Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

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Rev. 2
09/25/08

Record of Decision
for
Operable Unit 8
Potential Source of Contamination 47

Naval Air Station Jacksonville
Jacksonville, Florida

Contract Task Order 0244

September 2008

Naval Facilities Engineering Command
Southeast
NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH NUS, Inc.

Rev. 2
09/25/08

RECORD OF DECISION
FOR
OPERABLE UNIT 8
POTENTIAL SOURCE OF CONTAMINATION 47

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
Southeast
NAS Jacksonville
Jacksonville, Florida 32212-0030

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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0244

SEPTEMBER 2008

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LIST OF ACRONYMS

ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
BEI	Bechtel Environmental, Inc.
BHC	Hexachlorocyclohexane (Lindane)
bls	Below land surface
BRE	Brown and Root Environmental, Inc.
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chemical of concern
COPC	Chemical of potential concern
CSF	Cancer slip factor
CSM	Conceptual Site Model
CTL	Cleanup target level
DCE	Dichloroethene
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DPT	Direct-push technology
DVECC	Disease Vector Ecology and Control Center
ERA	Ecological Risk Assessment
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FFA	Federal Facilities Agreement
FS	Feasibility Study
ft^2	Square feet
ft/day	Feet per day
ft/yr	Feet per year
GCTL	Groundwater Cleanup Target Level
HHRA	Human Health Risk Assessment
HI	Hazard Index
HLA	Harding Lawson Associates
HQ	Hazard Quotient
ILCR	Incremental Lifetime Cancer Risk

LIST OF ACRONYMS

IR	Installation Restoration
LUC	Land use controls
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
mg/kg/day	Milligrams per kilogram per day
NAS	Naval Air Station
Navy	United States Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NPW	Net Present Worth
O&M	Operations and maintenance
OU	Operable Unit
PAH	Polynuclear aromatic hydrocarbon
PRG	Preliminary Remediation Goal
PSC	Potential Source of Contamination
RAO	Remedial Action Objective
RBCA	Risk based corrective action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfD	Reference dose
RI	Remedial Investigation
ROD	Record of Decision
RUST	RUST Environment and Infrastructure
SCTL	Soil Cleanup Target Level
SF	Slope factor
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	Semivolatile organic compound
TBC	To Be Considered
µg/L	Micrograms per liter
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground storage tank
VOC	Volatile organic compound
yd^3	Cubic yard

1.0 DECLARATION OF THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Naval Air Station (NAS) Jacksonville occupies 3,896 acres on the western bank of the St. Johns River in southeastern Duval County, Florida. Potential Source of Contamination (PSC) 47 consists of a former pesticide mixing, usage, and storage area that was housed in Building 536 and a former pesticide underground storage tank (UST) area at Building 937. NAS Jacksonville was placed on the National Priorities List (NPL) in December 1989 with the United States Environmental Protection Agency (USEPA) Identification Number FL6170024412. The Operable Unit (OU) 8, PSC 47 site is part of a comprehensive environmental investigation and cleanup program currently being performed at NAS Jacksonville under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority pursuant to the Federal Facility Agreement (FFA) entered into by the Navy, USEPA, and Florida Department of Environmental Protection (FDEP) in October 1990.

Building 536, the Pesticide Shop, is in the northernmost portion of PSC 47. It is located on Child Street approximately 600 feet south of Birmingham Avenue, a main east-to-west artery at NAS Jacksonville. Building 937, the Naval Entomology Center of Excellence (NECE) [known as Disease Vector Ecology and Control Center (DVECC) until renamed in 2007], occupies the adjoining property to the south. A chain-link fence, situated approximately 75 feet south of the Building 536, separates the two areas which comprise PSC 47.

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for contaminated soil and groundwater at PSC 47. The remedial action was selected by the United States Department of the Navy and USEPA in accordance with the CERCLA of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) § 300]. This decision document was prepared in accordance with USEPA Record of Decision (ROD) document guidance (USEPA, 1999a). This decision is based on information contained in the Administrative Record file, which is located at the Webb Wesconnett Branch of the Jacksonville Public Library, 6887 103rd Street, Jacksonville, Florida 32210. The FDEP concurs with the selected remedy. Representatives from these three government agencies are members of the NAS Jacksonville Partnering Team.

1.3 ASSESSMENT OF THE SITE

The response actions authorized by this ROD are necessary to protect the public health and welfare and/or the environment from actual or threatened releases of pollutants or contaminants from this site, which may present an imminent and substantial endangerment to public health or welfare. The soil at PSC 47 has been found to contain chemicals of concern (COCs) including polynuclear aromatic hydrocarbons (PAHs), pesticides, and arsenic, and groundwater COCs including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and arsenic. The types of Target Compound List pesticides present reflect both the nature of the materials handled at PSC 47 and its historical use for pesticide mixing, application training, and equipment cleaning and maintenance. The presence of petroleum hydrocarbons, PAHs, and chlorinated solvents are also consistent with the fact that substances containing these compounds were formerly stored on site in aboveground storage tanks (ASTs) and USTs. If not addressed by implementing the response action selected in this ROD, these contaminants may present an imminent and substantial endangerment to public health, welfare, and/or the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY

This ROD presents the selected final remedy for the PSC 47 Site, which includes previously implemented interim actions for contaminated soil and selection of monitored natural attenuation for contaminated groundwater, as well as land use controls (LUCs), to prevent unacceptable exposures to soil and groundwater contamination remaining at the site. A Remedial Investigation (RI), Feasibility Study (FS), Ecological Risk Assessment (ERA) and Human Health Risk Assessment (HHRA) have been prepared for PSC 47, and the results are summarized in this document.

The major components of the selected remedy are as follows:

- Excavation of contaminated soil areas with COC concentrations greater than commercial/industrial cleanup levels, followed by backfilling and off-site disposal of excavated soils in a permitted landfill. The excavation component was completed in October 2007 as an interim remedial action to prevent direct exposure under current land use.
- Installation of impervious cover system (i.e., cap) at areas with concentrations of soil COCs greater than groundwater leachability cleanup levels in immediate areas of known elevated groundwater contamination. The capping component was completed in April 2008 as an interim remedial action (continuance of 2007 excavation) to prevent continued leaching of soil COCs into groundwater.
- Groundwater monitoring to verify the effectiveness of the cap and evaluate potential leaching of soil COCs into groundwater in both capped and uncapped areas.

- Monitored natural attenuation of contaminated groundwater to evaluate decreases in COC concentrations in the surficial aquifer. Natural attenuation of the contaminants at PSC 47 is expected to occur via physical processes (e.g., dispersion, adsorption, dilution, etc.) and/or chemical processes (e.g., biodegradation). COC concentrations in groundwater will be monitored for natural attenuation in accordance with USEPA guidance to evaluate decreases in constituent concentrations and to verify that migration off-site is not occurring. At completion of the first five year monitoring period, or earlier, the parties will evaluate data to determine whether natural attenuation is effective at reducing the COCs in the groundwater at a rate that can achieve the Remedial Action Objectives (RAOs) within a reasonable time frame. If the parties determine the attenuation is not effective based upon the data, the parties may determine that a contingent remedy, which may include one or more the approaches specified in remedial alternatives GW3-A or GW3-B, is necessary.
- Implementation and maintenance of LUCs to prevent unacceptable exposure to soil and groundwater contamination remaining at the Site. Periodic inspections will be conducted to verify continued implementation of the LUCs.

Soil and groundwater contamination will remain at the Site at concentrations that preclude unrestricted use and unlimited exposure; therefore, the remedy includes LUCs (including institutional and engineering controls) to prevent unacceptable exposure to residual contaminated soil and groundwater. Institutional controls would include update of installation's Master Plan and procedures to prohibit residential uses at the Site, prohibit use of the groundwater, and prohibit intrusive activities in contaminated areas. Engineering controls would include the cap over the contaminated soils and signs to advise that intrusive activities at PSC 47 require authorization. The boundaries of PSC 47 and the area subject to LUCs are shown on Figures 1-1 (Soil LUC Boundaries) and 1-2 (Groundwater LUC Boundaries). Consistent with the RAOs developed for the site, the specific performance objectives of the LUCs to be implemented at PSC 47 are as follows.

- Prohibit residential, recreational, or agricultural use of the area within the LUC boundary for soil (Figure 1-1). Prohibited residential uses shall include, but are not limited to, any form of housing, childcare facilities, pre-schools, elementary schools, secondary schools, play grounds, convalescent, or nursing care facilities.
- Prohibit disturbance of the cap and/or underlying soils at the Site to prevent unacceptable occupational exposure unless prior written approval is obtained from the Navy, USEPA, and FDEP.

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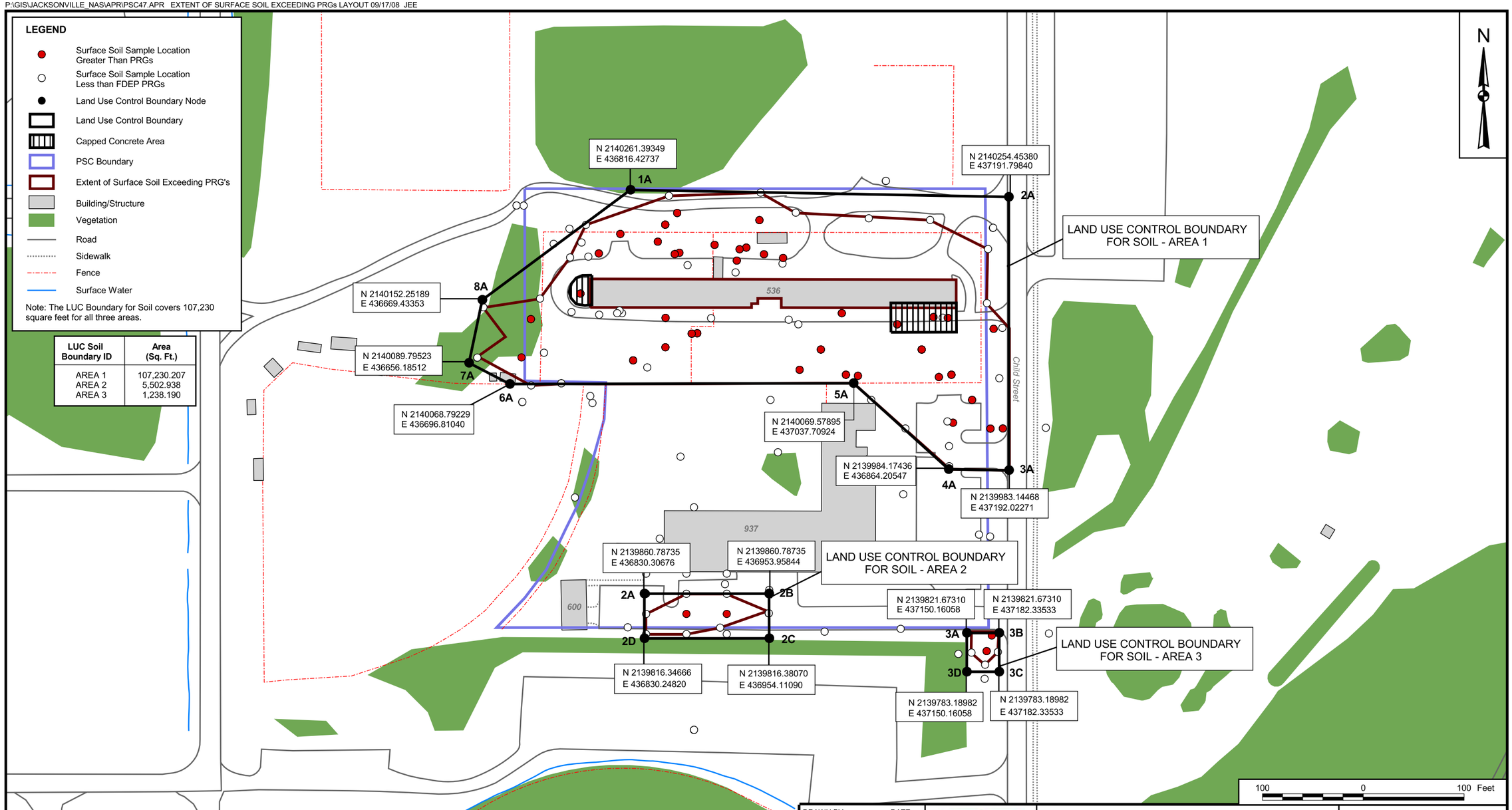

LUC Soil Boundary ID	Area (Sq. Ft.)
AREA 1	107,230.207
AREA 2	5,502.938
AREA 3	1,238.190

DRAWN BY S. PAXTON	DATE 04/23/07
CHECKED BY J. JOHNSON	DATE 09/17/08
REVISED BY J. ENGLISH	DATE 09/17/08
SCALE AS NOTED	

NAVFAC

LAND USE CONTROL BOUNDARIES FOR SOIL
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. CTO 0047
APPROVED BY ____ DATE ____
APPROVED BY ____ DATE ____
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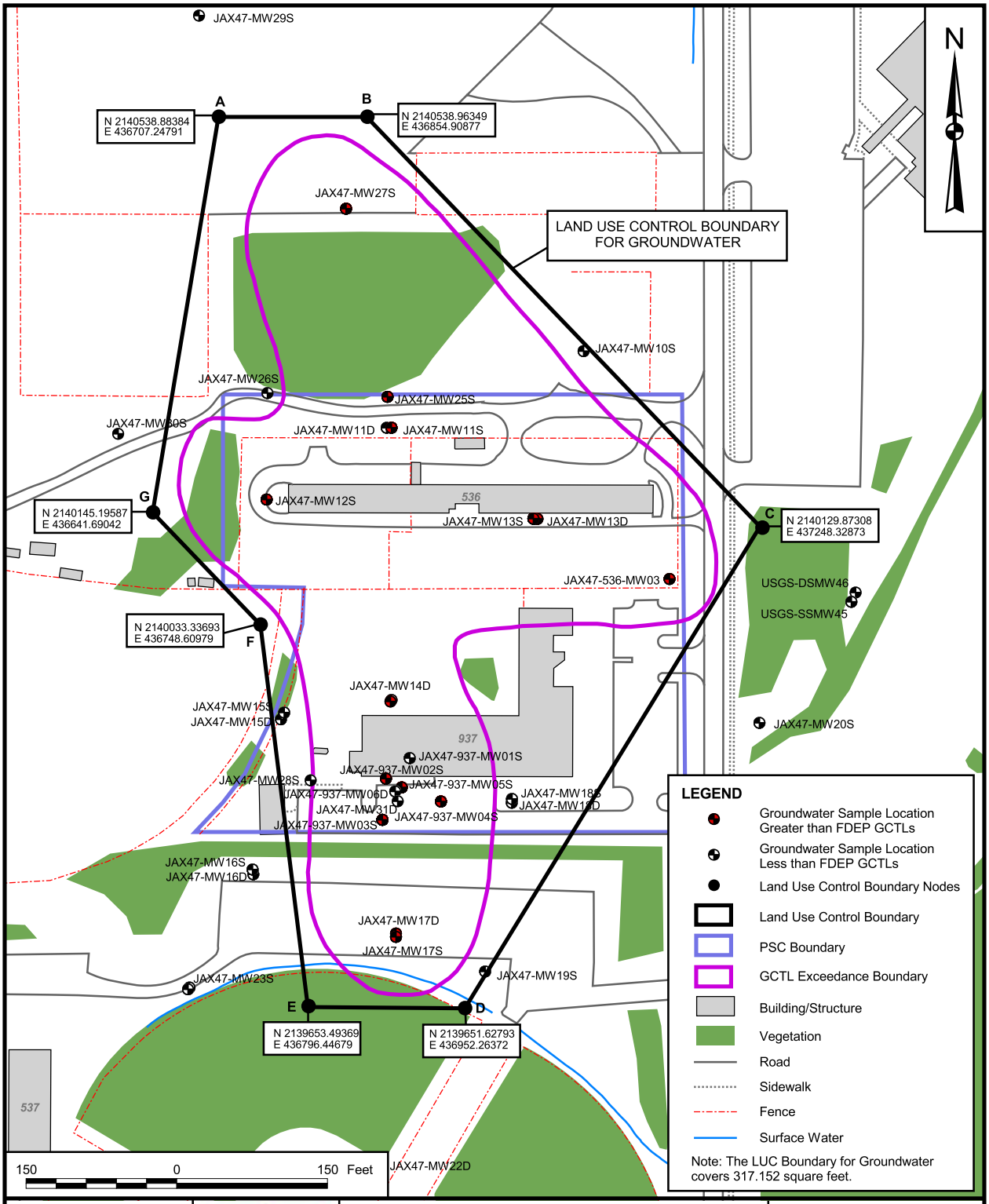
REV. 0



DRAWN BY J. ENGLISH	DATE 04/24/08	LAND USE CONTROL BOUNDARY FOR GROUNDWATER PSC 47 NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER 4232
CHECKED BY J. JOHNSON	DATE 09/17/08		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 REV 0

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- Prohibit withdrawal of groundwater from the surficial aquifer underlying the Site for all uses including but not limited to, human consumption, dewatering, irrigation, heating/cooling, and industrial processes. Extraction of groundwater for the purpose of monitoring will be allowed.
- Maintain the integrity of any existing or future monitoring or remediation system (including but not limited to, the monitoring wells and the cap).

LUCs will be implemented, monitored, reported, and maintained by the Navy for PSC 47 to ensure that the surficial aquifer is not used for drinking water purposes and to prevent uncontrolled worker exposure to potentially contaminated soil and groundwater. The LUC implementation actions including monitoring and enforcement requirements will be provided in a LUC Remedial Design (RD) that will be prepared by the Navy as the component of the overall RD. Within 90 days of ROD signature, the Navy shall prepare and submit to USEPA and FDEP for review and approval (pursuant to those Primary Document review procedures stipulated in the FFA) the LUC RD for PSC 47 that shall contain implementation and maintenance actions, including periodic inspections that the Navy and/or NAS Jacksonville shall undertake to achieve the LUC performance objectives. The Navy or any subsequent owners shall not modify, delete, or terminate any LUC without USEPA and FDEP approval. The LUCs will be maintained until the concentrations of hazardous substances in soil and groundwater are at levels that allow for unrestricted use and unlimited exposure.

1.5 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, is cost-effective, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and utilizes permanent solution and alternative treatment technologies to the maximum extent practicable. The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at this site and satisfies the preference for treatment as a principal element. Of those alternatives that are protective of human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs), the selected remedy meets the threshold criteria and provides the best balance of trade-offs in terms of the balancing and modifying criteria. Because this remedy will result in contaminated soil and groundwater remaining on site, LUCs will be instituted to prevent residential, agricultural, and recreational uses and to ensure that RAOs are being achieved. This remedy will result in hazardous substances, pollutants, or contaminants remaining on site at levels that do not allow for unlimited use and unrestricted exposure; therefore, in accordance with Section 121(c) of CERCLA and NCP 300.430(f)(5)(iii)(c), a statutory review will be conducted within five years of the initiation of remedial action, and every five years thereafter, to ensure that the remedy continues to be protective of human health and the environment. If the remedy is determined not to be protective of human health and the environment, the Navy may be required to undertake additional remedial action.

1.6 ROD DATA CERTIFICATION CHECKLIST

The information required to be included in this ROD is summarized in Table 1-1. These data are presented in Section 2.0, Decision Summary. Additional information, if required, can be found in the Administrative Record file for PSC 47 located at the Information Repository at the Webb Wesconnett Branch of the Jacksonville Public Library, 6887 103rd Street, Jacksonville, Florida 32210.

TABLE 1-1

ROD DATA CERTIFICATION CHECKLIST
PSC 47 RECORD OF DECISION
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

INFORMATION	ROD REFERENCE
COCs and their concentrations.	Section 2.5.3
Baseline risks represented by the COCs.	Section 2.6
Cleanup goals [Preliminary Remediation Goals (PRGs)] established for the COCs.	Section 2.7.1
Current and reasonably anticipated future land use and groundwater use scenarios used for risk assessment.	Section 2.5.4
Potential land and groundwater uses available at the site as a result of the selected remedy.	Section 2.11.2
Estimated capital, operations and maintenance (O&M), and total present worth costs of selected remedy. Discount rate used and timeframe over which these costs are projected.	Section 2.8
Key factors that lead to the selection of the remedy.	Section 2.11

1.7 AUTHORIZING SIGNATURES

Captain John C. Scorby, Jr.
Commanding Officer
Naval Air Station Jacksonville

26 SEP 08
Date

Franklin E. Hill, Director
Superfund Division, Region 4
United States Environmental Protection Agency

9-30-08
Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

NAS Jacksonville, as shown on Figure 2-1, occupies 3,896 acres on the western bank of the St. Johns River in the southeastern part of Duval County, Florida. NAS Jacksonville, located approximately 13 miles south of downtown Jacksonville, was commissioned in 1940 to provide facilities for pilot training and a Navy Aviation Trades School for ground crewmen. Facilities at NAS Jacksonville more than doubled during World War II to provide support for military operations during the war. Since 1951, the facility has been used for training pilots and ground crewmen while also supporting operational patrol and carrier squadrons.

PSC 47 occupies an area of 185,000 square feet (ft^2) (4.25 acres) and includes the Pesticide Shop (Building 536) and the NECE (Building 937) (see Figure 2-2). The land comprising PSC 47 is a relatively flat parcel bounded on the east by Child Street, on the north by a wooded parcel and grass area, and on the west and south by athletic fields (baseball diamonds). A southern-flowing drainage ditch, dry except during rain events, is present along the eastern boundary of PSC 47 parallel to Child Street. A chain-link fence, situated approximately 75 feet south of the Pesticide Shop, separates the Building 536 and the Building 937 areas.

The Navy is the lead agency for this site and is supported by the USEPA and FDEP.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

NAS Jacksonville was placed on the NPL in November 1989 because of documented past releases of hazardous waste at the facility. The NAS Jacksonville NPL site currently includes eight OUs. PSC 47 is contained within OU 8.

2.2.1 Enforcement Activities

An FFA was finalized for NAS Jacksonville in October 1989. The FFA is a three-party agreement signed by the Navy, USEPA, and the State of Florida. Pursuant to the FFA, the Navy conducted remedial investigations and response actions under CERCLA authority. CERCLA response actions and Resource Conservation and Recovery Act (RCRA) corrective action obligations at NAS Jacksonville are being integrated through implementation of the FFA such that activities covered by the FFA will achieve compliance with CERCLA, applicable sections of RCRA, and all applicable or relevant and appropriate federal and state laws and regulations, to the extent required by Section 121 of CERCLA, 42 United States Code Section 9621. Therefore, CERCLA remedial actions selected, implemented, and completed

DRAWN BY J. LAMEY	DATE 08/18/03	SITE LOCATION MAP PSC 47 NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER 3966
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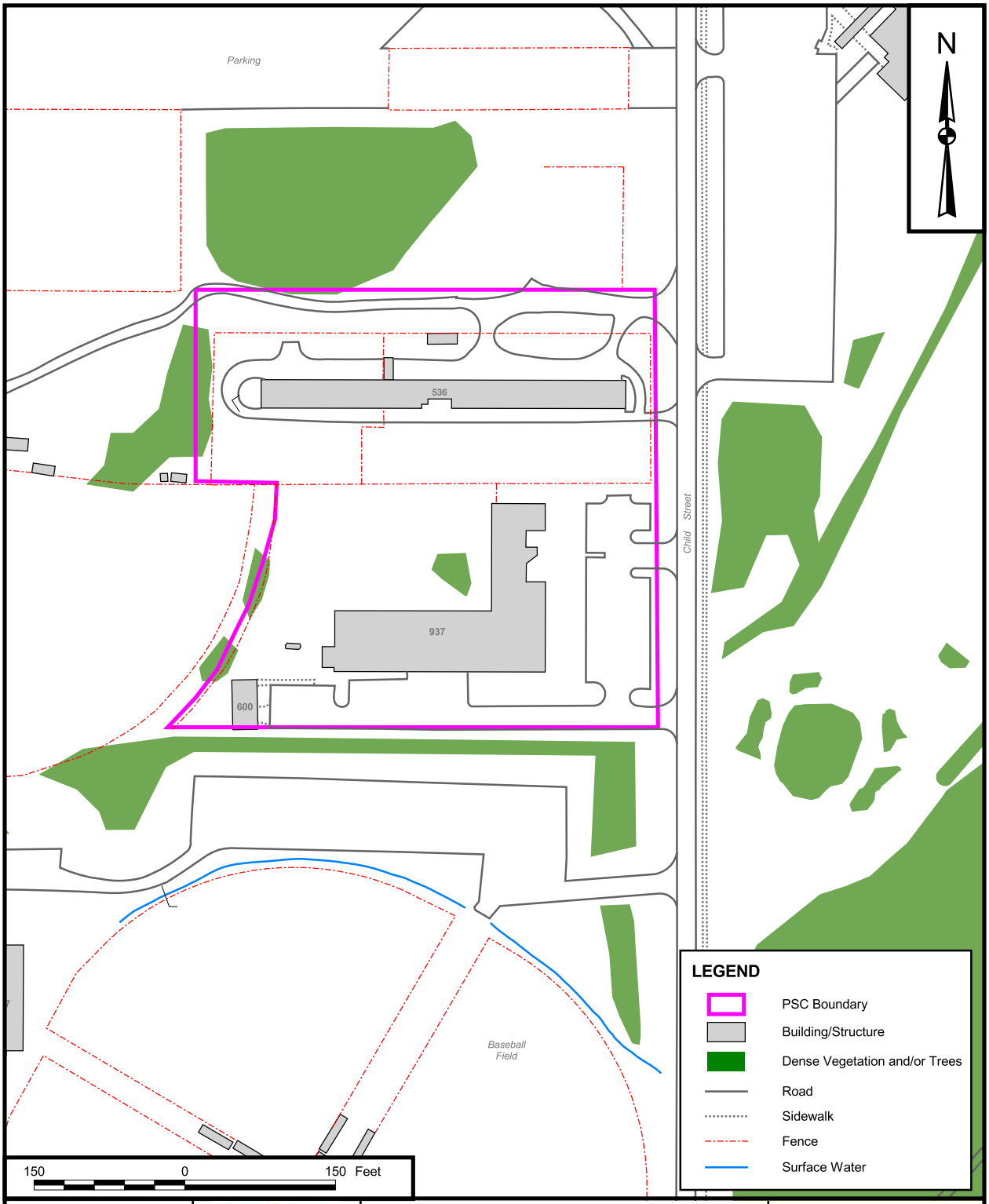
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 2-1 / REV 0

P:\GIS\JACKSONVILLE_NAS\APR\PSC47.APR SITE LOCATION LAYOUT 5/5/08 KM



DRAWN BY S. PAXTON	DATE 11/16/06	SITE MAP PSC 47 NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER 3966
CHECKED BY J. JOHNSON	DATE 5/5/08		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-2 REV 0

P:\GIS\JACKSONVILLE_NAS\APR\PSC47.APR SITE LAYOUT 5/5/08 KM

under the FFA will be protective of human health, welfare, and the environment such that further corrective action under RCRA, as amended, will not be required.

There have been no cited violations under federal or state environmental law or any past or pending enforcement actions pertaining to the cleanup of PSC 47.

2.2.2 Site History

The Pesticide Shop, Building 536, has occupied its current location since mid- to late 1960. It was identified as a PSC and added to NAS Jacksonville's Hazardous and Solid Waste Amendments permit in 1993 because past practices included use of pesticides, storage of pesticides and herbicides, and calibration and testing of pesticide application equipment. Additionally, chlordane was applied to and around test slabs of concrete, cinder block, and brick in the southeastern corner of the property during termite control training exercises [Harding Lawson Associates (HLA), 1999].

In 1991, approximately 30 empty, rusted 55-gallon drums were removed from the southwestern corner of the Building 536 property. According to waste handlers at NAS Jacksonville, the drums had once contained malathion and other pesticides. An unspecified amount of chlordane was reportedly spilled in the northwestern corner of PSC 47 at an unknown date (HLA, 1999).

Other previous potential sources of contamination in the vicinity of Building 536 include soakage pits formerly located at the southeastern and southwestern corners of the building and one UST and two ASTs formerly located south of the building. The soakage pits were 2 feet square by 3 feet deep. The purpose of the pits is not known, although it is believed that the southeastern pit received drainage from inside the bays of Building 536 and both could have been used during training exercises. The UST and one of the ASTs reportedly contained diesel fuel, and the other AST contained a mixture of diesel fuel and malathion for use as a "hot fogger" for mosquito control prior to 1972.

Building 937 (NECE, formerly known as DVECC) was dedicated on January 25, 1978. One of the functions performed at Building 937 is the development of effective pest management programs. Prior to 1978, these activities were conducted at the Pesticide Shop. From approximately 1978 to 1988, a pesticide mixing room with a sink and three floor drains was located in the south-central portion of Building 937. Rinse water and excess liquids from the sink and floor drains discharged to a 1,000-gallon fiberglass UST known as the "DVECC Tank." The UST was taken out of service in 1989, the same year that representatives from NECE and the Navy expressed concern about the possibility of significant contamination on the grounds of Buildings 937 and 536 due to the long history of pesticide application training.

NAS Jacksonville prepared the DVECC tank for RCRA closure in a revised permit application submitted to the FDEP on October 13, 1993. The FDEP issued the permit on September 21, 1995, authorizing closure of the DVECC tank as part of the Closure Permit for Hangar 1000, which also addressed NECE (DVECC). In April 1994, prior to issuance of the application, a residual volume (approximately 15 gallons) of residual liquid was removed from the tank, and the building floor drains were capped with concrete.

Closure work was performed by Bechtel Environmental, Inc. (BEI) from October 16 through December 6, 1995 [Environment and Infrastructure (RUST), 1996]. Confirmatory soil and groundwater samples collected after excavation, and removal of the DVECC tank revealed the presence of pesticides in these environmental media, the most prevalent being chlordane. Because "clean closure" was not achieved, an additional subsurface investigation was performed in December 1996 to evaluate the extent of contamination in the area. Soil samples were collected from 14 locations, and groundwater samples were collected from 6 locations in and around the former DVECC tank excavation. Pesticide concentrations exceeded regulatory criteria in soil and groundwater samples, although the distribution of contaminants appeared random and was not centered on the location of the former DVECC tank. This random contaminant distribution in the vicinity of the DVECC tank suggested that the tank may not be the source of pesticide contamination in this area. In October 1997, the NAS Jacksonville Partnering Team reached consensus that a post-closure permit was not required under the NCP and FFA if NECE (DVECC) was included in CERCLA activities at PSC 47.

2.2.3 Site Investigations

Remediation investigations and cleanup activities that have been performed within PSC 47 since 1995 are listed below. Detailed information about each of these investigations was provided in the RI/FS for PSC 47 (TtNUS, 2008a).

- Remediation Work Plan for DVECC Used Oil Tank Removal, September 1995
- Tank Closure Report, January 1996
- DVECC RCRA Facility Investigation, January 1997
- RCRA Application for Closure Permit, September 1998
- Sampling Event Report, February 1999
- Soil Excavation (1st interim remedial action) around Building 536, July 1999
- Remedial Investigation, Phase I, June to December 2001
- Remedial Investigation, Phase II, March 2002 to July 2003
- Remedial Investigation, Phase III, November 2006 to April 2007
- Soil Excavation and Capping (2nd interim remedial action) around Building 536, September 2007 to April 2008

RI activities were conducted in a phased approach with a screening effort conducted during Phase I, which included soil and groundwater sampling via direct-push technology (DPT) and on-site mobile laboratory analyses. Follow on activities conducted in Phases II and III consisted of more detailed soil sampling to delineate prior detections and installation of groundwater monitoring wells verifying the extent of contamination in groundwater. Subsequent to field activities, an ERA and HHRA were performed, and an RI/FS was completed (TtNUS, 2008a). A second interim remedial action was conducted in 2007/2008 to excavate soil presenting a risk to site workers and a cap was installed over soil that presented a potential to leach to groundwater.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Navy performed public participation activities in accordance with CERCLA and the NCP to the extent practicable throughout the CERCLA site cleanup process. Public notices on the availability of the Proposed Plan for PSC 47 were placed in the Florida Times-Union on June 29, 2008. A 30-day comment period was held from July 1 to August 1, 2008. The results of the RI, the HHRA, the ERA, the remedial alternatives evaluated in the FS (TtNUS, 2008a), and the preferred alternative of the Proposed Plan (TtNUS, 2008b) were presented and discussed at a Restoration Advisory Board meeting and public meeting held on July 29, 2008, during which comments were solicited from the community. Three emails were received with comment to the proposed plan and both concurred with the proposed remedy and therefore required no response.

Documents that are part of the Administrative Record file for PSC 47 are available to the public at the Information Repository located at the Webb Wesconnett Branch of the Jacksonville Public Library, 6687 103rd Street, Jacksonville, Florida 32210. This signed ROD will be added to the contents of the Administrative Record file consistent with NCP at 40 CFR 300.810.

2.4 SCOPE AND ROLE OF REMEDIAL ACTION SELECTED FOR PSC 47

As with many Superfund sites, there are multiple contaminated areas at NAS Jacksonville. Due to the complex environmental concerns at NAS Jacksonville, work at multiple sites in the Installation Restoration (IR) Program has been organized into eight OUs. The IR Program at NAS Jacksonville is governed by the FFA and Site Management Plan, and cleanup activities are being performed under CERCLA.

This ROD is the final action for OU 8 (PSC 47). Final RODs have been approved for OU 1 through OU 7 at NAS Jacksonville. This ROD only addresses contamination found in media at PSC 47, OU 8 and presents the final response action selected for that site.

Two interim actions were conducted at PSC 47. The first interim action was conducted in 1998 and addressed gross contamination in shallow soils that was perceived to present a risk to on-site workers. A second interim action was conducted beginning in September 2007 and completed in April 2008 using risk based corrective action (RBCA) guidance under Chapter 62-780, Florida Administrative Code (FAC) to further reduce site risks. The second interim action included an evaluation of soil areas to meet both apportioned and non apportioned cleanup target levels (CTLs) to allow commercial/industrial use and provide for capping of areas that pose a risk of leachability to groundwater. The actions were conducted in accordance with an Interim Remedial Action Work Plan (CH2MHill, 2007) approved by both FDEP and USEPA. This second interim action is included as part of Alternative S-3 for soil, which is a component of the selected remedy for this site.

2.5 SUMMARY OF SITE CHARACTERISTICS

Physical characteristics of PSC 47 and the nature and extent of contamination are summarized in the following paragraphs. For greater detail, refer to Section 2.0 of the RI/FS Report that is kept in the Information Repository located at the Webb Wesconnett Branch of the Jacksonville Public Library.

2.5.1 Surface Hydrology and Hydrogeology

PSC 47 is situated approximately 4,500 feet (5/6 mile) west of the St. Johns River. The only surface water body of significant dimension closer than this is Casa Linda Lake (OU 4), located on the golf course approximately equidistant between PSC 47 and the St. Johns River, or about 2,200 feet east of the site. A small perennial retention basin comprising an area of approximately 1,000 ft^2 is located 400 feet north of PSC 47 at the southwestern quadrant of the intersection of Child Street and Birmingham Avenue. Groundwater beneath PSC 47 is not currently used; however, the aquifer is a potential source of drinking water and is classified (Class G-II) under FDEP regulations.

