Final

No Action/No Further Action Decision Document 7 Consent Order Sites and 14 PI/PAOC Sites

Former Vieques Naval Training Range
Vieques, Puerto Rico

Naval Facilities Engineering Command

Prepared for

Department of the Navy

NAVFAC ATLANTIC

Contract No.
N62470-08-D-1000
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Prepared by

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Acronyms and Abbreviations

amsl	above mean sea level
AOC	Area of Concern
AST	aboveground fuel storage tank
AVGAS	aviation gasoline
B(a)A	Benzo(a)anthracene
B(a)P	Benzo(a)pyrene
B(b)F	Benzo(b)fluoranthene
bgs	below ground surface
bls	below land surface
BTEX	benzene, ethylbenzene, toluene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
CLP	Contract Laboratory Program
COPC	constituent of potential concern
CPC	Navy's Central Processing Center
CSM	conceptual site model
DAF	dilution attenuation factor
D(a,h)A	dibenz(a,h)anthracene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DoD	Department of Defense
DOI	Department of the Interior
DRO	diesel range organics
EBS	Environmental Baseline Survey
ELCR	excess lifetime cancer risk
EMA	Eastern Maneuver Area
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
EQB	Environmental Quality Board
ERI	Environmental Research Inc.
ERP	Environmental Restoration Program
ESI	Expanded Site Investigation
FID	flame ionization detector
ft	foot or feet
ft^2	square feet
GRO	Gasoline Range Organics

HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	hazard quotient
I(123cd)P	indeno(1,2,3-cd)pyrene
IAS	Initial Assessment Study
JP	jet propellant
lf	linear feet
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MC	methylene chloride
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mm	millimeter
MOGAS	unleaded gasoline
MS/MSD	matrix spike / matrix spike duplicate
MTBE	methyl tert-butyl ether
MW	Monitoring Well
NAPR	Naval Activity Puerto Rico
NASD	Naval Ammunition Support Detachment
NAVFAC	Naval Facilities
Navy	United States Navy
NCEA	National Center for Environmental Assessment
NFA	no further action
NFESC	Naval Facilities Engineering Command
NOAA	National Oceanic and Atmospheric Administration
NOAELs	no observable adverse effect level
NPL	National Priorities List
NSRR	Naval Station Roosevelt Roads
OD	outer diameter
OP	observation post
ORO	oil range organics
OVA	organic vapor analyzer
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PAOC	potential area of concern
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
PI	photo identified
PID	Photoionization detector
POL	petroleum, oil, and lubricant
Ppm	parts per million
ppt	parts per trillion
PREQB	Puerto Rico Environmental Quality Board

ProUCL	statistical software that calculates UCL
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RSL	Regional Screening Level
SAP	Sampling and analysis plan
SB	subsurface soil sample
SI	Site Investigation
SIA	Surface Impact Area
SOP	standard operating procedures
SS	surface soil sample
SSL	soil screening level
SVOC	semivolatile organic compound
SW	surface water sample
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
TCLP	toxicity characteristic leaching procedure
TCE	trichloroethene
TEQ	toxicity equivalence
TP	test pit
TPH	total petroleum hydrocarbon
TRPH	total recoverable petroleum hydrocarbons
UCL	Upper Confidence Limit
UFP-SAP	Unified Federal Policy Sampling and Analysis Plan
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USMC	United States Marine Corps
UST	underground storage tank
UTL	upper tolerance limits
VNTR	Vieques Naval Training Range
VOC	volatile organic compound
VSI	Visual Site Inspection

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Declaration

The United States Department of the Navy (US Navy), in partnership with the United States Environmental Protection Agency (USEPA), Puerto Rico Environmental Quality Board (PREQB), and United States Department of Interior Fish and Wildlife Service (USFWS), has determined, based on the information contained within this Decision Document, that no further investigative activities are warranted and that no action/no further action is necessary to be protective of human health and the environment at the following sites:

- Solid Waste Management Unit (SWMU) 2 – Fuels Off-loading Site
- SWMU 4 – Waste Areas of Building 303 (Camp Garcia)
- SWMU 6 & 7 – Waste Oil and Paint Accumulation Areas (Seabees Area, Camp Garcia)
- SWMU 10 – Sewage Treatment Lagoons
- Area of Concern (AOC) A – Diesel Fuel Fill Pipe Area
- AOC G – Pump Station and Chlorination Building at Sewage Lagoons
- Photo-Identified site (PI) 5 – Former Airfield and Associated Ditches
- PI 6 – Former PCB Storage Pad and Vehicle Wash Pad
- PI 8 – Former Motor Pool Maintenance Area
- PI 10 – Former Wastewater Leach Field
- PAOC I – Former Power Plant and Mechanics Shop
- PAOC J – Former Vehicle Maintenance Area
- PAOC K – Former Wash Rack
- PAOC L – Former Paint and Transformer Storage Area
- PAOC M – Former Fuel Facility
- PAOC N – Former Fuel Farm and Filling Station
- PAOC O – Former Boiler Room in Heat Plant Building 238
- PAOC P – Former Water Treatment Pumphouse
- PAOC S – Former POL Pipeline and Power Plant
- PAOC X – Debris Area in Ephemeral Stream

Kevin Cloe, US Navy Remedial Project Manager	9/16/10 Date
Daniel Rodriguez, USEPA Remedial Project Manager	9/17/2010 Date
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Executive Summary

This Decision Document provides formal concurrence among the stakeholder agencies (United States Navy [Navy], United States Environmental Protection Agency [USEPA] Region 2, Puerto Rico Environmental Quality Board [PREQB], and United States Fish and Wildlife Service [USFWS]) that no action is necessary at 21 sites located within the former Vieques Naval Training Range (VNTR) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). **Figure ES-1** shows the geographic location of Vieques, including the former VNTR, in relation to mainland Puerto Rico and the surrounding islands. The locations of the sites contained within this Decision Document are shown in **Figure ES-2**. The sites included in this Decision Document are:

- Solid Waste Management Unit (SWMU) 2 – Fuels Off-loading Site
- SWMU 4 – Waste Areas of Building 303 (Camp Garcia)
- SWMU 6 & 7 – Waste Oil and Paint Accumulation Areas (Seabees Area, Camp Garcia)
- SWMU 10 – Sewage Treatment Lagoons
- Area of Concern (AOC A) – Diesel Fuel Fill Pipe Area
- AOC G – Pump Station and Chlorination Building at Sewage Lagoons
- Photo-Identified site (PI) 5 – Former Airfield and Associated Ditches
- PI 6 – Former PCB Storage Pad and Vehicle Wash Pad
- PI 8 – Former Motor Pool Maintenance Area
- PI 10 – Former Wastewater Leach Field
- PAOC I – Former Power Plant and Mechanics Shop
- PAOC J – Former Vehicle Maintenance Area
- PAOC K – Former Wash Rack
- PAOC L – Former Paint and Transformer Storage Area
- PAOC M – Former Fuel Facility
- PAOC N – Former Fuel Farm and Filling Station
- PAOC O – Former Boiler Room in Heat Plant Building 238
- PAOC P – Former Water Treatment Pumphouse
- PAOC S – Former Power Plant
- PAOC X – Debris Area in Ephemeral Stream

The no action determinations made for these sites is based on an understanding of historical site uses, potential contaminant sources, and potential CERCLA-related release mechanisms; site visit observations; and, where warranted, collection and evaluation of site-specific environmental media samples. **Table ES-1** summarizes the information upon which the no action determinations have been made for each of the sites. More detailed discussion is presented in each of the site-specific sections contained in this Decision Document.

TABLE ES-1
Summary of Conclusions and Recommendations
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site Name	Site Description	Site History	Potential Source(s)	Potential Release Mechanism(s)	Site-specific Data Collected	Results of 7-step Decision Analysis	Rationale for No Action / No Further Action Determination
SWMU 2	Fuels Off-loading	Fuel offloaded from barges, pumped to series of above-ground storage tanks (ASTs)	Fuel transfer operations and ASTs	Leaks or spills to ground surface	30 surface soil samples and 15 subsurface soil samples around fuel offloading area, along former fuel transfer pipeline, and in vicinity of all former ASTs	Data suggest potential source areas were sufficiently characterized	Data suggest a localized release at one former AST, but contaminant concentrations (primarily lead) across site do not pose an unacceptable human health or ecological risk or leaching concern for groundwater; average lead concentration is less than PREQB Land Pollution Control Corrective Action Level
SWMU 4	Waste Areas of Building 303 (Camp Garcia)	Storage sheds for spent batteries, waste rags, absorbent material, and grease; catch basin for hydraulic oil and cleaning/degreasing	Materials stored in sheds; catch basin	Leaks or spills to ground surface	12 surface soil samples and 1 subsurface soil sample around all potential source areas; 1 regional groundwater sample	Data suggest potential source area was sufficiently characterized	Data suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
SWMU 6/7	Waste Oil and Paint Accumulation Areas	Concrete pad and caged area used to stage waste oil in 55-gallon drums and paint in small containers	Drums and small containers of waste oil and paint	Leaks or spills to concrete surface; runoff to ground surface	16 surface soil samples and 6 subsurface soil samples around entire perimeter of concrete pad	Data suggest potential source area was sufficiently characterized	Data suggest there has not been a CERCLA-related release that has resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
SWMU 10	Sewage Treatment Lagoons	Four historically unlined lagoons for Camp Garcia sanitary sewage treatment from 1950s to 2000 (lined in 1974); treated effluent discharged to land and/or sea until 1974; no discharge after 1974	Sewage treatment lagoons	Discharge to ground surface; leaching from lagoons into soil and/or groundwater	20 co-located surface soil and subsurface soil samples within lagoons; 5 monitoring wells (4 within and 1 outside lagoons); 8 additional surface soil samples for thallium analysis only	Data suggest potential source area was sufficiently characterized	Data suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
AOC A	Diesel Fuel Fill Pipe Area	15,000-gallon diesel fuel underground storage tank (UST) at OP-1; first one removed in 1997; second removed in 2003	UST and associated piping	Leaks or spills to ground surface and to subsurface soil	10 confirmatory subsurface soil samples around and beneath UST and associated piping following removal; additional soil removal and 26 confirmatory soil samples during ESI	Data suggest potential source area was sufficiently characterized	Following tank, associated piping, and adjacent soil removal, current total petroleum hydrocarbon (TPH) concentrations are acceptable relative to the PREQB Land Pollution Control Corrective Action Level

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AOC G	Pump Station and Chlorination Building	Building used for chlorination and pumping of sewage being treated in lagoons (SWMU 10)	Chlorine contact chamber; piping; pump maintenance activities	Spills or leaks from chlorine contact chamber and/or associated piping to ground surface; spills or other discharge of pump maintenance fluids outside building	7 surface soil and 2 subsurface soil samples around building and chlorine contact chamber	Data suggest potential source areas were sufficiently characterized	Data suggest there has not been a CERCLA-related release that has resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PI 5	Former Airfield and Associated Ditches	Airfield, fire department, temporary tents	Airfield staining	Runoff from stained areas into ditches and transport in ephemeral streams	4 co-located surface soil and subsurface soil samples and 4 additional surface soil samples in former stained areas and depositional areas in ditches and ephemeral streams	Data suggest potential source areas were sufficiently characterized	Data suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PI 6	Former PCB Storage Pad and Vehicle Wash Pad	Fresh water storage, UST, vehicle washing, PCB storage	PCB storage on pad; vehicle washing activities	Runoff from vehicle wash pad, runoff from PCB storage pad to ground surface and sump	6 wipe samples on PCB concrete storage pad, 2 co-located surface and subsurface soil samples adjacent to PCB storage pad, and 1 surface soil sample within concrete pad sump; 3 surface soil samples near UST; 1 co-located surface and subsurface soil sample adjacent to vehicle wash pad	Data suggest potential source areas were sufficiently characterized	Data associated with PCB storage pad suggest a CERCLA-related release of PCBs has not occurred. Data associated with UST and vehicle wash pad suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PI 8	Former Motor Pool Maintenance Area	Motor pool maintenance area, car wash, oil drum storage and disposal area, asphalt emulsion drum storage area, storage area for hazardous materials and petroleum products	Vehicle maintenance; drums, hazardous materials, and petroleum products	Spills or leaks to ground	Magnetic survey to look for buried drums; 9 co-located surface and subsurface soil samples and 4 additional surface soil samples in most likely areas of release; 1 surface soil sample in drainage ditch where runoff from site is most likely	Data suggest potential source areas were sufficiently characterized	Data suggest there has not been a CERCLA-related release that has resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PI 10	Former Wastewater Leach Field	Former sludge drying lagoons (leach field) for former wastewater treatment plant	Wastewater sludge	Leaching from sludge	3 co-located surface soil and subsurface soil samples and 3 additional surface soil samples within and adjacent to former lagoons	Data suggest potential source areas were sufficiently characterized	Data suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater

TABLE ES-1
Summary of Conclusions and Recommendations
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site Name	Site Description	Site History	Potential Source(s)	Potential Release Mechanism(s)	Site-specific Data Collected	Results of 7-step Decision Analysis	Rationale for No Action / No Further Action Determination
PAOC I	Former Power Plant and Mechanics Shop	Building formerly used as a power plant and mechanics shop	Power plant and mechanic activities	Discharge through building pipe penetrations or via doors	5 co-located surface soil and subsurface soil samples; one each adjacent to 3 pipe penetrations and 2 doors	Data suggest potential source areas were sufficiently characterized	Data suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PAOC J	Former Vehicle Maintenance Area	Vehicle maintenance; facility demolished prior to 1980	Vehicle maintenance operations	Spills or leaks to ground surface	6 co-located surface soil and subsurface soil samples across former vehicle maintenance area; 1 regional groundwater sample	Data suggest potential source area was sufficiently sampled	Data suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PAOC K	Former Wash Rack	Vehicle washing on a rack; facility demolished prior to 1980	Vehicle washing operations	Runoff of vehicle wash fluids to ground surface	5 co-located surface soil and subsurface soil samples at former wash rack location; 1 regional groundwater sample	Data suggest potential source area was sufficiently sampled	Data suggest there has not been a CERCLA-related release or, if a release occurred, it has not resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PAOC L	Former Paint and Transformer Storage Area	Small, single room concrete block building used for storage of paints and transformers	Containers of paints; transformers	Spills or leaks onto concrete floor and tracked outside; spills or leaks outside building	4 co-located surface soil and subsurface soil samples and 1 monitoring well around building during SI; 8 surface soil samples and 4 confirmatory subsurface soil samples following soil removal	Data suggest potential source areas were sufficiently characterized	Data suggest sufficient soil contaminated with pesticides was removed and that residual pesticide concentrations are consistent with concentrations attributable to normal pesticide use, not a CERCLA-related release
PAOC M	Former Fuel Facility	Former dispatch office, sleeping quarters, fuel facility	Fuel-related materials, if historically present	Spills or leaks to ground surface	4 continuous soil borings around footprint of former building for visual, odor, or PID evidence of contamination	No visual, odor, or PID evidence of contamination detected; no sampling required	Visual, odor, and PID evidence suggests a CERCLA-related release did not occur
PAOC N	Former Fuel Farm and Filling Station	3 ASTs present from 1985 through 1992; two-compartment AST (gas and diesel) installed in 2000	ASTs	Spills or leaks onto ground surface	Geophysical survey to determine if underground fuel pipeline is present; 3 co-located surface soil and subsurface soil samples around the former ASTs; 1 co-located surface soil and subsurface soil sample and 1 monitoring well at the former fuel building location	Data suggest potential source area was sufficiently sampled	Geophysical survey confirmed no underground fuel pipeline present; data suggest there has not been a CERCLA-related release that has resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater

TABLE ES-1
Summary of Conclusions and Recommendations
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site Name	Site Description	Site History	Potential Source(s)	Potential Release Mechanism(s)	Site-specific Data Collected	Results of 7-step Decision Analysis	Rationale for No Action / No Further Action Determination
PAOC O	Former Boiler Room in Heat Plant Building 238	Boiler room in building constructed in 1953 and demolished in 1989	Boiler	Spills or leaks to ground surface	2 co-located surface and subsurface soil samples within footprint of former building	Data suggest potential source area was sufficiently sampled	Data suggest there has not been a CERCLA-related release that has resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PAOC P	Former Water Treatment Pumphouse	Water treatment pumphouse in building constructed in 1953 and demolished in 1989. Mobile generator removed during SI.	Mobile generator	Leaks or spills to ground surface	1 co-located surface and subsurface soil sample beneath mobile generator	Data suggest potential source area was sufficiently sampled	Mobile generator removal has eliminated the potential future source of contamination; data suggest there has not been a CERCLA-related release that has resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PAOC S	Former POL Pipeline and Power Plant	Two physically separate areas - underground fuel transfer pipeline from SWMU 2 to airfield (removed in 1984); former power plant in Camp Garcia	Former pipeline; power plant operations	Spills or leaks to ground surface; release also to subsurface from pipeline	Geophysical survey to determine if underground fuel pipeline or UST is present; 14 co-located surface soil and subsurface soil samples along former pipeline; 2 surface soil samples between pipeline and salt flat; 5 co-located surface soil and subsurface soil samples and 1 monitoring well at the former power plant location	Data suggest potential source area was sufficiently sampled	Geophysical survey confirmed no underground fuel pipeline or UST present; data suggest there has not been a CERCLA-related release that has resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater
PAOC X	Debris Area in Ephemeral Stream	Automobile, tires, scrap metal, and construction-type debris disposed in and adjacent to an ephemeral stream. Debris removed during SI.	Miscellaneous debris	Leaching of constituents from debris to soil	4 surface soil samples in vicinity of debris; 7 confirmatory surface soil samples and 4 confirmatory subsurface soil samples beneath debris following removal	Data suggest potential source areas were sufficiently characterized	Debris removal has eliminated the potential future source of contamination; data suggest there has not been a CERCLA-related release that has resulted in soil contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater

FIGURE ES-1
Regional Location Map
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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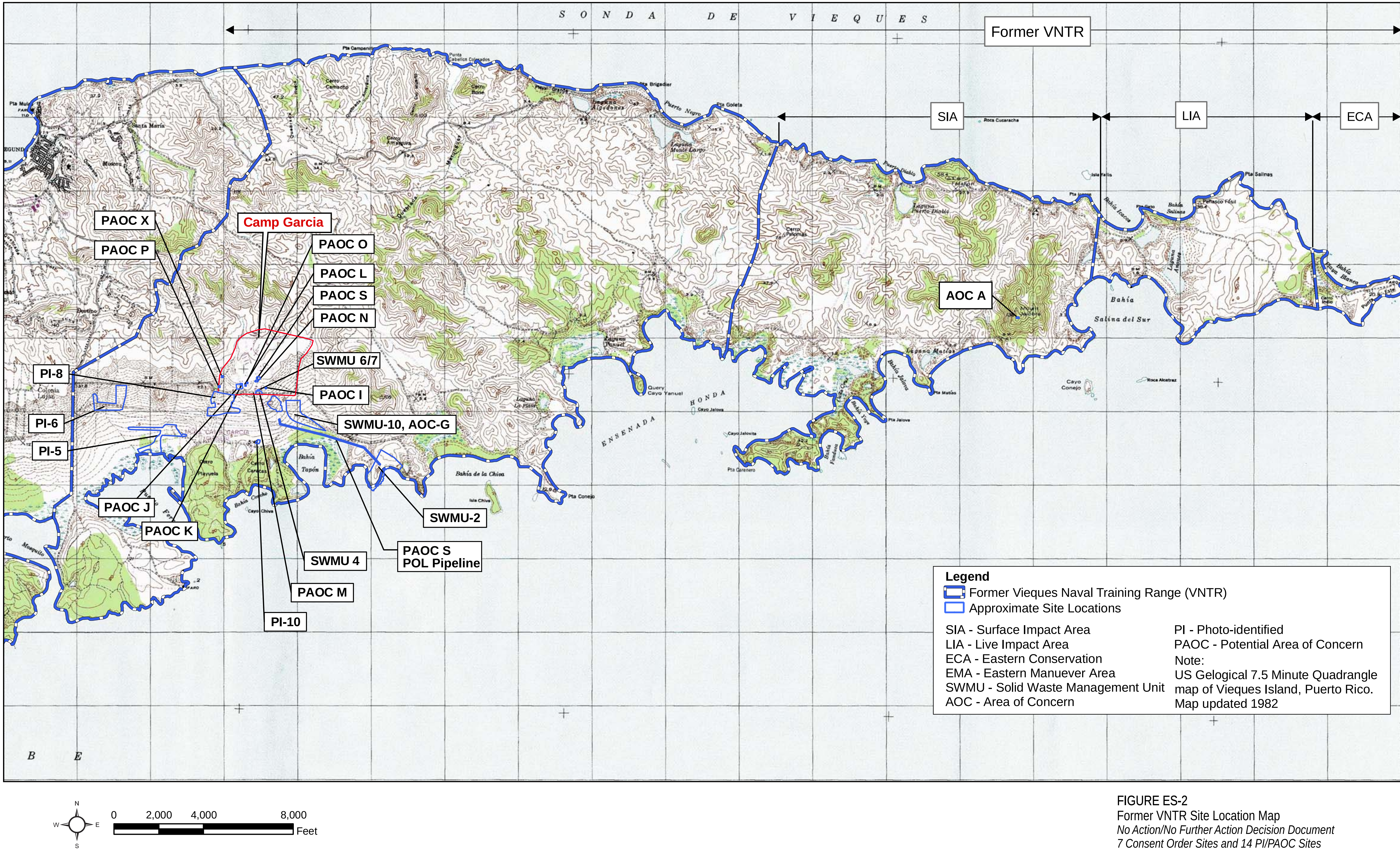

FIGURE ES-2
Former VNTR Site Location Map
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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Resumen Ejecutivo

Este documento de decisión presenta el acuerdo formal entre las agencias involucradas (la Marina de los EE.UU.,la Agencia de Protección Ambiental de los EE.UU. Región 2 [EPA por sus siglas en inglés), la Junta de Calidad Ambiental de Puerto Rico [JCA) y el Servicio de Pesca y Vida Silvestre de los EE.UU.) [USFWS por sus siglas en inglés) de que no es necesaria ninguna acción adicional en 21 sitios localizados dentro de la antigua Área de Adiestramiento Naval de Vieques (VNTR, por sus siglas en ingles) bajo la Ley de Respuesta Ambiental de Compensación y Responsabilidad (CERCLA, por sus siglas en ingles). La **Figura ES-1** muestra la ubicación geográfica de Vieques, incluyendo el antiguo VNTR, en relación con la isla de Puerto Rico y las islas circundantes. La ubicación de estos sitios dentro de este Documento de Decisión se muestra en la **Figura ES-2**. Los sitios incluidos en este Documento de Decisión son:

- Unidad de Manejo de Desperdicios Sólidos (SWMU por sus siglas en inglés) 2 – Sitio de Descarga de Combustibles
- SWMU 4 – Área de Desperdicios del Edifico 303 (Camp Garcia)
- SWMU 6 & 7 – Áreas de Acumulación de Aceite y Pintura Usados (Seabees Area, Camp Garcia)
- SWMU 10 – Lagunas de Tratamiento de Aguas Usadas
- Área de Preocupación (AOC A) – Área de Llenado de Tanques de Diesel
- AOC G – Estación de Bombeo y Edificio de Cloronización en las Lagunas de Aguas Usadas
- Sitio Identificado por Fotografía (PI por sus siglas en inglés) 5 – Antiguo Aeropuerto y Zanjas Asociadas
- PI 6 – Antigua Plataforma de Almacenamiento de PCB y Plataforma de Lavado de Vehículos
- PI 8 – Antigua Área de Mantenimiento de Vehículos
- PI 10 – Antiguo Campo de Lixiviación de Aguas Usadas
- PAOC I – Antigua Planta de Energía Eléctrica y Taller Mecánico
- PAOC J – Antigua Área de Mantenimiento de Vehículos
- PAOC K – Antigua Área de Lavado
- PAOC L – Antigua Área de Almacenamiento de Pintura y Transformadores
- PAOC M – Antigua Área de Combustible
- PAOC N – Antigua Gasolinera y Área de Almacenamiento de Combustibles

- PAOC O – Antigua Caldera en el Edificio de la Planta de Calefacción 238
- PAOC P – Antigua Casa de Bomba de Tratamiento de Agua
- PAOC S – Antigua Planta de Energía Eléctrica
- PAOC X – Área de Disposición en el arroyo efímero

La determinación de que no se necesita ninguna acción adicional para estos sitios se basa en el entendimiento de los usos históricos de los sitios, fuentes potenciales de contaminación y mecanismos potenciales de escape relacionados a CERCLA; observaciones durante las visitas a los sitios; y, donde fue necesario, la obtención y evaluación de muestras de medios ambientales específicas para cada sitio. La **Tabla ES-1** resume la información sobre la cual se determinó ninguna acción adicional para cada uno de estos los sitios. Una discusión más detallada se presenta en las secciones específicas para cada sitio que se incluyen en este Documento de Decisión.

