COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) II
Contract No. N62474-94-D-7609
Contract Task Order No. 0289

Prepared for

DEPARTMENT OF THE NAVY
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Final Closeout Report
Removal of Contaminated Surface Soil at Installation Restoration Site 02
Fleet and Industrial Supply Center Oakland
Alameda Facility/Alameda Annex, Alameda, California

DS.0289.17216
December 26, 2001

DEPARTMENT OF TOXIC SUBSTANCES CONTROL
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ABBREVIATIONS AND ACRONYMS

40 CFR	Title 40 of the Code of Federal Regulations
95 UCL	95 percent upper confidence level
ARAR	Applicable or relevant and appropriate requirement
BRAC	Base Realignment and Closure
Cal-EPA	California Environmental Protection Agency's
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CLEAN II	Comprehensive Long-term Environmental Action Navy contract number N62474-94-D-7609
CTO	Contract Task Order
DRMO	Defense Reutilization and Marketing Office
DTSC	Department of Toxic Substances Control
ECC	Environmental Chemical Corporation
EFA West	Engineering Field Activity West
EFD Southwest	Engineering Field Division Southwest
EPA	U.S. Environmental Protection Agency
FFSRA	Federal Facilities Site Remediation Agreement
FISCO	Fleet and Industrial Supply Center Oakland
FS	Feasibility study
FSP/QAPP	Field sampling plan and quality assurance project plan
IR	Installation Restoration
IR02	IR site 02
mg/kg	Milligram per kilogram
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PID	Photoionization detector
ppm	Part per million
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
RAP/ROD	Remedial action plan and record of decision
RCRA	Resource Conservation and Recovery Act
RD	Remedial design
RI	Remedial investigation
ROICC	Resident Officer in Charge of Construction

ABBREVIATIONS AND ACRONYMS (Continued)

SSHP	Site safety and health plan
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TtEMI	Tetra Tech EM Inc.
VOC	Volatile organic compound
WET	Waste extraction test

EXECUTIVE SUMMARY

Alameda Facility/Alameda Annex is a former facility of the U.S. Department of the Navy (Navy). It occupies approximately 143 acres 1.5 miles east of the former Naval Air Station Alameda, along the southern shore of Oakland Inner Harbor in Alameda, California. Installation Restoration (IR) Site 02 (IR02) occupies approximately 10.65 acres in the south-central portion of the facility. The Defense Reutilization and Marketing Office (DRMO) operated a screening lot and scrap yard at IR02 until 1998.

A remedial investigation (RI) was conducted at IR02 in 1996 (PRC Environmental Management, Inc. [PRC] 1996a). During the RI, polychlorinated biphenyl (PCB) and cadmium were found in the soil at concentrations high enough to cause unacceptable risks to human health; the concentrations were mostly confined to the top few inches of soil. A possible source of the PCB contamination is leakage from PCB-containing electrical equipment potentially stored at various locations at the site in the past. Cadmium is a compound with many industrial uses, including such things as paints and metal bearings, which may have been among the many items formerly stored at the site. Two removal actions have been performed earlier at the site as a result of the RI. In the first removal action, a small area of lead-contaminated surface soil and a small area of high PCB surface soil contamination were removed; in the second removal action, an area with PCB contamination at a depth of several feet was excavated at the former site of an underground sump (PRC 1996b; Tetra Tech EM Inc. [TtEMI] 1998).

A feasibility study (FS) was conducted to evaluate potential options for remediation of the PCB and cadmium contamination at the site (TtEMI 1999) as identified by the RI. Excavation and off site disposal of the contaminated surface soil was selected as the method for remediating the soil as documented by the remedial action plan and record of decision (RAP/ROD) (EFD Southwest 2001a). A remedial design (RD) to implement the excavation and off-site disposal was prepared by the Navy (TtEMI 2001a). Surface soil samples from the RI contained PCB concentrations as high as 43 milligrams per kilogram (mg/kg), and cadmium concentrations as high as 86 mg/kg. However, the RI did not determine the locations of the original contaminant sources, so there was potential for PCB and cadmium contamination to exist at other areas of the site where no samples had been collected from the surface soil. Therefore, the RD required additional soil sampling according to a statistically based grid system specified in the field sampling plan and quality assurance project plan (FSP/QAPP), to determine the location of all significant areas of PCB and cadmium contamination (TtEMI 2001b). Under this grid sampling system, the site was divided into a regular network of square grids 46 feet on each side, and an investigative sample would be

collected in the center of each grid square. A grid square would be declared contaminated only if the investigative sample collected within exceeded the cleanup level.

The planned use of the IR02 site is for residential purposes in the western side of the site, and industrial purposes on the eastern side of the site. Therefore, the RAP/ROD required that the site be cleaned up to the residential standards on the western third of the site and to the industrial standards on the eastern two thirds of the site. The RAP/ROD also requires an institutional control ensuring that the development on the eastern side of the site, which is planned for industrial use, and restricted against residential use.

The residential cleanup level selected in the RAP/ROD for PCBs is 1 mg/kg, based on Title 40 Code of Federal Regulations (CFR) Section 761.61. The industrial cleanup level is 10 mg/kg as agreed in the RAP/ROD. The FS estimated that the 95 percent upper confidence level (95 UCL) concentration of PCBs remaining within the surface soil at the site was 7.27 mg/kg (TtEMI 1999).

Cadmium contamination detected in surface soil at the site during the RI clearly exceeded background concentrations with a 95 UCL of 14.3 mg/kg and a maximum site-wide concentration of 86.4 mg/kg. The residential cleanup level approved in the RAP/ROD for cadmium is 12 mg/kg, as established in the FS. The 95 UCL was only slightly above the 12 mg/kg cleanup level; however, variability in the cadmium concentrations appeared high, so the FS concluded that there were likely areas of soil with cadmium concentrations significantly above that. The industrial cleanup level derived in the FS for cadmium is 450 mg/kg, which is well above concentrations found at the site.