Three aquifer systems are present in northeastern Florida: the surficial aquifer, intermediate aquifer (Hawthorn Group), and Floridan aquifer system. The surficial aquifer is the only aquifer relevant to potential contamination from historical activities at PSC 47 due to the depth and thickness of the underlying confining units. Shallow groundwater is present under unconfined conditions and is typically encountered at depths ranging from approximately 2 feet below land surface (bls) to 7 feet bls. Generally, the water table is shallower in the area south of NECE and deeper in the area north of the Pesticide Shop.

2.5.1.1 Groundwater Flow in the Surficial Aquifer

RI groundwater monitoring results and the results of flow models generated by the United States Geological Survey (USGS) (Davis et al., 1996) show groundwater flow direction in the upper and lower

surficial aquifer beneath PSC 47 to be northwesterly. There is a downward gradient in the surficial aquifer underlying PSC 47.

2.5.1.2 Aquifer Characteristics in Upper and Lower Zones of the Surficial Aquifer

Aquifer (slug) tests were performed at PSC 47 on 10 shallow monitoring wells, one intermediate well, and six deep wells installed during the RI. Hydraulic conductivity values calculated for the 10 shallow zone wells ranged from 3 feet per day (ft/day) to 7 ft/day and averaged 3.9 ft/day. The flow velocity in the shallow zone of the surficial aquifer at PSC 47 was estimated to be 0.0468 ft/day or 17.08 feet per year (ft/yr) toward the northwest. Flow velocity in the deep zone of the surficial aquifer was estimated to be 0.067 ft/day or 24.48 ft/yr toward the northwest using the same computational methods.

2.5.2 Site-Specific Geology

A weathered limestone unit is encountered beneath PSC 47 at a depth of 45 to 53 feet bls or, in places, slightly shallower or slightly deeper than this. The shallowest occurrences of the limestone unit are in the southern part of the study area, and the deepest occurrences are in the northern part. Clastic sediments, consisting predominantly of sand, are present from land surface to the top of the weathered limestone. In the few feet immediately overlying the limestone, sediments grade from sand to clayey sand to predominantly clay and are distinctively dark gray in color. Above this transition zone, the sediments are mainly fine and very fine grained sands interspersed with occasional clay stringers up to 2 inches thick. Small quantities of disseminated silt and clay are present in some sections of the sand, whereas at other horizons, sorting is better and the sand is virtually free of finer grained components. In the southwestern section of PSC 47, appreciably more clay is present in the upper 25 feet. The colors of the clastic sediments range from very pale brown to orange or yellowish brown to dark gray.

2.5.3 Nature and Extent of Contamination

Suspected sources of contamination at PSC 47 are the former NECE tank area south of Building 937 and the areas around Building 536 where pesticides were once mixed and stored, pesticide application equipment was tested and calibrated, chlordane was applied to concrete slabs for termite control training, drums of unknown content were stored, chlordane was allegedly spilled, and diesel and diesel-malathion mixtures were stored in ASTs or USTs. Previous investigations by HLA (HLA, 1999) and BEI (BEI, 1999) indicated that the greatest pesticide concentrations in soil are present south of the western half of Building 536. The former soakage pit locations near the southeastern and southwestern corners of Building 536 are additional areas where COCs have been identified at elevated levels. The distribution of COCs in groundwater has been documented and is contained within the boundaries of OU 8.

2.5.3.1 Soil Conditions Prior to 2007 Interim Remedial Action

Overall, soil contaminated with pesticides was present in a large area around the Pesticide Shop and was mostly confined within the Building 536 fenced boundary except for the drainage swale southeast of this building.

Pesticide concentrations exceeding residential screening criteria, including numerous concentrations exceeding industrial and leachability Soil Cleanup Target Levels (SCTLs), were present in soil surrounding the Building 536 area despite removal of approximately 1,300 cubic yards (yd^3) of soil in 1999. Surface soil contamination (0 to 2 feet bls) was mainly present in the non-excavated areas surrounding Building 536. Impacted subsurface soil was primarily located in the southern half of the fenced Building 536 area, beyond either the lateral or vertical extent of the 1999 soil removal area. Limited surface and subsurface soil contamination above industrial SCTLs was present in the drainage swale located immediately southeast of Building 536 and adjacent to Child Street.

The most frequently identified pesticide compounds remaining in soil at PSC 47, as determined by the post-excavation soil sampling by BEI (BEI, 1999), are essentially the same as those reported by HLA in 1997 before the soil interim action [i.e., 4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), dieldrin, and hexachlorocyclohexane (BHC) isomers]. Pesticide compounds most frequently found both before and after the interim action were chlordane, endrin, and aldrin.

As shown on Figure 2-3, three areas of surface soil contamination exceeding residential SCTLs were identified. The largest area of surface soil contamination is shown on the figure located around Building 536. Two smaller areas (one south of the southwestern corner of Building 937 and the second in a drainage swale southeast of Building 937) of surface soil contamination are shown in the southern portion of the PSC. Surface soil concentrations of pesticide COCs in excess of residential, industrial, and leachability SCTLs were reported over a large portion surrounding Building 536. Surface soil industrial and leachability exceedances are shown on Figures 2-4 and 2-5, respectively. Pesticide concentrations in the drainage swale adjacent to Building 536 also exceeded SCTLs. A small area of arsenic-contaminated surface soil located south of the southwestern corner of Building 937 was identified under an existing asphalt parking lot utilized by the tenants of Building 937. Concentrations of arsenic in this area exceeded the residential SCTL only. Surface soil in the drainage swale had concentrations of 4,4'-DDT exceeding residential, industrial, and leachability SCTLs.

Subsurface soil sampling results indicated that arsenic and various pesticide COCs were present at PSC 47. Pesticide COCs were found predominantly in subsurface soil samples collected from within the fenced area on the southern side of Building 536 and in the drainage swale adjacent to Child Street.

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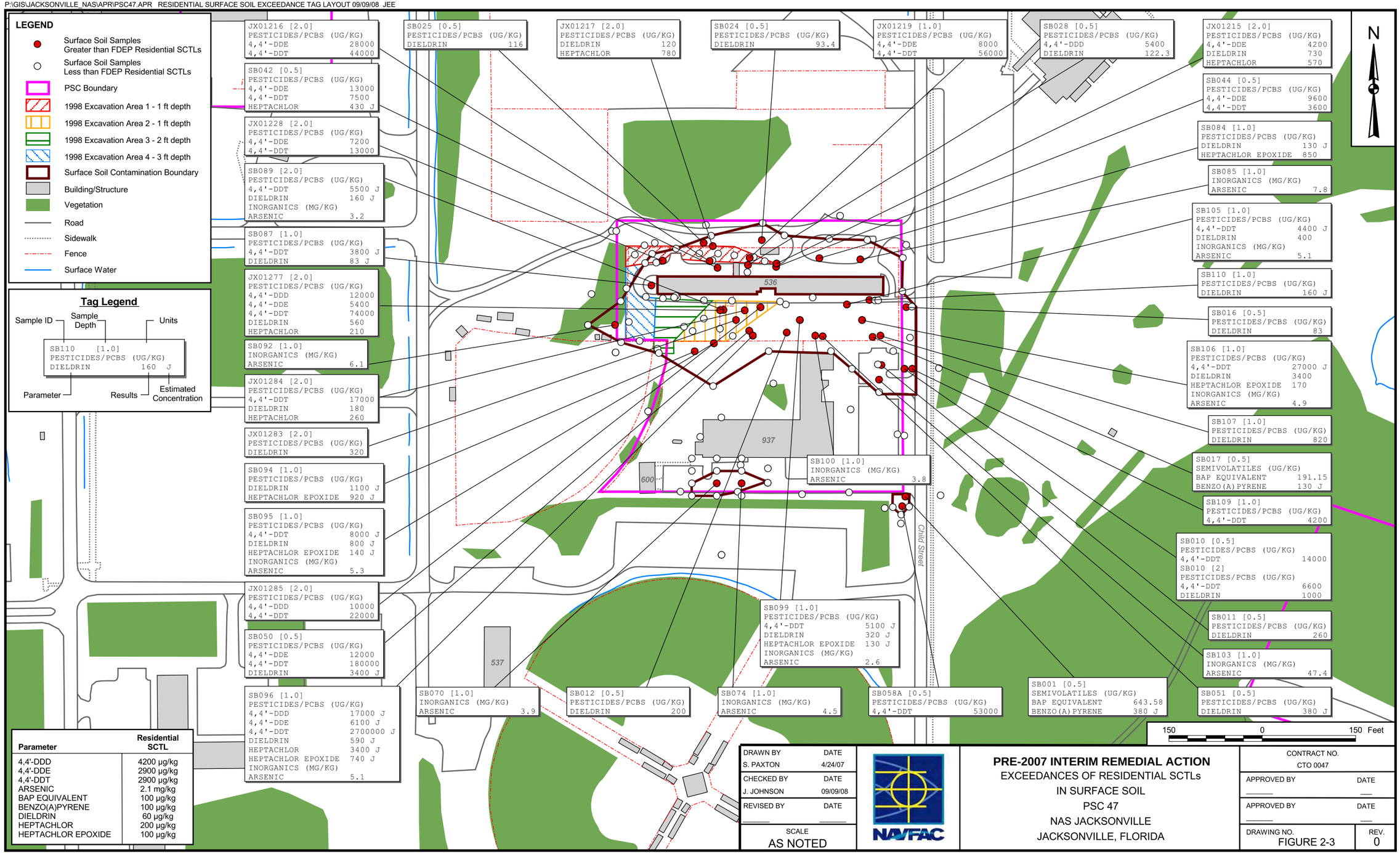

Parameter	Residential SCTL
4,4'-DDD	4200 µg/kg
4,4'-DDE	2900 µg/kg
4,4'-DDT	2900 µg/kg
ARSENIC	2.1 mg/kg
BAP EQUIVALENT	100 µg/kg
BENZO(A)PYRENE	100 µg/kg
DIELDRIN	60 µg/kg
HEPTACHLOR	200 µg/kg
HEPTACHLOR EPOXIDE	100 µg/kg

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PRE-2007 INTERIM REMEDIAL ACTION
EXCEEDANCES OF RESIDENTIAL SCTLs
IN SURFACE SOIL
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. CTO 0047	
APPROVED BY	DATE
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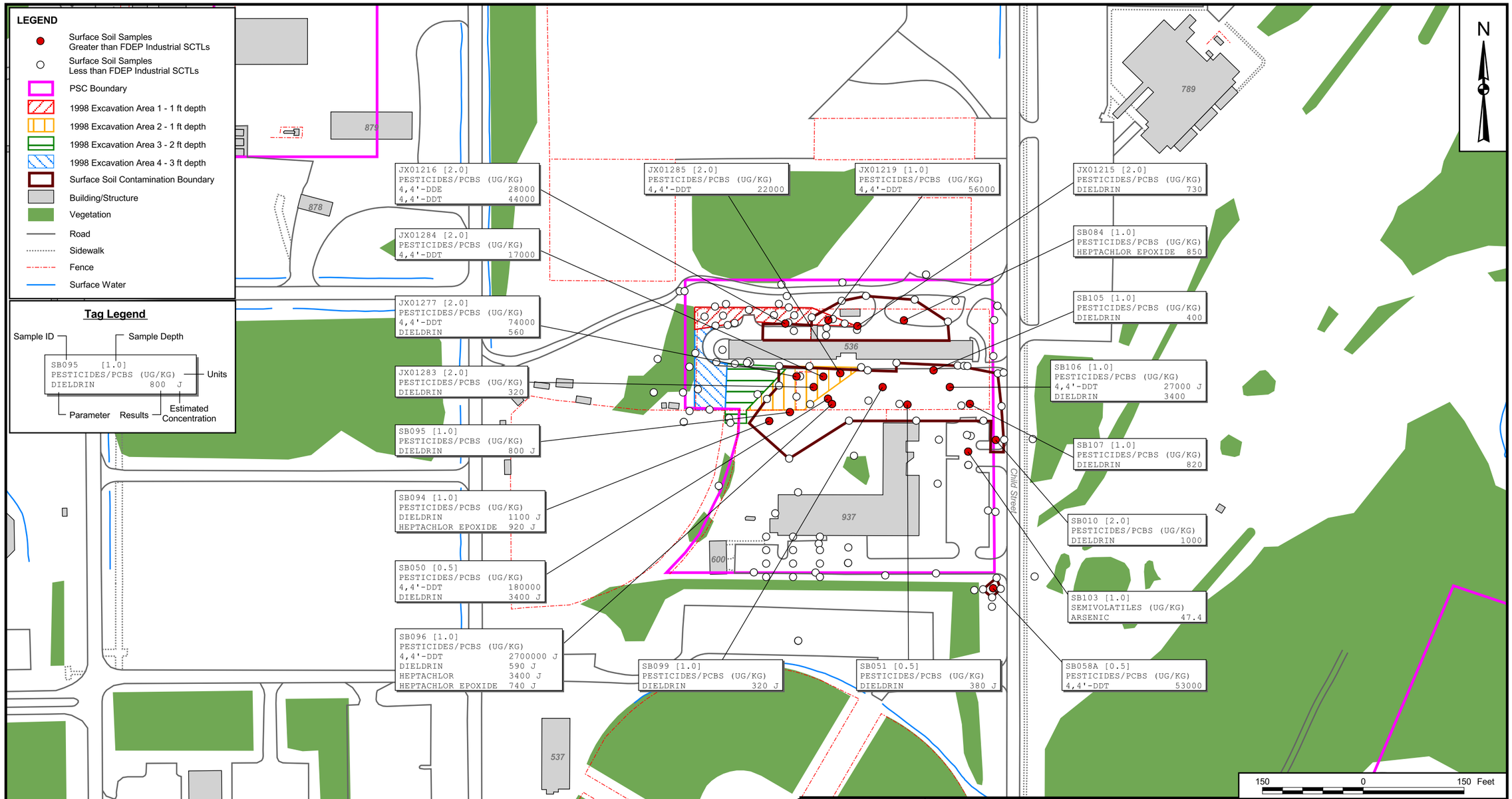

Parameter	Industrial SCTL
4,4'-DDE	15000 µg/kg
4,4'-DDT	15000 µg/kg
ARSENIC	12 mg/kg
DIELDRIN	300 µg/kg
HEPTACHLOR	1000 µg/kg
HEPTACHLOR EPOXIDE	500 µg/kg

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PRE-2007 INTERIM REMEDIAL ACTION
EXCEEDANCES OF INDUSTRIAL SCTLs
IN SURFACE SOIL
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. CTO 0047	
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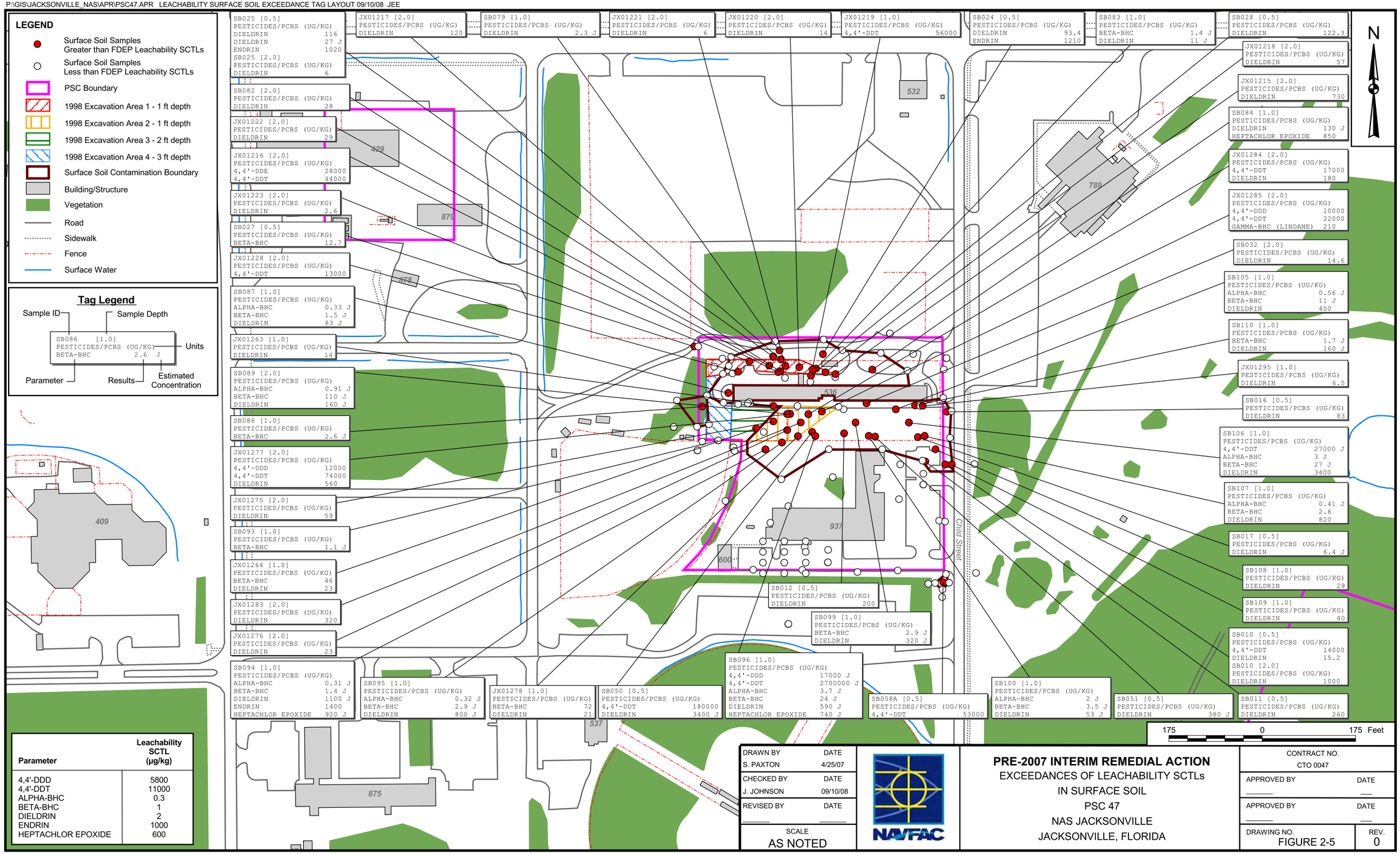
P:\GIS\JACKSONVILLE_NAS\APR\PSC47.APR LEACHABILITY SURFACE SOIL EXCEEDANCE TAG LAYOUT 09/10/08 JEE



Parameter	Leachability SCTL (µg/kg)
4,4'-DDD	5800
4,4'-DDT	11000
ALPHA-BHC	0.3
BETA-BHC	1
DIELDRIN	2
ENDRIN	1000
HEPTACHLOR EPOXIDE	600

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PRE-2007 INTERIM REMEDIAL ACTION
EXCEEDANCES OF LEACHABILITY SCTLs
IN SURFACE SOIL
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO.	
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Exceedances of residential, industrial, and leachability SCTLs in subsurface soil are shown on Figures 2-6, 2-7, and 2-8, respectively. Arsenic exceedances were located predominantly on the southern side of Building 536, but were also identified in a small area off the southwestern corner of Building 937. Arsenic concentrations exceeded the residential and industrial SCTLs in both areas. One subsurface soil sample collected in the drainage swale southeast of Building 536 had a benzo(a)pyrene equivalent concentration greater than the residential SCTL. This sample was collected from the drainage swale and may have been the result of runoff from the adjacent road (Child Street) and/or parking lot associated with Building 937.

2.5.3.2 Current Soil Conditions (Post 2007- 2008 Interim Remedial Action)

In an effort to meet Navy goals of having a remedy in place for PSC 47 by September 30, 2007, the NAS Jacksonville Partnering Team agreed to conduct an interim remedial action to meet this goal. While the interim remedial action was conducted as a non CERCLA action (due to time limitations), it was completed following FDEP Chapter 62-780 (RBCA), FAC. The team agreed to the work plan and chose to proceed without the CERCLA comment period believing that the selected interim remedial action conducted under RBCA would be as protective as CERCLA. RBCA was selected by the team in order to implement the interim remedy and meet the remedy in place goal of September 30, 2007.

A RBCA evaluation that follows the FDEP regulation as presented in Chapter 62-780, FAC, was utilized to delineate the soil presenting an unacceptable risk under current land use (industrial) and address RAOs 1 and 2.

The following steps were used during the RBCA evaluation:

1. Compare the surface soil (0 to 2 feet bls) data to FDEP SCTLs for direct exposure risk under commercial/industrial land use and compare the unsaturated soil (0 to 5 feet bls) data to FDEP leachability SCTLs.
2. Calculate the 95% Upper Confidence Limit (UCL) of the mean concentration to determine the extent of risk for the chemicals that exceeded the commercial/industrial SCTLs.
3. Determine hot spot areas of contamination based on concentrations greater than three times the default commercial/industrial SCTLs.
4. Calculate apportioned commercial/industrial SCTLs to address potential additive toxicity from more than one chemical to the same target organs/systems.
5. Evaluate areas of potential contaminant leaching based on an evaluation of unsaturated soil, synthetic precipitation leaching procedure (SPLP), and groundwater data.

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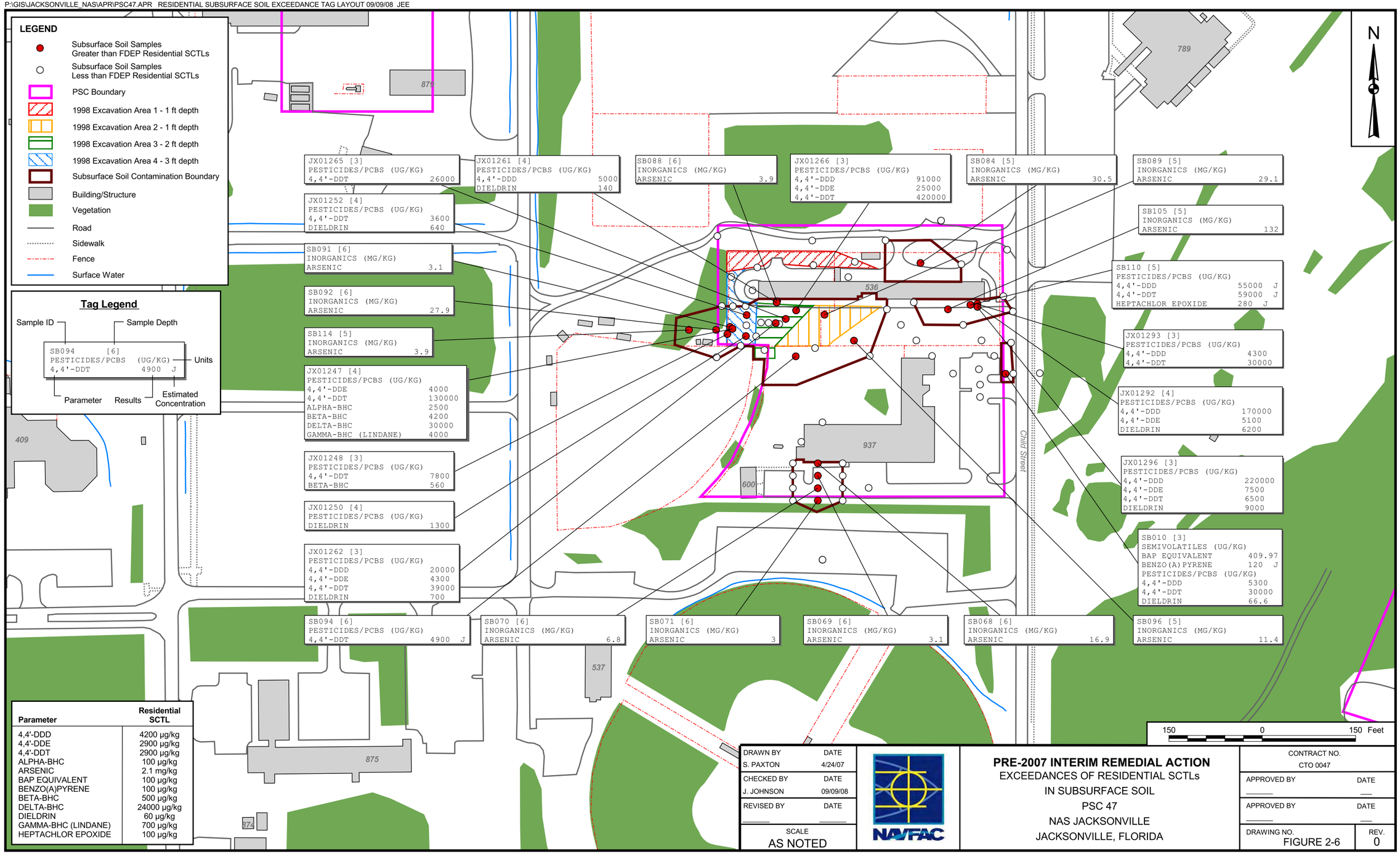

Parameter	Residential SCTL
4,4'-DDD	4200 µg/kg
4,4'-DDE	2900 µg/kg
4,4'-DDT	2900 µg/kg
ALPHA-BHC	100 µg/kg
ARSENIC	2.1 mg/kg
BAP EQUIVALENT	100 µg/kg
BENZO(A)PYRENE	100 µg/kg
BETA-BHC	500 µg/kg
DELTA-BHC	24000 µg/kg
DIELDRIN	60 µg/kg
GAMMA-BHC (LINDANE)	700 µg/kg
HEPTACHLOR EPOXIDE	100 µg/kg

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PRE-2007 INTERIM REMEDIAL ACTION
EXCEEDANCES OF RESIDENTIAL SCTLs
IN SUBSURFACE SOIL
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. CTO 0047	
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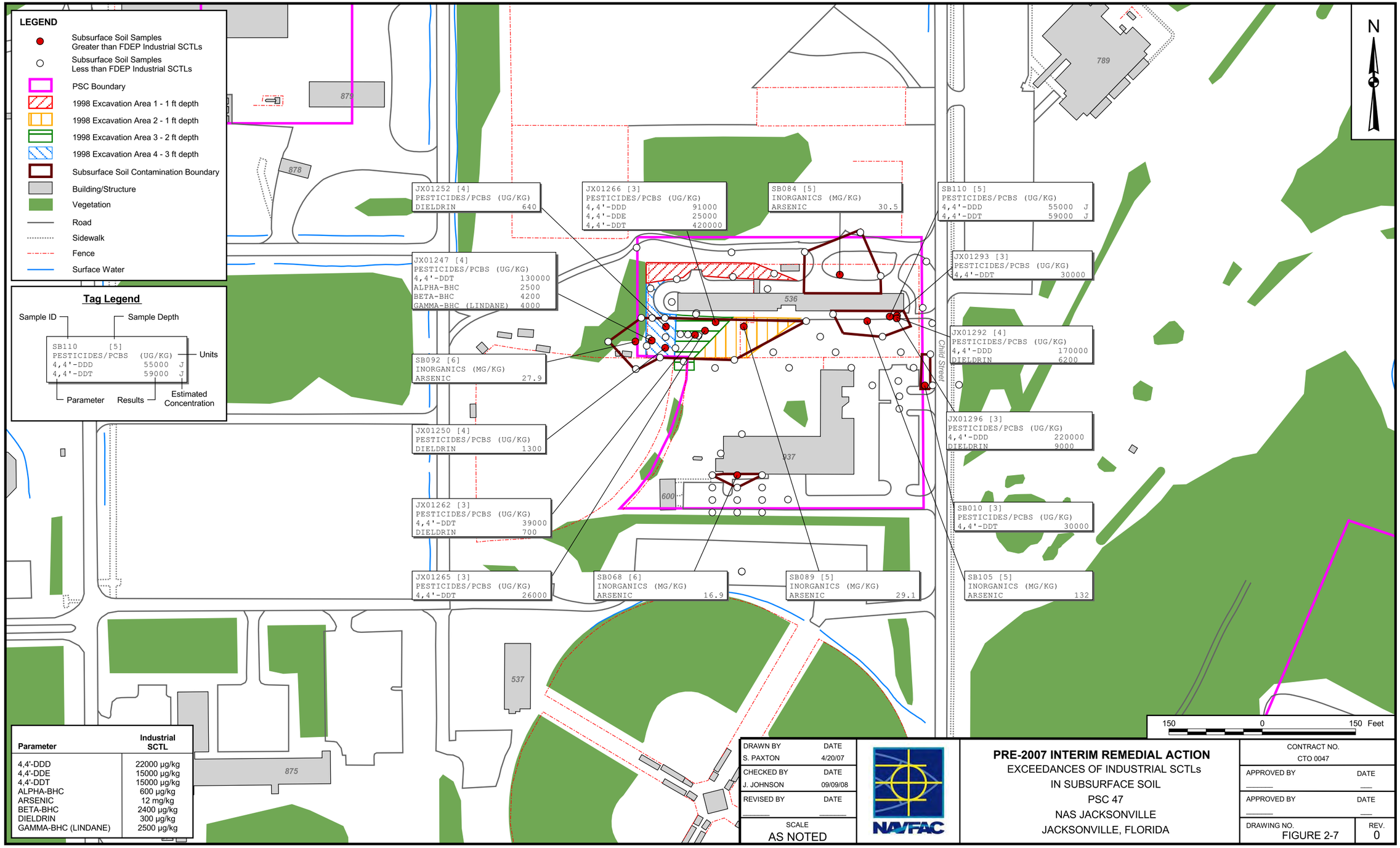

Parameter	Industrial SCTL
4,4'-DDD	22000 µg/kg
4,4'-DDE	15000 µg/kg
4,4'-DDT	15000 µg/kg
ALPHA-BHC	600 µg/kg
ARSENIC	12 mg/kg
BETA-BHC	2400 µg/kg
DIELDRIN	300 µg/kg
GAMMA-BHC (LINDANE)	2500 µg/kg

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PRE-2007 INTERIM REMEDIAL ACTION
EXCEEDANCES OF INDUSTRIAL SCTLs
IN SUBSURFACE SOIL
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

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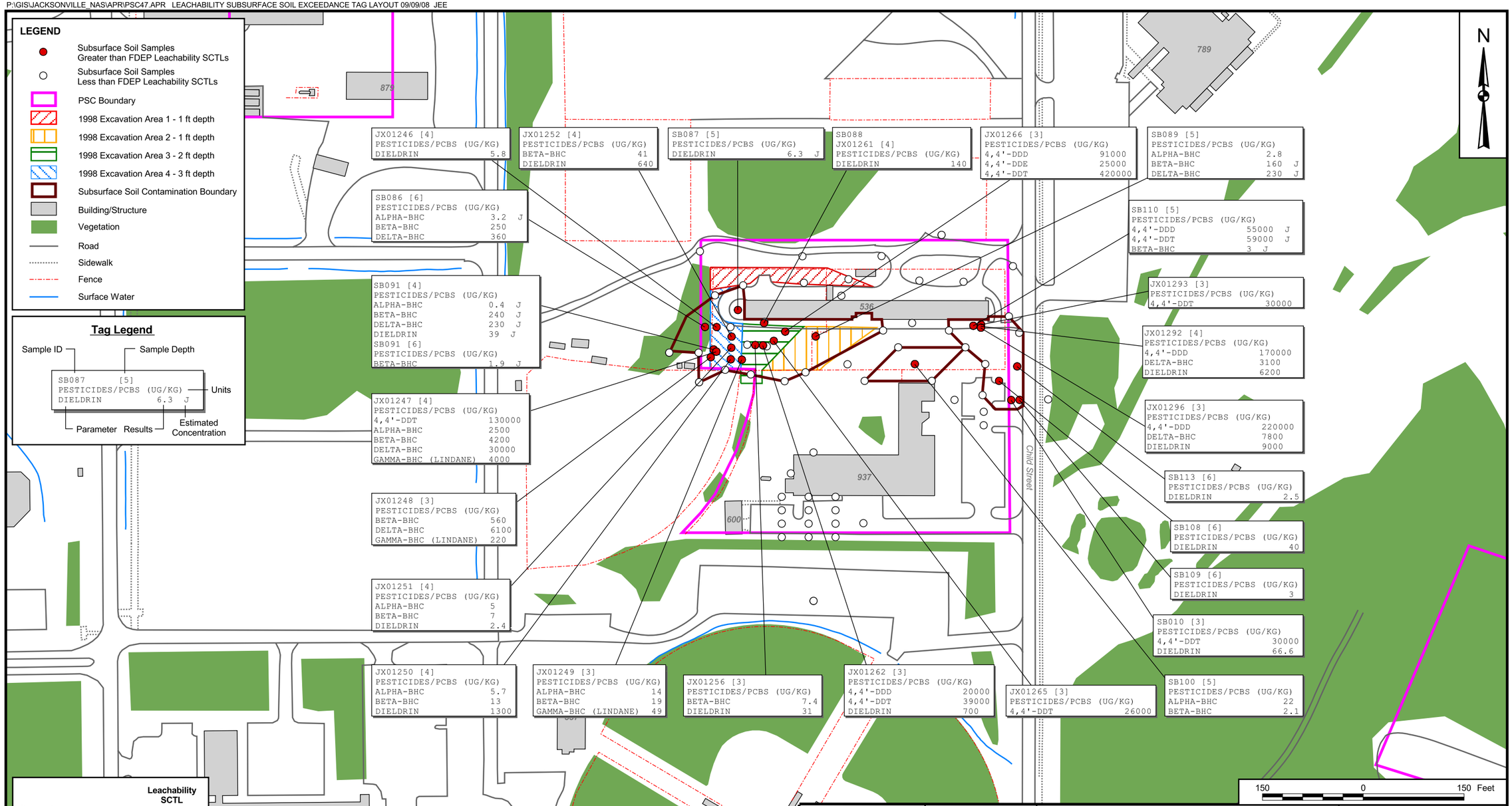

Parameter	Leachability SCTL (µg/kg)
4,4'-DDD	5800
4,4'-DDE	18000
4,4'-DDT	11000
ALPHA-BHC	0.3
BETA-BHC	1
DELTA-BHC	200
DIELDRIN	2
GAMMA-BHC (LINDANE)	9

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EXCEEDANCES OF LEACHABILITY SCTLs
IN SUBSURFACE SOIL
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. CTO 0047	
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Excavation limits for surface soil were then established through kriging, which was used to geospatially determine the isoconcentration boundaries based on contaminant concentrations. The processes used and the results from each of these steps are presented in the Interim Remedial Action Work Plan (CH2MHILL, 2007). The areas delineated for excavation and concrete placement are presented on Figure 2-9.

Soil Excavation, Removal, and Backfill

Personnel and equipment were mobilized to prepare the project site for excavation activities and perform a utilities survey on September 24 and 25, 2007.