TABLE ES-1
Resumen de Conclusiones y Recomendaciones
Documento de Decisión de No Acción/Ninguna Acción Adicional
7 Sitios dentro de la Orden de Consentimiento y 14 Sitios PI/PAOC
Vieques, Puerto Rico

Nombre del Sitio	Descripción del Sitio	Historia del Sitio	Fuente(s) Potencial(es)	Mecanismo(s) de Descarga(s) Potenciales	Datos Recolectados Específicos del Sitio	Resultados del Análisis de Decisión de 7 pasos	Argumentos para la Determinación de No Acción / No Acción Posterior
SWMU 2	Descarga de Combustibles	Combustible descargado por barcazas, bombeado a una serie de tanques de almacenamiento sobre la superficie (ASTs por sus siglas en inglés)	Operaciones de transferencia de combustibles y los tanques	Goteos o derrames en la superficie del suelo	30 muestras de suelo y 15 muestras de subsuelo alrededor del área de descarga de combustibles, sobre la antigua tubería de transferencia de combustible y alrededor de todos los antiguos tanques	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos sugieren que hubo un derrame localizado en uno de los antiguos tanques, aunque las concentraciones de contaminantes (principalmente plomo) en el sitio no presentan un riesgo inaceptable a la salud humana o al ambiente, o filtraciones de preocupación que pudieran afectar al agua subterránea, las concentraciones promedio de plomo son menores que el Nivel de Acción Correctiva y Control de Contaminación de Suelos de la Junta de Calidad Ambiental de Puerto Rico (JCA)
SWMU 4	Áreas de Disposición del Edificio 303 (Campamento García)	Cobertizos de almacenamiento de baterías usadas, trapos usados, material absorbente y grasa; recolectores de aceite hidráulico y limpieza/desengrasado	Materiales almacenados en cobertizos, recolectores	Goteos o derrames en la superficie del terreno	12 muestras de suelo y 1 muestras de subsuelo alrededor de todas las áreas de fuentes potenciales ; 1 muestra regional de agua subterránea	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame,éste no ha resultado en contaminación del suelo o agua subterránea en concentraciones que puedan presentar un riesgo potencial inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
SWMU 6/7	Áreas de Acumulación de Aceite Usado y Pintura	Plataforma de concreto y área cerrada usada para colocar aceite usado en envases de 55 galones y pintura en contenedores pequeños	Envases de 55 galones y pequeños contenedores de aceite usado y pintura	Goteos o derrames en la superficie del concreto; escorrentias al suelo	16 muestras de suelo y 6 muestras de subsuelo alrededor de todo el perímetro de la plataforma de concreto	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea

TABLE ES-1
Resumen de Conclusiones y Recomendaciones
Documento de Decisión de No Acción/Ninguna Acción Adicional
7 Sitios dentro de la Orden de Consentimiento y 14 Sitios PI/PAOC
Vieques, Puerto Rico

Nombre del Sitio	Descripción del Sitio	Historia del Sitio	Fuente(s) Potencial(es)	Mecanismo(s) de Descarga(s) Potenciales	Datos Recolectados Específicos del Sitio	Resultados del Análisis de Decisión de 7 pasos	Argumentos para la Determinación de No Acción / No Acción Posterior
SWMU 10	Lagunas de Tratamiento de Aguas Usadas	Cuatro lagunas históricas sin cubierta para el tratamiento de aguas usadas del Campamento García desde los años 1950s al 2000 (se instaló una cubierta en 1974); el efluente tratado se descargaba en el terreno y/ o en el mar hasta 1974; no se han descargado desde 1974	Lagunas de tratamiento de aguas usadas	Derrame a la superficie del suelo; percolado de las lagunas al suelo y/o agua subterránea	20 muestras de suelo y subsuelo co localizadas dentro de las lagunas; 5 pozos de monitoreo (4 dentro y 1 fuera de las lagunas); 8 muestras de suelo adicionales para análisis de talio únicamente	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
AOC A	Area de llenado de Combustible Diesel	Tanques soterrados de almacenamiento (UST por sus siglas en inglés) de combustible diesel de 15,000 galones en OP-1; el primero removido en 1997; el segundo removido en 2003	Tanques soterrados y la tubería asociada	Goteos o derrames en la superficie del suelo o subsuelo	10 muestras de subsuelo confirmatorias alrededor y bajo los tanques y la tubería asociada luego de su remoción; remoción de suelo adicional y 26 muestras de suelo confirmatorias durante la Investigación del Sitio Expandida (ESI)	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	Luego de la remoción del tanque, la tubería asociada y la remoción de suelo adyacente; las concentraciones actuales de Hidrocarburos de Petróleo Totales (TPH) son aceptables en relación con el Nivel de Acción Correctiva y Control de Contaminación de Suelos de la JCA
AOC G	Estación de Bombeo y Edificio de Clorinización	Edificio usado para la clorinización y bombeo de aguas usadas a ser tratadas en las lagunas (SWMU 10)	Cámara de contacto de Cloro, tuberías; actividades de mantenimiento de bombas	Goteo o derrame de la cámara de contacto de cloro y/o la tubería asociada sobre el suelo; derrames u otras descargas de fluidos de mantenimiento de bombas hacia fuera del edificio	7 muestras de suelo y 2 muestras de subsuelo alrededor del edificio y la cámara de contacto de cloro	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en una contaminación del suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación que afecte el agua subterránea
PI 5	Antigua Pista Área y Zanjas Asociadas	Pista aérea, estación de bomberos, carpas temporeras	Manchas en la pista aérea	Escorrentias desde áreas manchadas hacia las zanjas y transporte en corrientes efímeras	4 muestras de suelo y muestras de subsuelo co localizadas y 4 muestras de suelo adicionales en las antiguas áreas manchadas y áreas de descarga en zanjas y corrientes efímeras	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea

TABLE ES-1
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Vieques, Puerto Rico

Nombre del Sitio	Descripción del Sitio	Historia del Sitio	Fuente(s) Potencial(es)	Mecanismo(s) de Descarga(s) Potenciales	Datos Recolectados Específicos del Sitio	Resultados del Análisis de Decisión de 7 pasos	Argumentos para la Determinación de No Acción / No Acción Posterior
PI 6	Antigua Plataforma de Almacenamiento de PCB y Plataforma de Lavado de Vehículos	Almacenamiento de agua dulce, tanques soterrados, lavado de vehículos, almacenamiento de PCB	Almacenamiento de PCB en plataforma; actividades de lavado de vehículos	Escorrentias de la plataforma de lavado de vehículos, escorrentias de la plataforma de almacenamiento de PCB hacia el suelo y sumideros	6 muestras "wipe" sobre la plataforma de concreto de PCB, 2 muestras de suelo y subsuelo co localizadas junto a la plataforma de almacenamiento y 1 muestra de suelo dentro del sumidero de la plataforma de concreto ; 3 muestras de suelo cerca al tanque soterrado; 1 muestra de suelo y de subsuelo co localizadas junto a la plataforma de lavado de vehículos.	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos asociados con la plataforma de almacenamiento de PCB sugieren que no ha habido un derrame de PCB relacionado con CERCLA. Los datos asociados con el tanque soterrado y la plataforma de lavado de vehículos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan presentar un riesgo potencial inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PI 8	Antigua Área de Mantenimiento de Vehículos	Área de mantenimiento de vehículos, lavado de vehículos, almacenamiento de aceite y área de disposición, área de almacenamiento de emulsión de asfalto, área de almacenamiento de materiales peligrosos y productos de petróleo	Mantenimiento de vehículos; contenedores, materiales peligrosos y productos de petróleo	Goteos o derrames en la superficie del suelo	Estudio magnético para localizar los contenedores enterrados; 9 muestras de suelo y de subsuelo co localizadas y 4 muestras de suelo adicionales en las áreas más propensas a descargas ; 1 muestra de suelo en la zanja de drenaje hacia donde más probable llega la escorrentia del sitio	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PI 10	Antiguo Campo de Lixiviación de aguas usadas	Antiguas lagunas de secado de lodo (campo de lixiviación) para la antigua planta de tratamiento de aguas usadas	Lodo de aguas usadas	La lixiviación del lodo	3 muestras de suelo y de subsuelo co localizadas y 3 muestras de suelo adicionales dentro y junto a las antiguas lagunas	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, este no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea

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PAOC I	Antigua Planta de Energía y Taller Mecánico	Edificio antiguamente usado como planta de energía y taller mecánico	Planta de energía y actividades mecánicas	Descarga a través de las penetraciones de la tubería del edificio o a través de puertas	5 muestras de suelo y muestras de subsuelo co locallizadas; cada una junto a 3 penetraciones de tubería y 2 puertas	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan presentar un riesgo potencial inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PAOC J	Antigua Área de Mantenimiento de Vehículos	Mantenimiento de vehículos; el edificio fue demolido antes de 1980	Operaciones de mantenimiento de vehículos	Goteos o derrames en la superficie del suelo	6 muestras de suelo y muestras de subsuelo co localizadas sobre la antigua área de mantenimiento de vehiculo; 1 muestra regional de agua subterránea	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PAOC K	Antigua Área de Lavado	Vehículos lavados sobre una plataforma; la construcción fue demolida antes de 1980	Operaciones de lavado de vehículos	Escorrentias de fluidos de lavado de vehículos hacia el suelo	5 muestras de suelo y muestras de subsuelo co localizadas sobre la antigua área de lavado; 1 muestra regional de agua subterránea	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PAOC L	Antigua Área de Almacenamiento de Pintura y Transformadores	Edificio de concreto de un solo cuarto usado para el almacenamiento de pintura y transformadores	Contenedores de pintura; transformadores	Goteos o derrames sobre el piso de concreto y que se filtran al exterior; goteos o derrames fuera del edifico	4 muestras de suelo y muestras de subsuelo co localizadas y 1 pozo de monitoreo alrededor del edificio durante la investigación; 8 muestras de suelo y 4 muestras de subsuelo confirmatorias luego de la remoción del terreno	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	Los datos sugieren el suelo contaminado con plaguicidas fue removido de manera suficiente y que las concentraciones residuales de plaguicidas son consistentes con las concentraciones atribuibles a su uso normal, y no a un derrame relacionado con CERCLA
PAOC M	Antigua Área de Combustible	Antigua oficina de despacho, barracas, edificio de combustible	Materiales relacionados a combustibles, si estuvieron presentes históricamente	Goteos o derrames en la superficie del suelo	4 perforaciones de suelo continuas alrededor del antiguo edificio para determinar visualmente, por olores, o PID (instrumento) evidencia de contaminación	No hay evidencia visual, de olores, o por el instrumento PID de detección de contaminación; no se requiere muestreo	La evidencia visual, por olores y PID sugiere que no ha ocurrido un derrame relacionado con CERCLA

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PAOC N	Antigua Gasolinera y Área de Almacenamiento de Combustibles	3 tanques sobre la superficie presentes desde 1985 a 1992; dos tanques de dos compartimentos (gasolina y diesel) instalados en el 2000	Tanques sobre la superficie (AST)	Goteos o derrames en la superficie del suelo	Análisis geofísico para determinar si existe una tubería soterrada de combustible; 3 muestras de suelo y muestras de subsuelo co localizadas alrededor de los antiguos tanques; 1 muestra de suelo y muestra de subsuelo co localizada y 1 pozo de monitoreo en la antigua ubicación del edificio	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	El estudio geofísico confirmó que no hay presencia de tubería soterrada; los datos sugieren que no ha habido un derrame relacionado con CERCLA y no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PAOC O	Antigua Caldera en el Edificio de la Planta de Calefacción 238	Cuarto de calderas del edificio construido en 1953 y demolido en 1989	Caldera	Goteos o derrames en la superficie del suelo	2 muestras de suelo y muestras de subsuelo co localizadas alrededor del antiguo edificio	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	Los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PAOC P	Antigua Cuarto de Bomba de Tratamiento de Agua	Cuarto de bombeo de agua tratada construido en 1953 y demolido en 1989. Generador movible removido durante la inspección del sitio (SI)	Generador movible	Goteos o derrames en la superficie del suelo	1 muestra de suelo y muestra de subsuelo bajo el generador movible	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	La remoción del generador movible eliminó la fuente potencial futura de contaminación; los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea

TABLE ES-1
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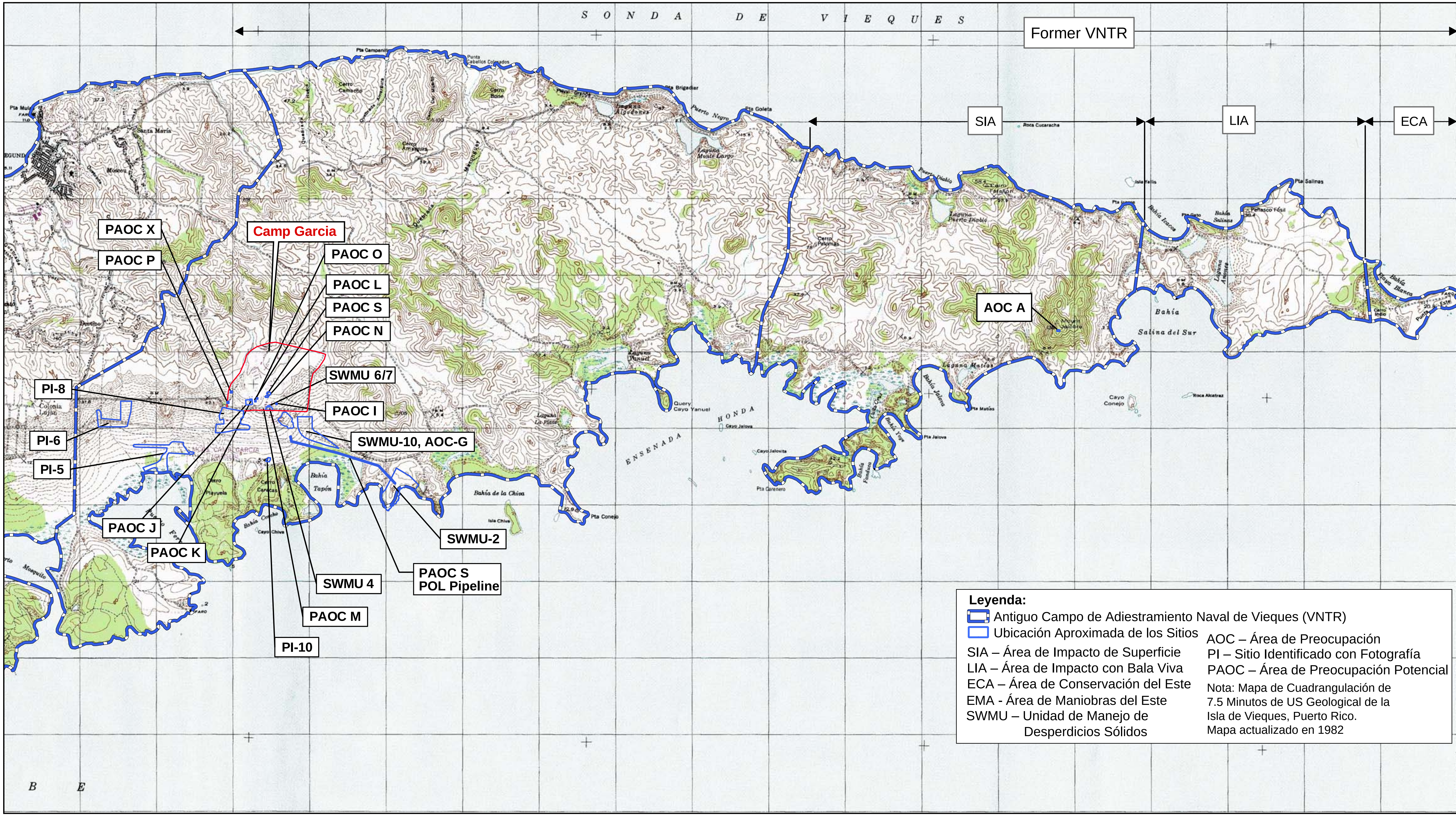
PAOC S	Antigua tubería de productos de petróleo y planta de energía	Dos áreas físicamente separadas - tubería soterrada de transferencia de combustible desde SWMU 2 hacia la pista aérea (removido en 1984); antigua planta de energía del Campamento García	Antigua tubería; operaciones de la planta de energía	Goteos o derrames en la superficie del suelo; derrames también bajo la superficie por las tuberías	Estudio geofísico para determinar la presencia de una tubería soterrada de combustible o un tanque soterado (UST); 14 muestras de suelo y muestras de subsuelo co localizadas sobre la antigua tubería; 2 muestras de suelo entre la tubería y las salinas; 5 muestras de suelo y muestras de subsuelo co localizadas y 1 pozo de monitoreo en la antigua ubicación de la planta de energía	Los datos sugieren que el área identificada como fuente potencial fue caracterizada de manera suficiente	El estudio geofísico confirmó que no existe una tubería ni un tanque soterrados; los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan potencialmente presentar un riesgo inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea
PAOC X	Área con escombros en un arroyo efímero	Escombros de automóviles, neumáticos, metal y material de construcción dispuesto en y junto al arroyo efímero. Los escombros fueron removidos durante la investigación (SI).	Varios tipos de escombros	Lixiviado de los componentes de los escombros hacia el suelo	4 muestras de suelo alrededor de los escombros; 7 muestras de suelo confirmatorias y 4 muestras de subsuelo confirmatorias bajo los escombros luego de su remoción	Los datos sugieren que las áreas identificadas como fuentes potenciales fueron caracterizadas de manera suficiente	La remoción de escombros ha eliminado la fuente potencial futura de contaminación; los datos sugieren que no ha habido un derrame relacionado con CERCLA o, si ocurrió un derrame, éste no ha resultado en contaminación de suelo o agua subterránea en concentraciones que puedan presentar un riesgo potencial inaceptable para la salud humana o para receptores ecológicos, o una filtración de preocupación al agua subterránea

FIGURA ES-1
Mapa de Ubicación Regional
Documento de Decisión de No Acción/Ninguna Acción Adicional
7 Sitios dentro de la Orden de Consentimiento y 14 Sitios PI/PAOC
Vieques, Puerto Rico



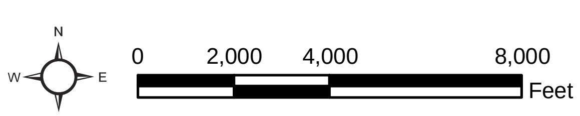


FIGURA ES-2
Mapa de Ubicación del Antiguo Sitio VNTR
Documento de Decisión de No Acción/Ninguna Acción Adicional
7 Sitios dentro de la Orden de Consentimiento y 14 Sitios PI/PAOC
Vieques, Puerto Rico

SECTION 1

Introduction

This Decision Document provides formal concurrence among the stakeholder agencies (United States Navy [Navy], United States Environmental Protection Agency [USEPA] Region 2, Puerto Rico Environmental Quality Board [PREQB], and United States Fish and Wildlife Service [USFWS]) that no action is necessary at 21 sites located within the former Vieques Naval Training Range (VNTR) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). **Figure 1-1** shows the geographic location of Vieques, including the former VNTR, in relation to mainland Puerto Rico and the surrounding islands. The locations of the sites contained within this Decision Document are shown in **Figure 1-2**. The sites included in this Decision Document are:

- Solid Waste Management Unit (SWMU) 2 – Fuels Off-loading Site
- SWMU 4 – Waste Areas of Building 303 (Camp Garcia)
- SWMU 6 & 7 – Waste Oil and Paint Accumulation Areas (Seabees Area, Camp Garcia)
- SWMU 10 – Sewage Treatment Lagoons
- Area of Concern (AOC A) – Diesel Fuel Fill Pipe Area
- AOC G – Pump Station and Chlorination Building at Sewage Lagoons
- Photo-Identified site (PI) 5 – Former Airfield and Associated Ditches
- PI 6 – Former PCB Storage Pad and Vehicle Wash Pad
- PI 8 – Former Motor Pool Maintenance Area
- PI 10 – Former Wastewater Leach Field
- PAOC I – Former Power Plant and Mechanics Shop
- PAOC J – Former Vehicle Maintenance Area
- PAOC K – Former Wash Rack
- PAOC L – Former Paint and Transformer Storage Area
- PAOC M – Former Fuel Facility
- PAOC N – Former Fuel Farm and Filling Station
- PAOC O – Former Boiler Room in Heat Plant Building 238
- PAOC P – Former Water Treatment Pumphouse
- PAOC S – Former Power Plant
- PAOC X – Debris Area in Ephemeral Stream

The four SWMUs and two AOCs were identified in the Resource Conservation and Recovery Act (RCRA) Consent Order (RCRA-02-99-7301) between USEPA and the Navy, issued January 20, 2000. The other fourteen sites were photo-identified (PI) or determined to be potential area of concern (PAOC) sites. Three of the above sites (SWMU 4, PAOC J, and PAOC K) were investigated as part of a Preliminary Assessment/Site Inspection (PA/SI). The rationale for no action at these sites is detailed in the *Final Preliminary Assessment/Site Inspection Report, 12 Consent Order Sites and 8 PI/PAOC Sites, Former Vieques Naval Training Range, Vieques, Puerto Rico* (CH2M HILL, 2008), hereafter referred to as the Final PA/SI Report.

The remaining 18 sites were investigated as part of a Site Inspection/Expanded Site Inspection (SI/ESI). The rationale for no action at these sites is detailed in the *Final Site Inspection/Expanded Site Inspection Report, 7 Consent Order Sites and 16 PI/PAOC Sites, Former Vieques Naval Training Range, Vieques, Puerto Rico* (CH2M HILL, 2010), hereafter referred to as the Final SI/ESI Report. The analytical data for these sites were evaluated via a decision analysis process that is depicted in **Figure 1-3**, which led to the no further action determination at these sites.

The remainder of this Decision Document presents site-specific sections for each of the 21 sites for which no action/no further action has been concurred upon by the stakeholder agencies. Each section summarizes pertinent historical information for a site, followed by the rationale upon which the no action/no further action determination is based. Details of the Former VNTR including the facility description and environmental history are provided in the Final SI/ESI Report (CH2M HILL, 2010).

This No Action/No Further Action Decision Document was prepared by CH2M HILL under Navy Contract N62470-08-D-1000, Comprehensive Long-term Environmental Action – Navy (CLEAN 1000), Contract Task Order 0083.

FIGURE 1-1
Regional Location Map
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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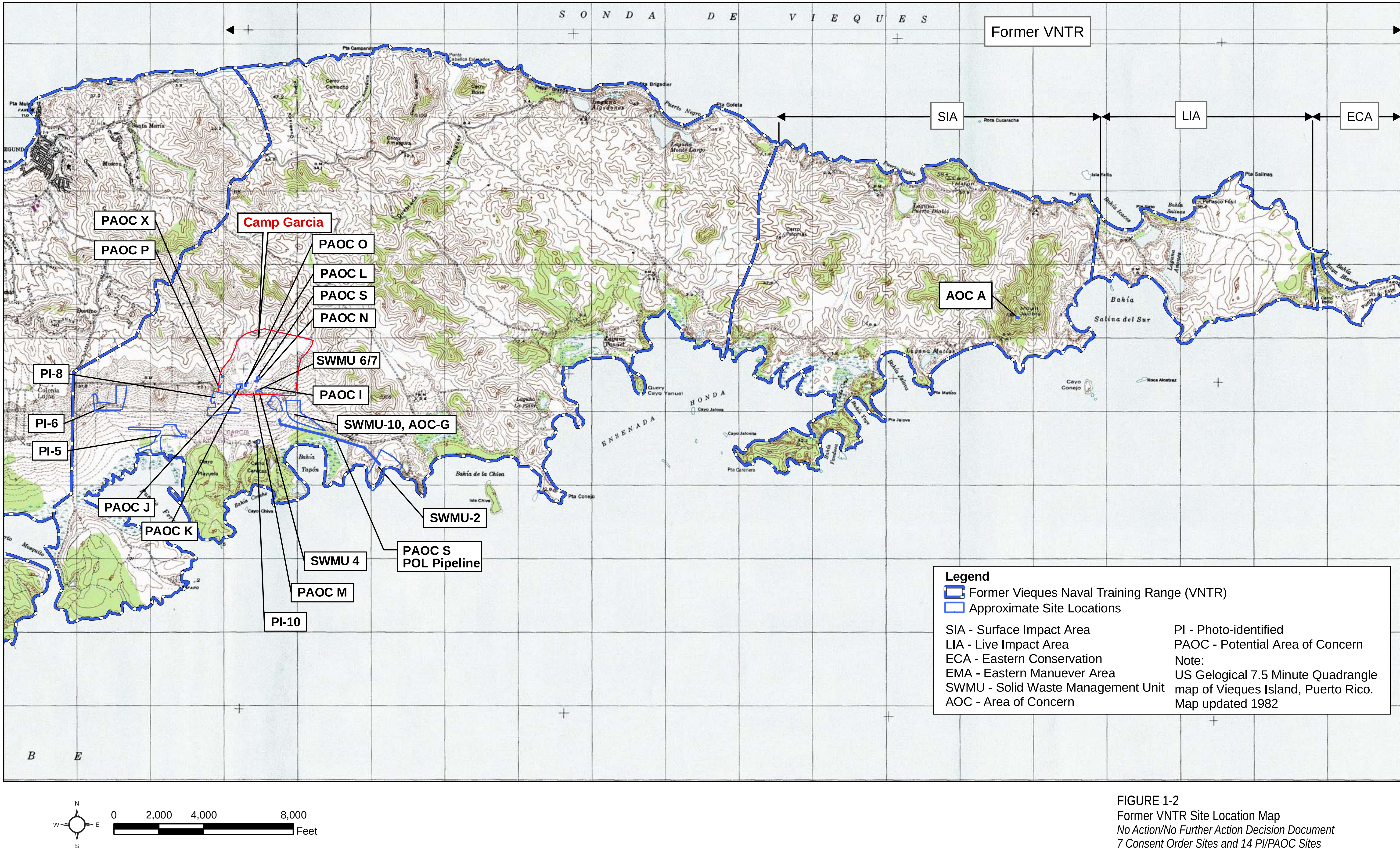