The construction contractor selected by the Navy to carry out the remedial action, Environmental Chemical Corporation (ECC), began investigative sampling activities under the FSP/QAPP on May 14, 2001, under contract number N62474-97-D-1512. Excavation of contaminated soil began July 5, 2001, and was completed by the week of November 5, 2001. Backfill of the excavated areas was completed by November 12, 2001.

The results of surface investigative sampling conducted during the remedial action determined that over half of the surface of the site exceeded the cleanup level for either PCBs or cadmium. Before excavating the site, the average PCB concentration in the remedial action investigative samples was 12.1 mg/kg, and the average cadmium concentration in the remedial action investigative samples was 23.4 mg/kg. The highest PCB concentration measured was 884 mg/kg, and the highest cadmium concentration measured was 377 mg/kg in the remedial action investigative samples.

A 6-inch layer of soil and other debris was excavated from each grid in which the soil cleanup level for PCB or cadmium was exceeded, and confirmation samples were collected from remaining soil in the center and at the edge of the excavated grid square. Additional 6-inch layers of soil were excavated in and at the edge of each grid where the confirmation sample still exceeded one of the cleanup levels, until all confirmation samples no longer exceeded the cleanup levels. As a result, soil was excavated to a maximum depth of 2 feet in some areas of the site.

During excavation of soil in the area of grid square 2D, an odor of volatile organic compounds (VOC) was observed. The Navy responded with the collection of additional soil samples in the area that were analyzed for VOCs. The sample results were evaluated for potential human health risk and to determine the extent and severity of the suspected VOC contamination as documented in a technical memorandum. As a result of the sampling and evaluation, the technical memorandum determined that the VOC odor was the caused by low levels of chlorinated benzene contamination in a small area of surface soil limited to chlorinated benzenes already detected during the RI, which the RI had evaluated and found not to cause unacceptable risk to human health or the environment. Therefore, it was concluded that no further action was required to address VOCs in grid square 2D.

Excavation in the area of grid square 2D uncovered the remains of what appeared to be various types of instruments. Because of the concern that instrument dials used during the World War II era sometimes used radium paint for illumination, further investigation was conducted. All the soil that had been excavated within the area in grid square 2D where the instruments were found was spread out in a l-foot-thick layer where it was screened with a gamma scintillation detector capable of detecting the radiation emitted by radium. There were no detections of radiation above background.

The Navy also collected additional samples for PAHs analysis in the eastern two thirds of the site. The results of this additional investigation will be provided under a future decision document titled, "Final Technical Memorandum Risk Assessment Summary for Polynuclear Aromatic Hydrocarbons In Soil at Installation Restoration Site 02 Fleet and Industrial Supply Center Oakland Alameda Facility/Alameda Annex, Alameda, California." The technical memorandum will evaluate the risks from the PAHs in support of the RAP/ROD and the "Draft Final Supplemental Remedial Investigation For Polynuclear Aromatic Hydrocarbon Contaminated Soil at Installation Restoration Site 02" (TtEMI 2000a).

A total of 16,082.66 tons of soil and debris were found to exceed one of the cleanup levels and were removed from the site for off-site disposal. Samples of the soil and debris from each grid that exceeded the cleanup levels were analyzed by the toxicity characteristic leaching procedure from the federal hazardous waste standards under the Resource Conservation and Recovery Act (RCRA), to determine if the soil was a RCRA hazardous waste. Samples of the soil that exceeded the cleanup levels were also analyzed by the State of California Waste Extraction Test to determine whether it was a California hazardous waste. The waste soil and other debris were then segregated into appropriate stockpiles on the site, and were then shipped to appropriate disposal facilities permitted to accept the wastes. After completing the removal of contaminated soil, the site was returned to nearly original grade by the placement of 14,228.78 tons of clean backfill soil.

Excavation activities at IR02 have been completed in accordance with the requirements of the RAP/ROD, and soil has been removed from each area of contamination identified by the investigative samples as exceeding one of the cleanup levels. All confirmation samples collected in accordance with the FSP/QAPP after the final round of excavation show PCB and cadmium levels less than the cleanup levels specified in the RD and the RAP/ROD. No further remedial action will be taken on the soil in the western one third of the site. This portion is ready for unrestricted residential use pending the investigation and resolution of the groundwater benzene plume issue. The investigation will be documented by the "Final Groundwater Technical Memorandum, Installation Restoration Site 02, Fleet and Industrial Supply Center Oakland alameda Facility/Alameda Annex, Alameda, California." No further remedial action will be taken on the soil on the eastern two-thirds of the site. This portion is ready for commercial industrial use and is restricted from residential use.

vehicular traffic. Two earlier PCB removal actions were performed at a small, isolated area of lead-contaminated surface soil; one was at a small area with greater PCB contamination at the surface; and one was at an area with PCB contamination at a depth of several feet at the former site of an underground sump (PRC 1996b, TtEMI 1998).

At the start of the RD, PCB-contaminated soil was known to remain at scattered locations indicated mainly by samples collected in the surface soil. The highest PCB concentrations were detected in samples collected from the top 1 inch of soil. Soil samples contained PCB concentrations as high as 43 milligrams per kilogram (mg/kg) and cadmium concentrations as high as 86 mg/kg. The locations of the original contaminant sources were not determined by the RI, so there was potential for PCB and cadmium contamination to exist at other areas of the site where no samples had been collected from the top 1 inch of soil. The remedial action therefore began with additional sampling to determine the location of all significant areas of cadmium and PCB contamination.