Final boundaries for excavation were surveyed and marked on September 26, 2007, as shown on Figure 2-9. Excavation activities were performed from September 28 through October 11, 2007, and included soil removal from 11 discrete areas presenting an unacceptable risk from exposure in a commercial/industrial setting. Soils were removed to 2 feet bls in these excavations to address human health concerns. Excavation activities in two additional areas were removed to 1 foot bls to facilitate the cap installation designed to address leachability concerns.

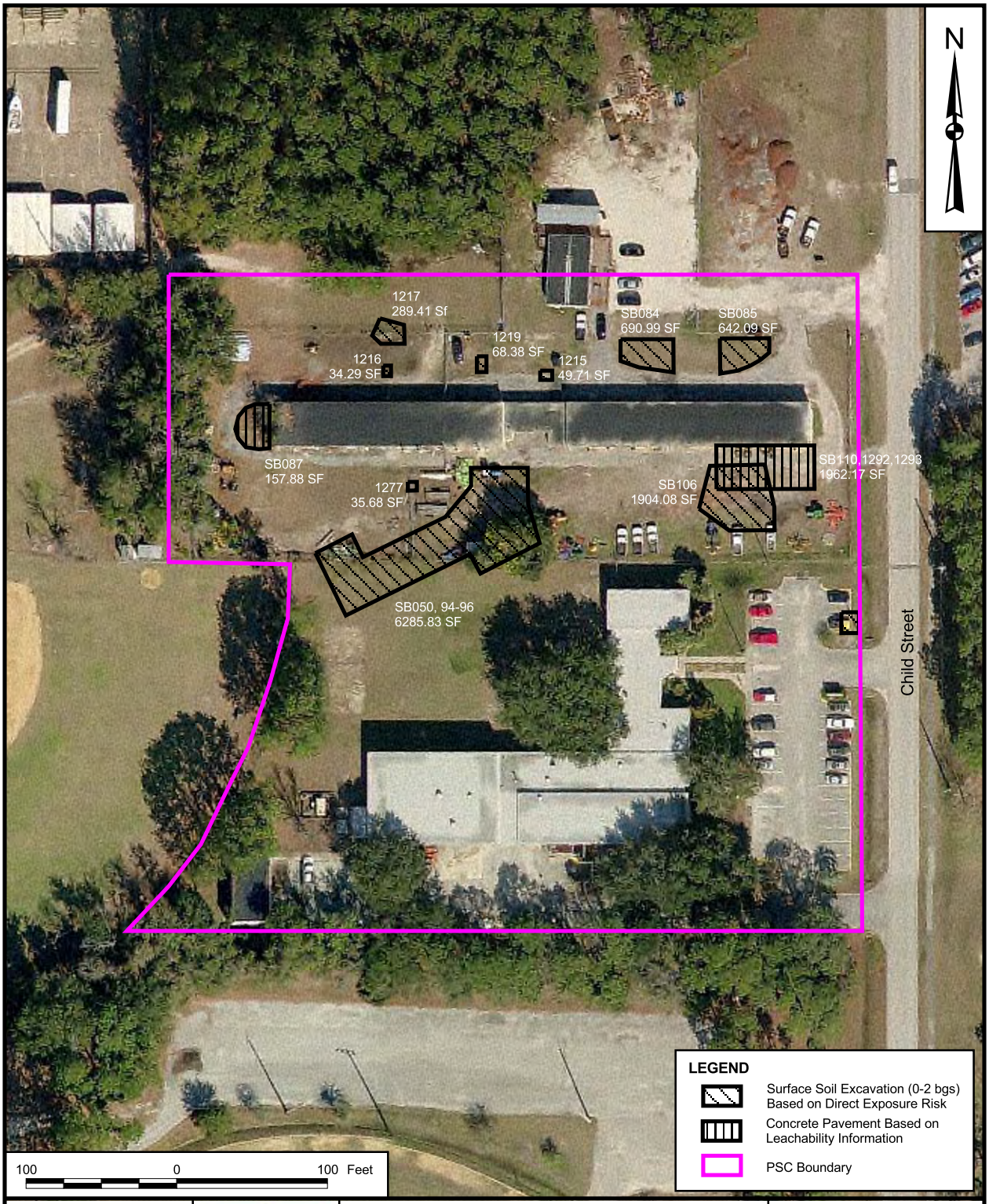
Stockpiled soils were sampled for waste characterization as described in the Interim Remedial Action Work Plan. Based on analytical results, approximately 930.21 tons of soil were transported for off-site disposal as non-hazardous waste at Chesser Island Landfill, a Subtitle D landfill located in Folkston, Georgia. Approximately 202.6 tons of soil were transported for off-site disposal as hazardous waste (arsenic/pesticide impacted soil) at the Waste Management Facility located in Emelle, Alabama.

Clean fill was used to return the surface soil excavations to match the surrounding elevation. Aggregate base course was used to bring the elevation in the two areas targeted for concrete placement to 1 foot bls. These two areas were covered with a 10-mil HDPE cover until the pavement was placed.

Following completion of excavation work, equipment and personnel were decontaminated in accordance with the Interim Remedial Action Work Plan and the Site-Specific Health and Safety Plan.

Concrete Placement

A concrete barrier designed in accordance with USEPA guidance [*Final Covers on Hazardous Waste Landfills and Surface Impoundments, (*USEPA, 1989b)], and meeting the relevant RCRA performance requirement of a landfill cap with a permeable rate of 1×10^{-7} centimeters per second, was placed in the two areas shown on Figure 2-9 (SB087; SB110,1292,1293) to meet Soil RAO 2 requirements (prevent migration of contaminants to groundwater from surface and subsurface soil). An asphalt cover was proposed in the Interim Remedial Action Work Plan, but permeability testing performed on several specifications of this material indicated the permeability would not meet CERCLA requirements.



DRAWN BY J. ENGLISH	DATE 09/15/08	**2007 - 2008 INTERIM REMEDIAL ACTION** AREAS OF EXCAVATION AND CAPPING PSC 47 NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER CTO 0244
CHECKED BY J. JOHNSON	DATE 09/15/08		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-9 REV 0

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An 8-inch thick cement concrete structural slab with reinforced steel with a compressive strength of 4,500 pounds per square inch, has microscopic voids as opposed to larger air voids in asphalt cement, and was shown to achieve the desired permeability specification. Prior to placement of the concrete cover slab, in-place density tests were performed in both areas to ensure that 90 percent compaction of the sub-grade is achieved. A 1-inch expansion joint was installed to tie in the existing concrete slab at Building 536 with the newly placed cement concrete slab at the two areas. In each area, #5 reinforced steel reinforcing rods were placed before the concrete was poured. Steel was tied with flexible steel wire and held at least 1-inch off the ground by cement blocks to prevent rust and corrosion of the concrete. A broom finish was completed to prevent slips and falls once the cement concrete slab was set.

Site Restoration

The excavated areas were fertilized and seeded with landscape grasses, and covered with mulch. CH2M Hill watered the area as needed to ensure the grasses germinated. Site restoration was performed from February 28, 2008 through April 17, 2008.

2.5.3.3 Groundwater

Groundwater contamination at PSC 47 results from two primary source areas, one being the pesticide-impacted areas around Building 536 (northern side of the PSC 47) and the other being the former UST location at Building 937 (southern side of PSC 47). As a result, these source areas are referred to as the northern and southern plumes. The northern plume consists primarily of low concentrations of pesticides that are centered on the Pesticide Shop. The southern plume is a mixture of pesticides, arsenic, and VOCs. A small arsenic “hot spot” is located within the southern plume in the area of the former mixing tanks. COCs identified in soils verses COCs identified in groundwater are dissimilar for some COCs. For example, no surface soil samples and only one subsurface soil sample (3 to 4 feet bls) had concentrations of BHC isomers exceeding residential SCTLs in the vicinity of the Pesticide Shop, whereas concentrations of these compounds exceeding Groundwater Cleanup Target Levels (GCTLs) in several groundwater samples collected in this area. This difference may be due to the varying solubilities of the pesticides or, as in the case of the BHC isomers, in their extremely low GCTLs compared to their residential and industrial SCTLs.

The estimated pesticide groundwater contamination plume from the shallow portion of the aquifer underlying PSC 47 is depicted on Figure 2-10 and includes both the northern and southern plumes. This figure should be considered a general depiction of impacted groundwater and does not depict GCTL exceedances for any one pesticide compound.

An isolated pesticide detection (dieldrin) was reported in monitoring well MW20S (located east of PSC 47 boundary on the NAS Jacksonville Golf Course) and is believed to be related to the golf course and not

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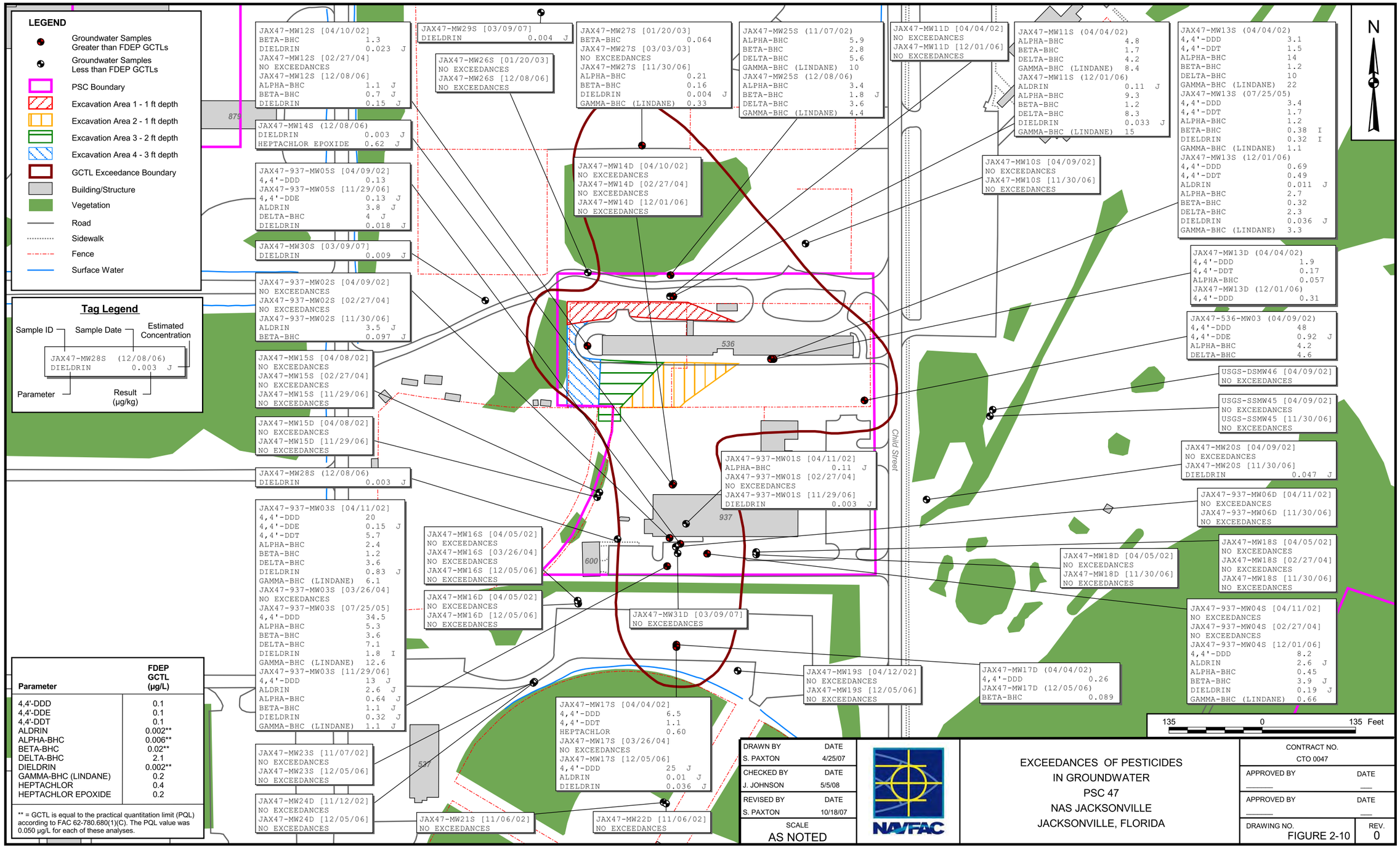

Parameter	FDEP GCTL (µg/L)
4,4'-DDD	0.1
4,4'-DDE	0.1
4,4'-DDT	0.1
ALDRIN	0.002**
ALPHA-BHC	0.006**
BETA-BHC	0.02**
DELTA-BHC	2.1
DIELDRIN	0.002**
GAMMA-BHC (LINDANE)	0.2
HEPTACHLOR	0.4
HEPTACHLOR EPOXIDE	0.2

** = GCTL is equal to the practical quantitation limit (PQL) according to FAC 62-780.680(1)(C). The PQL value was 0.050 µg/L for each of these analyses.

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REVISED BY S. PAXTON	DATE 10/18/07
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EXCEEDANCES OF PESTICIDES
IN GROUNDWATER
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. CTO 0047
APPROVED BY ____ DATE ____
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REV. 0

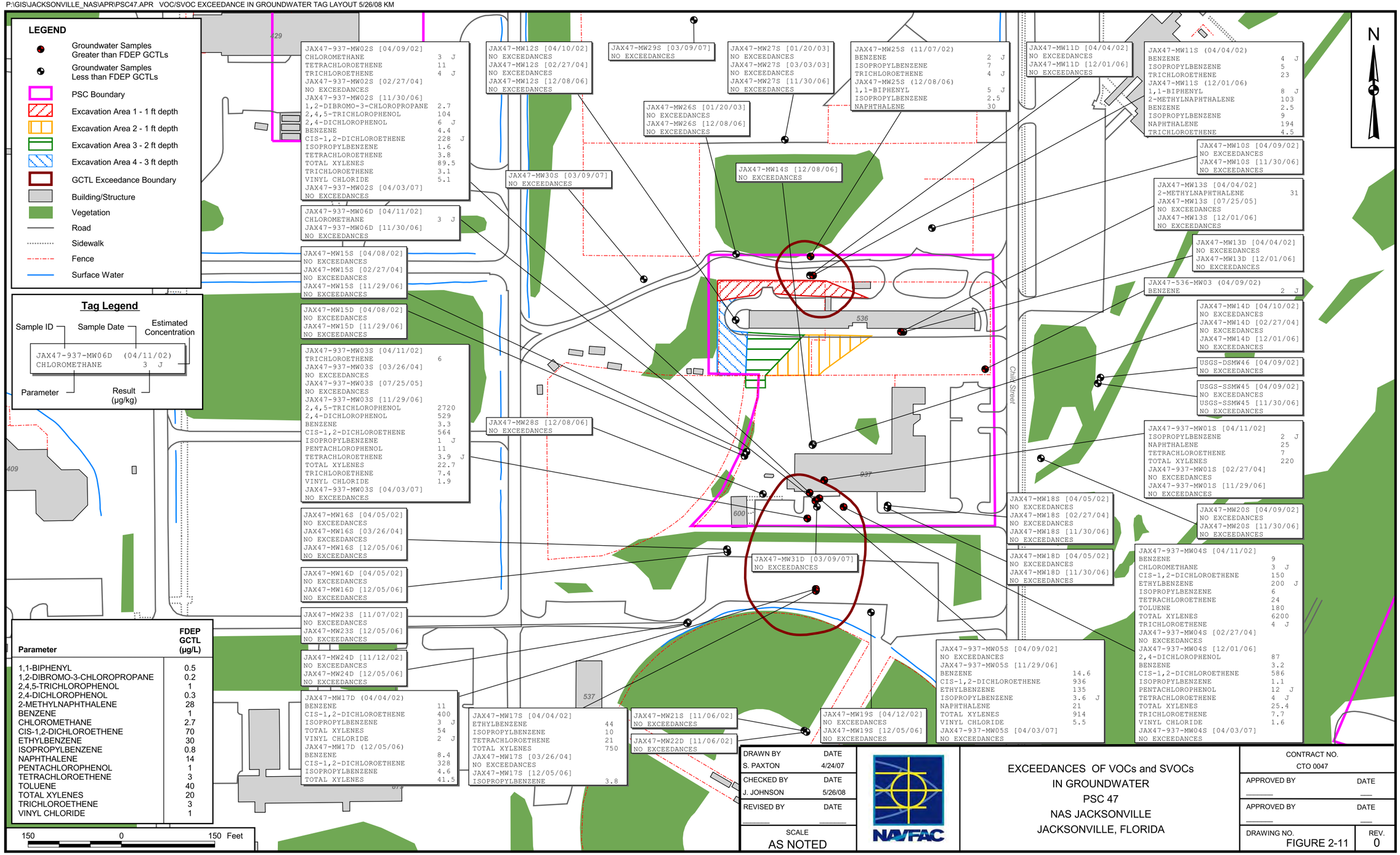
PSC 47. As a result, it is not considered to be related to PSC 47. Two monitoring wells [MW13D (northern plume) 4,4'-DDD, and MW17D (southern plume) Beta-BHC] screened in the deeper portion of the shallow aquifer had limited exceedances of GCTLs. Each of these wells had only one GCTL exceedance at concentrations within an order of magnitude of the GCTL value. The downward migration is believed to have been predominantly caused by the downward vertical gradient in these areas. A confining unit begins below the deepest groundwater sampling interval and is believed to contain any downward migration of contaminants.

The estimated VOC and SVOC plume boundaries in the shallow portion of the surficial aquifer are illustrated on Figure 2-11. Two areas of VOC and SVOC groundwater exceedances were identified, one in the vicinity of the removed DVECC tank and one on the north-central side of the Pesticide Shop. The suspected source(s) of VOC and SVOC contamination in the area of the Pesticide Shop are the single UST and/or one or both of the ASTs formerly in service at this building. The source of VOC/SVOC contamination south of Building 937 is presumably a former used oil UST. Site plans by RUST (RUST, 1996) and Brown and Root Environmental, Inc. (BRE) (1997) indicated the presence of such a tank approximately 10 feet east of the DVECC pesticide tank, yet none of the available documents describing site historical operations provided a narrative regarding origin, installation date, usage, closure, or disposition of this UST. The source of contamination slightly upgradient of NECE is unknown.

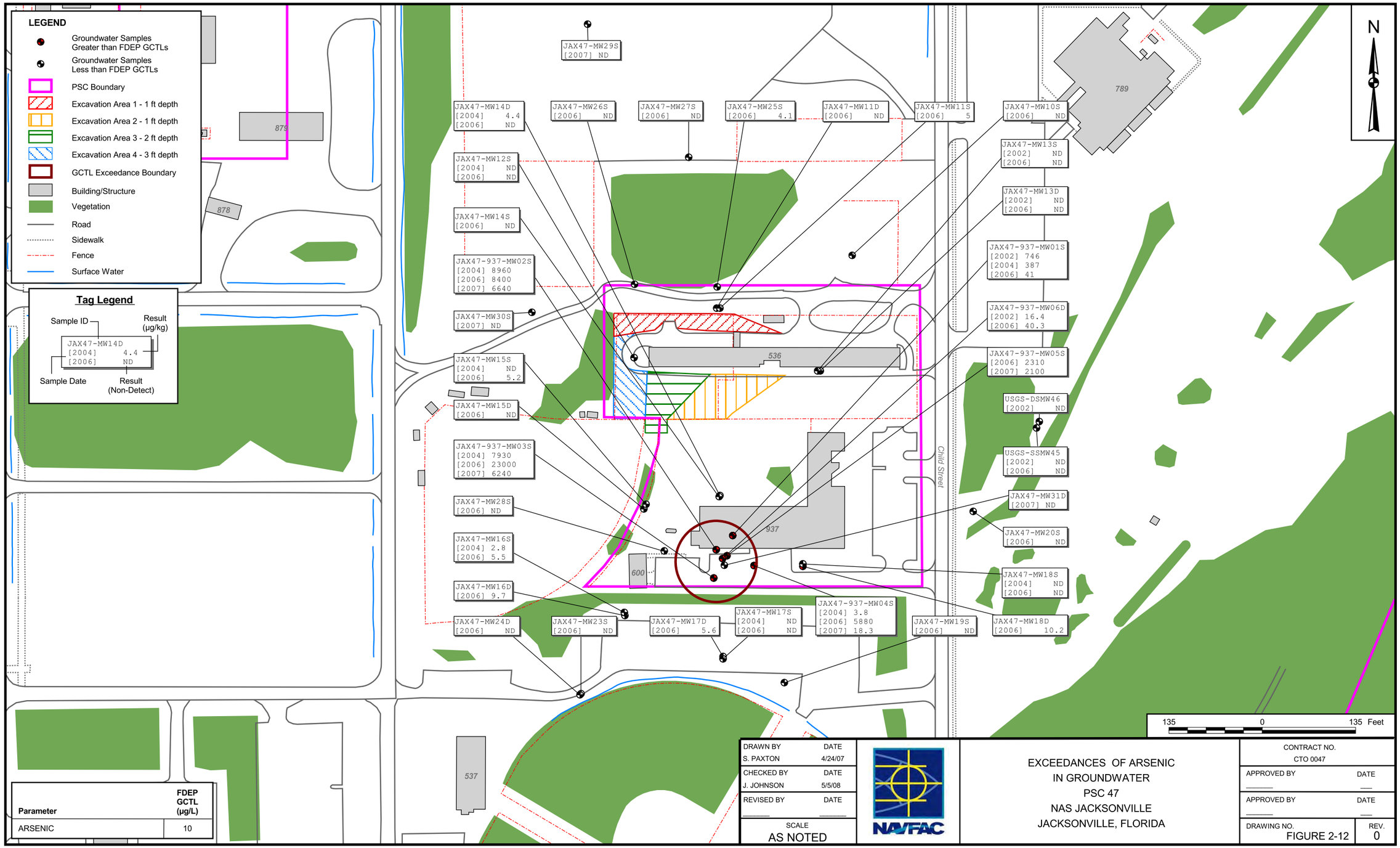
2,4,5-Trichlorophenoxyacetic acid and 2,4-dichlorophenoxyacetic acid were detected at estimated concentrations exceeding GCTLs. Herbicides were either not detected or were at concentrations less than GCTLs in other monitoring wells in close proximity.

Arsenic was the only inorganic detected in groundwater at concentrations exceeding GCTLs during sampling events. Arsenic exceedances have been limited to a small area of higher concentrations or a "hot spot" located at the southwestern corner of NECE where the former mixing tanks were located. Figure 2-12 shows the estimated extent of arsenic groundwater contamination. The area of arsenic groundwater contamination is commingled with the pesticide plume but is much smaller in size and is restricted to the immediate area of the former UST. Two wells sampled in April 2007 had concentrations of arsenic in excess of 6,000 micrograms per liter (µg/L), which are several orders of magnitude greater than the arsenic GCTL of 10 µg/L. Arsenic concentrations have remained in the 6,000 to 9,000 µg/L range in these two wells since 2004 when they were first sampled for arsenic. One of these wells had a reported concentration of 23,000 µg/L in 2006; however, this concentration decreased to 6,240 µg/L when the well was resampled in 2007 (4 months later). No obvious migration of arsenic groundwater contamination has occurred since it was detected in 2004, and there have been no detections of arsenic in the shallow or deep monitoring wells downgradient of the arsenic hot spot above the GCTL value.

P:\GIS\JACKSONVILLE_NAS\APR\PSC47.APR VOC/SVOC EXCEEDANCE IN GROUNDWATER TAG LAYOUT 5/26/08 KM



P:\GIS\JACKSONVILLE_NAS\APR\PSC47.APR ARSENIC EXCEEDANCE IN GROUNDWATER TAG LAYOUT 5/11/07 SP



Parameter	FDEP GCTL (µg/L)
ARSENIC	10

DRAWN BY	DATE
S. PAXTON	4/24/07
CHECKED BY	DATE
J. JOHNSON	5/5/08
REVISED BY	DATE
SCALE	
AS NOTED	

NAVFAC

EXCEEDANCES OF ARSENIC
IN GROUNDWATER
PSC 47
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. CTO 0047	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 2-12	REV. 0

Since the DVECC tank was removed in 1995 and the area of elevated arsenic concentrations are limited to the immediate vicinity of this area, it is surmised that arsenic mobility is restricted by a high retardation factor and, thus, it is anticipated that future transport of arsenic from the source area will continue to remain limited in nature.

Review of COC concentrations in both the northern and southern plumes indicates a lack of significant COC concentrations at downgradient locations. This is likely due to the site's flat topography and resultant flat hydraulic gradient and relatively slow groundwater velocity and/or to dispersion, adsorption, and/or natural attenuation of released compounds.

2.5.4 Current and Potential Future Land and Resource Uses

PSC 47 is currently used for industrial purposes and future use is expected to remain industrial. Portions of PSC 47 are currently used by NAS Jacksonville to administer landscaping services and to store and maintain landscaping equipment, and current adjacent land use is primarily recreational in nature. Due to the location of the PSC in the center of NAS Jacksonville, it is unlikely PSC 47 would be developed for residential uses in the future. Groundwater from the shallow aquifer is not currently used at PSC 47 nor is it used in adjacent areas. Irrigation water for adjacent recreational areas is not derived from the shallow aquifer. There is no surface water at PSC 47. As a result, it is not anticipated that groundwater from the shallow aquifer would be used in the future for beneficial uses. Groundwater at this site is a potential source of drinking water and the shallow unit is considered a Class G-II aquifer under FDEP groundwater regulations. However, due to the presence of contamination in groundwater, LUCs will be placed on groundwater to prevent use of shallow groundwater.

The potential future uses for PSC 47 will be limited to commercial/industrial land use. Any other use (e.g., residential or recreational land use) will require a re-evaluation of the risks posed from residual contamination remaining at the site and would potentially require additional site assessment and/or remedial action.

2.6 SUMMARY OF SITE RISKS

An HHRA and an ERA were completed to determine if the risks associated with contaminant concentrations at the site were acceptable using standard protocols. Detailed information for each is included in the RI/FS (TtNUS, 2008a).

2.6.1 Summary of Human Health Risk Assessment

The overall goal of the baseline HHRA for PSC 47 was to quantify risks associated with those chemicals that represent a potentially significant human health hazard on the basis of toxicity, environmental concentration, and mobility. USEPA guidance (USEPA, 1989a and USEPA, 2000) recommends focusing the baseline risk assessment by quantifying risk only for a select list of chemicals of potential concern (COPCs) at a site.

2.6.1.1 COPC Selection

Several types of screening levels were used to identify COPCs for PSC 47. Screening concentrations based on USEPA Region 9 PRGs (USEPA, 2004) were used, as well as other FDEP and USEPA criteria. The risk-based screening concentrations correspond to a systemic Hazard Quotient (HQ) of 0.1 (for non-carcinogens) or a lifetime cancer risk of 1×10^{-6} (for carcinogens). Note that the Region 9 PRGs are based on a HQ of 1.0 and the screening concentrations are based on a HQ of 0.1. Conservatively, PRGs used as screening levels for non-carcinogenic chemicals have been divided by a factor of 10 to further account for the potential cumulative effects of several chemicals affecting the same target organ or producing the same adverse non-carcinogenic health effect.

Exposure pathways were developed for each media at the site.

Based on the impacted media at the site, COPCs were evaluated based on exposure pathways for direct exposure to surface and subsurface soil, and for migration to groundwater for both surface and subsurface soil. COPCs evaluated based on exposure pathways for groundwater included direct contact with groundwater and vapor intrusion. COPCs identified for each exposure pathway are indicated by shading and are provided on the Tables 7-3 through 7-8 of the RI/FS that are included as Appendix B.

2.6.1.2 Exposure Assessment

An exposure assessment was conducted in the HHRA provided in Section 7.2 of the RI/FS to evaluate potential receptors for both current and future land use conditions. A Conceptual Site Model (CSM) was used to facilitate consistent and comprehensive evaluation of the potential risks to human health by creating a framework for identifying the pathways by which human receptors may come in contact with contaminated media originating from the source area.

The receptors were identified by analyzing the interaction of current land use practices and the identified sources of contamination as defined in the CSM. Future site use is expected to remain the same as current. The identified receptors are as follows:

- **Future construction workers** who may contact contaminated media while excavating or performing construction activities. Construction workers could be exposed to surface and subsurface soils (incidental ingestion, dermal contact), shallow groundwater pooling at the bottom of an excavation pit (dermal contact), and air (inhalation).

- **Current/future maintenance workers (groundskeepers)** who may contact contaminated surface soil while performing assigned duties. The maintenance worker could be exposed to surface soil (incidental ingestion, dermal contact) and air (inhalation) during grounds keeping or maintenance activities.

- **Current/future occupational (commercial/industrial) workers** who may contact contaminated surface soil media while performing work tasks. This receptor could be exposed to surface soil (incidental ingestion, dermal contact) and air (inhalation). It is anticipated that this receptor would not be routinely exposed to groundwater. Office workers may be minimally exposed to site-related contamination when compared to outdoor workers.

- **Current/future adult and adolescent trespassers** who may contact contaminated surface soil. Trespassers are not a likely receptor under current conditions since a fence surrounds PSC 47 and access to NAS Jacksonville is restricted. Trespassers may be exposed to potentially contaminated surface soil (incidental ingestion, dermal contact) and air (inhalation). Direct contact with groundwater or subsurface soils is not anticipated for this receptor.

- **Hypothetical future on-site residents** are evaluated as potential receptors. Future child and adult residents are not receptors under current or expected future land use and are included only to provide an indication of potential risks if the area was developed for residential use. Hypothetical future on-site residents may be exposed to contaminated surface soil and groundwater. In addition, future hypothetical residents could be exposed to subsurface soil that has been brought to the surface during construction activities. It is assumed that the hypothetical resident may be exposed to surface soils (incidental ingestion, dermal contact), groundwater (ingestion, dermal contact), and air (inhalation).

Recreational users were not considered to be a potential receptor group because the site is not currently used for recreational activities nor is it expected to be used for recreational activities in the future. If an individual did use the site for recreational activities, their exposures would be similar to those of the adolescent and adult trespassers.

2.6.1.3 Toxicity Assessment

A toxicity assessment was conducted to identify the potential for human health hazards and adverse effects in potentially exposed populations. Quantitative estimates of the relationship between the magnitude and type of exposures and the severity or probability of human health effects were defined for the identified COPCs. Quantitative toxicity values [cancer slope factors (CSFs) and reference doses (RfDs)] were integrated with outputs of the exposure assessment to characterize the potential for adverse health effects for each receptor group. A CSF is an indicator of the potency of a chemical carcinogen (i.e., the greater the CSF, the more potent the carcinogen). More formally, a CSF is an upper bound estimate, approximating a 95 percent confidence limit, on the increased cancer risk from a lifetime exposure to a carcinogen. This estimate is usually expressed in units of proportion (of a population) affected per milligrams per kilogram per day (mg/kg/day) of a carcinogen. The RfD is the dose at which and below which adverse non-carcinogenic effects are not anticipated.

A summary of the carcinogenic risk information which is relevant to the COPCs exposure both orally and dermally in surface and subsurface soil is presented in Table 7-18 of the RI/FS (see Appendix B). Carcinogenic risk information which is relevant to the COCs exposure via inhalation (vapor intrusion) from contaminated groundwater is presented in Table 7-19 of the RI/FS (see Appendix B).

2.6.1.4 Risk Characterization

Characterization of the risks posed by potential exposure to site contaminants was completed to evaluate COPCs to determine if constituents should be retained as COCs.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = chronic daily intake (CDI) x slope factor (SF)
Where: risk = a unitless probability (e.g., 2×10^{-5}) of an individuals developing cancer
CDI = Averaged over 70 years (mg/kg/day)
SF = Expressed as (mg/kg/day)-1

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicate than a individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an “excess lifetime cancer risk” because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an

individual developing cancer from all other causes has been estimated to be as high as 1 in 3. The USEPA's target risk range for site related exposures is 10^{-4} to 10^{-6}.

The potential for non-carcinogenic effects are evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with an RfD derived from a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is the HQ. An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g., liver) within a medium or across all media to which a given individual may reasonably be exposed. An HI less than 1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as non-cancer HQ = CDI/RfD.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Potential cancer risks and HIs were calculated for construction workers, site maintenance workers, occupational workers, adolescent and adult trespassers, and child and adult residents and are summarized in Table 7-20 of the RI/FS (see Appendix B). Chemicals with Incremental Lifetime Cancer Risks (ILCRs) and HIs exceeding USEPA and FDEP target levels are summarized in Table 7-21 of the RI/FS (see Appendix B).

HIs for exposures to soil by all of the evaluated receptor groups with the exception of child residents were less than unity indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions.

The HI for child residents (HI = 6) exposed to surface/subsurface soil exceeded the acceptable level of 1. 4,4'-DDT (HI = 5) was the major contributor to the HI for the child resident exposed to surface/subsurface soil.

HIs for domestic use of groundwater by child residents (HI = 2212) and adult residents (HI = 635) exceeded the acceptable level of 1. Arsenic was the major contributor to the HI for the child (HQ = 2197) and adult residents (HQ = 609). The HI for use of groundwater by the construction worker is approximately equal to the acceptable level of 1.

The Johnson and Ettinger volatilization model was used to estimate risks from exposures from vapor intrusion. HIs and ILCRs for residents exposed to COPCs that may volatilize from groundwater and migrate into indoor air was less than the USEPA target risk range and the FDEP level of concern indicating that adverse non-carcinogenic effects are not anticipated for residents under the defined exposure conditions.

Based on the risk characterization process, COCs were retained to be addressed via the final remedy and are provided in Table 7-21 of the RI/FS (see Appendix B).

HIs for exposures to soil by all of the evaluated receptor groups, with the exception of hypothetical future child residents and residents exposed to COPCs that may volatilize from groundwater and migrate into indoor air, were less than unity indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. The HI for child residents exposed to surface/subsurface soil exceeded the acceptable level of 1. The major contributor to the HI for the child resident exposed to surface/subsurface soil was 4,4'-DDT.

HIs for domestic use of groundwater by hypothetical future child residents and adult residents exceeded the acceptable level of 1. Aldrin, cis-1,2-dichloroethene (DCE), delta-BHC, gamma-BHC, heptachlor epoxide, and arsenic were the major contributors to the HI for the child resident. Arsenic was the major contributor to the HI for the adult resident.

ILCRs for exposures to soil by construction workers, maintenance workers, and adult trespassers were compared with USEPA and FDEP target risk levels. ILCRs for construction workers, maintenance workers, adolescent trespassers, adult trespassers, and adult residents were within the USEPA target risk range of $1x10^{-4}$ to $1x10^{-6}$, but exceeded the FDEP level of concern ($1x10^{-6}$). The ILCR for child residents exposed to surface/subsurface soil was equal to the upper bound of the USEPA target risk, but exceeded the FDEP level of concern. The ILCR for lifetime residents exposed to surface/subsurface soil exceeded the USEPA target risk range and the FDEP level of concern. 4,4'-DDT, dieldrin, and arsenic were the major contributors to the ILCRs.

ILCRs for domestic use of groundwater by hypothetical future child residents, adult residents, and lifelong residents exceeded the USEPA target risk range and the FDEP level of concern. Arsenic, vinyl chloride, aldrin, and alpha-BHC were the major contributors to the ILCRs.

