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DRAFT ECOLOGICAL SAMPLING TECHNICAL MEMORANDUM FOR SOLID WASTE
MANAGEMENT UNITS 1, 2, 3 AND 9 WITH TRANSMITTAL LETTER NAS KEY WEST FL
12/5/1995
BROWN AND ROOT ENVIRONMENTAL



Brown & Root Environmental

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SRC-OES-95-6598
December 5, 1995

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Mr. Dudley Patrick - Code 1858
Southern Division
NAVFACENGCOM
2155 Eagle Drive
North Charleston, SC 29419-9010

via FAX and Federal Express

REFERENCE: NAS Key West Project HK 7046-AD1 (040107)

SUBJECT: Ecological Sampling Technical Memorandum

Dear Mr. Patrick:

As we discussed in our meeting last week on November 30, at NAS Key West, enclosed is one copy of a draft Ecological Sampling Technical Memorandum. This document outlines the type of ecological sampling to be performed at Solid Waste Management Units (SWMUs) 1, 2, 3, and 9 as a part of the implementation of the Phase II RCRA Facility Investigation/Remedial Investigation (RFI/RI). This Technical Memorandum supplements the final RFI/RI workplan which is to be submitted to Regulators by ABB on December 6, 1995.

Please call me as soon as you have reviewed the document to discuss any changes and the method appropriate for transmission to Regulators. I can be reached at 800-368-5497 extension 341. As we agreed last week, I have also forwarded a copy of this draft Technical Memorandum to Richard Hicks of ABB and John Bleiler of ENSR, and formerly of ABB, for their comments.

Sincerely,

Kevin J. Walter, P.E.
Project Manager
NAS Key West (CTO 0007)

KJW:djm
(c:\djm\techmem.doc)

Enclosure: Draft Ecological Sampling Technical Memorandum

cc w/enclosure:
Richard Hicks, ABB
John Bleiler, ENSR
Mike Whitten, B&RE-Aiken
Kevin Donnelly, B&RE-Pittsburgh
Project File 7046-AD1 (040107)

cc w/o enclosure:
File 1.1.1

DRAFT

ECOLOGICAL SAMPLING TECHNICAL MEMORANDUM

NAVAL AIR STATION KEY WEST

PHASE II RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION

DRAFT



BY BROWN & ROOT ENVIRONMENTAL

**KEVIN J. WALTER, P.E.
PROJECT MANAGER
NAS KEY WEST (CTO 0007)**

1.0 INTRODUCTION

This technical memorandum is written to amplify the ecological sampling at four solid waste management units (SWMUs) at Naval Air Station (NAS) Key West as described in the final Work Plan for Phase II RFI/RI by ABB Environmental Services, Inc. dated December 6, 1995. The SWMUs covered herein include:

SWMU 1	Open Disposal Area
SWMU 2	DDT Mixing Area
SWMU 3	Fire Fighting Training Area
SWMU 9	Jet Engine Test Cell

In the following Chapters 2, 3, 4, and 5, each of these four sites will be discussed. Each SWMU-specific chapter contains sections on:

- site history;
- need for further ecological assessment;
- further sampling needs - biological sampling for toxicity testing and tissues analysis, and non-biological sampling.

Lastly, Chapter 6 covers sampling procedures and protocols common to all SWMUs.

The contents of all available ecological background documents were reviewed prior to the preparation of this technical memorandum with emphasis on two documents: 1) Ecological Survey of U.S. Navy Property in the Lower Florida Keys, Monroe County, Florida, August 1994, prepared by the Florida Natural Areas Inventory; and 2) Final Report of RFI/RI (Phase I) for NAS Key West, June 9, 1994, by IT Corporation. Additionally, on November 14-16, 1995, B&RE biologists conducted a community survey overview of all four SWMUs, and searched for potential ecological receptors and visible evidence of ecological stress.

In addition to ecological sampling of the four SWMUs, three facility-wide (Boca Chica) background sampling areas will also be investigated to represent Boca Chica as a whole. At each site background soil, sediment and surface water will be sampled. Also at each site biological sampling will be conducted of all types conducted at each SWMU. These background sites will form the basis for background comparison to all SWMU-specific sampling for both biological and non-biological/chemical samples. The background sites are, therefore, very critical. One of the background sites will be selected far removed from any SWMU, however, in close proximity to the runways of the NAS. This site will reflect any facility-wide contamination that may ubiquitous due to historic military/commercial operations. The two other background sites will be selected on Boca Chica but as far removed from airfield operations and military/civilian development as possible to represent pristine Boca Chica conditions as well as possible.