FIGURE 1-2
Former VNTR Site Location Map
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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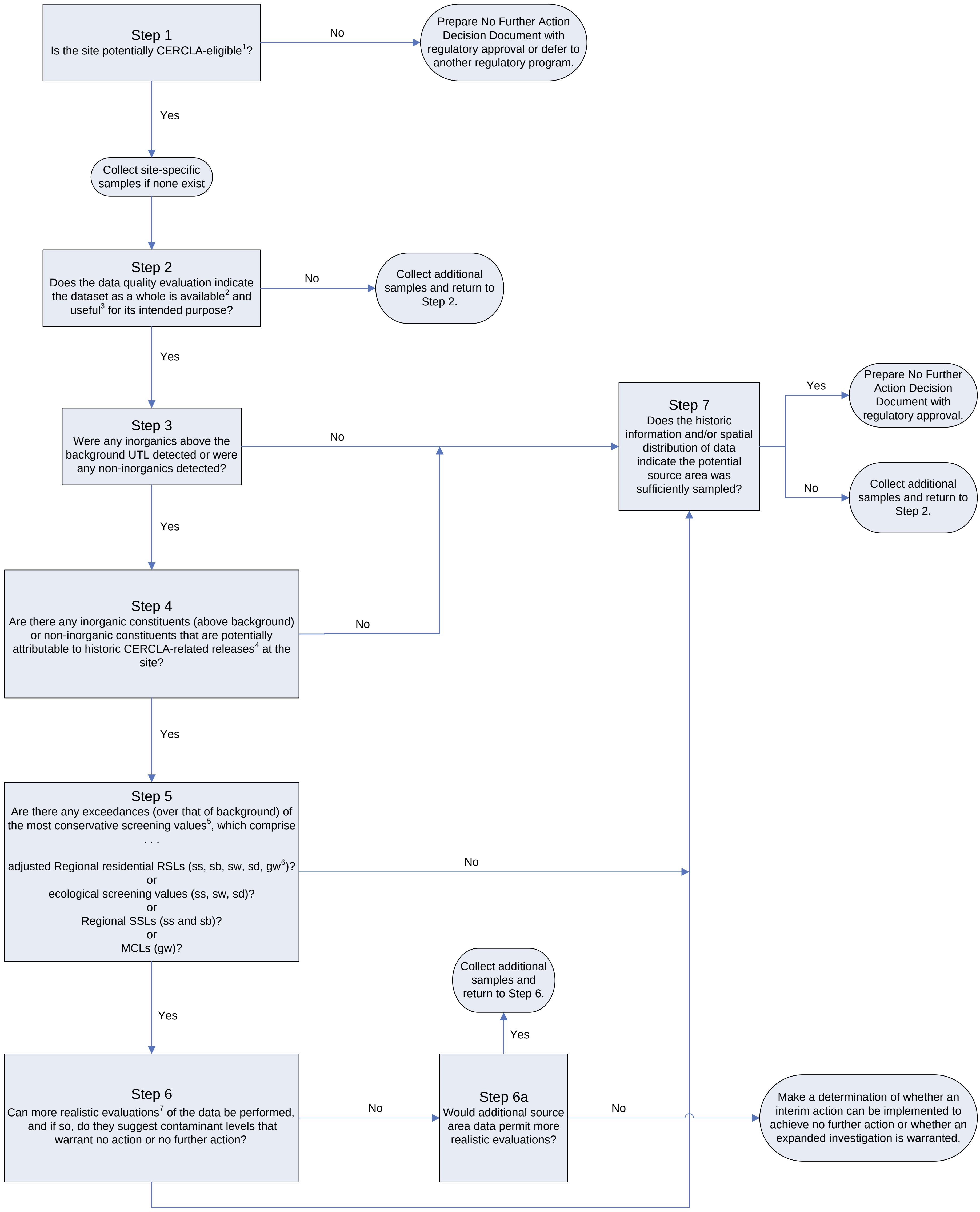

Notes:
The decision makers associated with this decision tree are the Navy, USEPA, PREQB, and USFWS.

[1] Determination of CERCLA eligibility is described in Section 1 of this SI/ESI Report (October 2009)

[2] “Available” data are described in Section 1 of this SI/ESI Report (October 2009)

[3] “Useful” data are described in Section 1 of this SI/ESI Report (October 2009)

[4] CERCLA-related releases are defined in Section 1 of this SI/ESI Report (October 2009)

[5] For UST sites, PREQB Land Pollution Control Corrective Action Levels

[6] ss = surface soil; sb = subsurface soil; sw = surface water; sd = sediment; gw = groundwater

[7] Examples of the types of more realistic evaluations that may be performed are described in Section 1 of this SI/ESI Report (October 2009)

FIGURE 1-3
SI/ESI Evaluation Decision Tree
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 2

SWMU 2—Fuels Off-loading Site

This section presents a summary of the pertinent historical information and rationale for the no action determination for SWMU 2. The detailed evaluation of SWMU 2 presented below is from the Final SI/ESI Report (CH2M HILL, 2010).

2.1 Conceptual Site Model

2.1.1 Site Description and Potential Sources of Release

SWMU 2 is located at the Former VNTR (**Figure 1-2**), and is the former location of aboveground fuel storage tanks (ASTs) and an area where fuels were offloaded from barges and pumped through an 8-inch line to each of these tanks. Two 20,000-gallon tanks and two 30,000-gallon tanks at this location were reported to have been used to store diesel fuel, unleaded gasoline (MOGAS), leaded gasoline, aviation gasoline (AVGAS), and JP-5 fuel (Greenleaf/Telesca and E&E, 1984). The tanks became operational in 1953, during which tank refueling occurred approximately every 3 months. The remaining ASTs and fuel transfer pipeline were reportedly demolished between 1978 and 1979, but historical records were not clear as to whether the fuel pipeline was removed or abandoned in place.

According to the 1984 IAS (Greenleaf/Telesca and E&E, 1984), this refueling process took place for approximately 25 years. The sludge that accumulated in the bottom of the tanks was removed periodically by a private contractor and disposed of on the main island of Puerto Rico (Kearney, 1988). The locations of tanks are shown in the 1959 (**Figure 2-1**), 1962 (**Figure 2-2**), 1964 (**Figure 2-3**), and 1970 (**Figure 2-4**) aerial photographs, which indicate that eight tanks were historically present at the site. The fuel offloading area identified in the 1970 aerial photograph (**Figure 2-4**) is not present in the 1959, 1962, or 1964 aerial photographs (**Figures 2-1 through 2-3**) even though tank refueling operations reportedly began in 1953. Also, the samples shown on all the aerial photographs were collected in 2004, at which time the fuel offloading area was present.

The only remaining visual signs of historical site activities are the concrete loading ramp and the steel pipeline supports next to the loading ramp (**Figure 2-5**). The 1995 RFA (PREQB, 1995) stated that the potential for waste or accumulated liquids to migrate into the soil, groundwater or surface water was very low. However, prior to the start of refueling, seawater had to be flushed from the underground line, which reportedly resulted in the discharge of fuel mixed with seawater into the ocean and onto the soil along the shoreline in the vicinity of the concrete loading ramp that is shown in **Figures 2-4 through 2-6**.

The potential sources of a release at SWMU 2 were from the former fuel tanks area, former fuel offloading area, and the former fuel transfer pipeline between these two areas (**Figure 2-7**).

2.1.2 Investigation History

An environmental survey was conducted in 1978 as part of preparation of an Environmental Impact Statement for continued range use (TAMS/E&E, 1979), shortly after the tanks were dismantled and the refueling halted. The survey did not find any indications of stressed vegetation, impacts to the fauna, oil-stained beaches, or other indications of pollution. Because no effects on the environment or to human health were observed or postulated, SWMU 2 was not recommended for a Confirmation Study (Greenleaf/Telesca and E&E, 1984).

A Phase II RFA was conducted by Kearney in 1988. The study concluded SWMU 2 had low to no potential for exposure to environmental receptors and recommended NFA (Kearney, 1988). No staining or other evidence of release was found during a VSI conducted in June 1995 (PREQB, 1995). The RFA Reports recommended NFA for this site based on the following conditions: the remote location, the inactive nature of the site, the minimal exposure potential from this SWMU to human receptors, and the absence of visible petroleum contamination on surface media (Kearney, 1988; PREQB, 1995). Although SWMU 2 was recommended for NFA in the Phase II RFA Reports, the site was investigated during the 2004 Phase I RFI (PA/SI) to determine whether there was evidence of historical releases. Based on the site history information summarized above, two areas were identified as potential source areas: (1) former AST area and (2) fuel offloading area. The conclusion of the Final PA/SI Report was that although the data collected during the PA/SI suggest there has not been a CERCLA-related release at the site that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater, the spatial coverage of the samples was inadequate to draw this conclusion with certainty because soil samples were not collected at all former tank locations and no soil samples were collected along the former fuel transfer pipeline.

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), the SI/ESI included a pipeline geophysical investigation and soil sampling at the pipeline, former ASTs, and fuel offloading area. The results of the geophysical survey show there was no evidence of a buried pipeline. Additionally, the geophysical survey concluded that two concrete areas identified north and west of SWMU 2 were isolated and not indicative of a buried pipeline. Since the geophysical investigation did not identify a buried pipeline, samples in the proximity of the estimated former pipeline location and debris were collected. Three soil borings were advanced at the pipeline (SS21, SS/SB22, and SS/SB25), sixteen soil borings were advanced at the former ASTs (SS/SB13 through SS/SB20 [SB13, SB19, and SB20 were not collected], SS/SB26 through SS/SB33), and two soil borings were advanced at the fuel offloading area (SS/SB23 and SS24). All samples were analyzed for BTEX, MTBE, and PAHs; lead, TPH-gas range organics (GRO), and TPH-DRO. Samples collected from borings SO26 through SO29 and SO33 were analyzed for lead only. Samples collected from borings SO30 through SO32 were not analyzed because the lead concentrations in the "inner ring" samples adjacent to these "outer ring" samples were not elevated.

Tables 2-1 and 2-2 summarize the constituents detected in SWMU 2 surface soil and subsurface soil samples, respectively, collected during the Phase I RFI (2004) and the ESI (2009). The tables also identify screening criteria exceedances.

2.1.3 Physical Setting

The site is currently overgrown with grasses and small shrubs. The SWMU 2 area is located on a bluff on the southern coast of the island with its highest elevation at approximately 32 ft amsl, as shown on the topographic map (**Figure 2-6**). The site is relatively flat with steep relief on all sides of the former AST location, as well as along the coast. The site resides within sedimentary and igneous rocks. The soil consists of silty sand, sandy silt, and gravels. Saprock was encountered as close as 1 ft bgs. Groundwater likely exists within the fractured bedrock and flows in a southerly direction toward the coast. There are no surface water bodies at or immediately adjacent to SWMU 2.