2.6.1.5 Application of Apportionment to Site COCs

As documented in section 2.5.3.2, an IRA was conducted at the site to address potential hazards to on-site workers and to mitigate potential for impacts to groundwater via leaching of contaminated soils. This work was conducted using RBCA procedures outlined in Chapter 62-780, FAC. To evaluate risk to direct exposure under current land use, 95% UCL concentrations were calculated for arsenic and seven pesticides that exceeded the commercial/industrial SCTLs. The use of the 95% UCL of the mean concentration assumes that an individual will be exposed over time to an area of contaminated soils rather than to soils and one specific location. The 95% UCL concentrations were calculated using the FDEP UCL Calculator Tool provided in the Technical Report: Development of Cleanup Target Levels for Chapter 62-777, FAC, Final Report (dated February 2005).

Based on the initial iteration, the 95% UCL concentrations of 4,4'DDT and dieldrin were greater than their commercial/industrial SCTLs. As a result, soil excavations were conducted in areas of greater concentrations to lower the 95% UCL values. The initial iteration of the calculation was conducted prior to calculating revised SCTLs using apportionment.

When 95% UCL concentrations are used for comparison to direct exposure SCTLs, the FDEP requires a quantitative approach to address potential additive toxicity from more than one chemical. SCTLs must be adjusted (or "apportioned") such that the total risk for carcinogens present at a site does not exceed $1x10^{-6}$, and the sum of the hazard quotients (i.e., the hazard index) for chemicals affecting the same target organ or producing the same effects does not exceed 1.

In this exercise the 95% UCL for each chemical subject to apportionment is divided by its default SCTL. If the sum of the ratios is less than 1, the chemicals have met FDEP's risk goals. The 95% UCL concentration for each chemical is divided by its SCTL. Summation of ratios (95%UCL/SCTL) for carcinogenic risk and for each target organ/system must be less than 1. If the ratio is greater than 1, the 95% UCL concentration is divided by the summation of the ratios to yield apportioned SCTLs. This process continues until the summation of ratios for carcinogenic risk and for each target organ/system is less than 1.

Three iterations were needed to produce summation of the carcinogenic ratio of less than 1 and the 95% UCL concentration for each chemical to be less than its apportioned SCTL. A summary of the site specific apportioned SCTLs is provided on the Cleanup Goals for Soil table provided in Section 2.7.1 and additional information on the 95% UCL concentrations for the eight chemicals is presented in Table 2-3 of the Interim Remedial Action Work Plan (CH2MHILL, 2007) provided in Appendix B.

2.6.2 Summary of Ecological Risk Assessment

An ERA was performed as part of the RI/FS to evaluate potential and adverse effects to ecological receptors exposed to contamination at PSC 47. The ERA concluded that the poor habitat, urban nature of the area, and small size of PSC 47 results in an exposure pathway that is essentially negligible for wildlife species. Therefore, with the exception of receptors such as soil invertebrates, the potential for ecological impacts from site-related contaminants is minor under current habitat conditions. As a result, the NAS Jacksonville Partnering Team agreed that potential ecological risks were acceptable.

2.6.3 Basis for Action

The response action selected in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Unacceptable risk due to potential exposure to COCs to both soil and groundwater exist and necessitate the implementation of a remedy to prevent exposure.

2.7 REMEDIAL ACTION OBJECTIVES FOR PSC 47

RAOs are medium-specific goals that define the objective of conducting remedial actions to protect human health and the environment. RAOs specify the COCs, potential exposure routes and receptors, and acceptable concentrations (i.e., cleanup goals) for a site and provide a general description of what the cleanup will accomplish. RAOs typically serve as the design basis for the remedial alternatives described in Section 2.8.

The following RAOs were established for PSC 47:

Soil RAO Number 1:
Prevent unacceptable risk from exposure to surface and subsurface soil with concentrations of benzo(a)pyrene equivalents, pesticides, and arsenic greater than FDEP SCTLs for direct industrial/commercial exposure.

Soil RAO Number 2:
Prevent migration of pesticides to groundwater from surface and subsurface soil with concentrations of these chemicals greater than FDEP SCTLs or site-specific criteria for leachability to groundwater.

Groundwater RAO Number 1:
Prevent unacceptable risk from exposure to groundwater with concentrations of VOCs, SVOCs, pesticides, and arsenic greater than FDEP GCTLs and USEPA Maximum Contaminant Levels (MCLs).

Groundwater RAO Number 2:
Prevent migration of groundwater COCs to surface water and restore groundwater quality at PSC 47 to meet drinking water standards based upon FDEP classification of the aquifer as a potential source of drinking water (Class G-II).

2.7.1 Cleanup Goals

A cleanup goal is the concentration of a contaminant in an environmental medium that, when attained, should achieve RAOs. Cleanup goals are developed to ensure that contaminant concentrations remaining on site are protective of human health and ecological receptors. In general, cleanup goals are established with consideration given to the following:

- Protecting human receptors from adverse health effects.
- Protecting the environment from detrimental impacts from site-related contamination.
- Compliance with federal and state ARARs.

Soil cleanup goals for PSC 47 were determined for the COCs identified in Section 2.6.1. These soil cleanup goals were based on the following:

- Protection of human health from direct exposure to COCs in soil at levels exceeding cleanup goals.
- Protection of potential ecological receptors from direct exposure to COCs in soil at levels exceeding cleanup goals.
- Protection of groundwater and surface water from migration of COCs from soil.
- Chemical-specific ARARs including default SCTLs for Leachability Based on Groundwater Criteria and alternative SCTLs for industrial use as provided in, or derived in accordance with FDEP regulations and guidance.

The cleanup goals for soil at PSC 47 are as follows:

Site-Specific COCs	Cleanup Goal (mg/kg)
Arsenic	1.65 (2)
Benzo(a)pyrene equivalent	0.7 (2)
alpha-BHC	0.0003 (1) (3)
beta-BHC	0.001 (1) (3)
delta-BHC	0.2 (1)
4,4-DDD	0.58 (2)
4,4-DDE	1.43 (2)
4,4'-DDT	2.53 (2)
Dieldrin	0.11 (2)
Endrin	1.0 (1)
Heptachlor	0.06 (2)
Heptachlor Epoxide	0.05 (2)
Total Chlordane	0.65 (2)

1 Based upon FDEP leachability SCTL based on groundwater criteria per Chapter 62-777, Table II.

2 The Apportioned alternative CTLs for industrial use were caluclated in accordance with Technical Report Chapter 62-777.100(2), FAC.

3 The laboratory practical quantitation limit (PQL) should be used if it is less stringent than the CTL according to Chapter 62-780.680(2)(b)2.a.(III), FAC. The PQL is the lowest concentration that a laboratory can accurately report on a chemical.

mg/kg = Milligrams per kilogram

Groundwater cleanup goals were determined for the COCs. The cleanup goals for groundwater were based upon chemical-specific ARARs, namely the state of Florida primary drinking water standards and the GCTLs, which are equal to or more stringent than the USEPA's Safe Drink Water Act regulations MCLs.

Cleanup goals for groundwater at PSC 47 are as follows:

Site-Specific COC	Cleanup Goal(1) (µg/L)
Aldrin	0.002(2)
Arsenic	10
Benzene	1
alpha-BHC	0.006(2)
beta-BHC	0.02(2)
delta-BHC	2.1
gamma-BHC	0.2
1,1-Biphenyl	0.1
4,4'-DDD	0.1

Site-Specific COC	Cleanup Goal[(1)] (µg/L)
4,4'-DDE	0.1
4,4'-DDT	0.1[(2)]
Dieldrin	0.002[(2)]
1,2-Dibromo-3-Chloropropane	0.2
cis-1,2-DCE	70
2,4-Dichlorophenol	0.3[(2)]
Endrin Ketone	2.0
Ethylbenzene	30
Heptachlor Epoxide	0.2
Isopropylbenzene	0.8[(2)]
2-Methylnaphthalene	28
Naphthalene	14
Pentachlorophenol	1.0
Tetrachloroethene	3.0
Trichloroethene	3.0
2,4,5-Trichlorophenol	1.0
Vinyl Chloride	1.0
Xylenes (total)	20

1 Based on FDEP GCTLs and MCLs in Chapter 62-777 and 62-550.310, FAC, respectively.

2 The laboratory practical quantitation limit (PQL) should be used if it is less stringent than the CTL according to Chapter 62-780.680(1)(c), FAC. The PQL is the lowest concentration that a laboratory can accurately report on a chemical.

2.8 DESCRIPTION OF REMEDIAL ALTERNATIVES

This section provides a narrative of each alternative evaluated for the remediation of contaminated soil and groundwater at PSC 47. For detailed information on the remedial alternatives, refer to the PSC 47 RI/FS Report (TtNUS, 2008a). As part of the FS, each of the following alternatives was evaluated with respect to the nine criteria outlined in the NCP at 40 CFR 300.430(e)(9)(iii). Section 2.9 summarizes the comparative analysis of alternatives that is documented in the FS.

This ROD documents the Partnering Team's selection of Alternative S-3 – Excavation and Off-Site Disposal to Allow Industrial Use, Capping to Prevent Leaching, LUCs, and Monitoring for soil and Alternative G-2 – Monitored Natural Attenuation and LUCs for groundwater. A detailed description of the alternatives evaluated is provided in the PSC 47 RI/FS Report, and these alternatives are summarized below.

It should be noted that the Navy has already implemented excavation and capping elements of Alternative S-3 as an Interim Remedial Action. The entire NAS Jacksonville Partnering Team agreed to proceed using Global RBCA regulations under Chapter 62-780, FAC to meet the Navy's goal of high risk remedy in place by September 30, 2007. The team approved the Interim Remedial Action Work Plan and

chose to proceed without the CERCLA comment period, believing that the selected remedy conducted under RBCA would be as protective as CERCLA. RBCA was selected in order to implement the interim remedy to meet the remedy in place goals.

2.8.1 Soil Remedial Alternatives

Alternative S-1 – No Action Alternative

Under this alternative, no remedial activities would occur to remove or treat contaminated soil, and no controls would be implemented to preclude future exposure of human receptors. No periodic monitoring would be performed to evaluate the effectiveness toward achieving the cleanup goals or to confirm that no downgradient migration of contaminants had occurred. Under this alternative, the property would be released for unrestricted use.

This alternative would not protect human health and the environment because COCs would remain in soil at levels that exceed SCTLs, and potential future unacceptable exposure to these concentrations would not be precluded. This alternative would not achieve the RAOs or comply with ARARs. No treatment would be employed in this alternative, and therefore there would be no reduction in toxicity, mobility, or volume of contaminants. Because no remedial action would take place, this alternative would not result in any short-term risks and would be very easy to implement. There would be no cost associated with this alternative.

Alternative S-2 – Capping To Allow Industrial Use and Prevent Leaching, LUCs, and Monitoring

Alternative S-2 consists of four major components: (1) capping to allow industrial use of the site and prevent leaching, (2) disposal of excavated soil removed for the purpose of installing the cap, (3) LUCs, and (4) monitoring.

Component 1 – Capping to Allow Industrial Use and Prevent Leaching: Areas of the site with concentrations of soil COCs greater than industrial and/or leachability SCTLs would be capped with an impervious cover system to allow industrial use and to prevent leaching of soil COCs to groundwater. Pre-construction sampling would be performed to verify the exact extent of the contamination.

It is estimated that approximately 6,300 yd^3 of surface soil would be excavated to install the cap as part of site preparation from a total area of 85,100 ft^2 (1.95 acres). Subsequently, an estimated 52,000 ft^2 (1.19 acres) of the exposed subsurface soil would be capped, and the remaining 33,100 ft^2 (0.76 acre) of excavated area would be backfilled with 2,450 yd^3 of clean fill material.

Component 2 – Disposal of Excavated Soil: To determine the proper method of disposal, composite samples would be collected from the excavated soil at the rate of approximately one sample per 100 yd^3. These samples would be analyzed for soil COCs (SVOCs, pesticides, and arsenic) to sort the excavated soil in the following three disposal categories:

- Soil with concentrations of COCs less than cleanup goals (residential or leachability SCTLs) would be identified as non-contaminated and could be reused on site or off-site. For the purpose of the RI/FS, it was assumed that 1,150 yd^3 of excavated soil would be in this category.

- Soil with concentrations of COCs less than industrial SCTLs, but greater than cleanup goals would be identified as RCRA non-hazardous and would be disposed at an off-site RCRA Subtitle D solid waste landfill. For the purpose of the RI/FS, it was assumed that 4,150 tons of excavated soil would be in this category.

- Soil with concentrations of COCs greater than industrial SCTLs would be identified as RCRA hazardous waste and would be disposed at an off-site RCRA Subtitle C hazardous waste landfill. For the purpose of the RI/FS, it was assumed that 1,000 tons of excavated soil would be in this category.

During off-site transportation of contaminated soil, appropriate spill prevention and control measures would be taken and United States Department of Transportation regulations would be adhered to. It is assumed that the contaminated soil disposed off-site would not require treatment prior to landfilling.

Component 3 – LUCs: LUCs in the form of institutional and engineering controls would be implemented to prevent unacceptable exposure to residual contaminated soil and groundwater remaining at levels that preclude unrestricted use and unlimited exposure. Institutional controls would include update of the installation's Master Plan and procedures to ensure industrial use at the Site, prohibit use of the groundwater, and prohibit intrusive activities in contaminated areas. Engineering controls would include the cap over the contaminated soils and signs to advise that intrusive activities require authorization.

Component 4 – Monitoring: A groundwater monitoring program would be developed and implemented to verify the long-term effectiveness of the cap and to evaluate the potential leaching of soil COCs into groundwater. Monitoring requirements would be determined during the final design of capping. For the purposes of the RI/FS, it was assumed that a total of five monitoring wells would be sampled and the collected samples would be analyzed for pesticides. Monitoring frequency would be semi-annually for the first 2 years and annually thereafter until the site meets requirements for unrestricted use based on achieving cleanup goals in successive events.

Alternative S-2 would be protective of human health and the environment. Placement of a cap over the area of soil with concentrations of COCs greater than industrial SCTLs would be protective of current site

users. In addition, the cap would also protect human health and the environment by minimizing the leaching of pesticides from soil to groundwater. LUCs would be protective of human health and the environment by preventing potential future residential development that could result in unacceptable human health risks. Monitoring would be protective of human health and the environment by providing an assessment of on-site concentrations of COCs in groundwater and a warning of their migration. Alternative S-2 would meet the soil RAOs. Alternative S-2 would not meet the chemical-specific ARARs in the short term. Compliance with these ARARs should eventually be achieved through natural attenuation, and this would be verified through monitoring. Alternative S-2 would comply with the location- and action-specific ARARs and fully take into consideration as appropriate all To Be Considered (TBC) criteria.

Implementation of Alternative S-2 could result in moderate short-term risks to on-site workers as a result of exposure to contamination during soil excavation and installation of a cap Alternative S-2 would be effective in the long-term. Installation of a cap would effectively cover soil with concentrations of COCs to which current site users should not be exposed. The cap would also effectively minimize water infiltration, which is the primary pathway for migration of pesticides from soil to groundwater. LUCs would effectively prevent residential development and, thus, no future resident would be exposed to contaminated soil. Monitoring would be an effective means to assess reduction of soil COCs concentrations through natural attenuation and to detect migration of soil COCs to groundwater.

Alternative S-2 could be completed in approximately 4 months and would achieve the soil RAOs at completion. The soil cleanup goals might eventually be met through natural attenuation, and this would be determined through monitoring. Alternative S-2 would be easy to implement, and resources, equipment, and materials would be readily available for this purpose. The capital cost, 30-year Net Present Worth (NPW) of O&M costs, and 30-year NPW cost for this alternative are estimated at $1.708 million, $393,000, and $2.101 million, respectively.

Alternative S3 – Excavation and Off-Site Disposal to Allow Industrial Use, Capping to Prevent Leaching, LUCs, and Monitoring

As previously noted, Component 1 – Excavation and Off-Site Disposal and Component 2 – Capping to Prevent Leaching have already been implemented as an IRA. Component 3 – Land Use Controls and Component 4 – Monitoring will be implemented as part of post ROD actions.

Completion of Components 1 and 2 involved the use of RBCA evaluation that follows the FDEP regulation as presented in Chapter 62-780, FAC to delineate the soil presenting an unacceptable risk under current land use (industrial) and address RAOs 1 and 2.

The following steps were used during the RBCA evaluation:

1. Compare the surface soil (0 to 2 feet bls) data to FDEP SCTLs for direct exposure risk under commercial/industrial land use and compare the unsaturated soil (0 to 5 feet bls) data to FDEP leachability SCTLs.
2. Calculate the 95% UCL of the mean concentration to determine the extent of risk for the chemicals that exceeded the commercial/industrial SCTLs.
3. Determine hot spot areas of contamination based on concentrations greater than three times the default commercial/industrial SCTLs.
4. Calculate apportioned commercial/industrial SCTLs to address potential additive toxicity from more than one chemical to the same target organs/systems.
5. Evaluate areas of potential contaminant leaching based on an evaluation of unsaturated soil, SPLP, and groundwater data.

Excavation limits for surface soil were then established through kriging, which was used to geospatially determine the isoconcentration boundaries based on contaminant concentrations. The processes used and the results from each of these steps are presented in the Interim Remedial Action Work Plan (CH2MHILL, 2007).

Component 1 – Excavation and Off-Site Disposal to Allow Industrial Use: Excavation activities were performed from September 28 through October 11, 2007, and included soil removal from 11 discrete areas presenting an unacceptable risk from exposure in a commercial/industrial setting. Soils were removed to 2 feet bls in these excavations. Excavation activities also included removal of soil from two additional areas presenting an unacceptable risk from leaching to groundwater. Soils were removed to 1 foot bls in these excavations.

Stockpiled soils were sampled for waste characterization as described in the Interim Remedial Action Work Plan (CH2MHILL, 2007). Based on analytical results, approximately 930.21 tons of soil were transported for off-site disposal as non-hazardous waste at Chesser Island Landfill, a Subtitle D landfill located in Folkston, Georgia. Approximately 202.6 tons of soil were transported for off-site disposal as hazardous waste (arsenic/pesticide impacted soil) at the Waste Management Facility located in Emelle, Alabama.

Clean fill was used at those sites not being capped, to return the surface soil excavations to match the surrounding elevation. The excavated areas were fertilized and seeded with landscape grasses, and covered with mulch.

Component 2 – Capping to Prevent Leaching: Aggregate base course was used to bring the elevation in the two areas targeted for concrete placement to 1 foot bls. These two areas were covered with a 10-mil HDPE cover until the pavement was placed. A concrete barrier designed in accordance with USEPA guidance [*Final Covers on Hazardous Waste Landfills and Surface Impoundments* (USEPA, 1989b)] and meeting the relevant RCRA performance requirement of a landfill cap with a permeable rate of 1×10^{-7} centimeters per second was placed in the two areas shown on Figure 2-9 to meet Soil RAO 2 requirements (prevent migration of contaminants to groundwater from surface and subsurface soil). An asphalt cover was proposed in the Interim Remedial Action Work Plan, but permeability testing performed on several specifications of this material indicated the permeability would not meet CERCLA requirements.

Component 3 – LUCs: LUCs in the form of institutional and engineering controls will be implemented to prevent unacceptable exposure to residual contaminated soil and groundwater remaining at levels that preclude unrestricted use and unlimited exposure. Institutional controls will include an update of the installation's Master Plan and procedures to ensure industrial use at the Site, prohibit use of the groundwater, and prohibit intrusive activities in contaminated areas. Engineering controls will include the cap over the contaminated soils and signs to advise that intrusive activities require authorization.

Component 4 – Monitoring: A groundwater monitoring program will be developed and implemented to verify the long-term effectiveness of the cap and to evaluate the potential leaching of soil COCs into groundwater. For the purposes of the RI/FS, it was assumed that a total of five monitoring wells would be sampled and the collected samples would be analyzed for pesticides and that monitoring will be semi-annually for the first 2 years and annually thereafter until the site meets requirements for unrestricted use (two successive events below cleanup goals). The exact design of the monitoring program will be determined in a post ROD document to be approved by FDEP and USEPA.

This alternative will be relatively easy to implement. The RAOs would be achieved, and soil cleanup goals may eventually be met. The activities for this alternative will be easy to implement. The capital cost, 30-year NPW of O&M costs, and 30-year NPW cost for this alternative are estimated at $2.598 million, $274,000, and $2.872 million, respectively.

Alternative S-4 – Excavation and Off-Site Disposal to Allow Residential Exposure and Prevent Leaching

Alternative S-4 would consist of two major components: (1) excavation of soil to allow residential exposure and to prevent leaching and (2) disposal of excavated soil.

Component 1 – Excavation to Allow Residential Exposure and Prevent Leaching: Areas of the site with concentrations of soil COCs greater than residential and/or leachability SCTLs would be excavated to allow residential use and to prevent leaching of soil COCs to groundwater. Pre-construction sampling would be performed to verify the exact extent of the contamination.

An estimated 8,200 yd^3 of surface soil would be excavated from a total area of 110,500 ft^2 (2.54 acres). An additional estimated 7,350 yd^3 of subsurface soil would then be excavated to the groundwater table, estimated at 5 feet bls, to address potential leaching for a total area of 66,400 ft^2 (1.52 acres). Excavated areas would be backfilled with an estimated 15,550 yd^3 of clean fill material. The backfilled areas would be revegetated or repaved to match original surface conditions.

The procedures followed and precautions taken would be the same as described for Component 1 of Alternatives S-2 and S-3.

Component 2 – Disposal of Excavated Soil: This component would be similar to Component 2 of Alternatives S-2 and S-3, except that the estimated volumes of soil for the three disposal categories would be: 1,300 yd^3 of non-contaminated soil, 19,750 tons of RCRA non-hazardous soil, and 1,625 tons of RCRA hazardous soil.

Alternative S-4 would be fully protective of human health and the environment under the current industrial exposure scenario and any other foreseeable site use. Excavation and off-site disposal of soil with concentrations of COCs greater than their cleanup goals would eliminate unacceptable risks from direct exposure to contaminated soil or from migration of soil COCs either offsite or to other media. Alternative S-4 would meet the soil RAOs. Alternative S-4 would comply with all chemical-, location-, and action-specific ARARs and fully take into consideration, as appropriate, all TBCs.

Alternative S-4 would be long-term effective and permanent. Excavation and off-site disposal would effectively and permanently remove soil with concentrations of COCs to which current or potential future site users should not be exposed. Excavation and off-site disposal would also remove soil with concentrations of COCs that pose a leaching threat to groundwater.

Alternative S-4 could be completed within approximately six months and could achieve the soil RAOs and meet the soil PRGs at completion.

Alternative S-4 would be easy to implement, and resources, equipment, and materials would be readily available for this purpose. The capital cost, 30-year NPW of O&M costs, and 30-year NPW cost for this alternative are estimated at $3.514 million, $0, and $3.514 million, respectively.

2.8.2 Groundwater Remedial Alternatives

Alternative GW-1 – No Action

Under this alternative, no remedial activities would occur to address contaminated groundwater, and no controls would be implemented to preclude future exposure of human receptors to this groundwater. No periodic monitoring would be performed to evaluate the effectiveness toward achieving the cleanup goals or to confirm that no downgradient migration of contaminants had occurred. Under this alternative, the property would be released for unrestricted use.

This alternative would not protect human health and the environment because concentrations of COCs would remain in groundwater at levels that exceed cleanup goals based on FDEP GCTLs and potential future unacceptable exposure to these concentrations would not be precluded. This alternative would not achieve the RAOs or comply with ARARs. No treatment would be employed in this alternative, and therefore there would be no reduction in toxicity, mobility, or volume of contaminants. Because no remedial action would take place, this alternative would not result in any short-term risks and would be very easy to implement. There would be no cost associated with this alternative.

Alternative GW-2 – Monitored Natural Attenuation and LUCs

Alternative GW-2 would consist of three major components: (1) natural attenuation, (2) monitoring, and (3) LUCs.

Component 1 – Natural Attenuation: This alternative uses natural attenuation for the remediation of those COCs that are the most prevalent and the most likely to respond to this technology (i.e., VOCs, SVOCs). In addition, the less transient COCs are not likely to migrate significant distances and may also be reduced in concentrations over time via control/removal of overlying impacted soils. Natural attenuation relies on naturally occurring processes within the aquifer to reduce the concentrations of VOCs, SVOCs, pesticides, and arsenic. Biodegradation, dispersion, and dilution through aquifer movement and adsorption on soil particles are expected to be the processes primarily responsible for this natural attenuation. Initial data suggest that natural attenuation of COCs is occurring at the site; however, additional data collection would be necessary to fully evaluate the effectiveness of the natural attenuation. The USEPA guidance document “Monitored Natural Attenuation of Inorganic Contaminants in Ground Water (Volumes 1 and 2)” issued in October 2007 and the “Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water" issued in October 1998, will be followed to implement the monitored natural attenuation portion of the alternative.

USEPA’s guidance document is based on a four tier approach to evaluate monitored natural attenuation at sites. At the completion of each step it allows decisions to be made on whether monitored natural

attenuation is still a viable alternative for site remediation. The four tiers and their main objectives, as listed in the 2007 USEPA guidance document are as follows:

1. **Tier I – Demonstration of plume stability and contaminant removal from groundwater**
   The objective under Tier I analysis would be to eliminate sites where site characterization indicates that the groundwater plume is continuing to expand in areal or vertical extent. For contaminates in which sorption onto aquifer solids is the most feasible attenuation process, an additional objective would be to demonstrate contaminant uptake onto aquifer solids.
2. **Tier II – Determine mechanisms and rate of attenuation**
   The objective under Tier II analysis would be to eliminate sites where further analysis shows that attenuation rates are insufficient for attaining cleanup objectives established for the site within a timeframe that is reasonable compared to other remedial alternatives. (See USEPA, 1999b, pages 19-21, for a discussion of "reasonable timeframe for remediation.")
3. **Tier III – Demonstrate capacity and stability of removal mechanism**
   The objective under Tier III would be to eliminate sites where site data and analysis show that there is insufficient capacity in the aquifer to attenuate the contaminant mass to groundwater concentrations that meet regulatory objectives or that the stability of the immobilized contaminant is insufficient to prevent re-mobilization due to future changes in groundwater chemistry.
4. **Tier IV – Create long-term performance monitoring plan and create contingency plans**
   The objective under Tier IV analysis is to develop a monitoring program to assess long-term performance of the monitored natural attenuation remedy and identify alternative remedies that could be implemented for situations where changes in site conditions could lead to remedy failure.

Tier I has been completed at PSC 47 as groundwater monitoring data has shown that the contaminants are not migrating (plume stability) and concentrations have not increased. Contaminant uptake is evident with arsenic, as it is being physically removed after leaving the arsenic "hot spot" or downgradient migration would be noticed. Upon implementation of Alternative 2, Tier II data would be collected as part of the monitoring program.

<u>Component 2 – Monitoring</u>: Monitoring would consist of regularly collecting and analyzing groundwater samples both from within the northern and southern plumes to assess natural attenuation and downgradient of the leading edge of the plumes to detect potential migration of groundwater COCs. A Monitored Natural Attenuation Performance Work Plan will be developed after approval of the remedy in accordance with USEPA guidance that will include the requirements of the monitoring program. Elements of the Work Plan include the monitoring objectives, the data quality requirements, the frequency and analyses required, data management and data evaluation methods and procedures, and decision

rules for the evaluation of data and for determining trigger points that require implementation of contingency actions.

Component 3 – LUCs: LUCs in the form of institutional and engineering controls would be implemented to prevent unacceptable exposure to residual contaminated soil and groundwater remaining at levels that preclude unrestricted use and unlimited exposure. Institutional controls would include update of the installation's Master Plan and procedures to ensure industrial use at the Site, prohibit use of the groundwater, and prohibit intrusive activities in contaminated areas. Engineering controls would include the cap over the contaminated soils and signs to advise that intrusive activities require authorization.

Alternative GW-2 would be protective of human health and the environment. Natural attenuation would be protective of human health and the environment because it would reduce concentrations of COCs until the cleanup goals are eventually achieved. LUCs would be protective because they would prevent unacceptable human health risks from exposure to contaminated groundwater until the groundwater cleanup goals have been met. Monitoring would be protective because it would assess the progress of natural attenuation and also because it would detect the potential migration of groundwater COCs to surface water, which would allow the prevention of unacceptable human health and ecological risks. The monitoring program would also provide a framework for evaluation of the effectiveness of natural attenuation and would establish trigger points for the implementation of contingent remedies to include one or more treatment options specified in GW-3A or GW3-B to achieve the RAOs.

Alternative GW-2 would be easy to implement. The capital cost, 30-year NPW of O&M costs, and 30-year NPW cost for this alternative are estimated at $16,000, $754,000, and $770,000, respectively.

Alternative GW-3A – Northern Plume In-Situ Treatment (Enhanced Bioremediation), Monitored Natural Attenuation, and LUCs

Alternative GW-3A would consist of four major components: (1) in-situ enhanced bioremediation of the northern plume, (2) natural attenuation, (3) monitoring, and (4) LUCs.

Component 1 – In-Situ Enhanced Bioremediation of Northern Plume: In-situ bioremediation would consist of using electron donor injection to enhance the growth of indigenous microorganisms and augment the natural biodegradation of the northern plume COCs, particularly pesticides. Under this alternative, 230 DPT wells would be installed to a depth of 25 feet bls. Emulsified oil would be injected in these wells at the rate of approximately 10 pounds of concentrate per foot of depth in the 5- to 25-feet bls interval, for a total emulsified oil concentrate use of approximately 46,000 pounds (6,200 gallons). The oil concentrate is typically diluted with water in the ratio of 10 to 1 prior to injection, and an additional volume of water is added into the wells following injection to promote dispersion. Because the

contaminant-degrading microorganisms function optimally in a pH range of 6.0 to 8.0 standard units, pH adjustment would probably be required with controlled injection of an alkaline reagent such as sodium hydroxide (caustic soda) at the same time as that of the emulsified oil. The exact design of the treatment system would be determined based on pilot-scale treatability testing prior to implementation.

Component 2 – Natural Attenuation: This component would be identical to Component 1 of Alternative GW-2.

Component 3 – Monitoring: This component would be identical to Component 1 of Alternative GW-2, except that the samples collected from the six wells in the northern plume would be analyzed for natural attenuation parameters after completion of the in-situ enhanced bioremediation.

Component 4 – LUCs: This component would be identical to Component 2 of Alternative GW-2.

Alternative GW-3A would be protective of human health and the environment. In-situ enhanced bioremediation of the northern Plume would be protective of human health and the environment because it would significantly accelerate the natural attenuation of groundwater contaminants in this area. LUCs would be protective because they would prevent unacceptable human health risks from exposure to contaminated groundwater until the groundwater cleanup goals have been met. Monitoring would be protective because it would assess the progress of in-situ bioremediation and natural attenuation and also because it would detect the potential migration of groundwater COCs to surface water, which would allow the prevention of unacceptable human health and ecological risks. Alternative GW-3A would meet the groundwater RAOs.

Alternative GW-3A would eventually comply with chemical-specific ARARs through the combination of active in-situ biological treatment and natural attenuation. Alternative GW-3A would also comply with location- and action-specific ARARs. All TBCs would be fully taken into consideration as appropriate.

Alternative GW-3A would be long-term effective and permanent. In-situ enhanced bioremediation of the northern plume would effectively and permanently reduce concentrations of COCs within that area of contaminated groundwater. However, the site-specific effectiveness of the proposed electron donor injection technology would have to be verified through pilot-scale testing, particularly for the removal of pesticides. Natural attenuation would effectively reduce concentrations of groundwater COCs and eventually achieve the groundwater cleanup goals as verified through monitoring. Until this occurs, LUCs would effectively prevent groundwater access and use. Monitoring would effectively determine whether or not groundwater COCs are migrating to off-site downgradient surface water.

Alternative GW-3A would reduce the toxicity, mobility, and volume of the northern plume COCs through treatment. An estimated 2.7 pounds of VOCs, SVOCs, and pesticides would be permanently and

irreversibly removed through in-situ enhanced bioremediation. Additional reduction in the toxicity, mobility, and volume of groundwater COCs would be achieved through natural attenuation, and this reduction would be quantified by monitoring. Alternative GW-3A would not generate any treatment residue.

Implementation of Alternative GW-3A could result in moderate short-term risks to on-site workers as a result of exposure to contamination during the installation and operation of an in-situ chemical injection system and as a result of monitoring.

Alternative GW-3A would be relatively easy to implement. In-situ enhanced bioremediation services are available from a number of qualified contractors. Installation of approximately 230 DPT wells for electron donor injection would likely interfere, at least temporarily, with the normal use of the site, especially the installation of those DPT wells that would be located on existing parking lots and next to Building 536. Pilot-scale treatability testing would have to be performed to verify the site-specific effectiveness and design parameters for the electron donor injection technology for the in-situ bioremediation of pesticides. A number of groundwater monitoring events have been implemented at PSC 47, and additional monitoring would be easy to perform.

The estimated capital cost, 30-year NPW of O&M costs, and 30-year NPW cost for Alternative GW-3A are estimated at $1.219 million, $813,000, and $2.032 million, respectively.

Alternative GW-3B – Southern Plume In-Situ Treatment (Chemical Oxidation and Precipitation), Monitored Natural Attenuation, and LUCs

Alternative GW-3B would consist of four major components: (1) chemical oxidation and precipitation of the southern plume, (2) natural attenuation, (3) monitoring, and (4) LUCs.

Component 1 – Chemical Oxidation and Precipitation of the Southern Plume: This component would consist of installing a DPT injection system for the in-situ chemical oxidation and precipitation of the southern plume arsenic source area hot spot. Arsenic is the primary COC in the southern plume with other constituents at levels that would not require treatment. Treatment would include two rounds of injection in rapid succession, with the first round providing the iron necessary for the arsenic co-precipitation process and the second round providing an oxygen-rich environment to oxidize arsenic from the trivalent to the pentavalent state, resulting in the co-precipitation of an arsenic ferro-oxide. The conceptual design of this component was based on general experience with DPT injection systems for the remediation of plumes similar to the PSC 47 southern plume arsenic hot spot. The exact design of the in-situ chemical oxidation and precipitation system would be verified through treatability testing prior to implementation.

The DPT injection system would consist of a grid of 55 DPT injection wells installed to a depth of 25 feet bls. For the first round of injection, the DPT injection system would be used to inject a total of approximately 5,850 pounds of a 40-percent (by weight) solution of ferric chloride (approximately 500 gallons), which corresponds to a total iron III addition of approximately 800 pounds, which corresponds to twice the stochiometric demand for arsenic co-precipitation. To promote dispersion, the ferric chloride solution would be diluted 100 to 1 providing approximately 920 gallons of dilute solution to be injected at each DPT point. For the second round of injection, 200 pounds of an oxygen enhancer such as oxygen releasing compound or a similar compound would be injected in each DPT well for a total injection of 11,000 pounds of an oxygen enhancer.