2.0 SWMU 1 - OPEN DISPOSAL AREA

Site History

SWMU 1 is located in the southeastern portion of Boca Chica Key. The site consists of a former open disposal and burning area bounded by access roads to the north and west and mangroves to the south and east. Mangroves to the east lead to Geiger Creek and mangroves to the south lead to a paved road near the ocean. SWMU 1 was used for open burning and disposal of general refuse and wastes generated from aircraft maintenance activities. The site is estimated to have received 2,600 tons of waste per year from 1942 through the mid-1960s, including solvents, hydraulic fluid, and waste oils. The waste area proper is flat with exposed soil and debris, and little vegetation. Rainwater frequently inundates this area; tidal flooding may occasionally reach the area. Therefore, this area may be considered to normally contain brackish water of less than 25 parts per thousand salinity.

Several previous studies have investigated media contamination at SWMU 1. Initial groundwater investigations were performed at the site by Geraghty and Miller in 1987. Several VOCs, PAHs, and some metals were detected in groundwater samples. IT also conducted a preliminary RI at this site. Only metals were detected in surface water. VOCs were detected in sediment but were not above project-specific action levels; aldrin and heptachlor were also detected in sediments. Several pesticides and PCBs were detected in soils, as well as some VOCs. Dichloroethene was detected in groundwater.

More extensive investigations were performed as part of the RFI/RI (Phase I) sampling effort by IT. One surface water sample contained chrysene and pyrene, as well as copper, lead, mercury, and zinc above background concentrations. Sediment samples included pesticides, PAHs, VOCs, and metals, including lead, in concentrations greater than background, as did soil samples. Groundwater samples contained both organic and inorganic contaminants, although concentrations did not greatly exceed background. Bechtel Environmental, Inc. also conducted soil and sediment sampling to determine the extent of lead contamination for an Interim Removal Action at this site. Several samples contained lead in sediments at concentrations above the sediment quality cleanup criteria of 30.2 ppm. As a result, an extensive excavation of soil and sediment at this site is planned for early 1996.

In addition, IT conducted a baseline ecological assessment at SWMU 1. The assessment concluded that several contaminants of concern (COCs) were present in surface water and soil at concentrations that pose a potential risk to ecological receptors. Piscivores appear to be at greatest risk from PAHs and pesticides bioaccumulated in food items, while fish are at greatest risk from pesticides in water. Complete exposure pathways exist for these receptors. Ingestion of contaminants from contaminated vegetation was determined to be minimal. IT concluded that ecological receptors were at "high" risk at this area from site contaminants. Since contaminants may be migrating via surface waters, offsite receptors may also be at potential risk.

Need for Further Ecological Risk Assessment

Conditions at this site appear to pose possible risks to ecological receptors. Several organic and inorganic contaminants are present in surface water, sediment, and soil at concentrations that may cause adverse effects to aquatic and terrestrial populations. The baseline assessment performed by IT did not fully characterize ecological risk at this site. The possibility of deleterious effects to ecological receptors has not been fully elucidated. No biological samples were taken as part of the baseline ecological assessment and the full extent of surface water, sediment, and soil contamination has not been adequately characterized, with the exception of lead. Therefore, the need for a more thorough investigation of possible ecological risks at this site exists.

Further Sampling Needs

Biological Sampling

Toxicity Testing

Laboratory toxicity testing will be conducted to measure the toxicity to ecological receptors of contaminants in soil, sediment, and surface water at SWMU 1. Sediment and surface water samples will be taken from locations outside the area proposed to be excavated as part of interim removal. Toxicity testing will be done with sediments and sediment pore water only since sediment contamination and risks to benthic organisms are the primary concerns. In cases where the volume of pore-water collected is insufficient to perform a specified test due to site-specific conditions, overlying surface water collected concurrently with sediment samples will be used as a surrogate medium. The samples will be shipped to an approved testing laboratory for screening-level toxicity tests. The amphipod crustacean *Hyaella azteca* will be used for 10-day sediment tests, while the silversides fish (*Menidia sp.*) will be used for 96-hour aquatic toxicity tests. These species have been chosen assuming salinity of less than 25 parts per thousand. Results will be compared to results of tests conducted with the same species using background samples. Testing procedures will follow ASTM Standards on Aquatic Toxicology and Hazard Evaluation.

