contact

Mr. Bill Dougherty
Public Affairs Office, Box 2
Naval Air Station Jacksonville
Jacksonville, Florida 32212-5000
Phone: (904) 772-4032
FAX: (904) 772-2413

Mailing List Additions

If you would like to be added to the NAS Jacksonville mailing list, please provide the following information to Mr. Dougherty at the address above.

Name: _____
Address: _____
_____
Telephone: _____
Affiliation: _____

You may also contact Mr. Dougherty by telephone.

7. GLOSSARY

Access restriction: Any physical or administrative barrier that prevents access. This may include fences, warning signs, or written restrictions.

Administrative record: A required file of documents that contains the information used to make site management decisions, including the Proposed Plan and the ROD containing the Responsiveness Summary. The record is a file maintained specifically for public review.

Air quality: An evaluation of the presence of contaminants such as dust, fumes, gas, mist, odor, smoke, or vapor in the air.

Alternative: A combination of technical and administrative actions, developed and evaluated in a feasibility study, that can be used to address contamination at a site.

Anaerobic conditions: Conditions where oxygen is not available.

Applicable or relevant and appropriate requirements (ARARs): The Federal and State requirements that a selected alternative must meet. These requirements vary among sites, contaminants of concern, and remedial alternatives considered.

Barrier: Any physical factor that restricts movement.

Biodegradation: The breaking down or decomposition of contaminants by biological agents (generally bacteria).

Bioremediation: The use of biodegradation as a cleanup process for contaminants at a site.

Breakthrough: When contaminants from one environmental medium pass into another environmental medium that was previously clean (for example, if contaminants found only in groundwater are detected in surface water).

Capping/covering: A system of geomembranes and soil layers designed to cover a landfill such that the landfill does not endanger public health or cause environmental damage.

Chemical analysis: Laboratory testing of a sample of a medium (e.g., soil, groundwater) to find out the types and amounts of contaminants present.

Chemicals of potential concern: Chemicals identified by the **risk assessment** that may be harmful to human or ecological **receptors**.

Clarified: Made clear by removing suspended matter, such as flocculated particles.

Coagulate: To cause particles to clump together.

Comment period: A specified period of time, usually 30 to 45 days for **remedial actions,** during which the public is encouraged to comment on a particular decision or document in the cleanup process, such as the Proposed Plan and the RI/FS report.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A law passed in December 1980 that was designed to resolve issues associated with abandoned, uncontrolled, inactive hazardous waste disposal sites.

Contingent action: An action developed to address problems that hinder performance of a selected cleanup remedy.

Dichloroethene (DCE): A **volatile organic compound** that formed as **trichloroethene (TCE)** is **biodegraded.**

Dioxin: A group of organic chemicals that are bioproducts of chemical processes.

Discharge: The release of water from one system or process to another (e.g., water from a treatment process flowing into a stream, groundwater flowing naturally into a lake or river).

Discharge requirements: Restrictions set by State or Federal agencies that establish requirements for water being discharged to another water body, such as a stream or river. The limits can be set for chemicals or for physical characteristics, such as water temperature. These requirements may be NPDES limits or State of Florida Surface Water Quality Criteria.

Earthen dam: A barrier made of natural soil material constructed to obstruct the flow of water.

Ecological receptor: An organism that could be exposed to a medium or contaminants at a site, such as a person using contaminated groundwater as drinking water or a fish swimming in contaminated surface water.

Enhanced bioremediation: The addition of nutrients into soil to stimulate biodegradation as a cleanup process for contamination at a site.

Environmental medium: Naturally occurring physical matter such as soil, groundwater, surface water, or sediment.

Excavation: Removal by digging.

Extraction wells: Monitoring wells that contain pumps for removing groundwater.

Feasibility study (FS): A description and engineering study of the potential cleanup alternatives for a site.

Federal Facility Agreement (FFA): An agreement among government agencies for joint decision making. FFAs are frequently used at Federal Facility National Priority List (NPL) sites, such as NAS Jacksonville.

Field investigation: The component of the study of a contaminated site that includes sampling and analysis of environmental media and studies of the physical characteristics of the site.