Component 2 – Natural Attenuation: This component would be identical to Component 1 of Alternative GW-2.

Component 3 – Monitoring: This component would be identical to Component 2 of Alternative GW-2, except that the samples collected from the nine wells in the southern plume would also be analyzed for natural attenuation parameters after completion of the in-situ chemical oxidation and precipitation, which is from Year 2 to Year 6 instead of from Year 1 to Year 5.

Component 4 – LUCs: This component would be identical to Component 3 of Alternative GW-2.

Alternative GW-3B would be protective of human health and the environment. In-situ chemical oxidation and precipitation of arsenic in the southern plume would be protective of human health and the environment because it would significantly accelerate the natural attenuation of these contaminates in groundwater. LUCs would be protective because they would prevent unacceptable human health risks from exposure to contaminated groundwater until the groundwater cleanup goals have been met. Monitoring would be protective because it would assess the progress of in-situ bioremediation and natural attenuation and also because it would detect the potential migration of groundwater COCs offsite, Alternative GW-3B would meet the groundwater RAOs.

Alternative GW-3B would eventually comply with chemical-specific ARARs through the combination of active in-situ chemical treatment and natural attenuation. Alternative GW-3B would also comply with location- and action-specific ARARs. All TBCs would be fully taken into consideration as appropriate.

Alternative GW-3B would be long-term effective and permanent. In-situ chemical oxidation and precipitation of the southern plume would effectively and permanently reduce concentrations of arsenic within that area of contaminated groundwater. However, the site-specific effectiveness of the proposed ferric iron and oxygen enhancer would have to be verified through bench- and pilot-scale testing. In addition, there would also be a slight possibility that the arsenic that had been removed from groundwater

and immobilized in the surrounding soil could be re-dissolved and remobilized over the long term as a result of naturally occurring changes in groundwater chemistry. Natural attenuation would effectively reduce concentrations of groundwater COCs and eventually achieve the groundwater cleanup goals as verified through monitoring. Until this occurs, LUCs would effectively prevent groundwater access and use that would result in unacceptable human health risk. Monitoring would effectively determine whether or not groundwater COCs are migrating off-site.

Alternative GW-3B would reduce the toxicity and mobility of the arsenic in the southern plume through treatment. An estimated 27 pounds of arsenic would be removed from groundwater and immobilized in the surrounding soil matrix through in-situ chemical oxidation and precipitation. However, as previously mentioned, this removal and immobilization might not be fully permanent and irreversible. Reduction in the toxicity, mobility, and volume of other groundwater COCs would be achieved through natural attenuation and this reduction would be quantified by monitoring. Alternative GW-3B would not generate any treatment residue.

Implementation of Alternative GW-3B could result in moderate short-term risks to on-site workers as a result of exposure to contamination during the installation and operation of an in-situ chemical injection system and as a result of monitoring. Alternative GW-3B would also not adversely impact the surrounding community or the environment.

Alternative GW-3B would also meet the arsenic cleanup goal for the southern plume arsenic hot spot within an estimated one year. The remaining groundwater cleanup goals would eventually be met through natural attenuation, and this would be determined through monitoring.

Alternative GW-3B could be implemented but not as readily as some other alternatives. In-situ chemical oxidation and precipitation is relatively innovative and this kind of service would only be available from a limited number of qualified contractors. Installation of a relatively large number of DPT wells for chemical injection might interfere, at least temporarily, with the normal use of the site, especially because most of those DPT wells would be located next to or under Building 937. Pilot-scale treatability testing would have to be performed to verify the site-specific effectiveness and the design parameters for the electron donor injection technology for the in-situ bioremediation of pesticides. A number of groundwater monitoring events have been implemented at PSC 47, and additional monitoring would be easy to perform.

The capital cost, 30-year NPW of O&M costs, and 30-year NPW cost for this alternative are estimated at $691,000, 790,000, and $1.481 million, respectively.

2.9 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of alternatives with respect to the nine evaluation criteria was completed and is provided below. Table 2-1 depicts a relative ranking of the alternatives. The distinguishing feature between the soil alternatives is capping and the combination of excavation and capping would require monitoring and LUCs while the excavation alternative would allow for unrestricted future use. The distinguishing feature between the groundwater alternatives is Alternatives GW-3A and GW-3B incorporate in-situ treatment of the plumes prior to monitored natural attenuation.

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment. The no action alternatives for soil and groundwater do not achieve RAOs and, therefore, do not protect human health and the environment and are not considered further in this ROD. All three remaining soil alternatives would provide adequate protection of human health by eliminating exposure to contaminated soil through either just capping or excavation or a combination of both. Excavation of all contaminated soil (Alternative S-4) would be the most protective as it would allow for unrestricted use and exposure to soil. For groundwater, both alternatives would be equally protective of human health and the environment by controlling exposure to groundwater through LUCs.

Compliance with ARARs. The ARARs include any federal or state standards, requirement, criteria, or limitations that are determined to be legally applicable or relevant and appropriate to a CERCLA site or action. TBC criteria are non-promulgated advisories or guidance issued by federal or state government and do not have the status of ARARs, but are evaluated along with ARARs. The soil and groundwater alternatives for PSC 47 would comply with all state ARARs and appropriately take into account all identified TBCs.

PRIMARY BALANCING CRITERIA

Long-Term Effectiveness and Permanence. All three soil alternatives would provide long-term effectiveness and permanence. Soil Alternative S-3 would be slightly more effective and permanent than Alternative S-2 because it would not cap any contaminated soil. Soil Alternative S-4 would be the most effective and permanent, as excavation and off-site disposal would allow the site to be used for unrestricted use and exposure. All three groundwater alternatives would be long-term effective and permanent once performance standards were met though either active treatment and/or monitored natural attenuation and LUCs.

Reduction in Toxicity, Mobility, or Volume through Treatment. While all the alternatives are expected to reduce toxicity, mobility, or volume, the only alternatives with active treatment are the soil alternatives (S-3 and S-4) involving excavation and capping, and Alternatives GW-3A and GW-3B for groundwater.

TABLE 2-1

RELATIVE RANKING OF REMEDIAL ALTERNATIVES
PSC 47 RECORD OF DECISION
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

CERCLA Criteria	Soil Alternatives				Groundwater Alternatives			
	No Action (S-1)	Capping, LUCs, and Monitoring (S-2)	Excavation, Capping, LUCs, and Monitoring (S-3)	Excavation and Off-Site Disposal (S-4)	No Action (GW-1)	MNA and LUCs (GW-2)	Northern Plume - Enhanced Bioremediation, MNA, and LUCs (GW-3A)	Southern Plume - Chemical Oxidation and Precipitation, MNA, and LUCs (GW-3B)
Threshold Criteria								
Overall Protection of Human Health and the Environment	☐	■	■	■	☐	■	■	■
Compliance with ARARs	☐	■	■	■	☐	■	■	■
Balancing Criteria								
Long-Term Effectiveness and Permanence	☐	❒	❒	■	☐	❒	❒	❒
Reduction in Toxicity, Mobility or Volume through Treatment	NA	NA	NA	NA	NA	NA*	❒	❒
Short-Term Effectiveness	☐	❒	❒	■	☐	☐	❒	❒
Implementability	■	❒	❒	❒	■	❒	☐	☐
Present-Worth Cost	$0	$2,101,000	$2,872,000	$3,514,000	$0	$770,000	$2,032,000	$1,481,000
Modifying Criteria								
State Acceptance	☐	❒	❒	■	☐	❒	■	■
Community Acceptance	NC	NC	NC	NC	NC	NC	NC	NC

Acceptance Ranking: ☐- Low ❒- Moderate ■- High

*- While MNA is not considered a treatment, the natural reduction of contaminant concentrations through a variety of physical, chemical, or biological activities is expected with a reasonable timeframe.

NA: Not applicable

NC: No significant public comments were received on the Proposed Plan; questions raised at the public meeting were general inquiries for informational purposes only

MNA: Monitored natural attenuation

LUC: Land use control

Capping will reduce mobility of soil COCs to groundwater. Monitored natural attenuation will reduce contaminant concentrations through a variety of physical, chemical, or biological activities within a reasonable timeframe.

Short-Term Effectiveness. Alternatives S-2, S-3, and S-4 would all be completed within 6 months, with components of Alternative S-3 already completed. There could be limited short-term risks associated with on-site workers being exposed to contamination, but these are easily controlled. The in-situ treatment options, monitored natural attenuation, and LUCs alternatives for groundwater poses minimal risk to workers conducting monitoring, but lack short term effectiveness.

Implementability. The capping along with excavation components were easily implemented using well established technologies with conventional equipment and standard construction methods. The in-situ treatment of groundwater would be more difficult to implement than just the monitored natural attenuation and LUCs alternative. However, there are a number of qualified contractors available to implement in-situ treatment options.

Cost. The estimated present-worth cost for soil Alternative S-3 (excavation, capping, LUCs, and monitoring) is $2,872,000. This cost is more than the $2,101,000 cost of soil Alternative S-2 (capping, LUCs, and monitoring, but less than the $3,514,000 cost of soil Alternative S-3 (excavation and off-site disposal). The estimated present-worth cost of monitored natural attenuation and LUCs is $770,000. This cost is significantly less than the cost of in-situ treatment for both the northern and southern plumes, monitored natural attenuation, and LUCs ($2,032,000 + $1,481,000, respectively). It should be noted that costs for excavation and capping for Alternative S-3 have already been incurred.

MODIFYING CRITERIA

State Acceptance. State involvement has been solicited throughout the CERCLA process. The FDEP, as the designated state support agency in Florida, concurs with the selected remedy.

Community Acceptance. The public expressed its support for the preferred alternative presented in the public meeting held July 29, 2008. The questions and concerns raised at the meeting were general inquiries for informational purposes only; no significant comments were received from the public.

2.10 PRINCIPAL THREAT WASTES

The NCP at 40 CFR 300.430(a)(1)(iii)(A) establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or that would present a significant risk to human health or the environment should exposure occur. A

source material is a material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or act as a source for direct exposure. There are no source materials constituting principal threat wastes at this site. The selected remedy will not satisfy the statutory preference for remedies that employ treatment that will immediately reduce toxicity, mobility, or volume. It is anticipated that capping of contaminated soils and natural attenuation will reduce the toxicity and mobility of COCs in groundwater over time.

2.11 SELECTED REMEDY

2.11.1 Summary of Rationale for Remedy Selection

The goals of the selected remedy are to protect human health and the environment by eliminating, reducing, or controlling hazards posed by PSC 47 soil and groundwater and to meet the ARARs. Based on consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives, and USEPA, FDEP, and public comments, Alternatives S-3 and GW-2 were selected to address soil and groundwater contamination at PSC 47, and the capping and excavation portions of Alternative S-3 have already been completed.

The remedy was selected for the following reasons:

- It will meet the RAOs and cleanup goals and comply with chemical- and action-specific ARARs.
- It will achieve risk reduction through mobility reduction and will effectively preclude future access to contaminated soil and groundwater, via LUCs, until the cleanup goals are met.
- Alternative S-3 was selected because it is the most cost effective method to provide adequate protection under current site use while providing protection via the reduction and/or elimination of COC migration from soil to groundwater at the site.
- Alternative GW-2 uses natural attenuation for the remediation of the COCs that are the most prevalent and most likely to respond to this technology (i.e., VOCs, SVOCs). In addition, the less transient COCs are not likely to migrate significant distances and may also be reduced in concentrations over time via control/removal of overlying impacted soil. .

Detailed information on the costs to implement the selected remedy may be found in the RI/FS (TtNUS 2008a). Costing tables for S-3 and GW-2 (from Appendix M of the RI/FS) are provided at the end of Appendix B and are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and

data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference, or a ROD Amendment. This is an order of magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project costs.

2.11.2 Selected Remedy Description

Alternative S3 – Excavation and Off-Site Disposal to Allow Industrial Use, Capping to Prevent Leaching, LUCs, and Monitoring

As previously noted, Component 1 – Excavation and Off-Site Disposal and Component 2 – Capping to Prevent Leaching have already been implemented as an IRA. Component 3 – Land Use Controls and Component 4 – Monitoring will be implemented as part of post ROD actions.

Component 1 – Excavation and Off-Site Disposal to Allow Industrial Use: Excavation activities were performed from September 28 through October 11, 2007, and included soil removal from 11 discrete areas presenting an unacceptable risk from exposure in a commercial/industrial setting. Soils were removed to 2 feet bls in these excavations. Excavation activities also included removal of soil from two additional areas presenting an unacceptable risk from leaching to groundwater. Soils were removed to 1 foot bls in these excavations to accommodate the cap.

Approximately 930.21 tons of soil were transported for off-site disposal as non-hazardous waste at Chesser Island Landfill, a Subtitle D landfill located in Folkston, Georgia. Approximately 202.6 tons of soil were transported for off-site disposal as hazardous waste (arsenic/pesticide impacted soil) at the Waste Management Facility located in Emelle, Alabama. Clean fill was used to return the surface soil excavations to match the surrounding elevation. The excavated areas were fertilized and seeded with landscape grasses, and covered with mulch.

Component 2 – Capping to Prevent Leaching: A concrete barrier designed in accordance with USEPA guidance [*Final Covers on Hazardous Waste Landfills and Surface Impoundments* (USEPA, 1989b)] and meeting the relevant RCRA performance requirement of a landfill cap with a permeable rate of 1×10^{-7} centimeters per second, was placed at two areas shown on Figure 2-9 to meet Soil RAO 2 requirements (prevent migration of contaminants to groundwater from surface and subsurface soil).

Component 3 – LUCs: Soil and groundwater contamination will remain at the Site at concentrations that preclude unrestricted use and unlimited exposure; therefore, the remedy includes LUCs (including institutional and engineering controls) to prevent unacceptable exposure to residual contaminated soil and groundwater. The boundaries of PSC 47 and the area subject to LUCs are presented on Figures 1-1

(soil) and 1-2 (groundwater). Consistent with the RAOs developed for the site, the specific performance objectives of the LUCs to be implemented at PSC 47 are as follows:

- Prohibit residential, recreational, or agricultural use of the LUC portions of the site. Prohibited residential uses shall include, but are not limited to, any form of housing, childcare facilities, pre-schools, elementary schools, secondary schools, play grounds, convalescent, or nursing care facilities.
- Prohibit disturbance of the cap and/or underlying soils at the Site to prevent unacceptable occupational exposure unless prior written approval is obtained from the Navy, USEPA, and FDEP.
- Prohibit withdrawal of groundwater from the surficial aquifer underlying the Site for all uses including, but not limited to, human consumption, dewatering, irrigation, heating/cooling, and industrial processes. Extraction of groundwater for the purpose of monitoring will be allowed.
- Maintain the integrity of any existing or future monitoring or remediation system (including, but not limited to, the monitoring wells and the cap).

The following generally describes the LUCs that will be implemented at PSC 47 to achieve the aforementioned LUC performance objectives:

- Incorporate the LUC boundary and land use restrictions for PSC 47 into the installation's Master Plan (and any other relevant documents governing land use at NAS Jacksonville).
- Utilize the installation Dig Permit process to require review/approval and implementation of worker protection practices before any intrusive activities are performed at the Site.
- Post signs adjacent to contaminated areas and cap advising that any excavation activity must be authorized in advance by the responsible environmental department. The size, location, and content of the signs will be specified in the LUC RD.
- Monitor and maintenance of cap and signs.
- In the event any portion of PSC 47 is transferred, land use restrictions consistent with LUC performance objectives will be included in the deed and/or lease.

The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. The LUCs will be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and unlimited exposure.

The LUC implementation actions including monitoring and enforcement requirements will be provided in a LUC RD that will be prepared by the Navy as the component of the overall RD. Within 90 days of ROD signature, the Navy shall prepare and submit to USEPA and FDEP for review and approval (pursuant to those Primary Document review procedures stipulated in the FFA) the LUC RD for PSC 47 that shall contain implementation and maintenance actions, including periodic inspections that the Navy and/or NAS Jacksonville shall undertake to achieve the LUC performance objectives. The Navy or any subsequent owners shall not modify, delete, or terminate any LUC without USEPA and FDEP approval.

Component 4 – Monitoring: A groundwater monitoring program will be developed and implemented to verify the long-term effectiveness of the cap and to evaluate the potential leaching of soil COCs into groundwater. The design of the monitoring program will be determined in a post ROD document to be approved by FDEP and USEPA.

Alternative GW-2 – Monitored Natural Attenuation and LUCs

Alternative GW-2 will consist of three major components: (1) natural attenuation, (2) monitoring, and (3) LUCs.

Component 1 – Natural Attenuation: Natural attenuation will be used for the remediation of those COCs that are the most prevalent and the most likely to respond to this technology (i.e., VOCs, SVOCs). In addition, the less transient COCs are not likely to migrate significant distances and may also be reduced in concentrations over time via control/removal of overlying impacted soils. Natural attenuation relies on naturally occurring processes within the aquifer to reduce the concentrations of VOCs, SVOCs, pesticides, and arsenic. Biodegradation, dispersion, and dilution through aquifer movement and adsorption on soil particles are expected to be the processes primarily responsible for this natural attenuation. Initial data suggest that natural attenuation of COCs is occurring at the site; however, additional data collection would be necessary to fully evaluate the effectiveness of the natural attenuation.

Component 2 – Monitoring: Monitoring will consist of regularly collecting and analyzing groundwater samples both from within the northern and southern plumes to assess natural attenuation and downgradient of the leading edge of the plumes to detect potential migration of groundwater COCs. A Monitored Natural Attenuation Performance Work Plan will be developed after approval of the remedy in accordance with USEPA guidance that will include the requirements of the monitoring program. The USEPA guidance document [Monitored Natural Attenuation of Inorganic Contaminants in Ground Water (Volumes 1 and 2)] issued in October 2007 will be followed for the southern plume to implement the monitored natural attenuation portion of the alternative. Elements of the Work Plan include the monitoring objectives, the data quality requirements, the frequency and analyses required, data management and

data evaluation methods and procedures, and decision rules for the evaluation of data for determining trigger points that require implementation of contingency actions.

Component 3 – LUCs: LUCs will be implemented as described above in Component 3 for Alternative S-3. Alternative GW-2 will be protective of human health and the environment. Natural attenuation would be protective of human health and the environment because it would reduce concentrations of COCs until the cleanup goals are eventually achieved. LUCs will be protective because they will prevent unacceptable human health risks from exposure to contaminated groundwater until the groundwater cleanup goals have been met. Monitoring will be protective because it would assess the progress of natural attenuation and also because it would detect the potential migration of groundwater COCs to surface water, which will allow the prevention of unacceptable human health and ecological risks. The monitoring program will also provide a framework for evaluation of the effectiveness of natural attenuation and would establish trigger points for the implementation of contingent remedies to include one or more treatment options specified in Alternatives GW-3A or GW-3B to achieve the RAOs.

2.11.3 Selected Alternative Contingency Actions

Because uncertainty exists whether the selected remedy will effectively achieve stated cleanup goals for groundwater, the Navy, USEPA, and the state of Florida have determined that it would be appropriate to identify certain contingent remedies for the remediation of the northern and/or southern groundwater plumes. Those contingent remedies were evaluated in the RI/FS as Alternatives GW-3A and GW-3B, respectively. One or both contingent remedies would be implemented only if groundwater monitoring data indicates that one or both plumes will not achieve the objectives stated in applicable USEPA guidance(s) and site cleanup goals. Trigger points will be established in the Monitored Natural Attenuation Performance Work Plan for the possible implementation of a contingent groundwater remedy(ies) to include one or more of the technical approaches specified in Alternatives GW-3A or GW-3B. Data collection and evaluation will be conducted for a period of up to five years to evaluate if the selected remedy for groundwater is meeting established RAOs. At completion of the first five year monitoring period, or earlier, the parties will evaluate data to determine whether natural attenuation is effective at reducing the COCs in the groundwater at a rate that can achieve the RAOs within a reasonable time frame. If the parties determine the attenuation is not effective based upon this data, the parties may determine that a contingent remedy, which may include one or more the approaches specified in remedial alternatives GW-3A or GW-3B, is necessary.

Implementation of the monitoring provisions of Alternatives S-3 and GW-2 include the development of trigger points that will require the implementation of contingency actions. Data collection and data evaluation will be conducted for a period of up to five years to evaluate if the selected remedy is meeting

the RAOs. At the completion of the five year monitoring period, or earlier, the Navy may determine contingency actions are necessary.

2.11.4 Summary of Estimated Selected Remedy Costs

Cost information including the major capitol and annual operations and maintenance cost for the Selected Remedy are provided in the Costing Tables provided in Appendix B. Pricing, including total present net worth values using a discount rate of 7 percent, were calculated for implementation of remedy components S-3 for soil and GW-2 for groundwater.

Alternative S-3 includes excavation and capping components (Components 1 and 2) that have already been implemented. As a result, future costing for completion of the Alternative S-3 includes LUCs (Component 3) and monitoring (Component 4). Costs for implementation of Components 3 and 4 include preparation of the LUC RD, site inspections, and reporting. Initial year one costs are estimated at $42,973 and subsequent years two and three are estimated at $27,905. After year three, annual costs are estimated at $13,386 per year. A total 30 year cost for implementation of components three and four is $460,205. It should be noted that LUCs may be required for an indefinite time period.

Alternative GW-2 includes natural attenuation (Component 1), Monitoring (Component 2) and LUCs (Component 3). Costs for implementation of these components include development of a Monitored Natural Attenuation Performance Work Plan, sampling and analysis of groundwater samples obtained from the site's monitoring well network, data management, data analysis and reporting, plus LUC inspections and reporting. Initial year one cost is estimated at $188,390. Subsequent years two and three are estimated at $95,658 each year and years four and five are estimated at $49,292 each year. Years six to 30 are estimated at $36,587 per year. A total five year cost is estimated at $478,290 with subsequent years of monitoring estimated at $36,687 per year. It should be noted that by year five, the Navy will complete data evaluation of alternative GW-2. If GW-2 does not remain protective then contingency actions will be invoked. Should contingency actions not be necessary, the total 30 year cost is estimated at $1,392,965 for implementation of GW-2.

In addition to these costs, statutory five year reviews will be conducted with a combined cost of $44,385 per five year review period.

It should be noted that cost estimates provided in Appendix B are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during engineering design of the selected remedy. Major changes may be documented in the form of a memorandum in the Administrative Record file, and

Explanation of Significant Difference, or a ROD amendment. The cost estimate is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

2.11.5 Expected Outcomes of the Selected Remedy

Due to the presence of capped contaminated soils remaining on site, it is believed that remedy implementation will not result in lifting of land use restrictions for residential purposes and, therefore, the site will remain available for industrial/commercial uses only. Due to the site's location within the boundaries of an active military facility, remedy implementation will likely have little impact on socio-economic or community revitalization efforts.

2.12 STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP, the selected remedy must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), be cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The following sections discuss how the selected remedy meets these statutory requirements.

2.12.1 Protection of Human Health and the Environment

The selected remedy, Alternatives S-3 and GW-2, will protect human health and the environment. Due to current human health risks and Navy funding requirements, excavation and capping components of Alternative S-3 implementation have been completed. The areas of maximum soil contamination have been removed, and a cap has been installed to prevent further leaching of soil contaminants into groundwater. In addition, natural attenuation will eventually reduce concentrations of pesticide, arsenic, and VOC constituents to cleanup goals through natural attenuation processes. This will reduce risks from exposure to contaminated groundwater and will provide protection to future human receptors.

LUCs to restrict land use and the use of surficial aquifer groundwater will protect human health and the environment during the remedial period until cleanup goals are met. Monitoring will be protective by evaluating the effectiveness of natural attenuation on the concentration and migration of groundwater COCs and prevent disturbances to the cap.

2.12.2 Compliance with ARARs

CERCLA Section 121(d) specifies in part that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs) to the hazardous substances or

particular circumstances at a site or obtain a waiver [see also 40 CFR 300.430(f)(1)(ii)(B)]. ARARs include only federal and state environmental or facility citing laws/regulations and do not include occupational safety or worker protection requirements. In addition, per 40 CFR 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (TBC criteria).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility citing laws that address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. However, this is not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

In accordance with 40 CFR 300.400(g), the Navy, FDEP, and USEPA have identified the specific ARARs for the selected remedy. The selected remedy is expected to comply with all ARARs related to implementing the selected action. Tables 2-2 and 2-3 list the chemical- and action-specific ARARs, respectively, that will be considered in the implementation of the selected remedy. As noted above, major components of S-3, the selected remedy for soils, were implemented prior to finalizing of this ROD. The regulatory requirements for the work conducted as interim actions under non-CERCLA authority are identified herein as ARARs. Consequently, some of the action-specific ARARs have been complied with by the Navy while implementing the interim actions.

2.12.3 Cost-Effectiveness

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

TABLE 2-2

CHEMICAL-SPECIFIC ARARs
POTENTIAL SOURCE OF CONTAMINATION 47
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Florida Groundwater Classes, Standards, and Exemptions	Chapter 62-520 and 62-520.420, Florida Administrative Code (FAC)	Applicable	This rule designates the groundwater of the state into five classes and establishes minimum criteria. This rule also specifies that Classes I and II must meet primary drinking water standards listed in Chapter 62-550, FAC	This rule was used to classify groundwater and establish cleanup goals for groundwater. Groundwater at this site is considered a potential source of drinking water (Class G-II).
Florida Drinking Water Standards, Monitoring and Reporting	Chapter 62-550.310, FAC	Relevant and Appropriate	This rule provides primary drinking water standards and maximum contaminant levels (MCLs) for public water supply systems.	Cleanup goals for some of the contaminants of concern (COCs) in groundwater are based upon USEPA MCLs listed in the Table 4 of this rule.
Florida Contaminant Cleanup Target Levels	Chapter 62-777.170, FAC	Relevant and Appropriate	This rule provides default criteria in tables and an explanation for deriving cleanup target levels (CTLs) for soil, groundwater and surface water that can be used for site rehabilitation (i.e., cleanup).	CTLs for groundwater in Table I of this rule were used to establish cleanup goals for some of the COCs in groundwater at this site. Soil CTLs in Table II for *Leachability Based on Groundwater Criteria* were used to establish cleanup goals for some of the soil COCs.
Florida Contaminated Site Cleanup Criteria – Alternative Soil CTLs	Chapter 62-780.110(5), FAC	Relevant and Appropriate	Allows derivation of apportioned Alternative CTLs to represent site-specific exposures rather than using Default Residential and Industrial Soil CTLs listed in Table II of Chapter 62-777 FAC.	Alternative Soil CTLs for Commercial/Industrial use were developed for some of the soil COCs at this site.
Florida Contaminated Site Cleanup Criteria – Alternative Soil CTLs	Chapter 62-780.680(2)(b)1.e.(V) FAC	Relevant and Appropriate	This rule provides that Alternative Soil CTLs shall be apportioned where more than one contaminant is present in the soil in the unsaturated zone at the site.	Apportioned Alternative Soil CTLs were developed for some of the soil COCs at this site based upon FDEP Technical Report [See below].
Florida Contaminated Site Cleanup Criteria – Alternative Soil CTLs	Chapter 62-780.680(2)(b)1.e.(II) FAC	Relevant and Appropriate	This rule provides that where the 95% UCL approach is utilized, maximum soil concentrations shall not exceed three times the applicable soil CTLs [apportioned pursuant to 62-780(2)(b)(1)].	The requirement was considered in determining soil areas for excavation to meet the Alternative Soil CTLs.

TABLE 2-2

CHEMICAL-SPECIFIC ARARs
POTENTIAL SOURCE OF CONTAMINATION 47
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Florida Contaminated Site Cleanup Criteria – Risk Assessment	Chapter 62-780.650(1)(d), FAC	Relevant and Appropriate	This rule provides that in developing site-specific or Alternative CTLs for soil COCs, calculations using a lifetime excess cancer risk level of 1×10^{-6} and a hazard index of 1 or less shall be used, as applicable.	A lifetime excess cancer risk level of 1×10^{-6} and a hazard index of 1 or less considered in developing apportioned Alternative Soil CTLs.
Technical Report: Development of Cleanup Target Levels for Chapter 62-777. FAC, Final Report, (dated February 2005)	Chapter 62-777.100(2) and 777.170(2)(b), FAC	TBC	Provides guidance on the derivation of site-specific and Alternative CTLs. Includes the Florida UCL-Tool that can be used to calculate average soil contaminant concentrations if the 95% UCL approach is utilized and guidelines for apportioning soil CTLs.	Technical Report was used to develop apportioned Alternative CTLs for COCs in soil at this site based on the 95% UCL approach.

TBC = To be considered

TABLE 2-3

ACTION-SPECIFIC ARARs
POTENTIAL SOURCE OF CONTAMINATION 47
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Florida Water Well Permitting and Construction Requirements	Chapter 62-532.500, FAC	Applicable	Establishes minimum standards for the location, construction, repair, and abandonment of water wells.	The requirements for the construction, repair, and abandonment of monitoring, extraction, and injection wells will be met.
Florida Hazardous Waste – Requirements for Remedial Action	Chapter 62-730.225(3), FAC	Applicable	Requires warning signs at sites suspected or confirmed to be contaminated with hazardous waste.	This requirement will be met.
Florida Natural Attenuation with Monitoring Regulation	Chapter 62-780.690(8)(a) through (c), FAC	Relevant and Appropriate	Specifies the minimum number of wells and sampling frequency for conducting groundwater monitoring as part of a natural attenuation remedy.	The requirements associated with implementation of groundwater monitoring as part of the natural attenuation remedy will be met. (1)
Resource Conservation Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Wastes	40 Code of Federal Regulations (CFR) Part 262.11 and 264.13(a)(1)	Applicable	Requires characterization of solid waste and additional characterization of waste determined to be hazardous. Part 261.11 requires determination of whether solid waste is hazardous. Part 263.13(a)(1) requires a detailed chemical and physical analysis of a representative sample of the waste to determine treatment, storage, and disposal requirements.	Response action will generate non-hazardous solid waste (contaminated soil determined not to be hazardous) and hazardous waste (contaminated soil determined to be RCRA hazardous due to load). No soil COCs failed TCLP but the Navy disposed of some soil as RCRA hazardous due to arsenic exceeding FDEP industrial criteria.
RCRA Regulations, Land Disposal Restrictions (LDRs) for Contaminated Soil	40 CFR Part 268.49	Applicable	This regulation prohibits the land disposal of untreated hazardous wastes and provides treatment standards for contaminated soil that is considered hazardous waste.	Excavated soil determined to be hazardous waste will be transported for off-site treatment and disposal.
RCRA Regulations, Use and Management of Containers	40 CFR Part 265.171 to 173	Applicable	Establish requirements for use and management of hazardous waste in containers	Containers that may be used for temporary storage of hazardous waste (i.e., contaminated soil) on site prior to off-site treatment and disposal will comply with these requirements.
Resource Conservation and Recovery Act (RCRA) regulations for	40 CFR 264.310 (a) (5)	Relevant and Appropriate	Defines the design requirements for a Subtitle C Landfill Cap.	This performance standard was considered in development of the impermeable cover. These regulations would apply when determining an acceptable cap to the migration of hazardous

TABLE 2-3

ACTION-SPECIFIC ARARs
POTENTIAL SOURCE OF CONTAMINATION 47
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Subtitle C Landfill Cap				constituents. Specifies a hydraulic conductivity of no more than 1 x 10^{-7} cm/sec.
Florida Solid Waste Management Facilities	Chapter 62-701.300, FAC	Relevant and Appropriate	Prohibits storage, processing, or disposal except at a permitted solid waste management facility.	Waste generated on site and deemed nonhazardous solid waste will be stored, transported, or disposed of properly.
Florida General Pollutant Emission Limitation Standards	Chapter 62-296.320, FAC	Applicable	Establishes requirements for generation of unconfined emissions of particulate matter from any activity.	Requires reasonable precautions such as application of water or other dust suppressants to control emission from construction and land clearing activities.
Florida Regulation of Stormwater Discharge	Chapter 62-25.025(7), FAC	Relevant and Appropriate	Establishes requirements for stormwater discharges to ensure protection of the surface water of the state.	Considers the impact of the discharge of untreated stormwater from the site. Erosion and stormwater control best management practices will be implemented during construction to retain sediment on site.
Monitored Natural Attenuation of Inorganic Contaminants in Ground Water (Volumes 1 and 2) issued in October 2007	EPA/600/R-07/139	TBC	Provides a framework for evaluation of monitored natural attenuation as an effective remedy for inorganics in groundwater.	Groundwater performance monitoring criteria will be considered in the development of the Monitored Natural Attenuation Performance Work Plan.

1 The designated number of wells, sampling time frames/frequencies, and specific parameters for analyses will be provided in a Monitoring Plan that is included in a post-ROD document (e.g., Remedial Design or Remedial Action Work Plan) that is approved by the USEPA and FDEP.

TBC = To be considered

effectiveness). The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs. The estimated 30-year NPW cost of the selected remedy is $3.642 million.

2.12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The Navy and USEPA, in consultation with the FDEP, have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at PSC 47. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy and USEPA, in consultation with the FDEP, have determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria while also considering the statutory preference for treatment as a principle element and bias against off-site treatment and disposal and considering state and community acceptance.

2.12.5 Preference for Treatment as a Principal Element

The selected remedy does not provide for the primary treatment of contaminated media at the site at this time. However, toxicity reductions are anticipated via natural attenuation of contaminants in groundwater and provisions for active treatment (contingent remedy) are incorporated into the remedy. Should progress towards cleanup goals be determined to be insufficient to meet the cleanup goals prior to or during the five year data review, a contingent remedy will be implemented.

2.12.6 Five-Year Review Requirement

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, in accordance with Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(c), a statutory review will be conducted within five years of initiation of remedial action and every five years thereafter to ensure that the remedy continues to be protective of human health and the environment.

2.13 DOCUMENTATION OF SIGNIFICANT CHANGES

As previously mentioned, Components 1 and 2 for Alternative S-3 have been completed as two interim actions using the FDEP RBCA process under Chapter 62-680, FAC to address contaminated soils that posed a risk to current industrial workers. The Navy, USEPA, and FDEP agreed to proceed with these interim actions considering the goal of remediating high-risk sites and the Navy's goal of achieving a remedy in place and response complete by September 30, 2007. A public meeting was held on July 29, 2008 at the Howard Johnson on US 17 to present and discuss the preferred alternatives. The public was invited to comment during a 30-day period extending from July 1 to August 1, 2008. Three emails were received with comment and all three concurred with proposed remedy and therefore required no

response. No changes to the proposed remedy, as originally identified in the Proposed Plan, have been made as a result of public comments.

The entire NAS Jacksonville Partnering Team agreed to proceed using Global RBCA (Chapter 62-780, FAC) to meet the Navy's goal of remediating high risk sites with remedy in place and response complete by September 30, 2007. The team approved the work plan and chose to proceed without the CERCLA comment period, believing that the selected remedy conducted under FDEP RBCA process would be as protective as CERCLA.