Soil samples will be collected for terrestrial toxicity tests. Samples will be collected from locations outside the area proposed to be excavated as part of interim removal. The samples will be shipped to an approved testing laboratory for 14-day screening-level toxicity tests using earthworms (*Eisenia foetida*). Results will be compared to results of tests conducted with the same species using background samples.

Tissue Analysis

Several shallow (<12 inches) ponded areas are present at SWMU 1. Wading birds were seen foraging and small fish were observed in this area during a site reconnaissance by Brown and Root Environmental in November 1995. IT also concluded that piscivores may be at risk. Therefore, fish samples will be collected from these areas to determine body burdens of contaminants in aquatic receptors and possible food chain transfer.

Due to the shallow water at SWMU 1, only minnow-sized fish exist at this site. No studies of fish species present have been conducted to date. Species present probably consist of killifish (*Cyprinodontidae*), and *Gambusia* spp. Attempts will be made to collect several fish samples from this site. However, very few fish were seen during the November 1995 visit; thus, the number of fish samples from this site may be limited by availability.

Fish will be collected using seines, dip nets, and funnel traps. Appropriate permits will be obtained. All samples will be collected, frozen, and shipped to the analytical laboratory in accordance with established chain-of-custody procedures. Samples will be analyzed for the chemicals identified as "chemicals of potential concern" in the earlier RFI/RI report (IT, 1994).

There is a possibility that key silversides (*Menidia conchorom*) and mangrove rivulus (*Rivulus marmoratus*) occur at SWMU 1. The Florida Game and Fresh Water Fish Commission lists the key silversides as threatened and the mangrove rivulus as a species of special concern. If any individuals of either of these species are captured, they will be immediately released.

To investigate bioaccumulation of contaminants by soil-dwelling organisms, earthworms will be reared in soil samples for an additional 14 days beyond the 14-day toxicity test described above. Following the 28-day study duration, earthworm samples will be subjected to chemical analysis.

Non-Biological Sampling

Groundwater, surface water, sediment, and soil and will be conducted as per the final work plan and the sampling and analyses plan submitted by ABB Environmental Services (December, 1995).

3.0 SWMU 2 - DDT MIXING AREA

Site History

SWMU 2 is located south of an active taxiway on Boca Chica Key, and adjacent to the north side of a man-made drainage ditch that is connected to a large ponded area in a former borrow pit to the east of the SWMU. Water flow in the ditch and borrow pit pond is tidally influenced and variable, however generally flows west. DDT operations were conducted from the 1940's to the early 1970's in and near Building 915 (demolished in 1982) located approximately 30 feet north of the drainage ditch. The area near the demolished building is sparsely covered by grasses. The water-filled ditch is lined with mangroves.

A previous study of soil contamination at SWMU 2 (Geraghty and Miller, 1987) found chlorinated hydrocarbon pesticides in soil throughout the site. The pesticides included DDT and its metabolites DDD and DDE, as well as hexachlorocyclohexanes. IT (1994) conducted a preliminary RI at this site. High concentrations of chlorinated hydrocarbon pesticides were found in soil, sediment, surface water, and ground water from SWMU 2. A few VOCs were also present.

More extensive investigations were performed as part of the RFI/RJ (Phase I) sampling effort. Soil, ground water, surface water and sediment contaminants consisted primarily of pesticides, but various metals and VOCs were also present in some samples at concentrations greater than background values. Bechtel Environmental, Inc. also conducted soil and sediment sampling to determine the extent of lead and DDT contamination for an Interim Removal Action at this site. Several samples contained lead, DDT, DDD or DDE in soil and sediments at concentrations above the soil and sediment quality cleanup criteria. As a result, an extensive excavation of soil and sediment at this site is planned for early 1996.

IT conducted a baseline ecological assessment at SWMU 2. The assessment concluded that several COCs were present in surface water and soil at concentrations that pose a potential risk to ecological receptors. Piscivores appear to be at greatest risk from pesticides bioaccumulated in food items, while fish are at greatest risk from pesticides in water. Complete exposure pathways exist for these receptors. Ingestion of contaminants from vegetation was determined to be minimal. IT concluded that ecological receptors were at "high to moderate" risk in this area from site contaminants. Since contaminants may be migrating offsite via the ditch, offsite receptors may also be at risk.