Flocculate: To join clumps of particles into loosely-held groups that settle more easily than the clumps themselves.

Florida Department of Environmental Protection (FDEP): The State agency that is involved in identifying regulations and concurring with the preferred remedy at a site. The FDEP is one of three parties (along with the USEPA and the Navy) in the FFA.

Focused feasibility study (FFS): An abbreviated version of a feasibility study that identifies and evaluates alternatives for addressing contaminant problems at a site undergoing an interim remedial action for a single medium or contaminant source.

Focused remedial investigation (FRI): A field investigation completed to provide information on the extent of contamination by a single source or in a single medium at a site. Information collected during the FRI is used to identify alternatives during an FFS.

Furan: A member of the dioxin family that is a byproduct of chemical processes.

Geomembrane: A strong, inert, usually plastic material designed to act as a barrier to water infiltration.

Geophysical survey: Field techniques, such as electrical, gravity, magnetic, radioactive, or seismic measurements, used to delineate areas of a site where materials (such as landfill debris) are buried, or areas of soil that have been dug up, reworked, or otherwise disturbed by human activity.

Granular activated carbon (GAC): A filtering material for water or air to which organic compounds adhere, thereby removing them.

Hot spots: Areas of higher contamination than the local surrounding areas.

Infiltrate: To pass through or enter gradually.

Infiltration: Seepage of rainwater or surface water through the ground surface and into the soil.

Infiltration gallery: A large, horizontal underground trench of porous material that allows water to infiltrate and collect.

Information repository: A public file containing the administrative record, site information, documents of onsite activities, and general information about a site.

Inorganics: Metal contaminants and contaminants that do not meet the definition of **organic**.

Installation Restoration program: The Department of Defense program created to identify, investigate, evaluate, and, if necessary, clean up sites to protect human health and the environment.

Institutional control: Any physical or administrative barrier that prevents access. This may include access restrictions, fences, warning signs, or written restrictions.

Interim remedial action (IRA): Steps to manage or remove a source of contamination at a site at which a full investigation and cleanup recommendations are not yet complete.

Intrinsic bioremediation: Breaking down contaminants using biological agents (generally bacteria) and nutrients already present in the environment. This process may also be referred to as natural attenuation.

Leachate: A liquid created when water **infiltrates** wastes or contaminated areas (such as in a landfill), causing contaminants to dissolve into and move with groundwater. Most cleanups at landfills involve some type of leachate management (e.g., containment, collection, treatment), either separate from or incorporated into contaminated groundwater management.

Light nonaqueous-phase liquid (LNAPL): An oily liquid or petroleum product that floats on water.

Maximum contaminant levels (MCLs): Concentrations of contaminants allowable in drinking water.

mil: 1,000th of an inch.

Milligram per kilogram: A unit of measure for concentrations of contaminants that relates the mass of a contaminant in milligrams to the mass of the sample in kilograms.

Mobility: The ease of movement.

Model: A description used to help visualize something that cannot be directly observed.

Monitoring well: Special type of well drilled at specific locations within or surrounding a waste site where groundwater can be sampled at selected depths and studied to obtain information about the site, such as the direction in which groundwater flows and the types and amounts of contaminants present.

Natural flushing: The removal or reduction of contaminants by natural processes such as dilution or scouring.

Navy and Marine Corps Installation Restoration Program (NIRP): A program developed by the Navy to address contamination resulting from past waste disposal practices. It complies with CERCLA, as well as other Federal and State regulations.

Nitrogen: An element used by bacteria as a nutrient for growth and reproduction.

Nonregulated, low-level radium: Radium present in the environment, but at levels that are not regulated.

NPDES limits: Restrictions set by State and Federal agencies that establish requirements for water being discharged to another water body, such as a stream or river. Limits can be set for chemicals or for physical characteristics, such as water temperature.

Operable unit (OU): Grouping of sites or media based on types of wastes disposed of, physical proximity, similar past uses, or the suspected contaminants of concern.

Organics: Contaminants containing carbon and hydrogen. Organics can usually be broken down by bacteria.