Cadmium contamination detected in surface soil at the site during the RI clearly exceeded background concentrations, with a 95 percent upper confidence level (95 UCL) of 14.3 mg/kg and a maximum site-wide concentration of 86.4 mg/kg. The residential cleanup level for cadmium is 12 mg/kg, as derived in the FS. The 95 UCL was only slightly above the 12 mg/kg cleanup level; however, variability in the cadmium concentrations appeared sufficient, so there were likely areas of soil with cadmium concentrations significantly above that. The industrial cleanup level derived in the FS for cadmium is 450 mg/kg, which is well above levels found at the site.

The residential cleanup level selected for PCBs is 1 mg/kg, based on U.S. Environmental Protection Agency (EPA) guidance (EPA 1990). The industrial cleanup level is 10 mg/kg based on the Toxic Substances Control Act (TSCA) regulations found at Title 40 of the Code of Federal Regulations (40 CFR), Part 761.

For the purpose of estimating the potential risk associated with exposure to surface soil, the FS assumed the average concentration of PCBs remaining within the surface soil at the site to be 7.27 mg/kg (TtEMI 1999). This value was determined by calculating the sum of the 95 UCL for the concentration of all three isomers of PCBs (Aroclor-1016, -1254, and -1260) detected in all 59 surface soil samples collected at the site. The most highly contaminated surface soil samples included a set of 10 samples collected from the sediment within several shallow depressions across the site. Water collects in the depressions during rain

events. Eight of these 10 samples were contaminated with PCBs. Contaminants in seven of the samples exceeded the residential cleanup level of 1 mg/kg. Concentrations in two of these samples (both on the industrial portion of the site) exceed the industrial cleanup standard for PCBs of 10 mg/kg. The contaminated samples were far apart and did not appear to be related, so the Navy assumed that other areas of the surface soil at the site were contaminated with PCBs, and the RD, therefore, required additional sampling to locate any areas where such contamination may exist. A few of the surface sediment samples exceeded the cadmium residential cleanup level of 12 mg/kg, so the Navy determined that soil would be sampled and remediated accordingly for exceedances of the cadmium cleanup level within the residential side of the site.

4.0 RISK TO HUMAN HEALTH AND THE ENVIRONMENT

The RI estimated that the existent risk of cancer to future site workers was greater than 1.0E-04 for exposure to PCBs and the existent non-cancer risk with hazard index was greater than 1.0 for exposure of future site workers to cadmium in surface water and soil. The RI found that there were no unacceptable risks to the environment, so the only action required was to address the human health risks. The FS determined that development of remedial action objectives was only necessary for PCBs and cadmium in surface soil to address these risks (TtEMI 1999). The remedial action objectives developed in the RD were to set cleanup goals for PCBs and cadmium in soil and to reduce exposure to soil that exceeded these cleanup goals. The remedial action plan and record of decision (RAP/ROD) required that the remedial action identify and remove soil that exceeded cleanup levels that allowed residential use on the western side of the site and industrial use on the eastern side of the site. The RAP/ROD also required that the Navy implement institutional controls that prevent redevelopment of the industrial side of the site for residential use.

The planned use of the western side of the site is residential use, and the planned use of the eastern side is industrial use, as shown on the figures. The FS determined that the soil cleanup goals are as follows:

Contaminant	Residential Cleanup Level (milligram per kilogram)	Industrial Cleanup Level (milligram per kilogram)
Total PCBs	1.0	10.0
Cadmium	12.0	450

1.0 INTRODUCTION

Tetra Tech EM Inc. (TtEMI), received Contract Task Order (CTO) 289 from the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Engineering Field Division Southwest (EFD Southwest), under Comprehensive Long-term Environmental Action Navy contract number N62474-94-D-7609 (CLEAN II). The CTO directed TtEMI to prepare a remedial design (RD) and oversee the implementation of a remedial action under the Navy's Installation Restoration (IR) program for contaminated surface soil at IR site 02 (IR02) at Fleet and Industrial Supply Center Oakland (FISCO), Alameda Facility/Alameda Annex, Alameda, California. This document is the site closeout report for the completed remedial action by excavation of contaminated soil with off-site disposal. This document satisfies the requirements set forth in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) pertaining to site closeout reports. Comments on this report were provided by California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). The comments and Navy responses are found in Appendix A.

The remedial action at IR02 addresses polychlorinated biphenyl- (PCB) and cadmium-contaminated surface soil at the site. The soil contamination was identified during the Alameda Facility/Alameda Annex remedial investigation (RI) (PRC Environmental Management, Inc. [PRC] 1996a), and remedial alternatives were evaluated in the feasibility study (FS) for soil at IR02 (TtEMI 1999). As a result of the evaluation of the remedial alternatives, described in the FS report, the alternative selected was excavation and off-site disposal of contaminated soil in an appropriate landfill.

During the investigatory sampling conducted during the remedial action for PCBs and cadmium, the Navy also collected soil samples that were analyzed for polynuclear aromatic hydrocarbons (PAH), to supplement the Navy's PAH sampling that had been conducted at the rest of Alameda Facility/Alameda Annex. The PAH sampling effort at IR02 is documented in a separate draft technical memorandum (TtEMI 2001d). The technical memorandum evaluates the risk due to the PAHs detected. The final technical memorandum will be completed in December 2001, after this final closeout report is submitted.

Section 2.0 describes IR02 and provides its location; Section 3.0 describes the background events leading to remedial action at IR02; Section 4.0 discusses the potential risk to human health and the environment caused by the release or threatened release of hazardous substances from IR02; Section 5.0 describes the organization of the remedial action; Section 6.0 describes the remedial action; Section 7.0 describes site

restoration at IR02; and Section 8.0 discusses recommendations for future actions at IR02.