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APPENDIX A

RESPONSIVENESS SUMMARY

Responsiveness Summary

Operable Unit 8
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

A public comment period on the Operable Unit 8, Potential Source of Contamination 47 Proposed Plan was held from 1 July 2008 through 1 August 2008. A public meeting was conducted on 29 July 2008 to hear public comment. The following comments were received. Personal names and addresses have not been included to protect the privacy of the individuals responding:

1. **"I received the environmental update by US mail yesterday. I have reviewed the entire document and the Navy's proposed plan in response to the actions evaluated for PSC 47. My wife (*deleted name for privacy*) owns a daycare at the north end of the base and our home is just west of the Ortega River.**

   My wife and I are in complete agreement with the Navy's proposed plan for the abatement of the source of contamination. We both feel the Navy is taking the appropriate steps to remedy this issue and trust that continued efforts will ensure that any ground water contamination will be monitored and kept to a minimum.

   Thank you for your efforts to address our communities concerns and potential heath risks.

   Please do not hesitate to call or email me if you have any questions."

Response: No response is offered.

2. **"Recently, I got a mailer titled "Fact Finder", an environmental update on Potential Source of Contamination (PSC) 47.**

   I read the flier and my opinion is to do what the Navy things is best.
   Do what is the best balance of conserving the Navy's budget and what is best for the environment.

   Furthermore, don't let anyone try to denounce the Navy over this. The value of our military far outweighs this environmental damage, especially when it may not have been known what damage would occur.

   Prior to the public meeting on June 29, 2008, just prepare rebuttals to those who may try to point blame on the Navy.

   Thank you for your time."

Response: No response is offered.

3. "Dear Sir,

I recently received the informational pamphlet that was mailed from the Public Affairs Office concerning the proposed clean-up. I am 100% behind the plan that the Navy has proposed.

If you have any questions, please feel free to contact me."

Response: No response is offered.

APPENDIX B

RI/FS TABLES
AND
INTERIM REMEDIAL ACTION WORK PLAN TABLE

Table 7-3
Occurrence, Distribution, and Selection of COPCs
Surface Soil - Direct Contact Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Nondetects[3]	Concentration Used for Screening[4]	Background Value[5]	Risk-Based COPC Screening Level[6]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[7]	USEPA SSL Soil to Air[8]	COPC Flag[9]	Rationale for Contaminant Deletion or Selection
Volatile Organics Compounds															
78-93-3	2-Butanone	12	77	µg/kg	JAX47-SB001	3/4	1.4 - 1.4	77	NA	2,200,000 N	16,000,000	FDEP	24,000,000 sat	No	BSL
67-64-1	Acetone	23.7 J	23.7 J	µg/kg	JAX47-SB118	1/4	6 - 22	23.7	NA	1,400,000 N	11,000,000	FDEP	NA	No	BSL
75-09-2	Methylene Chloride	5.6 J	20 J	µg/kg	JAX47-SB001	4/4	-	20	NA	9,100 C	17,000	FDEP	13,000 C	No	BSL
SemivolatileOrganicsCompounds															
	BaP Equivalent	190	640	µg/kg	JAX47-SB001	2/4	127 - 360	640	NA	**62 C**	**100**	FDEP	NA	**Yes**	ASL
56-55-3	Benzo(a)anthracene	120 J	230 J	µg/kg	JAX47-SB001	2/4	170 - 360	230	NA	620 C	1,000	FDEP	NA	No	BSL
50-32-8	**Benzo(a)pyrene**	130 J	380 J	µg/kg	JAX47-SB001	2/4	127 - 360	380	NA	**62 C**	**100**	FDEP	NA	**Yes**	ASL
205-99-2	Benzo(b)fluoranthene	120 J	560 J	µg/kg	JAX47-SB001	2/4	120 - 360	560	NA	620 C	1,000	FDEP	NA	No	BSL
191-24-2	Benzo(g,h,i)perylene	67 J	420 J	µg/kg	JAX47-SB001	2/4	152 - 360	420	NA	230,000 N[10]	2,500,000	FDEP	NA	No	BSL
207-08-9	Benzo(k)fluoranthene	140 J	410 J	µg/kg	JAX47-SB001	2/4	145 - 360	410	NA	6,200 C	10,000	FDEP	NA	No	BSL
117-81-7	Bis(2-ethylhexyl)phthalate	130 J	1400	µg/kg	JAX47-SB001	2/4	221 - 360	1400	NA	35,000 C	72,000	FDEP	NA	No	BSL
85-68-7	Butyl Benzyl Phthalate	35 J	360 J	µg/kg	JAX47-SB001	2/4	137 - 360	360	NA	1,200,000 N	17,000,000	FDEP	NA	No	BSL
218-01-9	Chrysene	150 J	480 J	µg/kg	JAX47-SB001	2/4	148 - 360	480	NA	62,000 C	100,000	FDEP	NA	No	BSL
53-70-3	**Dibenzo(a,h)anthracene**	28 J	140 J	µg/kg	JAX47-SB001	2/4	210 - 360	140	NA	**62 C**	**100**	FDEP	NA	**Yes**	ASL
131-11-3	Dimethyl Phthalate	340 J	340 J	µg/kg	JAX47-SB001	1/4	123 - 430	340	NA	61,000 N	690,000,000	FDEP	NA	No	BSL
206-44-0	Fluoranthene	93 J	530 J	µg/kg	JAX47-SB001	2/4	153 - 360	530	NA	230,000 N	3,200,000	FDEP	NA	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	76 J	400 J	µg/kg	JAX47-SB001	2/4	206 - 360	400	NA	620 C	1,000	FDEP	NA	No	BSL
85-01-8	Phenanthrene	21 J	160 J	µg/kg	JAX47-SB001	2/4	153 - 360	160	NA	230,000 N[10]	22,000	FDEP	NA	No	BSL
129-00-0	Pyrene	120 J	520 J	µg/kg	JAX47-SB001	2/4	159 - 360	520	NA	230,000 N	2,400,000	FDEP	NA	No	BSL
Pesticides/PCBs															
72-54-8	**4,4'-DDD**	0.63 J	17000 J	µg/kg	JAX47-SB096	76/130	0 - 10000	17000	NA	**2,400 C**	**4,200**	FDEP	NA	**Yes**	ASL
72-55-9	**4,4'-DDE**	0.37 J	28000	µg/kg	JX01216	115/130	0.34 - 12.5	28000	NA	**1,700 C**	**2,900**	FDEP	NA	**Yes**	ASL
50-29-3	**4,4'-DDT**	0.33 J	2700000 J	µg/kg	JAX47-SB096	110/130	0.18 - 12.5	2700000	NA	**1,700 C**	**2,900**	FDEP	**750,000** C	**Yes**	ASL
309-00-2	Aldrin	0.31 J	13.9	µg/kg	JAX47-SB029	3/130	0.2 - 5300	13.9	NA	29 C	60	FDEP	3,400 C	No	BSL
319-84-6	alpha-BHC	0.18 J	3.7 J	µg/kg	JAX47-SB096	12/130	0.13 - 5300	3.7	NA	90 C	100	FDEP	750 C	No	BSL
5103-71-9	**alpha-Chlordane**	0.33 J	50000 J	µg/kg	JAX47-SB094	47/130	0.27 - 2300	50000	NA	**1,600 C[11]**	**2,800[11]**	FDEP	72,000 C	**Yes**	ASL
319-85-7	beta-BHC	0.37 J	110 J	µg/kg	JAX47-SB089	23/130	0.34 - 5300	110	NA	320 C	500	FDEP	6,000 C	No	BSL
319-86-8	delta-BHC	0.34 J	82.5	µg/kg	JAX47-SB025	16/130	0.17 - 5300	82.5	NA	90 C[12]	24,000	FDEP	NA	No	BSL
60-57-1	**Dieldrin**	0.29 J	3400	µg/kg	JAX47-SB050, JAX47-SB106	59/130	0.24 - 4400	3400	NA	**30 C**	**60**	FDEP	**1,100** C	**Yes**	ASL
959-98-8	Endosulfan I	7.2	400 J	µg/kg	JAX47-SB094	3/130	0.27 - 5300	400	NA	37,000 N[13]	450,000[13]	FDEP	NA	No	BSL
33213-65-9	Endosulfan II	1.3 J	220 J	µg/kg	JAX47-SB087	7/130	0.23 - 10000	220	NA	37,000 N[13]	450,000[13]	FDEP	NA	No	BSL
1031-07-8	Endosulfan Sulfate	0.33 J	200	µg/kg	JAX47-SB011	23/130	0.27 - 10000	200	NA	37,000 N[13]	450,000[13]	FDEP	NA	No	BSL
72-20-8	Endrin	0.61 J	1400	µg/kg	JAX47-SB094	28/130	0.37 - 10000	1400	NA	1,800 N	25,000	FDEP	NA	No	BSL
7421-93-4	Endrin Aldehyde	0.24 J	130 J	µg/kg	JAX47-SB096	18/130	0.17 - 10000	130	NA	1,800 N[14]	NA	FDEP	NA	No	BSL
53494-70-5	Endrin Ketone	0.31 J	127.9	µg/kg	JAX47-SB024	17/130	0.3 - 10000	127.9	NA	1,800 N[14]	NA	FDEP	NA	No	BSL
58-89-9	gamma-BHC (Lindane)	0.28 J	210	µg/kg	JX01285	13/130	0.17 - 5300	210	NA	440 C	NA	FDEP	NA	No	BSL
5103-74-2	**gamma-Chlordane**	0.34 J	37000	µg/kg	JAX47-SB094	59/130	0.23 - 2300	37000	NA	**1,600 C[11]**	**2,800[11]**	FDEP	72,000 C	**Yes**	ASL

Table 7-3
Occurrence, Distribution, and Selection of COPCs
Surface Soil - Direct Contact Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Location of Maximum Concentration	Detection Frequency(2)	Range of Nondetects(3)	Concentration Used for Screening(4)	Background Value(5)	Risk-Based COPC Screening Level(6)		Potential ARAR/TBC Value	Potential ARAR/TBC Source(7)	USEPA SSL Soil to Air(8)	COPC Flag(9)	Rationale for Contaminant Deletion or Selection
76-44-8	**Heptachlor**	0.24 J	3400 J	µg/kg	JAX47-SB096	23/130	0.23 - 5300	3400	NA	**110**	**C**	**200**	FDEP	4,100 C	**Yes**	ASL
1024-57-3	**Heptachlor Epoxide**	0.82 J	920 J	µg/kg	JAX47-SB094	30/130	0.57 - 5300	920	NA	**53**	**C**	**100**	FDEP	4,700 C	**Yes**	ASL
72-43-5	Methoxychlor	0.45 J	210 J	µg/kg	JAX47-SB096	24/130	0.34 - 53000	210	NA	31,000	N	420,000	FDEP	NA	No	BSL
Inorganics																
7440-38-2	**Arsenic**	0.2	47.4	mg/kg	JAX47-SB103	27/54	0.2 - 2.2	47.4	NA	**0.39**	**C**	**2.1**	FDEP	769 C	**Yes**	ASL

Footnotes
1- Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Sample and duplicate are counted as one sample when determining frequency of detection.
3 - Values presented are sample-specific quantitation limits.
4 - The maximum detected concentration is used for screening purposes.
5 - Value presented is twice the mean concentration.
6 - The risk-based COPC screening level for residential exposures to soil is presented. The value is based on a target Hazard Quotient of 0.1 for non-carcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (USEPA, Region 9, October 2004). The RBCs for non-carcinogenic compounds are divided by 10.
7 - Soil Cleanup Target Levels taken from Table II, FAC 62-777 (FDEP, February 2005).
8 - USEPA Soil Screening Levels. USEPA Internet Site at http://risk.lsd.ornl.gov/calc_start.htm (SSLs for non-carcinogens are divided by 10).
9 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or ARAR/TBC(s) and background levels.
10 - Value is for pyrene.
11 - Value is for chlordane.
12 - Value is for alpha-BHC.
13 - Value is for endosulfan.
14 - Value is for endrin.

Shading indicates that the maximum detected concentration exceeded the screening criteria; therefore, the chemical was retained as a COPC.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value with undetermined bias
N = Non-carcinogen
NA = Not Applicable/Not Available
max = ceiling limit
sat = soil saturation limit
SSL = Soil Screening Level

Rationale Codes:
For selection as a COPC
ASL = Above COPC Screening Level/ARAR/TBC

For elimination as a COPC:
BSL = Below COPC Screening Level/ARAR/TBC

Table 7-4
Occurrence, Distribution, and Selection of COPCs
Surface Soil - Migration to Groundwater

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Nondetects[3]	Concentration Used for Screening[4]	Background Value[5]	USEPA SSL Soil to Groundwater[6]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[7]	COPC Flag[8]	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds														
78-93-3	2-Butanone	12	77	µg/kg	JAX47-SB001	3/4	1.4 - 1.4	77	NA	89000 N	17000	FDEP	No	BSL
67-64-1	Acetone	23.7 J	23.7 J	µg/kg	JAX47-SB118	1/4	6 - 22	23.7	NA	130000 N	25000	FDEP	No	BSL
75-09-2	Methylene Chloride	5.6 J	20 J	µg/kg	JAX47-SB001	4/4	-	20	NA	23 C	20	FDEP	No	BSL
SemivolatileOrganicsCompounds														
	BaP Equivalent	190	640	µg/kg	JAX47-SB001	2/4	127 - 360	640	NA	8200 MCL	8000	FDEP	No	BSL
56-55-3	Benzo(a)anthracene	120 J	230 J	µg/kg	JAX47-SB001	2/4	170 - 360	230	NA	3200 C	800	FDEP	No	BSL
50-32-8	Benzo(a)pyrene	130 J	380 J	µg/kg	JAX47-SB001	2/4	127 - 360	380	NA	8200 MCL	8000	FDEP	No	BSL
205-99-2	Benzo(b)fluoranthene	120 J	560 J	µg/kg	JAX47-SB001	2/4	120 - 360	560	NA	9800 C	2400	FDEP	No	BSL
191-24-2	Benzo(g,h,i)perylene	67 J	420 J	µg/kg	JAX47-SB001	2/4	152 - 360	420	NA	NA	32000000	FDEP	No	BSL
207-08-9	Benzo(k)fluoranthene	140 J	410 J	µg/kg	JAX47-SB001	2/4	145 - 360	410	NA	9800 C	24000	FDEP	No	BSL
117-81-7	Bis(2-ethylhexyl)phthalate	130 J	1400	µg/kg	JAX47-SB001	2/4	221 - 360	1400	NA	3600000 MCL	3600000	FDEP	No	BSL
85-68-7	Butyl Benzyl Phthalate	35 J	360 J	µg/kg	JAX47-SB001	2/4	137 - 360	360	NA	17000000 N	310000	FDEP	No	BSL
218-01-9	Chrysene	150 J	480 J	µg/kg	JAX47-SB001	2/4	148 - 360	480	NA	3200 C	77000	FDEP	No	BSL
53-70-3	Dibenzo(a,h)anthracene	28 J	140 J	µg/kg	JAX47-SB001	2/4	210 - 360	140	NA	30000 C	700	FDEP	No	BSL
131-11-3	Dimethyl Phthalate	340 J	340 J	µg/kg	JAX47-SB001	1/4	123 - 430	340	NA	NA	380000	FDEP	No	BSL
206-44-0	Fluoranthene	93 J	530 J	µg/kg	JAX47-SB001	2/4	153 - 360	530	NA	6300000 N	1200000	FDEP	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	76 J	400 J	µg/kg	JAX47-SB001	2/4	206 - 360	400	NA	28000 C	6600	FDEP	No	BSL
85-01-8	Phenanthrene	21 J	160 J	µg/kg	JAX47-SB001	2/4	153 - 360	160	NA	NA	250000	FDEP	No	BSL
129-00-0	Pyrene	120 J	520 J	µg/kg	JAX47-SB001	2/4	159 - 360	520	NA	4600000 N	880000	FDEP	No	BSL
Pesticides/PCBs														
72-54-8	**4,4'-DDD**	0.63 J	17000 J	µg/kg	JAX47-SB096	76/130	0 - 10000	17000	NA	**14000 C**	**5800**	FDEP	**Yes**	ASL
72-55-9	**4,4'-DDE**	0.37 J	28000	µg/kg	JX01216	115/130	0.34 - 12.5	28000	NA	45000 C	**18000**	FDEP	**Yes**	ASL
50-29-3	**4,4'-DDT**	0.33 J	2700000 J	µg/kg	JAX47-SB096	110/130	0.18 - 12.5	2700000	NA	**26000 C**	**11000**	FDEP	**Yes**	ASL
309-00-2	Aldrin	0.31 J	13.9	µg/kg	JAX47-SB029	3/130	0.2 - 5300	13.9	NA	500 C	200	FDEP	No	BSL
319-84-6	**alpha-BHC**	0.18 J	3.7 J	µg/kg	JAX47-SB096	12/130	0.13 - 5300	3.7	NA	**0.72 C**	**0.3**	FDEP	**Yes**	ASL
5103-71-9	**alpha-Chlordane**	0.33 J	50000 J	µg/kg	JAX47-SB094	47/130	0.27 - 2300	50000	NA	**9600[9] MCL**	**9600[9]**	FDEP	**Yes**	ASL
319-85-7	**beta-BHC**	0.37 J	110 J	µg/kg	JAX47-SB089	23/130	0.34 - 5300	110	NA	**2.6 C**	**1**	FDEP	**Yes**	ASL
319-86-8	delta-BHC	0.34 J	82.5	µg/kg	JAX47-SB025	16/130	0.17 - 5300	82.5	NA	NA	200	FDEP	No	BSL
60-57-1	**Dieldrin**	0.29 J	3400	µg/kg	47-SB050, JAX47-S	59/130	0.24 - 4400	3400	NA	**4.6 C**	**2**	FDEP	**Yes**	ASL
959-98-8	Endosulfan I	7.2	400 J	µg/kg	JAX47-SB094	3/130	0.27 - 5300	400	NA	NA	3,800	FDEP	No	BSL
33213-65-9	Endosulfan II	1.3 J	220 J	µg/kg	JAX47-SB087	7/130	0.23 - 10000	220	NA	NA	3,800	FDEP	No	BSL
1031-07-8	Endosulfan Sulfate	0.33 J	200	µg/kg	JAX47-SB011	23/130	0.27 - 10000	200	NA	NA	3,800	FDEP	No	BSL
72-20-8	**Endrin**	0.61 J	1400	µg/kg	JAX47-SB094	28/130	0.37 - 10000	1400	NA	**990 MCL**	**1000**	FDEP	**Yes**	ASL
7421-93-4	Endrin Aldehyde	0.24 J	130 J	µg/kg	JAX47-SB096	18/130	0.17 - 10000	130	NA	NA	NA	FDEP	No	NTX
53494-70-5	Endrin Ketone	0.31 J	127.9	µg/kg	JAX47-SB024	17/130	0.3 - 10000	127.9	NA	NA	NA	FDEP	No	NTX
58-89-9	**gamma-BHC (Lindane)**	0.28 J	210	µg/kg	JX01285	13/130	0.17 - 5300	210	NA	**9.4 MCL**	**9**	FDEP	**Yes**	ASL
5103-74-2	**gamma-Chlordane**	0.34 J	37000	µg/kg	JAX47-SB094	59/130	0.23 - 2300	37000	NA	**9600[9] MCL**	**9600[9]**	FDEP	**Yes**	ASL
76-44-8	Heptachlor	0.24 J	3400 J	µg/kg	JAX47-SB096	23/130	0.23 - 5300	3400	NA	23000 MCL	23000	FDEP	No	BSL
1024-57-3	**Heptachlor Epoxide**	0.82 J	920 J	µg/kg	JAX47-SB094	30/130	0.57 - 5300	920	NA	**670 MCL**	**600**	FDEP	**Yes**	ASL
72-43-5	Methoxychlor	0.45 J	210 J	µg/kg	JAX47-SB096	24/130	0.34 - 53000	210	NA	160000 MCL	160000	FDEP	No	BSL
Inorganics														
7440-38-2	**Arsenic**	0.2	47.4	mg/kg	JAX47-SB103	27/54	0.2 - 2.2	47.4	1.48	**5.8 MCL**	NA	FDEP	**Yes**	ASL

Table 7-4
Occurrence, Distribution, and Selection of COPCs
Surface Soil - Migration to Groundwater

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Footnotes
1- Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Sample and duplicate are counted as one sample when determining frequency of detection.
3 - Values presented are sample-specific quantitation limits.
4 - The maximum detected concentration is used for screening purposes.
5 - Value presented is twice the mean concentration.
6 - USEPA Soil Screening Levels. USEPA Internet Site at http://risk.lsd.ornl.gov/calc_start.htm (SSLs for non-carcinogens are divided by 10).
7 - Soil Cleanup Target Levels taken from Table II, FAC 62-777.
8 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or ARAR/TBC(s) and background levels.
9 - Value is for chlordane.

Shading indicates that the maximum detected concentration exceeded the screening criteria; therefore, the chemical was retained as a COPC.

Rationale Codes:
For selection as a COPC
ASL = Above COPC Screening Level/ARAR/TBC

For elimination as a COPC:
BSL = Below COPC Screening Level/ARAR/TBC
NTX = No toxicity criteria

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value with undetermined bias

Definitions Continued:
MCL = Maximum Contaminant Level
N = Non-carcinogen
NA = Not Applicable/Not Available
SSL = Soil Screening Level

Table 7-5
Occurrence, Distribution, and Selection of COPCs
Subsurface Soil - Direct Contact Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Nondetects[3]	Concentration Used for Screening[4]	Background Value[5]	Risk-Based COPC Screening Level[6]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[7]	USEPA SSL Soil to Air[8]	COPC Flag[9]	Rationale for Contaminant Deletion or Selection
Volatile Organics Compounds															
78-93-3	2-Butanone	43	43	µg/kg	JAX47-SB010	1/2	1.3 - 1.3	43	NA	2,200,000 N	16,000,000	FDEP	24,000,000 sat	No	BSL
67-64-1	Acetone	43	43.2 J	µg/kg	JAX47-SB118	2/2	-	43.2	NA	1,400,000 N	11,000,000	FDEP	NA	No	BSL
75-09-2	Methylene Chloride	5.1 J	8	µg/kg	JAX47-SB010	2/2	-	8	NA	9,100 C	17,000	FDEP	13,000 C	No	BSL
108-88-3	Toluene	6 J	6 J	µg/kg	JAX47-SB010	1/2	0.2 - 0.2	6	NA	520,000 sat	7,500,000	FDEP	650,000 sat	No	BSL
Semivolatile Organics Compounds															
CALC013	**BaP Equivalent**	410	410	µg/kg	JAX47-SB010	1/2	134 - 134	410	NA	**62 C**	**100**	FDEP	NA	**Yes**	ASL
56-55-3	Benzo(a)anthracene	86 J	86 J	µg/kg	JAX47-SB010	1/2	180 - 180	86	NA	620 C	1,000	FDEP	NA	No	BSL
50-32-8	**Benzo(a)pyrene**	120 J	120 J	µg/kg	JAX47-SB010	1/2	134 - 134	120	NA	**62 C**	**100**	FDEP	NA	**Yes**	ASL
205-99-2	Benzo(b)fluoranthene	180 J	180 J	µg/kg	JAX47-SB010	1/2	126 - 126	180	NA	620 C	1,000	FDEP	NA	No	BSL
191-24-2	Benzo(g,h,i)perylene	110 J	110 J	µg/kg	JAX47-SB010	1/2	160 - 160	110	NA	230,000 N[10]	2,500,000	FDEP	NA	No	BSL
207-08-9	Benzo(k)fluoranthene	120 J	120 J	µg/kg	JAX47-SB010	1/2	153 - 153	120	NA	6,200 C	10,000	FDEP	NA	No	BSL
117-81-7	Bis(2-ethylhexyl)phthalate	88 J	88 J	µg/kg	JAX47-SB010	1/2	233 - 233	88	NA	35,000 C	72,000	FDEP	NA	No	BSL
218-01-9	Chrysene	170 J	170 J	µg/kg	JAX47-SB010	1/2	156 - 156	170	NA	62,000 C	100,000	FDEP	NA	No	BSL
206-44-0	Fluoranthene	190 J	190 J	µg/kg	JAX47-SB010	1/2	161 - 161	190	NA	230,000 N	3,200,000	FDEP	NA	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	120 J	120 J	µg/kg	JAX47-SB010	1/2	218 - 218	120	NA	620 C	1,000	FDEP	NA	No	BSL
85-01-8	Phenanthrene	49 J	49 J	µg/kg	JAX47-SB010	1/2	161 - 161	49	NA	230,000 N[10]	22,000	FDEP	NA	No	BSL
129-00-0	Pyrene	210 J	210 J	µg/kg	JAX47-SB010	1/2	168 - 168	210	NA	230,000 N	2,400,000	FDEP	NA	No	BSL
Pesticides/PCBs															
72-54-8	**4,4'-DDD**	0.67 J	220000	µg/kg	JX01296	30/62	0.31 - 5	220000	NA	**2,400 C**	**4,200**	FDEP	NA	**Yes**	ASL
72-55-9	**4,4'-DDE**	0.54 J	25000	µg/kg	JX01266	44/62	0.34 - 5	25000	NA	**1,700 C**	**2,900**	FDEP	NA	**Yes**	ASL
50-29-3	**4,4'-DDT**	0.38 J	420000	µg/kg	JX01266	46/62	0.15 - 5	420000	NA	**1,700 C**	**2,900**	FDEP	750,000 C	**Yes**	ASL
309-00-2	Aldrin	0.24 J	0.24 J	µg/kg	JAX47-SB094	1/62	0.2 - 260	0.24	NA	29 C	60	FDEP	3,400 C	No	BSL
319-84-6	**alpha-BHC**	0.4 J	2500	µg/kg	JX01247	8/62	0.14 - 260	2500	NA	**90 C**	**100**	FDEP	**750** C	**Yes**	ASL
5103-71-9	**alpha-Chlordane**	0.32 J	37000	µg/kg	JX01296	27/62	0.27 - 5	37000	NA	**1,600 C[11]**	**2,800[11]**	FDEP	72,000 C	**Yes**	ASL
319-85-7	**beta-BHC**	0.44 J	4200	µg/kg	JX01247	17/62	0.34 - 260	4200	NA	**320 C**	**500**	FDEP	6,000 C	**Yes**	ASL
319-86-8	**delta-BHC**	0.22 J	30000	µg/kg	JX01247	16/62	0.17 - 260	30000	NA	**90 C[12]**	**24,000**	FDEP	NA	**Yes**	ASL
60-57-1	**Dieldrin**	0.26 J	9000	µg/kg	JX01296	27/62	0.24 - 500	9000	NA	**30 C**	**60**	FDEP	**1,100** C	**Yes**	ASL
959-98-8	Endosulfan I	0.32 J	0.4 J	µg/kg	JAX47-SB080	3/62	0.27 - 260	0.4	NA	37,000 N[13]	450,000[13]	FDEP	NA	No	BSL
33213-65-9	Endosulfan II	0.31 J	39 J	µg/kg	JAX47-SB087	6/62	0.24 - 500	39	NA	37,000 N[13]	450,000[13]	FDEP	NA	No	BSL
1031-07-8	Endosulfan Sulfate	0.42 J	7.2 J	µg/kg	JAX47-SB110	2/62	0.27 - 500	7.2	NA	37,000 N[13]	450,000[13]	FDEP	NA	No	BSL
72-20-8	Endrin	0.64 J	49 J	µg/kg	JAX47-SB110	6/62	0.37 - 500	49	NA	1,800 N	25,000	FDEP	NA	No	BSL
7421-93-4	Endrin Aldehyde	0.17 J	0.76 J	µg/kg	JAX47-SB079	5/62	0.17 - 500	0.76	NA	1,800 N[14]	NA	FDEP	NA	No	BSL
53494-70-5	Endrin Ketone	0.42 J	20.5	µg/kg	JAX47-SB010	6/62	0.31 - 500	20.5	NA	1,800 N[14]	NA	FDEP	NA	No	BSL
58-89-9	**gamma-BHC (Lindane)**	0.32 J	4000	µg/kg	JX01247	9/62	0.17 - 260	4000	NA	**440 C**		FDEP	NA	**Yes**	ASL
5103-74-2	**gamma-Chlordane**	0.26 J	47000	µg/kg	JX01296	30/62	0.24 - 260	47000	NA	**1,600 C[11]**	**2,800[11]**	FDEP	72,000 C	**Yes**	ASL
76-44-8	**Heptachlor**	0.29 J	190 J	µg/kg	JAX47-SB110	5/62	0.24 - 260	190	NA	**110 C**	200	FDEP	4,100 C	**Yes**	ASL
1024-57-3	**Heptachlor Epoxide**	0.98 J	280 J	µg/kg	JAX47-SB110	10/62	0.58 - 260	280	NA	**53 C**	**100**	FDEP	4,700 C	**Yes**	ASL
72-43-5	Methoxychlor	0.49 J	13.5	µg/kg	JAX47-SB010	4/62	0.34 - 2600	13.5	NA	31,000 N	420,000	FDEP	NA	No	BSL
Inorganics															
7440-38-2	**Arsenic**	0.2	132	mg/kg	JAX47-SB105	24/56	0.2 - 1.1	132	NA	**0.39 C**	**2.1**	FDEP	769 C	**Yes**	ASL

Table 7-5
Occurrence, Distribution, and Selection of COPCs
Subsurface Soil - Direct Contact Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Footnotes
1- Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Sample and duplicate are counted as one sample when determining frequency of detection.
3 - Values presented are sample-specific quantitation limits.
4 - The maximum detected concentration is used for screening purposes.
5 - Value presented is twice the mean concentration.
6 - The risk-based COPC screening level for residential exposures to soil is presented. The value is based on a target Hazard Quotient of 0.1 for non-carcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (USEPA, Region 9, October 2004). The RBCs for non-carcinogenic compounds are divided by 10.
7 - Soil Cleanup Target Levels taken from Table II, FAC 62-777 (FDEP, February 2005).
8 - USEPA Soil Screening Levels. USEPA Internet Site at http://risk.lsd.ornl.gov/calc_start.htm (SSLs for non-carcinogens are divided by 10).
9 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or ARAR/TBC(s) and background levels.
10 - Value is for pyrene.
11 - Value is for chlordane.
12 - Value is for alpha-BHC.
13 - Value is for endosulfan.
14 - Value is for endrin.