Need for Further Ecological Risk Assessment

Conditions at this site appear to pose risks to ecological receptors. Several organic and inorganic contaminants are present in surface water, sediment, and soil at concentrations that may cause adverse effects to aquatic and terrestrial species. Extensive excavation of soil is scheduled to occur at this site. However, the extent of excavation of sediment from the drainage ditch is dependent on on-going dredging/dewatering pilot testing. Since the possibility of deleterious effects to ecological receptors via sediment and surface water contamination has not been fully elucidated, and since no biological samples were taken as part of the baseline ecological assessment, the full extent of surface water and sediment contamination has not been adequately characterized. Therefore, the need for a more thorough investigation of possible ecological risks at this site exists.

Additional Ecological Sampling

Biological Sampling

Toxicity Testing

Laboratory toxicity testing will be conducted to measure the toxicity to ecological receptors of contaminants in sediment and surface water at SWMU 2. Six sediment and surface water samples will be taken from the ditch adjacent to the site, and will also be taken from the borrow pit pond. Toxicity testing will be done with sediments and sediment pore water only since sediment contamination and risks to benthic organisms are the primary concerns. In cases where the volume of pore-water collected is insufficient to perform a specified test due to site-specific conditions, overlying surface water collected concurrently with sediment samples will be used as a surrogate medium. The samples will be shipped to an approved testing laboratory for screening-

level toxicity tests. Mysid shrimp will be used for 10-day sediment tests, while the silversides fish (*Menidia sp.*), oyster, and sea urchin will be used for 96-hour aquatic toxicity tests. Results will be compared to results of tests conducted with the same species using background samples. Testing procedures will follow ASTM Standards on Aquatic Toxicology and Hazard Evaluation. Soil samples will not be collected for terrestrial toxicity tests since extensive excavation of soil is already planned at this site.

Tissue Analysis

Bechtel has reported that numerous fish were observed in the ditch adjacent to the site. Hence, fish samples will be collected from the ditch to determine body burdens of contaminants in aquatic receptors and possible food chain transfer. No studies of fish species present in the ditch have been conducted to date. However, based on an examination of the ditch habitat, possible species available for collection include mullet (*Mugilidae*), mojarra (*Gerreidae*), tarpon (*Megalops atlanticus*), killifish (*Cyprinodontidae*), and *Gambusia* spp. Attempts will be made to collect samples of a top predator species (e.g., tarpon), samples of a benthic species (e.g., mullet or mojarra) and samples of a prey species (e.g., killifish or *Gambusia*) from the ditch. Attempts will also be made to collect fish (several samples per trophic level described above) from the borrow pit at the east end of the ditch.

Fish will be collected using seines, dip nets, gillnets, and funnel traps. Appropriate permits will be obtained. All samples will be collected, frozen, and shipped to the analytical laboratory in accordance with established chain-of-custody procedures. Samples will be analyzed for the chemicals identified as "chemicals of potential concern" in the earlier RFI/RI report (IT, 1994).

There is a possibility that key silversides (*Menidia conchorom*) and mangrove rivulus (*Rivulus marmoratus*) occur in the ditch and/or borrow pit. The Florida Game and Fresh Water Fish Commission lists the key silversides as threatened and the mangrove rivulus as a species of special concern. If any individuals of either of these species are captured, they will be immediately released.

Non-biological Sampling

Extensive excavation of soil is scheduled to occur at this site. Therefore, media sampling will consist of surface water, ground water, and sediment. Sampling will be conducted as per the work plan and the sampling and analyses plan submitted by ABB Environmental Services in December, 1995.

4.0 SWMU 3 - FIRE FIGHTING TRAINING AREA

Site History

SWMU 3 is a former fire-fighting training area located adjacent to a blimp pad in the southeastern portion of Boca Chica Key. Two unlined circular pits are currently discernible at the site. The pits were previously used 5 to 10 times per year for training sessions, during which flammable liquids (jet fuel, waste oils, hydraulic fluids) were poured onto mock aircraft within the pits and ignited. The pits are surrounded by a gravel apron. A nearby lagoon is located to the west and northwest of the pits. Mangroves grow along the shoreline of the lagoon.

During a Preliminary RI conducted by IT, no contaminants were present in soil above established action levels. Several metals were detected in groundwater. Cadmium, chromium, and manganese were detected in concentrations slightly above action levels in groundwater, but the frequencies of detection were low. Some VOCs were also present in groundwater samples, but only in one well. No pesticides were detected in any groundwater samples.