2.0 SITE LOCATION

Alameda Facility/Alameda Annex occupies approximately 143 acres and is located approximately 1.5 miles east of the former Naval Air Station Alameda, along the southern shore of Oakland Inner Harbor in Alameda, California (Figure 1). IR02 occupies approximately 10.65 acres of Alameda Facility/Alameda Annex and is located in the south-central portion of the facility. The Defense Reutilization and Marketing Office (DRMO) operated a screening lot and scrap yard at IR02 until 1998. The DRMO is responsible for the sorting, resale, and proper disposal of property declared excess by the Department of Defense. The surplus equipment that was transferred to IR02 for processing may have contained fuel, oil, coolants, and other liquids that may have leaked onto the exposed surface soil. IR02 is essentially level, mostly unpaved, and completely enclosed by a chain-link, cyclone fence. The eastern portion of IR02 was used as a scrap yard and for temporary storage of discarded automobiles, stockpiled scrap metal, and surplus equipment. The western portion of IR02 was used as a screening lot and for temporary equipment storage.

The site has a maximum variation in elevation of about 4 feet and is mostly unpaved, except for various patches of asphalt and concrete pavement. An abandoned railroad track and siding runs along part of the site inside the south border (Figure 2). The site has two remaining structures, a small wood and concrete building (Building 366) and a large steel structure that originally served as an airplane hangar (Building 365). Neither of these buildings was affected by this project. The site's storm sewer system, which includes several catch basins, was left in place to provide drainage off site. A sanitary sewer system and other buried and aboveground utilities also remain at the site.

3.0 BACKGROUND

PCB and cadmium at concentrations high enough to cause unacceptable risks to human health were discovered during the RI, mostly confined to the top few inches of soil. A possible source of the PCB contamination is leakage from PCB-containing electrical equipment potentially stored at various locations at the site in the past. Cadmium is a compound with many industrial uses, including such things as paints and metal bearings, which may have been among the many items formerly stored at the site. It is believed that the contamination may have spread across unpaved areas of the site by surface erosion or as a result of

5.0 ORGANIZATION OF REMEDIAL ACTION

This section describes the organizational framework on which the remedial action was based. It includes points of contact, selection of remedial technology, and identification of applicable or relevant and appropriate requirements (ARAR).

5.1 POINTS OF CONTACT

This section identifies personnel from the contractors and agencies who were directly involved in the approval, design, and implementation of the remedial activities.

U.S. Navy – Naval Facilities Engineering Command Southwest Division

Mr. Michael McClelland, P.E., was the Base Realignment and Closure (BRAC) Environmental Coordinator responsible for approval of funding for the remedial action. Mr. Lou Ocampo P.E. was in charge of design and construction of the remedial action project.

U.S. Navy –Naval Facilities Engineering Command Engineering Field Activity West

Mr. John Anderle was the Navy's Administrative Contracting Officer with the Resident Officer in Charge of Construction (ROICC) for the remedial activities and is the point of contact on all environmental cleanup activities at Alameda Facility/Alameda Annex. Ms. Shirley Ng is the ROICC Project Engineer. The ROICC was in charge of managing the construction contractor during implementation of the RD.

California Environmental Protection Agency - Department of Toxic Substances Control

As set forth in the Federal Facilities Site Remediation Agreement (FFSRA), the California Environmental Protection Agency's (Cal-EPA) Department of Toxic Substances Control (DTSC) is the state lead agency with regulatory authority at FISCO. Mr. Henry Wong, the DTSC remedial project manager for the Office of Military Facilities, was provided with all documentation regarding the remedial action and was consulted whenever any changes not included in the approved FS were proposed for completing the remedial action.

Tetra Tech EM Inc.

TtEMI is the prime contractor to the Navy for RI work at Alameda Facility/Alameda Annex. Mr. James P. Wright, P.E., the lead engineer, was responsible for providing technical oversight and guidance to Mr. Lou Ocampo of all project activities performed during the remedial action. Mr. Wright prepared draft contract modifications when it was necessary to clarify how to implement the RD and to direct the construction contractor to perform additional work not covered in the RD. Mr. Wright prepared technical memoranda documenting technical issues that arose during the remedial action and prepared the closeout report.

Environmental Chemical Corporation

The Navy remedial action contractor for this remedial action was Environmental Chemical Corporation (ECC) under contract number N62474-97-D-1512. Mr. Kevin Spala was project manager for ECC on this remedial action.

5.2 SELECTION OF REMEDIAL TECHNOLOGY

Alternative cleanup technologies were considered in the FS (TtEMI 1999), which resulted in the selection of excavation and off-site disposal of contaminated soil as the preferred remedial action alternative. Cleanup alternatives considered at this site included (1) no action; (2) institutional controls; (3) institutional controls and single-layer asphalt cap; (4) excavation and disposal in an off-site landfill; (5) excavation and on-site soil washing; and (6) institutional controls, excavation, and on-site emulsion recycling. Alternative 4 was selected because it achieved equal or better protection of long-term human health and the environment than the other alternatives. Also, alternative 4 was less expensive than other alternatives that were judged equally effective in this regard, and alternative 4 was readily implementable and reliable.

5.3 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Only action-specific ARARs were found to pertain to remedial activities at IR02; no location- or contaminant-specific ARARs were identified. These ARARs included state of California regulations for the management of hazardous wastes under Title 22 of the California Code of Regulations (CCR) Division 4.5, Chapters 11, 12, and 18 and rules limiting air particulate emissions under the Bay Area Air Quality

Management District. Also included were federal regulations for the management of PCBs under 40 CFR 761 and federal regulations for the management of hazardous wastes under 40 CFR 261.