Shading indicates that the maximum detected concentration exceeded the screening criteria; therefore, the chemical was retained as a COPC.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value with undetermined bias
N = Non-carcinogen
NA = Not Applicable/Not Available
max = ceiling limit
sat = soil saturation limit
SSL = Soil Screening Level

Rationale Codes:
For selection as a COPC
ASL = Above COPC Screening Level/ARAR/TBC

For elimination as a COPC:
BSL = Below COPC Screening Level/ARAR/TBC

Table 7-6
Occurrence, Distribution, and Selection of COPCs
Subsurface Soil - Migration to Groundwater

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Nondetects[3]	Concentration Used for Screening[4]	Background Value[5]	USEPA SSL Soil to Groundwater[6]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[7]	COPC Flag[8]	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds														
78-93-3	2-Butanone	43	43	µg/kg	JAX47-SB010	1/2	1.3 - 1.3	43	NA	89000 N	17000	FDEP	No	BSL
67-64-1	Acetone	43	43.2 J	µg/kg	JAX47-SB118	2/2	-	43.2	NA	130000 N	25000	FDEP	No	BSL
75-09-2	Methylene Chloride	5.1 J	8	µg/kg	JAX47-SB010	2/2	-	8	NA	23 C	20	FDEP	No	BSL
108-88-3	Toluene	6 J	6 J	µg/kg	JAX47-SB010	1/2	0.2 - 0.2	6	NA	12000 MCL	500	FDEP	No	BSL
Semivolatile Organics Compounds														
	BaP Equivalent	410	410	µg/kg	JAX47-SB010	1/2	134 - 134	410	NA	8200 MCL	8000	FDEP	No	BSL
56-55-3	Benzo(a)anthracene	86 J	86 J	µg/kg	JAX47-SB010	1/2	180 - 180	86	NA	3200 C	800	FDEP	No	BSL
50-32-8	Benzo(a)pyrene	120 J	120 J	µg/kg	JAX47-SB010	1/2	134 - 134	120	NA	8200 MCL	8000	FDEP	No	BSL
205-99-2	Benzo(b)fluoranthene	180 J	180 J	µg/kg	JAX47-SB010	1/2	126 - 126	180	NA	9800 C	2400	FDEP	No	BSL
191-24-2	Benzo(g,h,i)perylene	110 J	110 J	µg/kg	JAX47-SB010	1/2	160 - 160	110	NA	NA	32000000	FDEP	No	BSL
207-08-9	Benzo(k)fluoranthene	120 J	120 J	µg/kg	JAX47-SB010	1/2	153 - 153	120	NA	9800 C	24000	FDEP	No	BSL
117-81-7	Bis(2-ethylhexyl)phthalate	88 J	88 J	µg/kg	JAX47-SB010	1/2	233 - 233	88	NA	3600000 MCL	3600000	FDEP	No	BSL
218-01-9	Chrysene	170 J	170 J	µg/kg	JAX47-SB010	1/2	156 - 156	170	NA	3200 C	77000	FDEP	No	BSL
206-44-0	Fluoranthene	190 J	190 J	µg/kg	JAX47-SB010	1/2	161 - 161	190	NA	6300000 N	1200000	FDEP	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	120 J	120 J	µg/kg	JAX47-SB010	1/2	218 - 218	120	NA	28000 C	6600	FDEP	No	BSL
85-01-8	Phenanthrene	49 J	49 J	µg/kg	JAX47-SB010	1/2	161 - 161	49	NA	NA	250000	FDEP	No	BSL
129-00-0	Pyrene	210 J	210 J	µg/kg	JAX47-SB010	1/2	168 - 168	210	NA	4600000 N	880000	FDEP	No	BSL
Pesticides/PCBs														
72-54-8	**4,4'-DDD**	0.67 J	220000	µg/kg	JX01296	30/62	0.31 - 5	220000	NA	**14000 C**	**5800**	FDEP	**Yes**	ASL
72-55-9	**4,4'-DDE**	0.54 J	25000	µg/kg	JX01266	44/62	0.34 - 5	25000	NA	45000 C	**18000**	FDEP	**Yes**	ASL
50-29-3	**4,4'-DDT**	0.38 J	420000	µg/kg	JX01266	46/62	0.15 - 5	420000	NA	**26000 C**	**11000**	FDEP	**Yes**	ASL
309-00-2	Aldrin	0.24 J	0.24 J	µg/kg	JAX47-SB094	1/62	0.2 - 260	0.24	NA	500 C	200	FDEP	No	BSL
319-84-6	**alpha-BHC**	0.4 J	2500	µg/kg	JX01247	8/62	0.14 - 260	2500	NA	**0.72 C**	**0.3**	FDEP	**Yes**	ASL
5103-71-9	**alpha-Chlordane**	0.32 J	37000	µg/kg	JX01296	27/62	0.27 - 5	37000	NA	**9600[9] MCL**	**9600[9]**	FDEP	**Yes**	ASL
319-85-7	**beta-BHC**	0.44 J	4200	µg/kg	JX01247	17/62	0.34 - 260	4200	NA	**2.6 C**	**1**	FDEP	**Yes**	ASL
319-86-8	**delta-BHC**	0.22 J	30000	µg/kg	JX01247	16/62	0.17 - 260	30000	NA	NA	**200**	FDEP	**Yes**	ASL
60-57-1	**Dieldrin**	0.26 J	9000	µg/kg	JX01296	27/62	0.24 - 500	9000	NA	**4.6 C**	**2**	FDEP	**Yes**	ASL
959-98-8	Endosulfan I	0.32 J	0.4 J	µg/kg	JAX47-SB080	3/62	0.27 - 260	0.4	NA	NA	3,800	FDEP	No	BSL
33213-65-9	Endosulfan II	0.31 J	39 J	µg/kg	JAX47-SB087	6/62	0.24 - 500	39	NA	NA	3,800	FDEP	No	BSL
1031-07-8	Endosulfan Sulfate	0.42 J	7.2 J	µg/kg	JAX47-SB110	2/62	0.27 - 500	7.2	NA	NA	3,800	FDEP	No	BSL
72-20-8	Endrin	0.64 J	49 J	µg/kg	JAX47-SB110	6/62	0.37 - 500	49	NA	990 MCL	1000	FDEP	No	BSL
7421-93-4	Endrin Aldehyde	0.17 J	0.76 J	µg/kg	JAX47-SB079	5/62	0.17 - 500	0.76	NA	NA	NA	FDEP	No	NTX
53494-70-5	Endrin Ketone	0.42 J	20.5	µg/kg	JAX47-SB010	6/62	0.31 - 500	20.5	NA	NA	NA	FDEP	No	NTX
58-89-9	**gamma-BHC (Lindane)**	0.32 J	4000	µg/kg	JX01247	9/62	0.17 - 260	4000	NA	**9.4 MCL**	**9**	FDEP	**Yes**	ASL
5103-74-2	**gamma-Chlordane**	0.26 J	47000	µg/kg	JX01296	30/62	0.24 - 260	47000	NA	**9600[9] MCL**	**9600[9]**	FDEP	**Yes**	ASL
76-44-8	Heptachlor	0.29 J	190 J	µg/kg	JAX47-SB110	5/62	0.24 - 260	190	NA	23000 MCL	23000	FDEP	No	BSL
1024-57-3	Heptachlor Epoxide	0.98 J	280 J	µg/kg	JAX47-SB110	10/62	0.58 - 260	280	NA	670 MCL	600	FDEP	No	BSL
72-43-5	Methoxychlor	0.49 J	13.5	µg/kg	JAX47-SB010	4/62	0.34 - 2600	13.5	NA	160000 MCL	160000	FDEP	No	BSL
Inorganics														
7440-38-2	**Arsenic**	0.2	132	mg/kg	JAX47-SB105	24/56	0.2 - 1.1	132	NA	**5.8 MCL**	NA	FDEP	**Yes**	ASL

Table 7-6
Occurrence, Distribution, and Selection of COPCs
Subsurface Soil - Migration to Groundwater

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Footnotes
1- Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Sample and duplicate are counted as one sample when determining frequency of detection.
3 - Values presented are sample-specific quantitation limits.
4 - The maximum detected concentration is used for screening purposes.
5 - Value presented is twice the mean concentration.
6 - USEPA Soil Screening Levels. USEPA Internet Site at http://risk.lsd.ornl.gov/calc_start.htm (SSLs for non-carcinogens are divided by 10).
7 - Soil Cleanup Target Levels taken from Table II, FAC 62-777.
8 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or ARAR/TBC(s) and background levels.
Shading indicates that the maximum detected concentration exceeded the screening criteria; therefore, the chemical was retained as a COPC.
9 - Value is for chlordane.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value with undetermined bias
Definitions Continued:
MCL = Maximum Contaminant Level
N = Non-carcinogen
NA = Not Applicable/Not Available
SSL = Soil Screening Level

Rationale Codes:
For selection as a COPC
ASL = Above COPC Screening Level/ARAR/TBC

For elimination as a COPC:
BKG = Within background levels
BSL = Below COPC Screening Level/ARAR/TBC
NTX = No toxicity criteria

Table 7-7
Occurrence, Distribution, and Selection of COPCs
Groundwater-Direct Contact Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Nondetects[3]	Concentration Used for Screening[4]	Background Value[5]	Risk-Based COPC Screening Level[6]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[7]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[8]	COPC Flag[9]	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds																
75-35-4	1,1-Dichloroethene	0.4 J	0.7 J	µg/L	JAX47-937-MW03S, JAX47-937-MW04S	4/34	0.2 - 0.2	0.7	NA	34 N	7	FDEP	7	NA	No	BSL
120-82-1	**1,2,4-Trichlorobenzene**	1.8	8.6	µg/L	JAX47-MW13S	4/34	0.1 - 0.9	8.6	NA	**0.72 N**	70	FDEP	70	MCL	**Yes**	ASL
96-12-8	**1,2-Dibromo-3-Chloropropane**	2.7	2.7	µg/L	JAX47-937-MW02S	1/34	0.3 - 0.3	2.7	NA	**0.0035 N**	200	FDEP	NA	MCL	**Yes**	ASL
95-50-1	1,2-Dichlorobenzene	0.3 J	4.4 J	µg/L	JAX47-MW13S	4/34	0.2 - 0.2	4.4	NA	37 N	600	FDEP	600	MCL	No	BSL
541-73-1	1,3-Dichlorobenzene	0.6 J	2 J	µg/L	JAX47-MW13S	2/34	0.2 - 0.2	2	NA	18 N	210	FDEP	NA	NA	No	BSL
106-46-7	**1,4-Dichlorobenzene**	0.4 J	6.3 J	µg/L	JAX47-MW13S	4/34	0.1 - 0.1	6.3	NA	**0.5 C**	75	FDEP	75	MCL	**Yes**	ASL
78-93-3	2-Butanone	4.06 J	4.06 J	µg/L	JAX47-MW30S	1/34	2 - 2	4.06	NA	700 N	4200	FDEP	NA	NA	No	BSL
71-43-2	**Benzene**	0.22 J	14.6	µg/L	JAX47-937-MW05S	14/34	0.2 - 0.2	14.6	NA	**0.35 C**	**1**	FDEP	**5**	MCL	**Yes**	ASL
75-25-2	Bromoform	1.5 J	1.5 J	µg/L	JAX47-937-MW02S	1/34	0.2 - 0.2	1.5	NA	8.5 C	4.4	FDEP	80	NA	No	BSL
108-90-7	**Chlorobenzene**	0.2 J	12.7	µg/L	JAX47-MW11S	10/34	0.2 - 0.2	12.7	NA	**11 N**	100	FDEP	100	NA	**Yes**	ASL
75-00-3	Chloroethane	1	1	µg/L	JAX47-937-MW02S	1/34	0.3 - 0.3	1	NA	4.6 C	12	FDEP	NA	NA	No	BSL
67-66-3	**Chloroform**	0.37 J	0.37 J	µg/L	JAX47-MW30S	1/34	0.2 - 0.2	0.37	NA	**0.017 N**	70	FDEP	80	MCL	**Yes**	ASL
156-59-2	**cis-1,2-Dichloroethene**	0.5 J	936	µg/L	JAX47-937-MW05S	15/34	0.2 - 0.2	936	NA	**6.1 N**	**70**	FDEP	**70**	MCL	**Yes**	ASL
110-82-7	Cyclohexane	1.5	38.3	µg/L	JAX47-MW11S	2/34	0.4 - 0.45	38.3	NA	1000 N	NA	FDEP	NA	NA	No	BSL
60-29-7	Diethyl Ether	0.8 J	0.9 J	µg/L	JAX47-937-MW05S	2/34	0.5 - 0.54	0.9	NA	120 N	750	FDEP	NA	NA	No	BSL
100-41-4	**Ethylbenzene**	0.5 J	135	µg/L	JAX47-937-MW05S	8/34	0.3 - 0.3	135	NA	**130 N**	**30**	FDEP	700	MCL	**Yes**	ASL
98-82-8	**Isopropylbenzene**	0.3 J	9	µg/L	JAX47-MW11S	10/34	0.1 - 0.1	9	NA	66 N	**0.8**	FDEP	NA	NA	**Yes**	ASL
108-87-2	Methyl Cyclohexane	0.7 J	22.7 J	µg/L	JAX47-MW11S	3/34	0.55 - 0.6	22.7	NA	520 N	NA	FDEP	NA	NA	No	BSL
1634-04-4	Methyl Tert-Butyl Ether	0.2 J	0.2 J	µg/L	JAX47-937-MW01S	1/34	0.2 - 0.2	0.2	NA	11 C	20	FDEP	NA	NA	No	BSL
100-42-5	Styrene	0.75 J	1.7	µg/L	JAX47-937-MW02S	2/34	0.1 - 0.1	1.7	NA	160 N	100	FDEP	100	MCL	No	BSL
127-18-4	**Tetrachloroethene**	0.9 J	4 J	µg/L	JAX47-937-MW04S	7/34	0.3 - 0.3	4	NA	**0.1 C**	**3**	FDEP	5	MCL	**Yes**	ASL
108-88-3	Toluene	0.6 J	21.9 J	µg/L	JAX47-937-MW05S	5/34	0.2 - 0.51	21.9	NA	72 N	40	FDEP	1000	MCL	No	BSL
1330-20-7	**Total Xylenes**	0.6 J	914	µg/L	JAX47-937-MW05S	8/34	0.3 - 0.43	914	NA	**21 N**	**20**	FDEP	10000	MCL	**Yes**	ASL
156-60-5	**trans-1,2-Dichloroethene**	0.5 J	4.5	µg/L	JAX47-937-MW04S	6/34	0.2 - 0.2	4.5	NA	12 N	**1**	FDEP	100	MCL	**Yes**	ASL
79-01-6	**Trichloroethene**	0.3 J	7.7	µg/L	JAX47-937-MW04S	11/34	0.3 - 0.3	7.7	NA	**0.028 C**	**3**	FDEP	**5**	MCL	**Yes**	ASL
75-01-4	**Vinyl Chloride**	0.4 J	5.5	µg/L	JAX47-937-MW05S	6/34	0.4 - 0.4	5.5	NA	**0.02 C**	**1**	FDEP	**2**	MCL	**Yes**	ASL
Semivolatile Organic Compounds																
92-52-4	**1,1-Biphenyl**	5 J	8 J	µg/L	JAX47-MW11S	2/34	3 - 3	8	NA	30 N	**0.5**	FDEP	NA	NA	**Yes**	ASL
95-95-4	**2,4,5-Trichlorophenol**	104	2720	µg/L	JAX47-937-MW03S	2/34	2 - 2	2720	NA	**360 N**	**1**	FDEP	NA	NA	**Yes**	ASL
120-83-2	**2,4-Dichlorophenol**	6 J	529	µg/L	JAX47-937-MW03S	3/34	2 - 2	529	NA	**11 N**	**0.3**	FDEP	NA	NA	**Yes**	ASL
105-67-9	2,4-Dimethylphenol	16	16	µg/L	JAX47-937-MW05S	1/34	2 - 2	16	NA	73 N	28	FDEP	NA	NA	No	BSL
91-57-6	**2-Methylnaphthalene**	10 J	103	µg/L	JAX47-MW11S	3/34	2 - 2	103	NA	**0.62 N**	**28**	FDEP	NA	NA	**Yes**	ASL
95-48-7	2-Methylphenol	6 J	6 J	µg/L	JAX47-937-MW05S	1/34	2 - 2	6	NA	180 N	35	FDEP	NA	NA	No	BSL
84-66-2	Diethyl Phthalate	9 J	9 J	µg/L	JAX47-MW29S	1/34	2 - 2	9	NA	2900 N	5600	FDEP	NA	NA	No	BSL
91-20-3	**Naphthalene**	14	194	µg/L	JAX47-MW11S	4/34	3 - 3	194	NA	**0.62 N**	**14**	FDEP	NA	NA	**Yes**	ASL
87-86-5	**Pentachlorophenol**	11	12 J	µg/L	JAX47-937-MW04S	2/34	1 - 1	12	NA	**0.56 C**	**1**	FDEP	**1**	NA	**Yes**	ASL

Table 7-7
Occurrence, Distribution, and Selection of COPCs
Groundwater-Direct Contact Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Location of Maximum Concentration	Detection Frequency(2)	Range of Nondetects(3)	Concentration Used for Screening(4)	Background Value(5)	Risk-Based COPC Screening Level(6)	Potential ARAR/TBC Value	Potential ARAR/TBC Source(7)	Potential ARAR/TBC Value	Potential ARAR/TBC Source(8)	COPC Flag(9)	Rationale for Contaminant Deletion or Selection
Pesticides/PCBs																
72-54-8	**4,4'-DDD**	0.001 J	25 J	µg/L	JAX47-MW17S	10/34	0.0004 - 0.0004	25	NA	**0.28 C**	**0.1**	FDEP	NA	NA	**Yes**	ASL
72-55-9	**4,4'-DDE**	0.002 J	0.13 J	µg/L	JAX47-937-MW05S	11/34	0.002 - 0.002	0.13	NA	0.2 C	**0.1**	FDEP	NA	NA	**Yes**	ASL
50-29-3	**4,4'-DDT**	0.002 J	0.49	µg/L	JAX47-MW13S	8/34	0.002 - 0.003	0.49	NA	**0.2 C**	**0.1**	FDEP	NA	NA	**Yes**	ASL
309-00-2	**Aldrin**	0.01 J	3.8 J	µg/L	JAX47-937-MW05S	7/34	0.002 - 0.002	3.8	NA	**0.004 C**	**0.002**	FDEP	NA	NA	**Yes**	ASL
319-84-6	**alpha-BHC**	0.003 J	9.3	µg/L	JAX47-MW11S	9/34	0.001 - 0.002	9.3	NA	**0.011 C**	**0.006**	FDEP	NA	MCL	**Yes**	ASL
5103-71-9	**alpha-Chlordane**	0.002 J	1.8	µg/L	JAX47-MW17S	12/34	0.001 - 0.001	1.8	NA	**0.19 C(10)**	2	FDEP	2	NA	**Yes**	ASL
319-85-7	**beta-BHC**	0.003 J	3.9 J	µg/L	JAX47-937-MW04S	12/34	0.002 - 0.002	3.9	NA	**0.037 C**	**0.02**	FDEP	NA	NA	**Yes**	ASL
319-86-8	**delta-BHC**	0.002 J	8.3	µg/L	JAX47-MW11S	15/34	0.001 - 0.062	8.3	NA	**0.011 C(11)**	**2.1**	FDEP	NA	NA	**Yes**	ASL
60-57-1	**Dieldrin**	0.003 J	0.32 J	µg/L	JAX47-937-MW03S	14/34	0.0008 - 0.0008	0.32	NA	**0.0042 C**	**0.002**	FDEP	NA	MCL	**Yes**	ASL
959-98-8	Endosulfan I	0.011 J	0.077	µg/L	JAX47-MW17S	3/34	0.002 - 0.002	0.077	NA	22 N(12)	42(12)	FDEP	NA	NA	No	BSL
33213-65-9	Endosulfan II	0.003 J	0.039 J	µg/L	JAX47-MW30S	8/34	0.002 - 0.002	0.039	NA	22 N(12)	42(12)	FDEP	NA	NA	No	BSL
1031-07-8	Endosulfan Sulfate	0.005 J	0.21 J	µg/L	JAX47-937-MW05S	10/34	0.002 - 0.002	0.21	NA	22 N(12)	42(12)	FDEP	NA	NA	No	BSL
72-20-8	Endrin	0.002 J	0.044 J	µg/L	JAX47-937-MW05S	6/34	0.002 - 0.003	0.044	NA	1.1 N	2	FDEP	2	MCL	No	BSL
7421-93-4	Endrin Aldehyde	0.011 J	0.021 J	µg/L	JAX47-MW13S	1/34	0.009 - 0.009	0.021	NA	1.1 N(13)	2(13)	FDEP	NA	MCL	No	BSL
53494-70-5	**Endrin Ketone**	0.004 J	4.7 J	µg/L	JAX47-937-MW02S	11/34	0.003 - 0.003	4.7	NA	**1.1 N(13)**	**2(13)**	FDEP	NA	NA	**Yes**	ASL
58-89-9	**gamma-BHC (Lindane)**	0.002 J	15	µg/L	JAX47-MW11S	10/34	0.002 - 0.002	15	NA	**0.052 C**	**0.2**	FDEP	**0.2**	NA	**Yes**	ASL
5103-74-2	**gamma-Chlordane**	0.016 J	1.1	µg/L	JAX47-MW17S	9/34	0.001 - 0.001	1.1	NA	**0.19 C(10)**	2	FDEP	2	NA	**Yes**	ASL
76-44-8	**Heptachlor**	0.001 J	0.22	µg/L	JAX47-MW17D	11/34	0.001 - 0.001	0.22	NA	**0.015 C**	0.4	FDEP	0.4	MCL	**Yes**	ASL
1024-57-3	**Heptachlor Epoxide**	0.004 J	0.62 J	µg/L	JAX47-MW14S	7/34	0.001 - 0.001	0.62	NA	**0.0074 C**	**0.2**	FDEP	**0.2**	NA	**Yes**	ASL
72-43-5	Methoxychlor	0.011 J	1.1 J	µg/L	JAX47-MW11S, JAX47-937-MW05S	6/34	0.003 - 0.003	1.1	NA	18 N	40	FDEP	40	MCL	No	BSL
Total Inorganics																
7440-38-2	**Arsenic**	4.1	6640	µg/L	JAX47-937-MW02S	12/34	4 - 18.3	6640	**13.2**	**0.045 C**	**10**	FDEP	**10**	MCL	**Yes**	ASL
Filtered Inorganics																
7440-38-2	**Arsenic**	10	26	µg/L	JAX47-937-MW01S	2/4	4 - 4	26	**13.2**	**0.045 C**	**10**	FDEP	**10**	MCL	**Yes**	ASL

Footnotes
1- Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Sample and duplicate are counted as one sample when determining frequency of detection.
3 - Values presented are sample-specific quantitation limits.
4 - The maximum detected concentration is used for screening purposes.
5 - Value presented is twice the mean concentration.
Footnotes Continued
6 - The risk-based COPC screening level for tap water use is presented. The value is based on a target Hazard Quotient of 0.1 for non-carcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (USEPA, Region 9, October 2004).
The PRG for non-carcinogenic compounds are divided by 10.
7 - Groundwater Cleanup Target Levels taken from Table I, FAC 62-777 (FDEP, February 2005).
8 - 2006 Edition of the Drinking Water Standards and Health Advisories, USEPA (EPA 822-R-06-013) Summer 2006.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogen
COPC = Chemical Of Potential Concern
FDEP = Florida Department of Environmental Protection
J = Estimated value with undetermined bias

Definitions
MCL = Maximum contaminant level
N = Non-carcinogen
NA = Not Applicable/Not Available

Rationale Codes:

Table 7-7
Occurrence, Distribution, and Selection of COPCs
Groundwater-Direct Contact Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Location of Maximum Concentration	Detection Frequency(2)	Range of Nondetects(3)	Concentration Used for Screening(4)	Background Value(5)	Risk-Based COPC Screening Level(6)	Potential ARAR/TBC Value	Potential ARAR/TBC Source(7)	Potential ARAR/TBC Value	Potential ARAR/TBC Source(8)	COPC Flag(9)	Rationale for Contaminant Deletion or Selection

9 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or ARAR/TBC(s) and background levels.
10 - Value is for chlordane.
11 - Value is for alpha-BHC.
12 - Value is for endosulfan
13 - Value is for endrin

For selection as a COPC
ASL = Above COPC Screening Level/ARAR/TBC

For elimination as a COPC:
BKG = Within background levels
BSL = Below COPC Screening Level/ARAR/TBC

Shading indicates that the maximum detected concentration exceeded the screening criteria; therefore, the chemical was retained as a COPC.

Table 7-8
Occurrence, Distribution, and Selection of COPCs
Groundwater-Vapor Intrusion

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Nondetects[3]	Concentration Used for Screening[4]	Background Value[5]	Risk-Based COPC Screening Level[6]	COPC Flag[7]	Rationale for Contaminant Deletion or Selection
Volatile Organic Compounds												
75-35-4	1,1-Dichloroethene	0.4 J	0.7 J	µg/L	JAX47-937-MW03S, JAX47-937-MW04S	4/34	0.2 - 0.2	0.7	NA	190 N	No	BSL
120-82-1	1,2,4-Trichlorobenzene	1.8	8.6	µg/L	JAX47-MW13S	4/34	0.1 - 0.9	8.6	NA	3400 N	No	BSL
96-12-8	1,2-Dibromo-3-Chloropropane	2.7	2.7	µg/L	JAX47-937-MW02S	1/34	0.3 - 0.3	2.7	NA	33 N	No	BSL
95-50-1	1,2-Dichlorobenzene	0.3 J	4.4 J	µg/L	JAX47-MW13S	4/34	0.2 - 0.2	4.4	NA	2600 N	No	BSL
541-73-1	1,3-Dichlorobenzene	0.6 J	2 J	µg/L	JAX47-MW13S	2/34	0.2 - 0.2	2	NA	830 N	No	BSL
106-46-7	1,4-Dichlorobenzene	0.4 J	6.3 J	µg/L	JAX47-MW13S	4/34	0.1 - 0.1	6.3	NA	8200 N	No	BSL
78-93-3	2-Butanone	4.06 J	4.06 J	µg/L	JAX47-MW30S	1/34	2 - 2	4.06	NA	440000 N	No	BSL
71-43-2	**Benzene**	0.22 J	14.6	µg/L	JAX47-937-MW05S	14/34	0.2 - 0.2	14.6	NA	**5 MCL**	**Yes**	ASL
75-25-2	**Bromoform**	1.5 J	1.5 J	µg/L	JAX47-937-MW02S	1/34	0.2 - 0.2	1.5	NA	**0.0083 C**	**Yes**	ASL
108-90-7	Chlorobenzene	0.2 J	12.7	µg/L	JAX47-MW11S	10/34	0.2 - 0.2	12.7	NA	390 N	No	BSL
75-00-3	Chloroethane	1	1	µg/L	JAX47-937-MW02S	1/34	0.3 - 0.3	1	NA	28000 C	No	BSL
67-66-3	Chloroform	0.37 J	0.37 J	µg/L	JAX47-MW30S	1/34	0.2 - 0.2	0.37	NA	80 MCL	No	BSL
156-59-2	**cis-1,2-Dichloroethene**	0.5 J	936	µg/L	JAX47-937-MW05S	15/34	0.2 - 0.2	936	NA	**210 N**	**Yes**	ASL
110-82-7	Cyclohexane	1.5	38.3	µg/L	JAX47-MW11S	2/34	0.4 - 0.45	38.3	NA	NA	No	NTX
60-29-7	Diethyl Ether	0.8 J	0.9 J	µg/L	JAX47-937-MW05S	2/34	0.5 - 0.54	0.9	NA	520 N	No	BSL
100-41-4	Ethylbenzene	0.5 J	135	µg/L	JAX47-937-MW05S	8/34	0.3 - 0.3	135	NA	700 MCL	No	BSL
98-82-8	**Isopropylbenzene**	0.3 J	9	µg/L	JAX47-MW11S	10/34	0.1 - 0.1	9	NA	**8.4 N**	**Yes**	ASL
108-87-2	Methyl Cyclohexane	0.7 J	22.7 J	µg/L	JAX47-MW11S	3/34	0.55 - 0.6	22.7	NA	710 N	No	BSL
1634-04-4	Methyl Tert-Butyl Ether	0.2 J	0.2 J	µg/L	JAX47-937-MW01S	1/34	0.2 - 0.2	0.2	NA	120000 C	No	BSL
100-42-5	Styrene	0.75 J	1.7	µg/L	JAX47-937-MW02S	2/34	0.1 - 0.1	1.7	NA	8900 N	No	BSL
127-18-4	Tetrachloroethene	0.9 J	4 J	µg/L	JAX47-937-MW04S	7/34	0.3 - 0.3	4	NA	5 MCL	No	BSL
108-88-3	Toluene	0.6 J	21.9 J	µg/L	JAX47-937-MW05S	5/34	0.2 - 0.51	21.9	NA	1500 N	No	BSL
1330-20-7	Total Xylenes	0.6 J	914	µg/L	JAX47-937-MW05S	8/34	0.3 - 0.43	914	NA	22000 N	No	BSL
156-60-5	trans-1,2-Dichloroethene	0.5 J	4.5	µg/L	JAX47-937-MW04S	6/34	0.2 - 0.2	4.5	NA	180 N	No	BSL
79-01-6	**Trichloroethene**	0.3 J	7.7	µg/L	JAX47-937-MW04S	11/34	0.3 - 0.3	7.7	NA	**5 MCL**	**Yes**	ASL
75-01-4	**Vinyl Chloride**	0.4 J	5.5	µg/L	JAX47-937-MW05S	6/34	0.4 - 0.4	5.5	NA	**2 MCL**	**Yes**	ASL
Semivolatile Organic Compounds												
92-52-4	1,1-Biphenyl	5 J	8 J	µg/L	JAX47-MW11S	2/34	3 - 3	8	NA	NA	No	NTX
95-95-4	2,4,5-Trichlorophenol	104	2720	µg/L	JAX47-937-MW03S	2/34	2 - 2	2720	NA	NA	No	NTX
120-83-2	2,4-Dichlorophenol	6 J	529	µg/L	JAX47-937-MW03S	3/34	2 - 2	529	NA	NA	No	NTX
105-67-9	2,4-Dimethylphenol	16	16	µg/L	JAX47-937-MW05S	1/34	2 - 2	16	NA	NA	No	NTX
91-57-6	2-Methylnaphthalene	10 J	103	µg/L	JAX47-MW11S	3/34	2 - 2	103	NA	3300 N	No	BSL
95-48-7	2-Methylphenol	6 J	6 J	µg/L	JAX47-937-MW05S	1/34	2 - 2	6	NA	NA	No	NTX
84-66-2	Diethyl Phthalate	9 J	9 J	µg/L	JAX47-MW29S	1/34	2 - 2	9	NA	NA	No	NTX
91-20-3	**Naphthalene**	14	194	µg/L	JAX47-MW11S	4/34	3 - 3	194	NA	**150 N**	**Yes**	ASL
87-86-5	Pentachlorophenol	11	12 J	µg/L	JAX47-937-MW04S	2/34	1 - 1	12	NA	NA	No	NTX

Table 7-8
Occurrence, Distribution, and Selection of COPCs
Groundwater-Vapor Intrusion

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Location of Maximum Concentration	Detection Frequency(2)	Range of Nondetects(3)	Concentration Used for Screening(4)	Background Value(5)	Risk-Based COPC Screening Level(6)	COPC Flag(7)	Rationale for Contaminant Deletion or Selection
Pesticides/PCBs												
72-54-8	4,4'-DDD	0.001 J	25 J	µg/L	JAX47-MW17S	10/34	0.0004 - 0.0004	25	NA	NA	No	NTX
72-55-9	4,4'-DDE	0.002 J	0.13 J	µg/L	JAX47-937-MW05S	11/34	0.002 - 0.002	0.13	NA	29 C	No	BSL
50-29-3	4,4'-DDT	0.002 J	0.49	µg/L	JAX47-MW13S	8/34	0.002 - 0.003	0.49	NA	NA	No	NTX
309-00-2	**Aldrin**	0.01 J	3.8 J	µg/L	JAX47-937-MW05S	7/34	0.002 - 0.002	3.8	NA	**0.071**	**Yes**	ASL
319-84-6	**alpha-BHC**	0.003 J	9.3	µg/L	JAX47-MW11S	9/34	0.001 - 0.002	9.3	NA	**3.1 C**	**Yes**	ASL
5103-71-9	alpha-Chlordane	0.002 J	1.8	µg/L	JAX47-MW17S	12/34	0.001 - 0.001	1.8	NA	12 C(8)	No	BSL
319-85-7	beta-BHC	0.003 J	3.9 J	µg/L	JAX47-937-MW04S	12/34	0.002 - 0.002	3.9	NA	NA	No	NTX
319-86-8	delta-BHC	0.002 J	8.3	µg/L	JAX47-MW11S	15/34	0.001 - 0.062	8.3	NA	NA	No	NTX
60-57-1	Dieldrin	0.003 J	0.32 J	µg/L	JAX47-937-MW03S	14/34	0.0008 - 0.0008	0.32	NA	0.86 C	No	BSL
959-98-8	Endosulfan I	0.011 J	0.077	µg/L	JAX47-MW17S	3/34	0.002 - 0.002	0.077	NA	NA	No	NTX
33213-65-9	Endosulfan II	0.003 J	0.039 J	µg/L	JAX47-MW30S	8/34	0.002 - 0.002	0.039	NA	NA	No	NTX
1031-07-8	Endosulfan Sulfate	0.005 J	0.21 J	µg/L	JAX47-937-MW05S	10/34	0.002 - 0.002	0.21	NA	NA	No	NTX
72-20-8	Endrin	0.002 J	0.044 J	µg/L	JAX47-937-MW05S	6/34	0.002 - 0.003	0.044	NA	NA	No	NTX
7421-93-4	Endrin Aldehyde	0.011 J	0.021 J	µg/L	JAX47-MW13S	1/34	0.009 - 0.009	0.021	NA	NA	No	NTX
53494-70-5	Endrin Ketone	0.004 J	4.7 J	µg/L	JAX47-937-MW02S	11/34	0.003 - 0.003	4.7	NA	NA	No	NTX
58-89-9	**gamma-BHC (Lindane)**	0.002 J	15	µg/L	JAX47-MW11S	10/34	0.002 - 0.002	15	NA	**11 C**	**Yes**	ASL
5103-74-2	gamma-Chlordane	0.016 J	1.1	µg/L	JAX47-MW17S	9/34	0.001 - 0.001	1.1	NA	12 C(8)	No	BSL
76-44-8	Heptachlor	0.001 J	0.22	µg/L	JAX47-MW17D	11/34	0.001 - 0.001	0.22	NA	0.4 MCL	No	BSL
1024-57-3	Heptachlor Epoxide	0.004 J	0.62 J	µg/L	JAX47-MW14S	7/34	0.001 - 0.001	0.62	NA	NA	No	NTX
72-43-5	Methoxychlor	0.011 J	1.1 J	µg/L	JAX47-MW11S, JAX47-937-MW05S	6/34	0.003 - 0.003	1.1	NA	NA	No	NTX

Footnotes
1- Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Sample and duplicate are counted as one sample when determining frequency of detection.
3 - Values presented are sample-specific quantitation limits.
4 - The maximum detected concentration is used for screening purposes.
5 - Value presented is twice the mean concentration.
6 - Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052. Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1.
7 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.
8 - Value is for chlordane.

Shading indicates that the maximum detected concentration exceeded the screening criteria; therefore, the chemical was retained as a COPC.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Consid
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value with undetermined bias
N = Non-carcinogen
NA = Not Applicable/Not Available

Rationale Codes:
For selection as a COPC
ASL = Above COPC Screening Level/ARAR/TBC

For elimination as a COPC:
BSL = Below COPC Screening Level/ARAR/TBC
NTX = No toxicity criteria available

Table 7-18
Cancer Toxicity Data - Oral/Dermal

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida
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Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	D	IRIS	04/18/2007
1,2-Dibromo-3-Chloropropane	8.0E-01	(mg/kg/day)-1	1	8.0E-01	(mg/kg/day)-1	NA	NCEA	04/6/2007
1,4-Dichlorobenzene	2.4E-02	(mg/kg/day)-1	1	2.4E-02	(mg/kg/day)-1	C	HEAST	07/97
Benzene	5.5E-02	(mg/kg/day)-1	1	5.5E-02	(mg/kg/day)-1	A	IRIS	04/18/2007
Chlorobenzene	NA	NA	NA	NA	NA	D	IRIS	04/18/2007
Chloroform	NA	NA	NA	NA	NA	B2	IRIS	04/18/2007
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	D	IRIS	04/18/2007
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	D	IRIS	04/18/2007
Isopropylbenzene	NA	NA	NA	NA	NA	D	IRIS	04/18/2007
Tetrachloroethene	5.4E-01	(mg/kg/day)-1	1	5.4E-01	(mg/kg/day)-1	NA	NCEA	04/6/2007
Total Xylenes	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	1.3E-02	$(mg/kg/day)^{-1}$	1	1.3E-02	$(mg/kg/day)^{-1}$	C	CA EPA	12/2002
Vinyl Chloride	1.5E+00	(mg/kg/day)-1	1	1.5E+00	(mg/kg/day)-1	A	IRIS	09/15/2003
Semivolatile Organic Compounds								
1,1-Biphenyl	NA	NA	NA	NA	NA	D	IRIS	04/18/2007
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	7.3E+00	(mg/kg/day)-1	1	7.3E+00	(mg/kg/day)-1	B2	IRIS	04/18/2007
Naphthalene	NA	NA	NA	NA	NA	C	IRIS	04/18/2007
Pentachlorophenol	1.2E-01	(mg/kg/day)-1	1	1.2E-01	(mg/kg/day)-1	B2	IRIS	04/18/2007
Pesticides/PCBs								
4,4'-DDD	2.4E-01	(mg/kg/day)-1	1	2.4E-01	(mg/kg/day)-1	B2	IRIS	04/18/2007
4,4'-DDE	3.4E-01	(mg/kg/day)-1	1	3.4E-01	(mg/kg/day)-1	B2	IRIS	04/18/2007
4,4'-DDT	3.4E-01	(mg/kg/day)-1	1	3.4E-01	(mg/kg/day)-1	B2	IRIS	04/18/2007
Alpha-BHC	6.3E+00	(mg/kg/day)-1	1	6.3E+00	(mg/kg/day)-1	B2	IRIS	04/18/2007
Alpha-Chlordane	3.5E-01	(mg/kg/day)-1	1	3.5E-01	(mg/kg/day)-1	B2	IRIS	04/18/2007
Beta-BHC	1.8E+00	(mg/kg/day)-1	1	1.8E+00	(mg/kg/day)-1	C	IRIS	04/18/2007
Delta-BHC	NA	NA	NA	NA	NA	D	IRIS	04/18/2007
Dieldrin	1.6E+01	(mg/kg/day)-1	1	1.6E+01	(mg/kg/day)-1	B2	IRIS	04/18/2007
Endrin Ketone	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	1.3E+00	(mg/kg/day)-1	1	1.3E+00	(mg/kg/day)-1	B2	HEAST	07/97

Table 7-18
Cancer Toxicity Data - Oral/Dermal

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida
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Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Gamma-Chlordane	3.5E-01	(mg/kg/day)-1	1	3.5E-01	(mg/kg/day)-1	B2	IRIS	04/18/2007
Heptachor	4.5E+00	(mg/kg/day)-1	1	4.5E+00	(mg/kg/day)-1	B2	IRIS	04/18/2007
Heptachor Epoxide	9.1E+00	(mg/kg/day)-1	1	9.1E+00	(mg/kg/day)-1	B2	IRIS	04/18/2007
Metals								
Arsenic	1.5E+00	(mg/kg/day)-1	1	1.5E+00	(mg/kg/day)-1	A	IRIS	09/15/2003

Notes:
(1) - USEPA, 2001a: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
(2) - Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

USEPA Group:
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.
E - Evidence of non-carcinogenicity.