2.2 SWMU 2 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 2-1 and 2-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former fuels off-loading site with several ASTs and a fuel transfer pipeline. Although the data evaluation presented in the PA/SI Report (CH2M HILL, 2008) indicated there likely was not a CERCLA-related release at the site that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater, the spatial coverage of the samples was inadequate to draw this conclusion with certainty. Therefore, an ESI was deemed necessary to determine if there was a CERCLA-related release of hazardous constituents at SWMU 2 and, if so, whether the release warrants further investigation or action. Additional sample collection took place during the 2009 ESI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Phase I RFI (2004)

Appendix N, Section N.4 of the PA/SI Report (CH2M HILL, 2008) discusses the evaluation of the SWMU 2 data quality, for those samples collected as part of the Phase I RFI (2004). As detailed in Section N.4, the SWMU 2 data collected in 2004 are acceptable for use in evaluating whether a CERCLA-related release of contaminants warranting further investigation or action occurred at SWMU 2. Although that evaluation was presented in the PA/SI Report (CH2M HILL, 2008), the data are re-evaluated in Steps 3 through 7 herein to account for any potential updates to regulatory screening criteria.

ESI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the Phase I RFI (2004) and the ESI (2009), the following inorganics above the background UTLs and non-inorganics were detected by sample event and by medium:

Phase I RFI (2004) Surface Soil

- VOCs: none detected
- SVOCs: benzo(a)pyrene, di-n-butylphthalate, indeno(1,2,3-cd)pyrene
- Pesticide: 4,4′-DDE
- Herbicides: none detected
- Dioxins: 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, 1,2,3,6,7,8- hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9- hexachlorodibenzo-p-dioxin, octachlorodibenzo-p-dioxin, total heptachlorodibenzo-p-dioxin, total hexachlorodibenzo-p-dioxin, total pentachlorodibenzo-p-dioxin
- PCBs: none detected
- Explosives: none detected
- Inorganics above background UTLs: arsenic, beryllium, cobalt, lead, selenium, tin, and zinc

Phase I RFI (2004) Subsurface Soil

- VOCs: none detected
- SVOCs: none detected
- Herbicides: none detected
- Dioxins: none detected
- Explosives: none detected
- Inorganics above background UTLs: none detected

ESI (2009) Surface Soil

- BTEX/MTBE: none detected
- PAHs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, indeno(1,2,3-cd)pyrene, pyrene
- Lead above background UTL
- TPHs: TPH-DRO, TPH-GRO

ESI (2009) Subsurface Soil

- BTEX/MTBE: none detected
- PAHs: benzo(a)anthracene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, di-n-butylphthalate
- Lead above background UTL
- TPHs: TPH-DRO, TPH-GRO

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

Potential releases at SWMU 2 would have involved petroleum hydrocarbons. Therefore, of the constituents detected in soil samples, only SVOCs, TPH, and inorganics are potentially attributable to historic CERCLA-related releases. The presence of the pesticide 4,4'-DDE is likely due to normal pesticide use, not a CERCLA-related release, especially because its detected concentrations (see **Table 2-1**) are similar to those found at multiple sites across Vieques (see Table O-1 of the Final SI/ESI Report (CH2M HILL, 2010)). For example, 4,4'-DDE was detected in SWMU 2 surface soil samples at concentrations between 0.080 µg/kg and 0.73 µg/kg, which are well within the range concentrations detected at other sites across east Vieques (0.08 µg/kg to 1,200 µg/kg for 4,4'-DDE). Consequently, pesticide results are not considered further in the decision analysis process.

Similarly, dioxins are not likely associated with fuels. Further, as shown in Table O-3 of the Final SI/ESI Report (CH2M HILL, 2010), the highest dioxin concentration at SWMU 2 (in TEQ) is approximately 2 ppt, which is an order of magnitude or more below the 72 ppt (TEQ) starting point concentration for developing cleanup levels for residential soil, and 950 ppt (TEQ) starting point for developing cleanup levels for commercial/industrial soil, proposed by EPA in the "Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites" (EPA, 2009). The other dioxin concentrations at SWMU 2 are even lower. Therefore, dioxins are not considered further in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown in the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by sampling event and by medium.

Phase I RFI (2004) Surface Soil

- Benzo(a)pyrene: three detections (samples SS01, SS10, and SS12) at concentrations (54, 47, and 48 µg/kg, respectively) above the Regional Screening Level (RSL) (15 µg/kg)
- Arsenic: four detections (sample SS07, SS10, SS11, and SS12) at concentrations (1.7 mg/kg to 2.3 mg/kg) above the RSL (0.39 mg/kg), SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)

- Cobalt: one detection (sample SS12) at a concentration (51 mg/kg) above the adjusted RSL (2.3 mg/kg), ecological soil screening value for plants and invertebrates (13 mg/kg), SSL at a DAF of 1 (0.49 mg/kg), and background UTL (26 mg/kg)
- Lead: two detections (samples SS01 and SS03) at concentrations (both 16 mg/kg) above the ecological soil screening value for birds and mammals (11 mg/kg) and background UTL (5.4 mg / kg).
- Selenium: two detections (samples SS01 and SS03) at concentrations (0.55 mg/kg and 0.63 mg/kg, respectively) above the ecological soil screening value for plants and invertebrates (0.52 mg/kg), SSL at a DAF of 1 (0.26 mg/kg), and background UTL (0.51 mg/kg). The maximum detection also equaled the ecological soil screening value for birds and mammals (0.63 mg/kg).

ESI (2009) Surface Soil

- PAHs: no exceedances
- Lead: nine detections (SS14, SS16, SS17, SS18, SS26, SS27, SS28, SS29, and SS33) at concentrations (11 to 144 mg/kg) above the ecological soil screening value for birds and mammals (11 mg/kg,), SSL at a DAF of 1 (27 mg/kg, SS16, SS17, SS18, SS27, SS28, SS29, and SS33 only), PREQB Land Pollution Control Corrective Action Level (50 mg/kg, SS18 and SS28 only), and background UTL (5.4 mg/kg). Lead also exceeded the ecological soil screening value for plants and invertebrates (120 mg/kg) in one sample (SS18).
- TPHs: no exceedances

ESI (2009) Subsurface Soil

- PAHs: no exceedances
- Lead: seven detections (SB17, SB18, SB23, SB27, SB28, SB29 and SB33) at concentrations (34 to 223 mg/kg) above the SSL at a DAF of 1 (27 mg/kg), PREQB Land Pollution Control Corrective Action Level (50 mg/kg, SS17, SS18, SS28, SS29 and SS33) and background UTL (3.3 mg/kg)
- TPHs: no exceedances

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the exposure point concentration (EPC) calculations could be assessed. For this evaluation, a “hot spot” was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at SWMU 2. Although SWMU 2 is approximately 23 acres in size whereas a residential lot may be approximately ¾ acre, no chemicals were detected above background and RSLs at concentrations exceeding 100 times the screening levels (**see Table 2-3**). Therefore, no hot spots were identified and all surface soil data were merged in the residential evaluation.

Three constituents - benzo(a)pyrene (B[a]P), arsenic, and cobalt – were detected in surface soil above their human health screening levels and background (for inorganics). B(a)P was detected in 3 of 25 surface soil samples above its RSL (15 µg/kg), at a maximum concentration of 54 µg/kg. Based on the maximum detected concentration that would be used in residential risk calculations, the ELCR is 4×10^{-6}, which is within the EPA acceptable range (1×10^{-4} to 1×10^{-6}), and B(a)P would not be identified as a risk driver (see Table 2-3).

Arsenic was detected in 4 of 12 surface soil samples above background and its RSL (0.39 mg/kg), at a maximum concentration of 2.3 mg/kg. Based on the maximum detected concentration, the residential ELCR for arsenic is 6×10^{-6} and the HI is 0.1, which are within EPA acceptable levels, and arsenic would not be identified as a risk driver (see **Table 2-3**). Because the maximum detected concentration yielded risk estimates within EPA acceptable levels, additional statistical evaluation of the potential EPC was not performed. It is also notable that although the arsenic background UTL is 1.6 mg/kg, arsenic concentrations up to 5 mg/kg were detected during the east Vieques background soil inorganics investigation (CH2M HILL, 2007b). Although concentrations above 1.6 mg/kg were considered outliers for the purposes of establishing a background UTL, those concentrations may very well be representative of true background arsenic concentrations.

Cobalt was detected in 1 of 12 surface soil samples above its background UTL and adjusted RSL (2.3 mg/kg), at a concentration of 51 mg/kg. As an initial screening approach, the maximum detected concentration was used to calculate risk estimates. However, risk estimates exceeded EPA acceptable levels and therefore the 95% UCL of the mean concentration (23 mg/kg) was calculated and used as the EPC in residential risk estimates, the residential ELCR for cobalt is 6×10^{-8} and the HI is 1.0 (which are within EPA acceptable levels), and cobalt would not be identified as a risk driver (see **Table 2-3**).

Two additional constituents (chromium and vanadium) were detected in soil above human health screening levels but below background UTLs. Based on the EPCs for B(a)P, arsenic, and cobalt identified above and the maximum detected concentrations of chromium and vanadium, the cumulative maximum target organ-specific HI is 1.0 and the ELCR is 1×10^{-5} (see **Table 2-3**) Based on the historical source of potential releases identified at the site and the environmental conditions on Vieques, the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Therefore, potential cumulative effects from multiple chemicals in soil are not a concern relative to background.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 2×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Three inorganics (cobalt, lead, and selenium) exceeded ecological screening values and background UTLs in at least one surface soil sample collected at the site (**Table 2-1**). Based on site size and habitat characteristics, exposure of bioaccumulative chemicals to upper trophic level receptors (birds and mammals) was considered in addition to direct exposure of all detected chemicals to soil organisms (plants and invertebrates). Accordingly, the results of screening value exceedances for each of these receptor groups are evaluated.

Cobalt, lead, and selenium exceeded soil screening values for soil organisms (plants and invertebrates). None of these constituents poses an unacceptable risk to plants and invertebrates based upon the following:

- The site is overgrown with vegetation, with no signs of stressed vegetation.
- Cobalt exceeded the background UTL in 1 of 12 samples at a maximum ratio of 1.97 (**Table 2-4**). All other cobalt concentrations were below the background UTL, indicating that exposures are generally attributable to background.
- Lead exceeded the ecological screening value for soil organisms (120 mg/kg) in 1 of 30 samples at a maximum HQ of 1.20 (**Table 2-4**). However, the mean HQ (0.14) was below 1.
- Selenium exceeded the ecological screening value for soil organisms (0.52 mg/kg) in 2 of 12 samples at a maximum HQ of 1.21 (**Table 2-4**). However, the mean HQ (0.67) was less than 1. Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the East Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at SWMU 2 (maximum of 0.63 mg/kg) may be within the range of background. Further, the screening value (0.52 mg/kg) is based upon potential impacts to plants. The site is heavily vegetated, with no apparent impacts to the terrestrial plant community. Maximum concentrations are less than soil screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates).

Lead and selenium equaled or exceeded screening values (Eco SSLs) protective of upper trophic level organisms. None of these constituents poses an unacceptable risk to birds and mammals based upon the following:

- Lead exceeded the Eco SSL for birds (11 mg/kg) in 11 of 30 samples. Food web HQs (and calculations) based upon maximum (screening) and mean (baseline) lead exposure doses for each target receptor are listed in **Tables 2-5 through 2-8**. Based upon a comparison to no observable adverse effect level (NOAELs), the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Therefore, lead does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- Selenium equaled the Eco SSL for mammals (0.63 mg/kg) in 1 of 12 samples. Food web HQs and calculations for each target receptor are listed in **Tables 2-5 through 2-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, but the mean exposure dose HQ was less than one. Therefore, selenium does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

Additional Comparisons

Although several individual lead concentrations in soil exceeded the PREQB Land Pollution Control Corrective Action Level of 50 mg/kg, the average lead concentration in soil at the site is 27 mg/kg.