6.0 DESCRIPTION OF REMEDIAL ACTION

This section discusses events pertinent to the remedial action conducted at IR02. It includes the order in which remedial events occurred; on-site activities, such as the submission of documents to DTSC; and the implementation of various actions under the RD.

6.1 CHRONOLOGY OF ACTION

This section provides a summary of the most important milestones for IR02, starting with the determination in the RI that remediation of the site was warranted, through selection of a remedial action alternative and the implementation of that remedial action. Photographs of the site are provided in Appendix B.

In January 1996, the Naval Facilities Engineering Command's Engineering Field Activity West (EFA West) submitted the final RI report (PRC 1996a) to DTSC. The RI report had been prepared by PRC, which subsequently became TtEMI, under the direction of EFA West. It was the RI that identified the need for a remedial action at IR02 to address risks to human health from contamination found at the site.

An FS was conducted by TtEMI under direction of EFA West, to develop appropriate actions to reduce risks identified in the RI report. The final FS report was submitted on January 22, 1999 (TtEMI 1999).

On January 31, 1999, EFD Southwest submitted a design basis report for removal of contaminated surface soil at IR02 (TtEMI 2000b). On May 9, 2001, EFD Southwest submitted the final RD for the removal of contaminated surface soil at IR02 (TtEMI 2001a), based on the conclusions of the design basis report. On May 9, 2001, ECC submitted the final work plan and final quality control plan (ECC 2001a) and the final site safety and health plan (SSHP) (ECC 2001b).

On May 14, 2001, EFD Southwest submitted the final field sampling plan and quality assurance project plan (FSP/QAPP) (TtEMI 2001b), which detailed the approach for collecting investigative samples to define areas of soil at the site that exceeded the cleanup levels and required removal and the approach for

collecting confirmation samples of remaining soil to prove that it was not contaminated after removal was completed.

On May 14, 2001, ECC began field sampling activities at the site, including surveying the site and laying out the grid squares, and investigative sampling of the surface soil as defined in the FSP/QAPP. On May 22, 2001, all investigative sample results showing PCB and cadmium concentrations in surface soil had been received.

On June 11, 2001, the laboratory analysis of the investigative samples for waste characterization was completed. Samples from the grid squares that had been found to exceed one of the cleanup levels for PCBs or cadmium were subjected to additional analysis for the federal toxicity characteristic leaching procedure (TCLP) and the state of California waste extraction test (WET), to determine whether the soil in each grid was either a federal or state of California hazardous waste.

The Navy and the State of California signed the RAP/ROD on June 26, 2001 (TtEMI 2001c). The RAP/ROD stated that IR02 would be remediated as described in the RD.

ECC began excavation work on July 5, 2001. Through July 26, 2001, first round excavations were completed. The second round excavations began July 26, 2001. Through August 22, 2001, second, third, and fourth rounds of excavations and confirmation sampling were completed. On August 30, 2001, ECC completed sampling of paved surfaces that had been within contaminated grid squares. Additional sampling at the site boundary (the fence line) where contamination extended outside the site boundary began on October 3, and ended on October 5, 2001. Demolition of the concrete pads in grids 3N through 3P, 4T through 4X, and 3T through 3X was completed by October 3, 2001; excavation of soil underneath these pads was completed by October 18, 2001. The removal of contaminated soil found in an abandoned catch basin under the concrete pads was completed the week of November 5, 2001.

Air monitoring for dust at the perimeter of the site was initiated on July 6, 2001, and continued until excavation and backfilling activities were completed on November 8, 2001.

Backfilling began on October 24, 2001, and continued until completed on November 6, 2001. Documentation certifying suitability of the material used for backfill is in Appendix C.

6.2 HEALTH AND SAFETY CONSIDERATIONS

ECC prepared an SSHP before mobilization to the site (ECC 2001b). The site safety officer appointed to the project briefed the crew about the various hazards associated with the project before work began. Daily tailgate meetings were held through the duration of the project. All subcontractors followed the SSHP. There were no reportable health or safety-related incidents during the remedial activities.

6.3 SAMPLING OBJECTIVES AND PROCEDURES

The objectives and procedures of sampling for the remedial action were documented in the FSP/QAPP (TtEMI 2001b). This plan specified the collection of samples of two different types, investigative samples collected according to a statistically designed grid, and confirmation samples collected within areas where contaminated soil had been excavated. Not described in the FSP/QAPP were samples collected and analyzed for the purpose of characterizing the waste, as required by the disposal facilities, additional edge confirmation samples, and volatile organic compound (VOC) samples. The purpose and results of the samples are described below.

6.3.1 Investigative Samples

As explained in the FSP/QAPP, the purpose of the investigative sampling was to detect a circular area of PCB or cadmium contamination exceeding the cleanup level in surface soil as small as 2,500 square feet, with a certainty of a false negative of 5 percent. A false negative would be concluding that no areas of surface contamination exist at the site that are 2,500 square feet or larger, when in fact such an area does exist. The cleanup level for PCBs was 1 mg/kg for the residential side of the site and 10 mg/kg for the industrial side of the site. The cleanup level for cadmium was 12 mg/kg for the residential side of the site and 450 mg/kg for the industrial side of the site.

The site was divided into grid squares 46 feet to each side (Figure 2), according to the methodology specified in the RD. Investigative samples were collected at the center point of each grid square, unless the grid square was entirely covered with pavement or was within building 365. There were 233 grid squares within the boundary of the site, and investigative samples were not collected in 14 of them. Eight of the 14 grid squares were inside building 365, and six of the 14 were paved grid squares, which were not sampled. In later rounds of excavation, two of the six paved grid squares were sampled and excavated.