Results from the RFI/RI (Phase I) conducted by IT showed that soils were contaminated with some pesticides (e.g. DDT at 25 mg/kg), VOCs, and PAHs. The VOCs and PAHs were consistent with petroleum fuels that were burned at the site. Zinc was the only inorganic contaminant detected at concentrations significantly above background. Surface water samples contained no organic contaminants of concern, but copper, lead, barium, and thallium were detected in concentrations greater than background. Sediments contained some organic contaminants in one sample, although these constituents were not believed to have originated from SWMU 3. Inorganic contaminants above background concentrations in sediments included lead, chromium, mercury, barium, and tin. These metals were not detected in on-site samples. One of the major recommendations from the RFI/RI for this site was a focused feasibility study to remediate the free product found under the northern burn pit.

IT also conducted a screening level ecological assessment of the site. The assessment concluded that the site as a whole poses low to moderate risk to ecological receptors. Soil contamination was relatively localized on and near the burn pits, and the areas immediately adjacent to the pits are concrete or gravel with little or no vegetation. Also, the highly compacted soils at SWMU 3 limit the amount of hydraulic erosion and vertical contaminant migration. VOCs were detected in groundwater from this site, but not at a downgradient well, suggesting a localized plume. The assessment concluded that the greatest risk to ecological receptors is to aquatic organisms in contact with contaminated surface water and sediments.

As part of an interim removal action sampling program, Bechtel Environmental, Inc. found BTEX at only a few locations outside the northern burn pit berm, and no PAHs outside the berm. BTEX and PAHs were detected inside the berm. No BTEX compounds were detected in any samples above the FDEP cleanup goal of 200 ppm. This study, along with the RFI/RI, established a boundary for soil contaminated with petroleum. Bechtel Environmental then executed the interim

removal in mid 1995, which consisted of removing all soil in the northern burn pit down to the water table. Only small amounts of free product were evident on groundwater (Akers, pers. comm.).

Need for Further Ecological Risk Assessment

Contaminant concentrations in soil and groundwater at SWMU 3 appear to be relatively low and confined. Contaminant migration is negligible due to highly compacted soils and lack of net water table migration. Nonetheless, fairly high concentrations of some contaminants were found in the lagoon surface water and sediment. Additionally, although only two burn pits are currently discernible at the site, historical photographs show that at least four pits were once in use at the site. An aerial photograph dated 11/25/85 shows four burn pits, with what appears to be petroleum product staining on the surface of one pit extending into the nearby lagoon. Based on this historical evidence, further sampling is recommended at SWMU 3 and is discussed below.

Further Sampling Needs

Biological Sampling

Toxicity Testing

Laboratory toxicity testing will be conducted to measure the toxicity to ecological receptors of contaminants in sediment and surface water at SWMU 3. Sediment and surface water samples are proposed from locations in the lagoon near the burn pits. Toxicity testing will be done with sediments and sediment pore water only since sediment contamination and risks to benthic organisms are the primary concerns. In cases where the volume of pore-water collected is insufficient to perform a specified test due to site-specific conditions, overlying surface water collected concurrently with sediment samples will be used as a surrogate medium. The samples will be shipped to an approved testing laboratory for screening-level toxicity tests. Mysid shrimp (*Mysidopsis sp.*) will be used for 10-day bulk sediment tests, while the silversides fish (*Menidia sp.*), oyster (*Crassostrea sp.*), and sea urchin (*Strongylocentrotus sp.*) will be used for 96-hour aquatic toxicity tests. Results will be compared to results of tests conducted with the same species using background samples. Testing procedures will follow ASTM Standards on Aquatic Toxicology and Hazard Evaluation.

Tissue Analysis

The lagoon near SWMU 3 is approximately 20 acres in extent. While no fish studies of the lagoon have been conducted, fish of various species are expected to occur there, and wading birds are known to forage in the lagoon. Therefore, fish samples will be collected from this area to determine body burdens of contaminants in aquatic receptors and possible food chain transfer. Attempts will be made to collect samples of a top predator species (e.g., tarpon), samples of a benthic species (e.g., mullet or mojarra) and samples of a prey species (e.g., killifish or *Gambusia*) from the lagoon. Fish will be collected using seines, dip nets, funnel traps, and gill net. Appropriate permits will be obtained. All samples will be collected, frozen, and shipped to the

analytical laboratory in accordance with established chain-of-custody procedures. Samples will be analyzed for the chemicals identified as "chemicals of potential concern" in the earlier RFI/RI report (IT, 1994).