Pesticides: Chemicals used in a variety of pest-control situations, including those used to control household pests.

Phosphorus: An element used by bacteria as a nutrient for growth and reproduction.

Physical analysis: Laboratory testing of a sample of a medium (e.g., soil, groundwater) to assess its physical characteristics, such as density or soil type.

Polychlorinated biphenyl (PCB): An oil-like substance, typically used as a coolant or insulating fluid in old transformers (commercially known as Aroclor).

Polymer: A chemical compound or mixture.

Potential source of contamination (PSC): Contaminants or a contaminated area that, under existing conditions, could be a source of contaminants to the environment.

Precipitate: To remove a dissolved chemical from a liquid by inducing a reaction that causes the chemical to become a solid.

Presumptive remedy: A preferred technology developed by the **USEPA** for common categories of sites, such as landfills. If a preferred technology is selected, other less practical technologies are not evaluated.

Proposed Plan: A document that describes the alternatives considered by the Navy for addressing contamination at a site or sites, including a description of the preferred alternative or alternatives for remedial action.

Pump-and-treat: To remove the groundwater using a pump and then to chemically or physically treat the water before discharge.

Quarterly: Occurring once every 3 months.

Radiological survey: A field activity completed to assess whether or not radiation above normal background activity is present in an area.

Radionuclides: A group of atoms that exhibit radioactivity.

Radium: A radioactive material that was previously used in paint to make airplane cockpit dials visible at night.

Record of Decision (ROD): A document that outlines the **remedial action** to be implemented at a site. It includes a Responsiveness Summary, the Navy's responses to comments on the Proposed Plan, and the RI/FS report.

Remedial action (RA): Steps taken to manage both a source or sources of contamination and migration of contamination at a site.

Restoration Advisory Board (RAB): A formal group of agencies, contractors, and citizens that attend public meetings to discuss program issues.

Remedial action objective (RAO): The final cleanup objectives that must be met by the selected alternative for a site.

Remedial investigation (RI): The first part of a two-part remedial investigation and feasibility study (RI/FS). The RI involves collecting and analyzing information about a site to evaluate the nature, magnitude, and extent of contamination in environmental media. The investigation also assesses how conditions at the site may affect human health and the environment in the present or future.

Responsiveness summary: A section within the ROD for a site that presents the Navy's responses to public comments on the RI/FS report and the Proposed Plan.

Risk assessment: An evaluation performed to define risks posed to human health and ecological receptors by the presence of contaminants at a site.

Semivolatile organic compounds (SVOCs): Compounds containing carbon and hydrogen that are slightly prone to evaporation (i.e., the compound has a relatively high vapor pressure). Also see the definition for **volatile organic compounds**.

Shallow surficial aquifer: The shallowest groundwater in a particular area.

Skimmer system: A system designed to remove scum, floating substances, or oil from the water surface.

Solvents: Liquids used in many industrial processes, such as paint removal, degreasing, and cleaning.

State of Florida Surface Water Quality Criteria: Restrictions set by the State that establish requirements for water being discharged to another water body, such as a stream or river. Limits can be set for chemicals or for physical characteristics, such as water temperature.

Spoils: Material (e.g., soil or sediment) generated during excavation.

Sump: A pit or reservoir in the lowest point in a drainage system.

Trichloroethene (TCE): A **volatile organic compound (VOC)** that is sometimes used in **solvents**.

Toxicity: A relative measure of a substance's ability to damage living tissue or impair normal biological functions.

Unacceptable risk: Risks posed to human health or ecological receptors above a threshold defined by USEPA and FDEP.

U.S. Environmental Protection Agency (USEPA): The Federal agency responsible for identifying regulations and concurring with the preferred alternative for a site. The USEPA has the authority to make the ultimate decision on selection of an alternative if consensus cannot be reached among the FFA parties.

Volatile organic compounds (VOCs): Compounds containing carbon and hydrogen that evaporate easily into the environment.

Vinyl chloride: A volatile organic compound that when formed as TCE and DCE is biodegraded.

Well points: A series of wells used to collect groundwater.