IRIS = Integrated Risk Information System.
HEAST= Health Effects Assessment Summary Tables.
NA = Not Available.
NCEA = USEPA National Center for Environmental Assessment (USEPA Region III RBC Table, April 25, 2003).
USEPA(1) = USEPA, Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, July 1993, EPA/600/R-93/089.
USEPA(2) = USEPA, PCBs: Cancer Dose-Response Assessment and Applications to Environmental Mixtures, September 1996, EPA/600/P-96/001F.

Table 7-19
Cancer Toxicity Data - Inhalation

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida
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Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds							
1,2,4-Trichlorobenzene	NA	NA	NA	NA	D	IRIS	04/18/2007
1,2-Dibromo-3-Chloropropane	6.0E+00	$(mg/m^3)^{-1}$	2.1E+01	$(mg/kg/day)^{-1}$	NA	NCEA	04/6/2007
1,4-Dichlorobenzene	6.3E-03	$(mg/m^3)^{-1}$	2.2E-02	$(mg/kg/day)^{-1}$	NA	NCEA	04/6/2007
Benzene	7.8E-03	$(mg/m^3)^{-1}$	2.7E-02	$(mg/kg/day)^{-1}$	A	IRIS	04/18/2007
Chlorobenzene	NA	NA	NA	NA	D	IRIS	04/18/2007
Chloroform	2.3E-02	$(mg/m^3)^{-1}$	8.1E-02	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
cis-1,2-Dichloroethene	NA	NA	NA	NA	D	IRIS	04/18/2007
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	D	IRIS	04/18/2007
Isopropylbenzene	NA	NA	NA	NA	D	IRIS	04/18/2007
Tetrachloroethene	5.7E-03	$(mg/m^3)^{-1}$	2.0E-02	$(mg/kg/day)^{-1}$	NA	NCEA	04/6/2007
Total Xylenes	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	2.0E-03	$(mg/m^3)^{-1}$	7.0E-03	$(mg/kg/day)^{-1}$	C	CA EPA	12/2002
Vinyl Chloride	8.8E-03	$(mg/m^3)^{-1}$	3.1E-02	$(mg/kg/day)^{-1}$	A	IRIS	04/18/2007
Semivolatile Organic Compounds							
1,1-Biphenyl	NA	NA	NA	NA	D	IRIS	04/18/2007
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	3.1E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Naphthalene	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	B2	IRIS	04/18/2007
Pesticides/PCBs							
4,4'-DDD	NA	NA	NA	NA	B2	IRIS	04/18/2007
4,4'-DDE	NA	NA	NA	NA	B2	IRIS	04/18/2007
4,4'-DDT	9.7E-02	$(mg/m^3)^{-1}$	3.4E-01	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Alpha-BHC	1.8E+00	$(mg/m^3)^{-1}$	6.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Alpha-Chlordane	1.0E-01	$(mg/m^3)^{-1}$	3.5E-01	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Beta-BHC	5.3E-01	$(mg/m^3)^{-1}$	1.9E+00	$(mg/kg/day)^{-1}$	C	IRIS	04/18/2007
Delta-BHC	NA	NA	NA	NA	D	IRIS	04/18/2007
Dieldrin	4.6E+00	$(mg/m^3)^{-1}$	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Endrin Ketone	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA

Table 7-19
Cancer Toxicity Data - Inhalation

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida
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Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Gamma-Chlordane	1.0E-01	$(mg/m^3)^{-1}$	3.5E-01	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Heptachor	1.3E-01	$(mg/m^3)^{-1}$	4.6E-01	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Heptachor Epoxide	2.6E+00	$(mg/m^3)^{-1}$	9.1E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/18/2007
Metals							
Arsenic	4.3E+00	$(mg/m^3)^{-1}$	1.5E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/18/2007

Notes:
1 - Inhalation CSF = Unit Risk * 70 kg / $20m^3$/day.

Definitions:
IRIS = Integrated Risk Information System.
HEAST= Health Effects Assessment Summary Tables.
NA = Not Available.
NCEA = USEPA National Center for Environmental Assessment
(USEPA Region 3 RBC Table, April 25, 2003).

USEPA Group:
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.
E - Evidence of non-carcinogenicity.

Table 7-20
Summary of Cancer Risks and Hazard Indices
Reasonable Maximum Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Construction Worker	Surface/Subsurface Soil	Incidental Ingestion	2E-06	- -	- -	- -	0.5	- -
		Dermal Contact	2E-07	- -	- -	- -	0.05	- -
		Inhalation	2E-07	- -	- -	- -	0.002	
		Total	2E-06	- -	- -	- -	0.5	- -
	Groundwater	Dermal Contact	4E-06	- -	- -	Arsenic	0.7	- -
		Inhalation	6E-09	- -	- -	- -	0.09	- -
		Total	4E-06	- -	- -	Arsenic	0.8	- -
		Total All Media	7E-06				1	
Maintenance Workers	Surface Soil	Incidental Ingestion	2E-06	- -	- -	- -	0.02	- -
		Dermal Contact	8E-07	- -	- -	- -	0.007	- -
		Inhalation	1E-09	- -	- -	- -	0.0000008	- -
		Total	2E-06	- -	- -	- -	0.02	- -
Occupational Workers	Surface Soil	Incidental Ingestion	3E-05	- -	- -	Benzo(a)pyrene Equivalents, 4,4'-DDT, Dieldrin, Arsenic	0.3	- -
		Dermal Contact	8E-06	- -	- -	4,4'-DDT, Dieldrin	0.07	- -
		Inhalation	1E-08	- -	- -	- -	0.000007	- -
		Total	3E-05	- -	4,4'-DDT	Benzo(a)pyrene Equivalents, Dieldrin, Arsenic	0.4	- -
Adolescent Trespassers	Surface Soil	Incidental Ingestion	6E-06	- -	- -	4,4'-DDT	0.2	- -
		Dermal Contact	2E-06	- -	- -	- -	0.05	- -
		Inhalation	6E-10				0.0000010	- -
		Total	9E-06	- -	- -	4,4'-DDT	0.2	- -
Adult Trespassers	Surface Soil	Incidental Ingestion	4E-06	- -	- -	4,4'-DDT	0.05	- -
		Dermal Contact	7E-07	- -	- -	- -	0.008	- -
		Inhalation	1E-09	- -	- -	- -	0.0000008	- -
		Total	4E-06	- -	- -	4,4'-DDT	0.06	- -

Table 7-20
Summary of Cancer Risks and Hazard Indices
Reasonable Maximum Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Child Residents	Surface/Subsurface Soil	Incidental Ingestion	1E-04	- -	4,4'-DDT, Arsenic	Benzo(a)pyrene Equivalents, 4,4'-DDD, 4,4'-DDE, alpha-BHC, alpha-Chlordane, Dieldrin, Heptachlor Epoxide	5	4,4'-DDT
		Dermal Contact	2E-05	- -	- -	Benzo(a)pyrene Equivalents, 4,4'-DDT, Dieldrin, Arsenic	0.5	- -
		Inhalation	9E-09	- -	- -	- -	0.00002	- -
		Total	1E-04	- -	4,4'-DDT, Dieldrin, Arsenic	Benzo(a)pyrene Equivalents, 4,4'-DDD, 4,4'-DDE, alpha-BHC, alpha-Chlordane, gamma-Chlordane, Heptachlor Epoxide	6	4,4'-DDT
	Groundwater	Ingestion	8E-02	Aldrin, alpha-BHC, Arsenic, gamma-BHC	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride, 4,4'-DDD, beta-BHC, Dieldrin, Heptachlor Epoxide	Benzene, Pentachlorophenol, alpha-Chlordane, gamma-Chlordane, Heptachlor	2184	cis-1,2-Dichloroethene, 2,4,5-Trichlorophenol, 2,4-Dichlorophenol, 2-Methylnaphthalene, Aldrin, delta-BHC, Endrin Ketone, gamma-BHC, Heptachlor Epoxide, Arsenic
		Dermal Contact	5E-04	- -	Pentachlorophenol, 4,4'-DDD, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, Arsenic	Tetrachloroethene, 4,4'-DDT, alpha-Chlordane, Dieldrin, gamma-Chlordane, Heptachlor Epoxide	13	2,4-Dichlorophenol, 2,4,5-Trichlorophenol, delta-BHC, 4,4'-DDT, Endrin Ketone, alpha-Chlordane, delta-BHC, gamma-BHC, Aldrin, Heptachlor Epoxide, Arsenic
		Inhalation	1E-04	- -	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride	Benzene	15	cis-1,2-Dichloroethene, 2-Methylnaphthalene
		Total	8E-02	4,4'-DDD, Aldrin, alpha-BHC, gamma-BHC, Arsenic	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Pentachlorophenol, beta-BHC, Dieldrin, Heptachlor Epoxide	1,4-Dichlorobenzene, Benzene Trichloroethene, 4,4'-DDT, gamma-Chlordane	2212	1,2-Dibromo-3-Chloropropane, cis-1,2-Dichloroethene, 2,4,5-Trichlorophenol. 2,4-Dichlorophenol, 2-Methylnaphthalene, Naphthalene, Vinyl Chloride, 4,4'-DDT, Aldrin, alpha-Chlordane, gamma-Chlordane, Dieldrin, delta-BHC, Endrin Ketone, gamma-BHC, Heptachlor Epoxide, Arsenic
		Total All Media	8E-02				2218	
Adult Residents	Surface/Subsurface Soil	Incidental Ingestion	5E-05	- -	4,4'-DDT	Benzo(a)pyrene Equivalents, 4,4'-DDD, Dieldrin, Arsenic	0.6	- -
		Dermal Contact	9E-06	- -	- -	4,4'-DDT, Arsenic	0.08	- -
		Inhalation	2E-08				0.000009	- -

Table 7-20
Summary of Cancer Risks and Hazard Indices
Reasonable Maximum Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida
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Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
		Total	6E-05	- -	4,4'-DDT	Benzo(a)pyrene Equivalents, 4,4'-DDD, 4,4'-DDE, Dieldrin, Arsenic	0.7	- -
	Groundwater	Ingestion	9E-02	Aldrin, alpha-BHC, gamma-BHC, Arsenic	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride, 4,4'-DDD, beta-BHC, Dieldrin, Heptachlor Epoxide	Benzene, Pentachlorophenol, 4,4'-DDT, alpha-Chlordane, gamma-Chlordane, Heptachlor	624	cis,1,2-Dichloroethene, 2,4-Dichlorophenol, 2,4,5-Trichlorophenol, Aldrin, delta-BHC, gamma-BHC, Arsenic, Heptachlor Epoxide
		Dermal Contact	1E-03	4,4'-DDD, alpha-BHC, Arsenic	Pentachlorophenol, Aldin, beta-BHC, Dieldrin, gamma-BHC, Heptachlor Epoxide	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride, 4,4'-DDE, 4,4'-DDT, alpha-Chlordane, gamma-Chlordane, Heptachlor	6	2,4,5-Trichlorophenol, delta-BHC, Endrin Ketone, gamma-BHC
		Inhalation	1E-04	- -	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride	Benzene	4	cis-1,2-Dichloroethene
		Total	9E-02	Vinyl Chloride, 4,4'-DDD, Aldrin, alpha-BHC, gamma-BHC, Arsenic	1,2-Dibromo-3-Chloropropane, Benzene, Tetrachloroethene, Pentachlorophenol, Dieldrin, Heptachlor Epoxide	1,4-Dichlorobenzene, Trichloroethene, 4,4'-DDE, gamma-Chlordane	635	cis,1,2-Dichloroethene, 2,4-Dichlorophenol, 2,4,5-Trichlorophenol, 2-Methylnaphthalene, Aldrin, delta BHC, gamma-BHC, Endrin Ketone, Heptachlor Epoxide, Arsenic
		Total All Media	9E-02				635	

Table 7-20
Summary of Cancer Risks and Hazard Indices
Reasonable Maximum Exposures

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Lifelong Residents (Child and Adult)	Surface/Subsurface Soil	Incidental Ingestion	2E-04	- -	4,4'-DDT, Dieldrin, Arsenic	Benzo(a)pyrene Equivalents, 4,4'-DDE, 4,4'-DDD, Alpha-BHC, Alpha-Chlordane, Gamma-Chlordane, Heptachlor Epoxide	NA	- -
		Dermal Contact	2E-05	- -	- -	Benzo(a)pyrene Equivalents, 4,4'-DDT, Dieldrin, Arsenic	NA	- -
		Inhalation	3E-08	- -	- -	- -	NA	- -
		Total	2E-04	- -	4,4'-DDT, Dieldrin, Arsenic	Benzo(a)pyrene Equivalents, 4,4'-DDE, 4,4'-DDD, Alpha-BHC, Alpha-Chlordane, Gamma-Chlordane, Heptachlor Epoxide	NA	- -
	Groundwater	Ingestion	2E-01	Aldrin, alpha-BHC, beta-BHC, gamma-BHC, Arsenic	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride, Pentachlorophenol, 4,4'-DDD, Dieldrin, Heptachlor, Heptachlor Epoxide	1,4-Dichlorobenzene, Benzene Trichloroethene, 4,4'-DDT, alpha-Chlordane, gamma-Chlordane	NA	- -
		Dermal Contact	2E-03	Pentachlorophenol, 4,4'-DDD, alpha-BHC, Arsenic	4,4'-DDT, Aldin, beta-BHC, Dieldrin, gamma-BHC, Heptachlor Epoxide	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride, 4,4'-DDE, alpha-Chlordane, gamma-Chlordane, Heptachlor	NA	- -
		Inhalation	2E-04	- -	1,2-Dibromo-3-Chloropropane, Tetrachloroethene, Vinyl Chloride	1,4-Dichlorobenzene, Benzene Trichloroethene	NA	- -
		Total	2E-01	Vinyl Chloride, Pentachlorophenol, 4,4'-DDD, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, Arsenic	1,2-Dibromo-3-Chloropropane, Benzene, Tetrachloroethene, 4,4'-DDT, alpha-Chlordane, Dieldrin, Heptachlor, Heptachlor Epoxide	1,4-Dichlorobenzene, Trichloroethene, 4,4'-DDE, gamma-Chlordane	NA	- -
		Total All Media	2E-01				NA	

Table 7-21
Chemicals Retained as Chemicals of Concern

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Chemical of Concern[1]	Impact on Human Receptors
Surface/Subsurface Soil	
Benzo(a)pyrene Equivalents	Occupation Workers ILCR = 3E-6
	Child Residents ILCR = 7E-6
	Adult Residents ILCR = 3E-6
	Lifelong Residents ILCR = 1E-5
4,4'-DDD	Child Residents ILCR = 5E-6
	Adult Residents ILCR = 2E-6
	Lifelong Residents ILCR = 8E-6
4,4'-DDE	Child Residents ILCR = 3E-6
	Adult Residents ILCR = 2E-6
	Lifelong Residents ILCR = 5E-6
4,4'-DDT	Occupation Workers ILCR = 2E-5
	Adolescent Trespassers ILCR = 4E-6
	Adult Trespassers ILCR = 2E-6
	Child Residents ILCR = 7E-5
	Adult Residents ILCR = 3E-5
	Lifelong Residents ILCR = 9E-5
alpha-BHC	Child Residents ILCR = 2E-6
	Lifelong Residents ILCR = 3E-6
alpha-Chlordane	Child Residents ILCR = 2E-6
	Lifelong Residents ILCR = 2E-6
Dieldrin	Occupation Workers ILCR = 5E-6
	Child Residents ILCR = 2E-5
	Adult Residents ILCR = 9E-6
	Lifelong Residents ILCR = 3E-5
gamma-Chlordane	Child Residents ILCR = 2E-6
	Lifelong Residents ILCR = 2E-6
Heptachlor	Lifelong Residents ILCR = 2E-6
Heptachlor Epoxide	Child Residents ILCR = 2E-6
	Lifelong Residents ILCR = 3E-6
Arsenic	Occupation Workers ILCR = 5E-6
	Child Residents ILCR = 2E-5
	Adult Residents ILCR = 1E-5
	Lifelong Residents ILCR = 3E-5
Groundwater - Direct Contact	
1,2-Dibromo-3-Chloropropane	Child Resident ILCR = 3E-6
	Adult Resident ILCR = 4E-6
	Lifelong Resident ILCR = 7E-6
1,4-Dichlorobenzne	Child Resident ILCR = 3E-6
	Adult Resident ILCR = 3E-6
	Lifelong Resident ILCR = 6E-6
Benzene	Lifelong Resident ILCR = 3E-6
cis-1,2-Dichloroethene	Child Resident HI = 18
	Adult Resident HI = 6
Tetrachloroethene	Child Resident ILCR = 4E-5
	Adult Resident ILCR = 2E-5
	Lifelong Resident ILCR = 6E-5
Trichloroethene	Child Resident ILCR = 2E-6
	Adult Resident ILCR = 2E-6
	Lifelong Resident ILCR = 4E-6
Vinyl Chloride	Child Resident ILCR = 2E-4
	Adult Resident ILCR = 2E-4
	Lifelong Resident ILCR = 3E-4

Table 7-21
Chemicals Retained as Chemicals of Concern

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Chemical of Concern[1]	Impact on Human Receptors
	Child Resident HI = 0.4
	Adult Resident HI = 0.1
2,4,5-Trichlorophenol	Child Resident HI = 3
	Adult Resident HI = 1
2,4-Dichlorophenol	Child Resident HI = 19
	Adult Resident HI = 6
2-Methylnaphthalene	Child Resident HI = 5
	Adult Resident HI = 2
Naphthalene	Child Resident HI = 3
Pentachlorophenol	Child Resident ILCR = 7E-5
	Adult Resident ILCR = 1E-4
	Lifelong Resident ILCR = 2E-4
	Child Resident HI = 0.2
	Adult Resident HI = 0.1
4,4'-DDD	Child Resident ILCR = 2E-4
	Adult Resident ILCR = 1E-4
	Lifelong Resident ILCR = 3E-4
4,4'-DDE	Child Resident ILCR = 1E-6
	Adult Resident ILCR = 2E-6
	Lifelong Resident ILCR = 3E-6
4,4'-DDT	Child Resident ILCR = 7E-6
	Adult Resident ILCR = 1E-5
	Lifelong Resident ILCR = 2E-5
	Child Resident HI = 0.5
	Adult Resident HI = 0.2
Aldrin	Child Resident ILCR = 5E-4
	Adult Resident ILCR = 6E-4
	Lifelong Resident ILCR = 1E-3
	Child Resident HI = 13
	Adult Resident HI = 4
alpha-BHC	Child Resident ILCR = 6E-4
	Adult Resident ILCR = 8E-4
	Lifelong Resident ILCR = 1E-3
alpha-Chlordane	Child Resident ILCR = 1E-5
	Adult Resident ILCR = 1E-5
	Lifelong Resident ILCR = 2E-5
	Child Resident HI = 0.6
	Adult Resident HI = 0.2
beta-BHC	Child Resident ILCR = 7E-5
	Adult Resident ILCR = 1E-4
	Lifelong Resident ILCR = 2E-4
delta-BHC	Child Resident HI = 3
	Adult Resident HI = 1
Dieldrin	Child Resident ILCR = 5E-5
	Adult Resident ILCR = 7E-5
	Lifelong Resident ILCR = 1E-4
	Child Resident HI = 0.8
	Adult Resident HI = 0.3
Endrin Ketone	Child Resident HI = 2
	Adult Resident HI = 0.8
gamma-BHC	Child Resident ILCR = 2E-4
	Adult Resident ILCR = 2E-4
	Lifelong Resident ILCR = 4E-4

Table 7-21
Chemicals Retained as Chemicals of Concern

Remedial Investigation/Feasibility Study
Potential Source of Contamination 47
Naval Air Station Jacksonville
Jacksonville, Florida

Chemical of Concern[1]	Impact on Human Receptors
	Child Resident HI = 0.4
	Adult Resident HI = 0.2
gamma-Chlordane	Child Resident ILCR = 6E-6
	Adult Resident ILCR = 9E-6
	Lifelong Resident ILCR = 1E-5
	Child Resident HI = 0.4
	Adult Resident HI = 0.2
Heptachlor	Child Resident ILCR = 1E-5
	Adult Resident ILCR = 1E-5
	Lifelong Resident ILCR = 2E-5
Heptachlor Epoxide	Child Resident ILCR = 5E-5
	Adult Resident ILCR = 7E-5
	Lifelong Resident ILCR = 1E-4
	Child Resident HI = 5
	Adult Resident HI = 2
Arsenic	Child Resident ILCR = 8E-2
	Adult Resident ILCR = 9E-2
	Lifelong Resident ILCR = 2E-1
	Child Resident HI = 2197
	Adult Resident HI = 608

HQ = Hazard Quotient
ILCR = Incremental Lifetime Cancer Risk
(1) - Any carcinogenic chemical contributing to an ICR greater than 1.0E-6 or any non-carcinogenic chemical contributing to target organ hazard indices (HI) greater than 0.1

NAS JACKSONVILLE
Jacksonville, Florida
PSC 47 RI/FS
Alternative S-3: Excavation & Off-Site Disposal to Allow Industrial Exposure, Capping to Prevent Leaching, LUCs, and Monitoring
Annual Cost

Item	Item Cost year 1	Item Cost years 2 & 3	Item Cost years 4 to 30	Item Cost every 5 years	Notes
Site Inspection: Visit	$1,860	$1,860	$1,860		One-day visit to verify LUC RD
Site Inspection: Report	$800	$800	$800		Report LUC RD
Cap Inspection	$1,860	$1,860	$1,860		Yearly inspection of cap
Cap Report	$800	$800	$800		Yearly Inspection report
Cap Repair	$6,350	$6,350		$6,350	Cap repair years 1, 2, 3, 5, 10,15, 20, 25, 30
Sampling	$18,120	$9,060	$4,530		Labor and supplies to collect samples from wells using a crew of two
Analysis/Water	$3,276	$1,638	$819		Analyze groundwater samples from 5 wells for pesticides in years 1 through 30. Collect samples 4 times a year in year 1, twice a year in years 2 & 3, and once a year for years 4 through 30.
Report	$6,000	$3,000	$1,500		Document sampling & results
Site Review				$17,000	Site Reviews
Subtotal	$39,066	$25,368	$12,169	$23,350	
Contingency @ 10%	$3,907	$2,537	$1,217	$2,335	
TOTAL	$42,973	$27,905	$13,386	$25,685	

NAS JACKSONVILLE
Jacksonville, Florida
PSC 47 RI/FS
Alternative S-3: Excavation & Off-Site Disposal to Allow Industrial Exposure, Capping to Prevent Leaching, LUCs, and Monitoring
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$2,597,778		$2,597,778	1.000	$2,597,778
1		$42,973	$42,973	0.935	$40,179
2		$27,905	$27,905	0.873	$24,361
3		$27,905	$27,905	0.816	$22,770
4		$13,386	$13,386	0.763	$10,213
5		$39,071	$39,071	0.713	$27,858
6		$13,386	$13,386	0.666	$8,915
7		$13,386	$13,386	0.623	$8,339
8		$13,386	$13,386	0.582	$7,791
9		$13,386	$13,386	0.544	$7,282
10		$39,071	$39,071	0.508	$19,848
11		$13,386	$13,386	0.475	$6,358
12		$13,386	$13,386	0.444	$5,943
13		$13,386	$13,386	0.415	$5,555
14		$13,386	$13,386	0.388	$5,194
15		$39,071	$39,071	0.362	$14,144
16		$13,386	$13,386	0.339	$4,538
17		$13,386	$13,386	0.317	$4,243
18		$13,386	$13,386	0.296	$3,962
19		$13,386	$13,386	0.277	$3,708
20		$39,071	$39,071	0.258	$10,080
21		$13,386	$13,386	0.242	$3,239
22		$13,386	$13,386	0.226	$3,025
23		$13,386	$13,386	0.211	$2,824
24		$13,386	$13,386	0.197	$2,637
25		$39,071	$39,071	0.184	$7,189
26		$13,386	$13,386	0.172	$2,302
27		$13,386	$13,386	0.161	$2,155
28		$13,386	$13,386	0.15	$2,008
29		$13,386	$13,386	0.141	$1,887
30		$39,071	$39,071	0.131	$5,118
		11350			
		1625		**TOTAL PRESENT WORTH**	**$2,871,446**

NAVAL AIR STATION, JACKSONVILLE
Jacksonville, Florida
PSC 47 RI/FS
Alternative GW-2: Monitored National Attenuation, and LUCs
Capital Cost

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Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare LUC RD Documents	300	hr			$35.00		$0	$0	$10,500	$0	$10,500
. **Subtotal**							$0	$0	$10,500	$0	$10,500
Local Area Adjustments							100.0%	113.5%	87.3%	87.3%	
							$0	$0	$9,167	$0	$9,167
Overhead on Labor Cost @ 30%									$2,750		$2,750
G & A on Labor Cost @ 10%									$917		$917
G & A on Material Cost @ 10%								$0			$0
G & A on Equipment Cost @ 10%										$0	$0
G & A on Subcontract Cost @ 10%							$0				$0
Tax on Materials and Equipment Cost @ 6%								$0		$0	$0
Total Direct Cost							$0	$0	$12,833	$0	$12,833
Indirects on Total Direct Cost @ 0%											$0
Profit on Total Direct Cost @ 10%											$1,283
Subtotal											$14,116
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$14,116
Contingency on Total Field Costs @ 10%											$1,412
Engineering on Total Field Cost @ 0%											$0
TOTAL CAPITAL COST											**$15,528**

NAVAL AIR STATION, JACKSONVILLE
Jacksonville, Florida
PSC 47 RI/FS
Alternative GW-2: Monitored National Attenuation, and LUCs
Annual Cost

Item	Item Cost year 1	Item Cost years 2 & 3	Item Cost years 4 & 5	Item Cost year 6 to 30	Item Cost every 5 years	Notes
Site Inspection: Visit	$1,860	$1,860	$1,860	$1,860		One-day visit to verify LUC RD
Site Inspection: Report	$800	$800	$800	$800		
Sampling	$59,720	$29,860	$14,930	$14,930		Labor and supplies to collect samples from wells using a crew of two.
Analysis/Water	$56,684	$28,342	$14,171	$14,171		Analyze groundwater samples from 20 wells for VOCs, SVOCs, pesticides & arsenic in years 1 through 30. Collect samples 4 times a year in year 1, twice a year in years 2 & 3, and once a year for years 4 through 30.
Analysis/Water	$46,200	$23,100	$11,550			Analyze groundwater samples from 14 wells for natural attenuation parameters in years 1 through 5. Collect samples 4 times a year in year 1, twice a year in years 2 & 3, and once a year for years 4 & 5.
Report	$6,000	$3,000	$1,500	$1,500		Document sampling events and results
Site Review					$17,000	Five Year Site Reviews
Subtotal	$171,264	$86,962	$44,811	$33,261	$17,000	
Contingency @ 10%	$17,126	$8,696	$4,481	$3,326	$1,700	
TOTAL	**$188,390**	**$95,658**	**$49,292**	**$36,587**	**$18,700**	

NAVAL AIR STATION, JACKSONVILLE

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Jacksonville, Florida

PSC 47 RI/FS

Alternative GW-2: Monitored National Attenuation, and LUCs

Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$15,528		$15,528	1.000	$15,528
1		$188,390	$188,390	0.935	$176,145
2		$95,658	$95,658	0.873	$83,510
3		$95,658	$95,658	0.816	$78,057
4		$49,292	$49,292	0.763	$37,610
5		$67,992	$67,992	0.713	$48,478
6		$36,587	$36,587	0.666	$24,367
7		$36,587	$36,587	0.623	$22,794
8		$36,587	$36,587	0.582	$21,294
9		$36,587	$36,587	0.544	$19,903
10		$55,287	$55,287	0.508	$28,086
11		$36,587	$36,587	0.475	$17,379
12		$36,587	$36,587	0.444	$16,245
13		$36,587	$36,587	0.415	$15,184
14		$36,587	$36,587	0.388	$14,196
15		$55,287	$55,287	0.362	$20,014
16		$36,587	$36,587	0.339	$12,403
17		$36,587	$36,587	0.317	$11,598
18		$36,587	$36,587	0.296	$10,830
19		$36,587	$36,587	0.277	$10,135
20		$55,287	$55,287	0.258	$14,264
21		$36,587	$36,587	0.242	$8,854
22		$36,587	$36,587	0.226	$8,269
23		$36,587	$36,587	0.211	$7,720
24		$36,587	$36,587	0.197	$7,208
25		$55,287	$55,287	0.184	$10,173
26		$36,587	$36,587	0.172	$6,293
27		$36,587	$36,587	0.161	$5,891
28		$36,587	$36,587	0.15	$5,488
29		$36,587	$36,587	0.141	$5,159
30		$55,287	$55,287	0.131	$7,243
				TOTAL PRESENT WORTH	**$770,314**

TABLE 2-3
RBCA Approach to Direct Exposure Evaluation Using Commercial/Industrial SCTLs
PSC 47, Naval Air Station Jacksonville
Jacksonville, Florida

Surface Soil (0 to 2 ft bgs)	Target Organs/ Systems or Effects	FDEP Commercial/ Industrial SCTL (mg/kg)	95% UCL (mg/kg)	Data Set Quantity/ Number of Detections	Soil Sample Data Removed from 95% UCL Calculation	Residual 95% UCL (mg/kg)	Ratio 95% UCL/ SCTL	Initial Iteration Site-Specific Apportioned SCTLs (mg/kg)	Additional Soil Sample Data Removed from 95% UCL Calculation	Second Iteration 95% UCL (mg/kg)	Second Iteration Ratio 95% UCL/ SCTL	Second Iteration Site-Specific Apportioned SCTLs (mg/kg)	Additional Soil Sample Data Removed from 95% UCL Calculation	Third Iteration 95% UCL (mg/kg)	Third Iteration Ratio 95% UCL/ SCTL
Arsenic	Cardiovascular, Skin, Carcinogen	12	4.35	56/27	NA	NA	0.36	1.34	JAX47-SB094 JAX47-SB096 JAX47-SB103 JAX47-SB106 JX01219 JX01277	2.14	0.18	1.65	JAX47-SB095 JAX47-SB085 JX01215 JX01216 JX01217 JX01285	1.54	0.13
4-4'-DDD[a]	Carcinogen	22	1.47	125/74	NA	NA	0.07	0.45	JAX47-SB010 JAX47-SB050 JAX47-SB058A JAX47-SB094 JAX47-SB096 JAX47-SB106 JX01219 JX01277	0.71	0.03	0.58	JAX47-SB084 JAX47-SB085 JX47-SB095 JX01215 JX01216 JX01217	0.48	0.02
4-4'-DDE[a]	Carcinogen	15	1.48	126/114	NA	NA	0.1	0.45	JAX47-SB010 JAX47-SB050 JAX47-SB058A JAX47-SB094 JAX47-SB096 JAX47-SB106 JX01219 JX01277	1.85	0.12	1.43	JX01285 JAX47-SB084 JAX47-SB085 JX47-SB095 JX01215 JX01216 JX01217	1.04	0.07
4-4'-DDT[a]	Liver, Carcinogen	15	119	126/107	JAX47-SB096	12	0.8	3.69	JAX47-SB010 JAX47-SB050 JAX47-SB058A JAX47-SB094 JAX47-SB106 JX01219 JX01277	3.23	0.22	2.53	JX01285 JAX47-SB084 JAX47-SB085 JX47-SB095 JX01215 JX01216 JX01217	1.6	0.11
total chlordane[a, b]	Liver, Carcinogen	14	4.48	126/59	NA	NA	0.32	1.38	JAX47-SB010 JAX47-SB050 JAX47-SB058A JAX47-SB094 JAX47-SB096 JAX47-SB106 JX01219 JX01277	0.84	0.06	0.65	JX01285 JAX47-SB084 JAX47-SB085 JX47-SB095 JX01215 JX01216 JX01217	0.5	0.04
dieldrin[a]	Liver, Carcinogen	0.3	0.36	126/58	JAX47-SB050 JAX47-SB106	0.18	0.6	0.06	JAX47-SB010 JAX47-SB058A JAX47-SB094 JAX47-SB096	0.14	0.47	0.11	JX01285 JAX47-SB084 JAX47-SB085 JX47-SB095	0.11	0.37

TABLE 2-3
RBCA Approach to Direct Exposure Evaluation Using Commercial/Industrial SCTLs
PSC 47, Naval Air Station Jacksonville
Jacksonville, Florida

Surface Soil (0 to 2 ft bgs)	Target Organs/ Systems or Effects	FDEP Commercial/ Industrial SCTL (mg/kg)	95% UCL (mg/kg)	Data Set Quantity/ Number of Detections	Soil Sample Data Removed from 95% UCL Calculation	Residual 95% UCL (mg/kg)	Ratio 95% UCL/ SCTL	Initial Iteration Site-Specific Apportioned SCTLs (mg/kg)	Additional Soil Sample Data Removed from 95% UCL Calculation	Second Iteration 95% UCL (mg/kg)	Second Iteration Ratio 95% UCL/ SCTL	Second Iteration Site-Specific Apportioned SCTLs (mg/kg)	Additional Soil Sample Data Removed from 95% UCL Calculation	Third Iteration 95% UCL (mg/kg)	Third Iteration Ratio 95% UCL/ SCTL
heptachlor[a]	Liver, Carcinogen	1	0.36	126/23	NA	NA	0.36	0.1	JX01219 JX01277 JAX47-SB010 JAX47-SB050 JAX47-SB058A JAX47-SB094 JAX47-SB096 JAX47-SB106	0.08	0.08	0.06	JX01215 JX01216 JX01217 JX01285 JAX47-SB084 JAX47-SB085 JX47-SB095	0.06	0.06
heptachlor-epoxide[a]	Liver, Carcinogen	0.5	0.32	126/29	NA	NA	0.64	0.1	JX01219 JX01277 JAX47-SB010 JAX47-SB050 JAX47-SB058A JAX47-SB094 JAX47-SB096 JAX47-SB106	0.07	0.14	0.05	JX01215 JX01216 JX01217 JX01285 JAX47-SB084 JAX47-SB085 JX47-SB095	0.05	0.1
Ratio Summation of Target Organs/Systems or Effects															
	Carcinogen						3.25				1.3				0.9
	Cardiovascular						0.36				0.18				0.13
	Liver						2.72				0.97				0.68
	Skin						0.36				0.18				0.13

Note:
[a] maximum concentration used for samples that have both mobile and fixed-based laboratory data
[b] total chlordane is a summation of alpha- and gamma-chlordane
NA – not applicable
mg/kg – milligram per kilogram
95% UCL – 95% upper confidence limit of the mean