There is a possibility that key silversides (*Menidia conchorom*) and mangrove rivulus (*Rivulus marmoratus*) occur at SWMU 3. The Florida Game and Fresh Water Fish Commission lists the key silversides as threatened and the mangrove rivulus as a species of special concern. If any individuals of either of these species are captured, they will be immediately released.

Non-biological Sampling

Groundwater, surface water, and sediment will be conducted as per the work plan and the sampling and analyses plan submitted by ABB Environmental Services (1995).

5.0 SWMU 9 - JET ENGINE TEST CELL

Site History

SWMU 9 is located in the northeastern portion of Boca Chica Key. The site consists of a facility that is used to test recently repaired jet engines. The site consists of the engine test cell, fuel storage tanks, an office, and a maintenance shed. The site is bordered on the south by an asphalt road that parallels an active runway, on the north by a saltwater inlet, and on the east and west by open grassy areas. ABB Environmental Services initially conducted a petroleum contamination assessment in response to a 700 gallon spill of JP-5 jet fuel that occurred in 1989, in which most of the fuel was recovered shortly after the spill. During their assessment they also tried to delineate soil contamination around the site from other possible historical discharges of chemicals, including a lubrication oil spill in 1992. Although petroleum constituents were found in the upper 1 foot of soil at several locations using an organic vapor analyzer in the field, ABB Environmental Services determined that this contamination was probably due to shallow groundwater contamination rather than soil contamination. ABB Environmental Services also detected the presence of several chlorinated solvents, such as DCE and TCE, in groundwater samples. The exact source of these contaminants was not determined.

As a result of these findings, ABB Environmental Services proposed further media sampling at SWMU 9 as part of the Phase II RFI/RI. Most of the proposed sampling centered around determining the extent of groundwater contamination as well as possible migration to the nearby saltwater inlet and subsequent surface water and sediment contamination.

During the summer of 1995, Bechtel Environmental, Inc. conducted extensive groundwater sampling at the site, as well as a pilot pump test using a carbon filtration system (Bechtel Tech Memo TM-321-001). Two wells were found to contain free product, and two wells had DCE contamination above regulatory criteria, while some other contaminants were also detected at various locations. However, most of these contaminant concentrations were below regulatory

guidelines. The extent of groundwater contaminant plumes was also further determined. Bechtel also concluded that the pump and treat pilot test was successful, indicating that this type of interim remedial action was feasible.

Upon further review of this sampling study, Bechtel determined that the solvent plume was smaller than previously estimated. Furthermore, Bechtel ascertained that the plume was not reaching the lagoon, due to possible natural degradation and the nature of groundwater flow under the site. As a result, Bechtel sent an addendum to TM-321-001 to the Navy suggesting that the interim remedy at SWMU 9 be "natural attenuation."

Need for Further Ecological Risk Assessment

Although the 1995 Bechtel study further evaluated the nature and extent of groundwater contamination at SWMU 9, several questions remain unresolved. To begin with, groundwater flow under the site has not been fully investigated. Groundwater may flow towards the inlet during some seasons, and if so, this is dominant contamination migration pathway. If this is the case site contaminants may have already reached the inlet, or may do so in the future. No surface water or sediment sampling has been performed in the inlet to date to confirm the presence or absence of contaminant migration from SWMU 9, nor has any biological sampling or toxicity testing been attempted. In addition, although ecological risk assessments have been performed at several SWMUs on NAS Key West, no similar studies have been conducted at SWMU 9. In light of this, the need for further ecological sampling and risk assessment is warranted at this site.

Further Sampling Needs

Biological Sampling

Toxicity Testing

As stated above, no ecological sampling of any type has been performed in the inlet adjacent to the Jet Engine Test Cell. Possible contamination of inlet sediments has not been investigated. As a result, toxicity testing will be done with sediments and sediment pore water collected from the inlet to determine whether contaminants which have migrated to open water may potentially be impacting the benthic community. In cases where the volume of pore-water collected is insufficient to perform a specified test due to site-specific conditions, overlying surface water collected concurrently with sediment surplus will be used as a surrogate medium. The Mysid shrimp, *Mysidopsis sp.*, will be employed as a sediment toxicity test species. Another species initially proposed in the Phase II SAP, the amphipod *Ampelisca abdita*, will not be used as per FDEP objections, since the species is highly tolerant of many contaminants and may not exhibit chronic toxicity. Hence, the chronic sea urchin toxicity test, using *Strongylocentrotus sp.*, will be used as a surrogate. The oyster, *Crassostrea sp.*, will also be employed as a sediment toxicity test species, as mangrove oysters have been observed in the inlet (see rationale below). These organisms are all appropriate for tests with salinities > 25 ppt, which the inlet possesses. Sediment samples for use in toxicity testing will be collected concurrently with samples collected