Also, several grid squares were not sampled in the center because either the center was obstructed by pavement or a structure (in which case the grid square was sampled in whatever exposed soil was nearest the center) or the grid square center was located outside the sample boundary (in which case the grid square was sampled along the site boundary at a location inside the fence nearest to the actual grid square center). Figure 2 shows the grid squares and the approximate locations of the investigative samples (those in the center of the grid squares) and the confirmation samples (those at the edges of the grid squares), color-coded to show whether the cleanup levels were exceeded. There were several grid squares that were entirely covered with pavement but were sampled by collecting soil that was found on top of the pavement. Section 6.3.3 discusses these paved areas in greater detail. The results of all investigation and confirmation samples collected at the surface are listed in Table 1.

After the investigative samples were collected and analyzed, any grid square with an investigative sample exceeding one of the cleanup levels was considered contaminated, and all soil within the grid was excavated to a depth of 6 inches. The only exception to this was when grid squares that were partially outside of the site boundary had only the portion within the site boundary excavated. After this first round of excavation, confirmation samples were collected as described in Section 6.3.2.

6.3.2 Confirmation Samples

As explained in the FSP/QAPP, confirmation samples were collected in the center of each contaminated grid after it was excavated to confirm that the soil remaining in the grid square no longer exceeded the cleanup levels after a 6-inch layer of soil was excavated. Additional confirmation samples were collected at each edge of the excavation to confirm that the area of contamination did not extend beyond the edges of the grid square. These edge confirmation samples were collected at the surface of the soil at the center of the edge of the grid square boundary and are shown on Figure 2. The results of all surface samples are presented in Table 1. If the center confirmation sample was found to exceed one of the cleanup levels, then another 6-inch layer of soil was excavated from that grid square. If an edge confirmation sample was found to exceed one of the cleanup levels, then a 6-inch layer of soil from the adjacent grid square was excavated from the half of the adjacent grid square closest to the contaminated edge. This pattern of collecting additional confirmation samples and removing soil that exceeded the cleanup levels continued until all the edge and center samples no longer exceeded the cleanup level.

Figures 2 through 5 show the progression of investigative and confirmation sampling as the excavations proceeded to greater depths. The sample symbols are color coded to show whether the sample exceeded the cleanup level. Figure 2 shows all investigative samples and the subsequent confirmation samples at the edges of contaminated grid squares that were collected at the ground surface. These samples determined the entire area within the site boundary that was found to be contaminated; then, this entire area was subjected to the first round of excavation to a depth of 0.5 foot. Once these areas were excavated, confirmation samples were taken within each grid as explained above. The results of investigation and confirmation samples collected at the surface are shown in Table 1.

Figure 3 shows all the confirmation samples that were collected at a depth of 0.5 foot, after the first round of excavation was completed. The results of all samples collected from a depth of 0.5 foot are presented in Table 2. The areas determined to exceed the cleanup levels were then excavated an additional 0.5 foot, to a depth of 1.0 foot below the original surface.

Figure 4 shows all the confirmation samples that were collected at a depth of 1.0 foot, after the second round of excavation was completed. The results of all samples collected from a depth of 1.0 foot are presented in Table 3. The areas determined to exceed the cleanup levels were then excavated an additional 0.5 foot, to a depth of 1.5 feet below the original surface.

Figure 5 shows all the confirmation samples that were collected at a depth of 1.5 feet and 2.0 feet, after the third and fourth rounds of excavation were completed. The results of all samples collected from a depth of 1.5 and 2.0 feet are presented in Table 4. Grid squares 4N, 4I, 3N, 3O, 3P, and 3Q were the only grid squares found to exceed a cleanup level at this depth, and were excavated to 2.0 feet, at which point the center confirmation samples verified that the soil no longer exceeded a cleanup level.

6.3.3 Paved Surfaces Inside the Site Boundary

After the initial round of excavation was attempted to a depth of 6 inches as shown on Figure 2, many of the grid squares could not be excavated to a full 6 inches because of areas of concrete or asphalt pavement. These paved areas composed approximately 20 percent of the area identified in the investigative sampling to require excavation to a depth of 6 inches, as shown on Figure 6. Since the RD required the removal of a full 6-inch layer of soil within each grid square where the soil had been found to exceed one of the cleanup levels (TtEMI 2001a), it was decided that these paved areas could be left unexcavated only if they were

sampled and found to be uncontaminated. Otherwise, the pavement would have to be broken up and removed. Therefore, Addendum 1 to the work plan was prepared by EFD Southwest (EFD Southwest 2001b). The modification required the removal of any paved area of less than 144 square feet within a contaminated grid square without further sampling because the cost of collecting and analyzing a sample was greater than simply removing pavement from an area less than this size. The collection of one surface core sample was required at the center of each paved area within a contaminated grid square with an area between 144 square feet to 529 square feet. This resulted in dividing a grid square into a maximum of four square sub-areas if it was entirely paved. This frequency of sampling was selected because it resulted in collecting a similar number of samples in each grid, as required for confirmation samples, and because the grid square could be subdivided easily into four equal parts. As Figure 6 shows, most of the pavement sampled in this manner was found not to exceed the cleanup levels and was not removed. Figure 6 also shows the locations where pavement was removed because it was found to exceed one of the cleanup levels.