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic soil screening levels (SSLs), applying a dilution attenuation factor (DAF) of 1, were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

– depth of contamination with respect to estimated groundwater depth

– mobility of contaminant

– number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Four inorganics (arsenic, cobalt, lead, and selenium) were detected above their respective SSLs at a DAF of 1 and background UTLs in surface soil. Lead was also detected above its SSL at a DAF of 1 and background UTL in subsurface soil. However, due to the small area where these constituents were detected above the SSL and background UTL (i.e., arsenic, lead, and selenium in samples collected around several former ASTs, and arsenic and cobalt in samples collected around the former fuel offloading area, an SSL at a higher DAF is likely to be more realistic, as indicated in Section 1.1.2 of the Final SI/ESI Report (CH2M HILL, 2010). As demonstrated at several east Vieques sites (e.g., PI 4 and SWMU 10), the SSLs at a DAF of 1 are not representative of leaching to groundwater. For the SWMU 2 data, none of the arsenic, cobalt, lead, and selenium concentrations exceeds SSLs at a DAF of 2 (cobalt and lead) or 3 (arsenic and selenium).

All of the above information suggests that if there was a CERCLA-related release, the residual contaminant concentrations (i.e., PAHs, lead, TPH) do not likely pose an unacceptable human health or ecological risk or leaching risk to groundwater.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases at SWMU 2 are historical fuel transfer activities around the former ASTs, fuel offloading area, and fuel transfer pipeline. As shown in **Figure 2-8**, the spatial coverage of the samples collected was adequate to evaluate potential releases from all of these areas. As shown in the SWMU 2 analytical data tables, no evidence of a petroleum-related release was observed during the ESI (i.e., absence of visual, odor, and PID indication of a release; absence of elevated petroleum-related constituent concentrations in soil; absence of wide spread elevated lead concentrations in soil). In addition, the maximum concentrations of lead in soil do not exceed the SSL at a DAF of 2. Therefore, groundwater sampling at SWMU 2 is not warranted.

2.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-related release at SWMU 2 that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. In addition, the average lead concentration in soil at the site is approximately half the PREQB Land Pollution Control Corrective Action Level. Therefore, a no action determination is made for SWMU 2.

Table 2-1
Surface Soil Detection and Exceedance Results
SWMU 2
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (Kv)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	**PREQB Corrective Action Level**	CGW2SS01	CGW2SS02	CGW2SS03	CGW2SS04	CGW2SS05	CGW2SS06	CGW2SS07	CGW2SS08		CGW2SS09	CGW2SS10	CGW2SS11	CGW2SS12
Sample ID						CGW2SS01-R01	CGW2SS02-R01	CGW2SS03-R01	CGW2SS04-R01	CGW2SS05-R01	CGW2SS06-R01	CGW2SS07-R01	CGW2FD01P-R01	CGW2SS08-R01	CGW2SS09-R01	CGW2SS10-R01	CGW2SS11-R01	CGW2SS12-R01
Sample Date						01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04	01/21/04
Chemical Name																		
Volatile Organic Compounds (UG/KG)																		
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)																		
Benzo(a)anthracene	--	150	--	10	--	372 U	389 U	388 U	372 U	373 U	379 U	391 U	389 U	386 U	343 U	343 U	353 U	342 U
Benzo(a)pyrene	--	15	--	240	--	**54 J**	389 U	388 U	372 U	373 U	379 U	391 U	389 U	386 U	343 U	**47 J**	353 U	**48 J**
Benzo(b)fluoranthene	--	150	--	35	--	372 U	389 U	388 U	372 U	373 U	379 U	391 U	389 U	386 U	343 U	343 U	353 U	342 U
Benzo(g,h,i)perylene	--	170,000	--	120,000	--	372 U	389 U	388 U	372 U	373 U	379 U	391 U	389 U	386 U	343 U	343 U	353 U	342 U
Chrysene	--	15,000	--	1,100	--	372 U	389 U	388 U	372 U	373 U	379 U	391 U	389 U	386 U	343 U	343 U	353 U	342 U
Di-n-butylphthalate	--	610,000	40,000	9,200	--	372 U	146 J	386 J	418	373 U	331 J	416	227 J	140 J	79 J	55 J	45 J	49 J
Indeno(1,2,3-cd)pyrene	--	150	--	120	--	372 U	389 U	388 U	372 U	373 U	379 U	391 U	389 U	386 U	343 U	114 J	116 J	342 U
PAH HMW (Total)	--	--	1,100	--	--	54 J	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	161 J	116 J	48 J
PAH LMW (Total)	--	--	29,000	--	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Pyrene	--	170,000	--	120,000	--	372 U	389 U	388 U	372 U	373 U	379 U	391 U	389 U	386 U	343 U	343 U	353 U	342 U
Pesticide/Polychlorinated Biphenyls (UG/KG)																		
4,4'-DDE	--	1,400	21	47	--	3.7 U	3.9 U	0.40 J	0.28 J	0.73 J	3.8 U	0.16 J	3.9 U	3.9 U	0.59 J	0.50 J	0.13 J	0.080 J
Herbicides (UG/KG)																		
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dioxin/Furans (PG/G)																		
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	13	NA	NA	NA	5.4	NA	NA	114	NA	NA	3.7
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	2.5 U	NA	NA	NA	2.5 U	NA	NA	2.9	NA	NA	2.5 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	2.5 U	NA	NA	NA	2.5 U	NA	NA	4.8	NA	NA	2.5 U
Octachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	173	NA	NA	NA	71	NA	NA	781	NA	NA	48
Total heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	28	NA	NA	NA	14	NA	NA	220	NA	NA	10
Total hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	3.5	NA	NA	NA	2.5 U	NA	NA	53	NA	NA	2.5 U
Total pentachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	1.0 U	NA	NA	NA	1.0 U	NA	NA	9.0	NA	NA	1.0 U
Explosives (UG/KG)																		
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Metals (MG/KG)																		
Antimony	35,000	3.1	0.27	0.27	--	0.64 J	0.58 J	0.15 J	0.29 J	0.22 J	0.21 J	0.46 J	0.093 UJ	0.093 UJ	0.71 J	0.68 J	0.48 J	0.65 J
Arsenic	1.6	0.39	18	0.29	--	1.3 J	0.23 J	1.1 J	0.72 J	1.3 J	0.46 J	**1.7**	1.4 J	1.1 J	1.2 J	**2.0**	**2.3**	**1.8**
Barium	212	1,500	330	82	--	54 J	66 J	69 J	74 J	73 J	65 J	67 J	62 J	61 J	55 J	54 J	89 J	45 J
Beryllium	0.27	16	21	3.2	--	**0.35 J**	**0.38 J**	**0.34 J**	**0.31 J**	**0.32 J**	0.26 J	**0.36 J**	**0.39 J**	**0.37 J**	0.098 J	0.12 J	0.14 J	0.11 J
Cadmium	2.2	7.0	0.36	0.38	--	0.19 J	0.13 J	0.050 J	0.011 U	0.045 J	0.011 U	0.044 J	0.093 J	0.012 U	0.15 J	0.11 J	0.19 J	0.053 J
Chromium	72	0.29	26	0.00083	--	19 J	18 J	21 J	56 J	19 J	17 J	19 J	20 J	19 J	11 J	20 J	19 J	13 J
Cobalt	26	2.3	13	0.49	--	13 J	11 J	14 J	10 J	13 J	11 J	15 J	13 J	12 J	19 J	21 J	25 J	**51 J**
Copper	94	310	28	46	--	28 J	17 J	24 J	22 J	33 J	11 J	29 J	30 J	29 J	77 J	71 J	48 J	43 J
Cyanide	0.33	160	15.8	2.0	--	NA	NA	0.30 J	NA	NA	NA	0.16 U	NA	NA	0.14 U	NA	NA	0.14 U
Lead	5.4	400	11	27	50	**16 J**	3.2 J	**16 J**	5.1 J	4.2 J	1.2 J	**5.9 J**	2.4 J	2.6 J	3.1 J	3.7 J	1.7 J	2.5 J
Mercury	0.057	0.78	0.10	0.57	--	0.018 J	0.011 J	0.013 J	0.011 J	0.015 J	0.005 J	0.020 J	0.010 J	0.009 J	0.004 J	0.015 J	0.005 J	0.005 J
Nickel	41	160	38	48	--	8.0 J	7.9 J	10 J	24 J	8.5 J	6.8 J	6.4 J	8.6 J	8.4 J	8.5 J	11 J	13 J	7.3 J
Selenium	0.51	39	0.52	0.26	--	**0.55 J**	0.21 J	**0.63 J**	0.33 J	0.35 J	0.17 U	0.42 J	0.45 J	0.23 J	0.20 J	0.18 J	0.44 J	0.32 J
Silver	0.22	39	4.2	1.6	--	0.10 J	0.16 J	0.072 J	0.13 J	0.057 J	0.11 J	0.078 J	0.037 J	0.057 J	0.053 J	0.084 J	0.075 J	0.082 J
Tin	--	4,700	--	5,500	--	0.24 J	0.22 U	0.29 J	0.19 U	0.19 U	0.20 U	0.21 U	0.22 U	0.22 U	0.19 U	0.37 J	0.26 J	0.18 U
Vanadium	144	39	7.8	180	--	117 J	114 J	89 J	97 J	67 J	95 J	140 J	67 J	58 J	82 J	74 J	97 J	71 J
Zinc	32	2,400	46	680	--	21 J	19 J	18 J	15 J	16 J	20 J	19 J	9.6 J	9.8 J	**40 J**	31 J	29 J	24 J
Total Petroleum Hydrocarbons (MG/KG)																		
TPH-diesel range	--	--	--	--	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-gas range	--	--	--	--	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL, and ECO (E)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, ECO (E), SSL (DAF=1) and PREQB Corrective Action Level

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 2-1
Surface Soil Detection and Exceedance Results
SWMU 2
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (Kv)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	**PREQB Corrective Action Level**	VEW02-SO13	VEW02-SO14	VEW02-SO15		VEW02-SO16	VEW02-SO17	VEW02-SO18	VEW02-SO19	
Sample ID						VEW02-SS13-01-0209	VEW02-SS14-01-0209	VEW02-SS15-01-0209	VEW02-SS15P-01-0209	VEW02-SS16-01-0209	VEW02-SS17-01-0209	VEW02-SS18-01-0209	VEW02-SS19-01-0209	VEW02-SS19P-01-0209
Sample Date						02/13/09	02/13/09	02/13/09	02/13/09	02/12/09	02/12/09	02/12/09	02/13/09	02/13/09
Chemical Name														
Volatile Organic Compounds (UG/KG)														
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)														
Benzo(a)anthracene	--	150	--	10	--	9.2 J	22 U	24 U	23 U	23 U	25 U	22 U	21 U	8.9 J
Benzo(a)pyrene	--	15	--	240	--	26 U	22 U	24 U	23 U	23 U	25 U	22 U	21 U	21 U
Benzo(b)fluoranthene	--	150	--	35	--	26 U	22 U	24 U	23 U	23 UJ	25 U	22 UJ	21 U	6.3 J
Benzo(g,h,i)perylene	--	170,000	--	120,000	--	26 U	22 U	24 U	23 U	23 U	25 U	22 U	21 U	21 U
Chrysene	--	15,000	--	1,100	--	26 U	22 U	24 U	23 U	23 U	25 U	22 U	21 U	21 U
Di-n-butylphthalate	--	610,000	40,000	9,200	--	130 U	110 U	120 U	110 U	110 U	120 U	110 U	100 U	100 U
Indeno(1,2,3-cd)pyrene	--	150	--	120	--	26 U	22 U	24 R	23 U	23 UJ	25 UJ	22 UJ	21 U	21 R
PAH HMW (Total)	--	--	1,100	--	--	9 J	0 U	0 U	0 U	0 U	0 U	0 U	0 U	15 J
PAH LMW (Total)	--	--	29,000	--	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Pyrene	--	170,000	--	120,000	--	26 U	22 U	24 U	23 U	23 U	25 UJ	22 U	21 U	21 U
Pesticide/Polychlorinated Biphenyls (UG/KG)														
4,4'-DDE	--	1,400	21	47	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides (UG/KG)														
No Detections	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxin/Furans (PG/G)														
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total pentachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/KG)														
No Detections	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (MG/KG)														
Antimony	35,000	3.1	0.27	0.27	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.6	0.39	18	0.29	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	212	1,500	330	82	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.27	16	21	3.2	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.2	7.0	0.36	0.38	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	72	0.29	26	0.00083	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	26	2.3	13	0.49	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	94	310	28	46	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	0.33	160	15.8	2.0	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	5.4	400	11	27	50	2.6	**14**	1.3 J	2.0 J	**38 J**	**33 J**	**144 J**	2.2	1.7
Mercury	0.057	0.78	0.10	0.57	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	41	160	38	48	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.51	39	0.52	0.26	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	0.22	39	4.2	1.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	--	4,700	--	5,500	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	144	39	7.8	180	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	32	2,400	46	680	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (MG/KG)														
TPH-diesel range	--	--	--	--	100	14	9.2	5.9 J	17 J	7.1	34	39	16 J	10 J
TPH-gas range	--	--	--	--	100	3.5 U	4.1 J	3.3 U	3.2 U	3.0 U	3.6 U	2.9 U	2.8 U	2.8 U