for contaminant analysis, as described below. Results will be compared to results of tests conducted with the same species using background samples. Testing procedures will follow ASTM Standards on Aquatic Toxicology and Hazard Evaluation.

Tissue Analysis

To this point no organisms have been collected at SWMU 9 to determine tissue contaminant concentrations in native aquatic organisms. Fish at this location would not be appropriate to collect for tissue analysis due to the open nature of the inlet and the transient nature of fish in this area. Also, it does not appear that any benthic species are present in the inlet that are suitable or feasible for collection and subsequent tissue analysis. However, mangrove oysters were observed on mangrove roots in the inlet close to the Jet Engine Test Cell during a November 1995 site reconnaissance by Brown and Root Environmental. If these organisms are present in significant numbers during sampling, they will be collected, along with any other bivalves present, for tissue contaminant analysis. Samples will be analyzed for the chemicals identified as "chemicals of potential concern" in the earlier RFI/RI (Phase I) report (IT, 1994).

Non-Biological Sampling

Additional non-biological sampling is also necessary at SWMU 9. As previously stated, the flow of groundwater has not been fully defined, and although Bechtel has done extensive work delineating groundwater plumes, free product was found in some of their wells. The extent of free product under the site is in need of additional investigation. Therefore, as stated in the Phase II SAP, four new shallow monitoring wells will be installed and along with four existing wells, groundwater sampling will be done at eight locations (Phase II SAP Figure 3-20). Surface water and sediment will also be sampled at five locations along the shoreline of the inlet north of the site (Phase II SAP Figure 3-19). Soil sampling at this site to date has also been inadequate to fully characterize the extent of soil contamination. Five surface and five subsurface soil samples will be taken around the site to verify the vertical extent of soil contamination (Phase II SAP Figure 3-18). Samples in all media will be analyzed for VOCs, SVOCs, pesticides, PCBs, TAL metals, and cyanide.

6.0 SAMPLING PROCEDURES AND PROTOCOLS

General Aquatic Survey

As previously noted, fish will be collected in available habitats at SWMUs 1, 2, and 3, and shellfish will be collected at SWMU 9, and both taken at appropriate reference sites to provide qualitative information on species distribution and abundance, and for quantitative analysis of contaminants in tissue. General field observations of habitat conditions (water depth, bottom type, cover type and extent, channel/basin morphology) and diurnal field measurements of physical/chemical water quality parameters (pH, conductivity/salinity, dissolved oxygen, and

water temperature) using portable field instrumentation will be made at each site at least once during the sampling period (1-3 days) to better assess habitat conditions and assist in interpretation of fish and shellfish sampling results.

Fish will be collected using active or passive gear, as suitable to local site conditions. Fish will be removed from passive gear at frequencies appropriate to minimize fish mortality or deterioration. Upon collection at each sampling location, fish will be identified to species and enumerated. In this process, priority will be given to segregating and returning to the source water as soon as possible any special status species (e.g., key silverside, mangrove rivulus) noted in the collection to minimize potential for mortality. Individuals of species potentially targeted for tissue analysis will be segregated by species/sample in plastic bags and placed on wet ice immediately for later processing, as noted below. Estimates or actual measurements of maximum total length will be obtained for individuals of remaining (nontarget) species as appropriate to provide indication of general health of resident populations (e.g., presence of multiple size classes, evidence of stunting, etc.). Healthy fish will be returned to the source waterbody; expired or disabled fish will be disposed of in accordance with provisions in the scientific collecting permit issued for this work.

Shellfish will be collected with active methods, such as (by hand, with substrate rakes, or in the case of mangrove oysters, knives. Individuals will be taken from all species present on all substrates. Only live organisms will be taken. They will be documented, wrapped in aluminum foil, sealed in plastic bags and shipped to the laboratory within 24 hours. Samples may be placed on ice and frozen prior to shipment.