The pavement in the area of grid squares 3N through 3R, 4T through 4X, and 3T through 3X was of unique concern because some of the highest concentrations of PCB contamination were found above the pavement in these areas. In the most extreme case, one confirmation sample collected at the grid boundary between grids 3U and 3V (sample 3U-E-00), from small amounts of soil found on top of the pad had concentrations as high as 884 mg/kg PCBs. The pavement in these two areas consisted of large concrete pads as shown on Figure 6. Core samples of the concrete were collected in accordance with the paved surface sampling protocol in Addendum 1, after which portions of the pads were excavated where the cleanup level was exceeded, and soil underneath was sampled and found to exceed the cleanup level for PCBs. Because of this, the Navy concluded that PCB-contaminated soil potentially existed below other areas of these two concrete pads. Therefore, the Navy directed the complete removal of the remaining portions of these two pads and sampling of the soil underneath them, as shown on Figure 7. After removal of the pads, soil exceeding the PCB cleanup level under the pads was found in grid squares 3N, 3O, 3P, and 3Q and between grids 3U and 3V. This soil was removed, and confirmation samples were collected until no more contamination remained. The final depth of soil removal in the area of the two pads is shown on Figure 8.

6.3.4 Additional Edge Samples

After collection of the initial rounds of investigative and confirmation samples at the surface, there were several grid squares at which contamination was found at the boundary of the site, requiring additional sampling and excavation beyond the boundary, as shown on Figure 8 and as described below.

After initial excavations, excavated grid squares 1D through 1J, 6A 7B, 7D, 7E, 7I, 7J, 7K, 10Q, 10R, and 10AA all had been excavated to the fence line and still had either an edge confirmation sample that exceeded the PCB cleanup level or an edge confirmation sample had not been collected. Edge confirmation samples were collected for those grid squares that did not have an edge confirmation sample. Additional soil was then excavated at the edge of any grid squares where there was surface soil not covered with pavement. For any grid square in which the edge confirmation sample still exceeded a cleanup level, samples were collected beyond the edge of the latest excavation at a distance of 5 feet, 10 feet, and 15 feet from center of the grid edge. Samples were collected at 0 to 6 inches, 6 to 12 inches and 12 to 18 inches below ground surface (bgs) (except that the 0 to 6 inch sample was eliminated if this interval was pavement). Additional soil was then excavated out to the depth of the first sample that was found not to exceed a cleanup level. The final boundary is that shown on Figure 8.

6.3.5 Volatile Organic Compound Sampling and Potential Radium Instrument Dials in Grid Square 2D

Volatile Organic Compound Sampling: An odor of organic chemicals was observed during soil remediation activities in grid square 2D. Upon investigation, organic vapors were detected with a hand-held photoionization detector (PID). Further investigation of the area was then conducted under an addendum to the FSP/QAPP (TtEMI 2001f). To find the area with the highest VOC concentration, two intersecting trenches were dug in the area, and soil samples were collected at the locations having the highest VOC readings on the PID.

Analytical results of the VOC sampling detected low concentrations of 11 different VOCs, one of which, 1,4-dichlorobenzene, exceeded the EPA Region 9 preliminary remediation goal (PRG) of 3.4 mg/kg in two samples (EPA 2000). The two samples that exceeded the PRG were found to have 1,4-dichlorobenzene at 18.0 and 14.0 mg/kg. These two samples were within a close grouping of samples in which higher levels of VOCs were detected and were estimated to represent a very small area of about 37.5 square feet of contamination, at a depth of 0.5 to 2.0 feet bgs.

The results of the VOC investigation were evaluated in a technical memorandum (Appendix D), which concluded, with DTSC concurrence, that no further action was required at the site to address VOCs. The technical memorandum compared the VOC concentrations detected in grid 2D with VOC data from the RI (PRC 1996a) and determined that several of the same VOCs were detected infrequently during the RI at other locations within IR02. During the RI, 1,4-dichlorobenzene was detected at IR02 at a concentration as high as 17 mg/kg, very close to the 18.0 mg/kg level detected in this sampling effort. The technical memorandum concluded that potential risks and hazards associated with potential exposure to this soil contamination were limited. Of 11 VOCs detected in soil samples collected from two trenches at grid 2D, only 1,4-dichlorobenzene exceeded its EPA Region 9 residential PRG. The risk due to the other detected VOCs was insignificant and did not warrant further evaluation. The technical memorandum found that the concentrations of 1,4-dichlorobenzene measured in soil samples collected at grid 2D are similar to those measured at other locations at IR02 during the RI. As stated in the RI, the risk associated with potential residential exposure to 1,4-dichlorobenzene was calculated as 5E-06. Based on its infrequent detection and the low magnitude of the calculated residential risk, 1,4-dichlorobenzene was not identified as requiring remediation based on the RI results (PRC 1996a). Therefore, the technical memorandum concluded that since the VOC contamination in grid square 2D was similar in magnitude to that found and evaluated in the RI, no further action was required to remediate it.

Potential Radium Instrument Dials: During excavation of surface soil, fragments of several instrument dials were uncovered in the area of grid square 2D. Because of the concern that such dials could have been of the type that the military once used that used radium paint, a limited investigation was conducted. It should also be noted that an extensive and systematic investigation for radioactivity had been conducted at IR02 during the RI, which found no detections of radioactivity above background. Photographs of the dials found in grid square 2D during the remedial action were forwarded to radioactive materials expert Robert O'Brien of TtEMI, who examined photographs of the items and confirmed that they were not recognizable as items that typically contain radium. To be cautious, however, the dials were screened for radiation by ECC using a gamma scintillation detector and were found not to emit radioactivity. All the soil that had been excavated within the area in grid square 2D where the instruments were found was spread out in a 1-foot-thick layer where it was also screened with the scintillation detector before being shipped off site for disposal. There were no detections of radiation above background. The investigation of radium dials at grid square 2D was documented in an electronic mail memorandum submitted by ECC, included as Appendix E.