General field observations; sampling/measurement parameters and methods (e.g., gear type, methods, calibration data, sampling times, responsible crew member) and resulting sampling/measurement data (e.g., physical/chemical measurements; fish and shellfish species composition, abundance, lengths, weights) will be recorded in ink on standard aquatic field survey data sheets. A formal field notebook will be maintained to document field activities, including any problems and deviations from plans and procedures, with appropriate references to standard data sheets, for all field sample collection and processing activities (i.e., general aquatic survey and tissue sample collection/preparation).

Fish Tissue Sample Collection and Preparation

Sample collection and preparation for fish and shellfish tissue analysis will be conducted in accordance with Florida Department of Environmental Protection (FDEP) standard operating procedures (FDEP 1992) and relevant guidance (e.g., EPA 1981, 1993) to the extent appropriate for whole fish and shellfish analysis for ecological risk assessments. Any deviation from FDEP SOPs will be discussed and resolved with FDEP prior to sampling. Essential elements of this protocol are as follows:

Sample Composition - Fish potentially useful as samples for tissue analysis will be segregated by species and size class, placed in plastic bags, temporarily labeled, and placed on wet ice upon collection. Each sample will consist of a single species and may consist of one or more individuals, depending on sampling success and minimum sample weight requirements for

analysis. A minimum of 200 grams per sample is established as an initial target (EPA 1993); final minimum weight requirements will be established in consultation with the selected analytical laboratory. Shellfish useful as samples will be segregated by species and size class, and processed as previously described. The laboratory will be consulted prior to field collection to identify the proper number and weight of shellfish needed for analysis.

Preservation of Sample Integrity - All reasonable efforts will be made to preserve fish sample integrity in collecting, processing, preserving, and packaging samples for shipping by preventing loss of contaminants from collected fish samples and by preventing contamination of these samples from other sources. Specific measures will include (1) segregation of individual fish or fish in a size class potentially comprising separate samples in plastic bags upon collection; (2) decontaminating sampling equipment that could potentially come in contact with samples (e.g., measuring boards, balances) using Liquinox, Alconox, or comparable detergent and rinsates as required by FDEP SOPs prior to initiating sampling, between sampling sites, and between processing of individual samples; (3) wearing disposable gloves for processing and changing gloves as necessary to minimize cross contamination as noted above for decontamination; and (4) packaging samples or sample components separately for shipment. Care will be taken during collection not to breach individual shellfish shells with sampling equipment, such as rakes or knives. Live individuals will be taken; these include animals whose shell cannot be manually pried open. In addition, twice as many specimens as the laboratory requires will be collected if possible, since many specimens will open during transit. Proper decontamination procedures and cross-contamination avoidance methods will be employed during shellfish collection, as per EPA guidance (EPA, 1993).

Sample Processing, Packaging and Shipping - Tentatively designated fish samples (consisting of appropriately segregated, bagged, and tagged specimens placed on wet ice upon collection) will be processed and packaged for shipment as soon as possible after collection. Individual specimens will be measured for wet weight and maximum total length. Length ranges and total weight only may be recorded for composite samples of enumerated small forage fish specimens. Data will be recorded on standard field data sheets. Sample specimens will then be wrapped in extra heavy duty aluminum foil (spines will be clipped before wrapping to prevent puncture of packaging). If deemed acceptable based on discussions with FDEP and the analytical laboratory, composite samples consisting of numerous small specimens may be wrapped as unit samples. A standard sample identification tag will be completed and taped to each foil package, which will in turn be sealed in a plastic bag and either frozen for later shipment or packed in ice for immediate shipment. Frozen samples will be packed (e.g., in dry ice) to ensure they do not thaw prior to receipt by the analytical laboratory; arrangements will be made to ensure that fresh samples shipped in wet ice will be received by the analytical laboratory within 24 hours of collection. Each sample package (e.g., ice chest) for shipment will be sealed and will be accompanied by a properly completed chain-of-custody form. As previously stated, all live shellfish specimens from one location will be wrapped securely in aluminum foil and placed in labeled plastic bags. Wet weights and lengths will be taken in the field for each specimen. Determination of sex for each individual may be done at the laboratory, and the laboratory will be consulted prior to field collection to ascertain the proper number of individuals and/or weights needed for each species for each sample. All relevant sample data specified by EPA (1993) will be recorded on standard

field data sheets. Samples will be packed on wet ice and shipped to the laboratory within 24 hours of collection. Each sample will be accompanied by the properly completed chain-of-custody form.

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