Catch Basin Under Grid Square 3U: After demolishing the large concrete pads that had covered grid squares 3N through 3R, 4T through 4X, and 3T through 3X, six concrete sumps or vaults that had been catch basins from an old storm drain system were found. The catch basins measured approximately 5 square feet square, and 6 feet deep, and were full or partially full of soil or sediment. The soil and sediment within one of the catch basins in grid square 3U appeared stained and was removed after it was sampled. The sample from grid square 3U was found to exceed the industrial cleanup level for PCBs. The catch basin in grid square 3U was left in place and backfilled after a confirmation sample of the bottom of the catch basin verified that the structure did not exceed the cleanup level for PCBs or cadmium. The other five catch basins were also left in place.

6.4 QUANTITIES OF MATERIAL REMOVED AND DISPOSAL PROCEDURES

Waste characterization samples were collected from the soil that investigative or confirmation samples had shown to exceed one or more of the cleanup levels. The characterization samples were analyzed for the purpose of determining the regulatory requirements for disposal and to meet the requirements of the disposal facilities that ECC selected for disposal of contaminated soil from the site. To do this, the contaminated soil samples were analyzed by the TCLP and the California WET tests. The analytical requirements of the characterization samples were not specified in the FSP/QAPP because the requirements are dictated by the receiving disposal facility. The characterization samples consisted of additional aliquots of soil taken from the investigative and confirmation samples that were found to exceed one of the cleanup levels. These aliquots were analyzed before the grid squares they represented were excavated so that the soil could be excavated and stockpiled with soil of similar characteristics and disposal requirements. Figure 9 shows the waste category determined for soil in each of the grid squares. Soil was excavated from each of the grid squares and stockpiled with similarly categorized soil prior to being loaded onto trucks for shipment to off-site disposal facilities. Additional characterization samples were also collected directly from the soil stockpiles when the need for additional characterization for other metals was required by the disposal facilities.

At the completion of the excavation, a total of 16,082.66 tons of soil, concrete and asphalt pavement, and miscellaneous debris was removed from grid squares that exceeded either the cadmium or PCB cleanup level and shipped off site for disposal. The waste was separated into five regulatory categories as defined below. The quantities of waste material in each of the five categories are shown in Table 5.

- Non-hazardous -Waste material with concentration of PCBs of less than 50 parts per million (ppm) and did not fail either the TCLP or California WET tests

- California Hazardous -Waste material with concentration of PCBs of less than 50 ppm and that failed the California WET test, but not the TCLP test

- Resource Conservation and Recovery Act (RCRA) Hazardous - Waste material with concentration of PCBs of less than 50 ppm and failed the TCLP test and may have failed the California WET test

- California Hazardous and TSCA-regulated -Waste with concentration of PCBs of more than 50 ppm and that did not fail the TCLP test

- RCRA Hazardous and TSCA-regulated - Waste with concentration of PCBs of more than 50 ppm and that failed the TCLP test

The Navy's Caretaker Support Officer, Mr. Doug Delong, reviewed records of all manifests of shipments of waste shipped off site and verified that a weight ticket and certificate of disposal were received for each truckload shipped.

7.0 SITE RESTORATION AND CONCLUSION

After completion of excavation, ECC submitted the required documentation for the selected backfill material, including the following documents (see Appendix B):

- Supplier certification of clean backfill material
- Total petroleum hydrocarbons and polycyclic aromatic hydrocarbons
- PCBs and metals
- Proctor analysis of optimal water content for compaction

At completion of the project, 14,228.78 tons of backfill have been placed at the site. The backfill material was placed approximately equal to the original contours at the site so as not to change surface water drainage patterns. Final as-built drawings prepared by ECC are provided in Appendix F. The as-built drawings show the final excavation depths, the locations of various items removed from the site, and the final configuration of the site fence.

The results of surface investigative sampling conducted during the remedial action determined that prior to the remedial action, over half of the surface of the site exceeded the cleanup level for either PCBs or

cadmium. Before excavating the site, the average PCB concentration in the investigative samples was 12.1 mg/kg, and the average cadmium concentration in the investigative samples was 23.4 mg/kg. The highest PCB concentration measured was 884 mg/kg (at the surface of grid 3U), and the highest cadmium concentration measured was 377 mg/kg (0.5 feet deep in grid 1D).

Excavation activities at IR02 have been completed in accordance with the requirements of the RAP/ROD, and soil has been removed from each area of contamination identified by the investigative samples as exceeding one of the cleanup levels. All confirmation samples collected according to the FSP/QAPP after the final round of excavation show PCB and cadmim levels less than the cleanup levels specified in the RD and the RAP/ROD.

As required by the RAP/ROD, an institutional control has been implemented ensuring that the development on the eastern side of the site is restricted to industrial uses, rather than residential development (Navy. 2000a, 2000b). No further remedial action will be taken on the soil in the western third of the site. This portion is ready for unrestricted residential use pending the investigation and resolution of the groundwater benzene plume issue. The investigation will be documented in the "Final Groundwater Technical Memorandum, Installation Restoration Site 02, Fleet and Industrial Supply Center Oakland alameda Facility/Alameda Annex, Alameda, California." The draft version of this report was submitted in November 2001 (TtEMI 2001f).

The Navy also collected additional samples for PAH analysis in the eastern two-thirds of the site. The results of this additional investigation is provided in a decision document titled, "Final Technical Memorandum on the Polynuclear Aromatic Hydrocarbons In Soil at the Eastern Portion of Installation Restoration Site 02, Fleet and Industrial Supply Center Oakland Alameda Facility/Alameda Annex, Alameda, California" (TtEMI 2001d). The technical memorandum evaluates the risks from PAHs in support of the RAP/ROD and the "Draft Final Supplemental Remedial Investigation for Polynuclear Aromatic Hydrocarbon Contaminated Soil at Installation Restoration Site 02" (TtEMI 2000a). No further remedial action will be taken on the soil on the eastern two-thirds of the site. This portion is ready for commercial or industrial use and is restricted from residential use.

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