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL, and ECO (E)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, ECO (E), SSL (DAF=1) and PREQB Corrective Action Level

NA - Not Analyzed
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-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
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U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 2-1
Surface Soil Detection and Exceedance Results
SWMU 2
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (Kv)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	**PREQB Corrective Action Level**	VEW02-SO20	VEW02-SO21	VEW02-SO22	VEW02-SO23				VEW02-SO24	
Sample ID						VEW02-SS20-01-0209	VEW02-SS21-01-0209	VEW02-SS22-01-0209	VEW02-SS23-01-0209	VEW02-SS23P-01-0209	VEW02-SS23-01-0209A	VEW02-SS23P-01-0209A	VEW02-SS24-01-0209	VEW02-SS24-01-0209A
Sample Date						02/13/09	02/17/09	02/17/09	02/11/09	02/11/09	02/12/09	02/12/09	02/11/09	02/12/09
Chemical Name														
Volatile Organic Compounds (UG/KG)														
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	NA	NA	ND	NA
Semivolatile Organic Compounds (UG/KG)														
Benzo(a)anthracene	--	150	--	10	--	21 U	21 U	22 U	21 U	21 U	NA	NA	22 U	NA
Benzo(a)pyrene	--	15	--	240	--	21 U	21 U	22 U	21 U	21 U	NA	NA	22 U	NA
Benzo(b)fluoranthene	--	150	--	35	--	21 U	21 U	22 U	8.5 J	9.4 J	NA	NA	22 UJ	NA
Benzo(g,h,i)perylene	--	170,000	--	120,000	--	21 U	21 U	22 U	11 J	11 J	NA	NA	22 U	NA
Chrysene	--	15,000	--	1,100	--	21 U	21 U	22 U	4.7 J	21 U	NA	NA	22 U	NA
Di-n-butylphthalate	--	610,000	40,000	9,200	--	110 U	100 U	110 U	100 U	100 U	NA	NA	110 U	NA
Indeno(1,2,3-cd)pyrene	--	150	--	120	--	21 U	21 U	22 U	21 U	7.0 J	NA	NA	22 UJ	NA
PAH HMW (Total)	--	--	1,100	--	--	0 U	0 U	0 U	28 J	27 J	NA	NA	0 U	NA
PAH LMW (Total)	--	--	29,000	--	--	0 U	0 U	0 U	0 U	0 U	NA	NA	0 U	NA
Pyrene	--	170,000	--	120,000	--	21 U	21 U	22 U	3.9 J	21 U	NA	NA	22 U	NA
Pesticide/Polychlorinated Biphenyls (UG/KG)														
4,4'-DDE	--	1,400	21	47	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides (UG/KG)														
No Detections	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxin/Furans (PG/G)														
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total pentachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/KG)														
No Detections	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (MG/KG)														
Antimony	35,000	3.1	0.27	0.27	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.6	0.39	18	0.29	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	212	1,500	330	82	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.27	16	21	3.2	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.2	7.0	0.36	0.38	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	72	0.29	26	0.00083	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	26	2.3	13	0.49	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	94	310	28	46	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	0.33	160	15.8	2.0	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	5.4	400	11	27	50	**11**	4.2	**6.0**	2.6 J	**5.5 J**	NA	NA	2.6 J	NA
Mercury	0.057	0.78	0.10	0.57	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	41	160	38	48	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.51	39	0.52	0.26	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	0.22	39	4.2	1.6	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	--	4,700	--	5,500	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	144	39	7.8	180	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	32	2,400	46	680	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (MG/KG)														
TPH-diesel range	--	--	--	--	100	16	21	11	NA	NA	8.8	5.6 U	NA	5.2 U
TPH-gas range	--	--	--	--	100	2.9 U	2.6 U	3.3 U	2.4 J	2.8 U	NA	NA	3.1 U	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL, and ECO (E)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, ECO (E), SSL (DAF=1) and PREQB Corrective Action Level

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
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MG/KG - Milligrams per kilogram
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Table 2-1
Surface Soil Detection and Exceedance Results
SWMU 2
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (Kv)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	PREQB Corrective Action Level	VEW02-SO25	VEW02-SO26		VEW02-SO27	VEW02-SO28	VEW02-SO29	VEW02-SO33
Sample ID						VEW02-SS25-01-0209	VEW02-SS26-01-0609	VEW02-SS26P-01-0609	VEW02-SS27-01-0609	VEW02-SS28-01-0609	VEW02-SS29-01-0609	VEW02-SS33-01-0609
Sample Date						02/17/09	06/02/09	06/02/09	06/02/09	06/02/09	06/02/09	06/02/09
Chemical Name												
Volatile Organic Compounds (UG/KG)												
No Detections	--	--	--	--	--	ND	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)												
Benzo(a)anthracene	--	150	--	10	--	22 U	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	--	15	--	240	--	22 U	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	150	--	35	--	22 U	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	--	170,000	--	120,000	--	22 U	NA	NA	NA	NA	NA	NA
Chrysene	--	15,000	--	1,100	--	22 U	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	--	610,000	40,000	9,200	--	110 U	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	--	150	--	120	--	22 U	NA	NA	NA	NA	NA	NA
PAH HMW (Total)	--	--	1,100	--	--	0 U	NA	NA	NA	NA	NA	NA
PAH LMW (Total)	--	--	29,000	--	--	0 U	NA	NA	NA	NA	NA	NA
Pyrene	--	170,000	--	120,000	--	22 U	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/KG)												
4,4'-DDE	--	1,400	21	47	--	NA	NA	NA	NA	NA	NA	NA
Herbicides (UG/KG)												
No Detections	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
Dioxin/Furans (PG/G)												
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
Total pentachlorodibenzo-p-dioxin	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/KG)												
No Detections	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA
Total Metals (MG/KG)												
Antimony	35,000	3.1	0.27	0.27	--	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.6	0.39	18	0.29	--	NA	NA	NA	NA	NA	NA	NA
Barium	212	1,500	330	82	--	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.27	16	21	3.2	--	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.2	7.0	0.36	0.38	--	NA	NA	NA	NA	NA	NA	NA
Chromium	72	0.29	26	0.00083	--	NA	NA	NA	NA	NA	NA	NA
Cobalt	26	2.3	13	0.49	--	NA	NA	NA	NA	NA	NA	NA
Copper	94	310	28	46	--	NA	NA	NA	NA	NA	NA	NA
Cyanide	0.33	160	15.8	2.0	--	NA	NA	NA	NA	NA	NA	NA
Lead	5.4	400	11	27	50	0.34	**11**	**8.2**	**30**	**63**	**40**	**43**
Mercury	0.057	0.78	0.10	0.57	--	NA	NA	NA	NA	NA	NA	NA
Nickel	41	160	38	48	--	NA	NA	NA	NA	NA	NA	NA
Selenium	0.51	39	0.52	0.26	--	NA	NA	NA	NA	NA	NA	NA
Silver	0.22	39	4.2	1.6	--	NA	NA	NA	NA	NA	NA	NA
Tin	--	4,700	--	5,500	--	NA	NA	NA	NA	NA	NA	NA
Vanadium	144	39	7.8	180	--	NA	NA	NA	NA	NA	NA	NA
Zinc	32	2,400	46	680	--	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (MG/KG)												
TPH-diesel range	--	--	--	--	100	5.6 U	NA	NA	NA	NA	NA	NA
TPH-gas range	--	--	--	--	100	3.5 U	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL, and ECO (E)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, ECO (E), SSL (DAF=1) and PREQB Corrective Action Level

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 2-2
Subsurface Soil Detection and Exceedance Results
SWMU 2
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (Kv)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	**PREQB Corrective Action Level**	CGW2SB01	CGW2SB02	VEW02-SO14	VEW02-SO15	VEW02-SO16	VEW02-SO17	VEW02-SO18	VEW02-SO22	VEW02-SO23	
Sample ID					CGW2SB01-R01-10	CGW2SB02-R01-5	VEW02-SB14-46-0209	VEW02-SB15-46-0209	VEW02-SB16-24-0209	VEW02-SB17-35-0209	VEW02-SB18-24-0209	VEW02-SB22-46-0209	VEW02-SB23-24-0209	VEW02-SB23-24-0209A
Sample Date					01/21/04	01/22/04	02/13/09	02/13/09	02/12/09	02/12/09	02/12/09	02/17/09	02/11/09	02/12/09
Chemical Name														
Volatile Organic Compounds (UG/KG)														
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)														
Benzo(a)anthracene	--	150	10	--	362 U	382 U	21 U	24 U	9.1 J	21 U	22 U	21 U	21 U	NA
Benzo(b)fluoranthene	--	150	35	--	362 U	382 U	21 U	24 U	22 UJ	21 UJ	22 UJ	21 U	6.1 J	NA
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	--	362 U	382 U	100 U	100 U	110 U	270	240	100 U	100 U	NA
Di-n-butylphthalate	--	610,000	9,200	--	362 U	382 U	100 U	120 U	110 U	24 J	110 U	110 U	110 U	NA
Herbicides (UG/KG)														
No Detections	--	--	--	--	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA
Dioxin/Furans (PG/G)														
No Detections	--	--	--	--	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/KG)														
No Detections	--	--	--	--	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (MG/KG)														
Lead	3.3	400	27	50	NA	NA	0.38	0.43	2.2 J	**58 J**	**128 J**	0.93	**47 J**	NA
Total Petroleum Hydrocarbons (MG/KG)														
TPH-diesel range	--	--	--	100	NA	NA	2.4 J	5.2 J	5.6 U	36	24	5.4 U	NA	14
TPH-gas range	--	--	--	100	NA	NA	2.4 U	5.6 J	3.0 U	3.4 U	2.4 J	2.7 U	3.2	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, SSL (DAF=1) and PREQB Corrective Action Level

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 2-2
Subsurface Soil Detection and Exceedance Results
SWMU 2
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (Kv)	Adjusted RSL for Residential Soil	SSL (DAF=1)	PREQB Corrective Action Level	VEW02-SO25	VEW02-SO26	VEW02-SO27	VEW02-SO28	VEW02-SO29	VEW02-SO33
Sample ID					VEW02-SB25-46-0209	VEW02-SB26-46-0609	VEW02-SB27-24-0609	VEW02-SB28-12-0609	VEW02-SB29-45-0609	VEW02-SB33-12-0609
Sample Date					02/17/09	06/02/09	06/02/09	06/02/09	06/02/09	06/02/09
Chemical Name										
Volatile Organic Compounds (UG/KG)										
No Detections	--	--	--	--	ND	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)										
Benzo(a)anthracene	--	150	10	--	6.9 J	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	150	35	--	21 U	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	--	100 U	NA	NA	NA	NA	NA
Di-n-butylphthalate	--	610,000	9,200	--	100 U	NA	NA	NA	NA	NA
Herbicides (UG/KG)										
No Detections	--	--	--	--	NA	NA	NA	NA	NA	NA
Dioxin/Furans (PG/G)										
No Detections	--	--	--	--	NA	NA	NA	NA	NA	NA
Explosives (UG/KG)										
No Detections	--	--	--	--	NA	NA	NA	NA	NA	NA
Total Metals (MG/KG)										
Lead	3.3	400	27	50	0.48	**15**	**34**	**81**	**223**	**69**
Total Petroleum Hydrocarbons (MG/KG)										
TPH-diesel range	--	--	--	100	6.0	NA	NA	NA	NA	NA
TPH-gas range	--	--	--	100	2.8 U	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, SSL (DAF=1) and PREQB Corrective Action Level

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 2-3
HHRA COPC Summary Table
SWMU-2
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: SWMU-2
Media: Surface Soil
Historical Function: Fuels Off-Loading Site

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KV (1)	Max Exceeds Background KV	December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
SWMU-2 Surface Soil	7440-38-2	Arsenic	2.3E-01	J	2.33E+00		mg/kg	CGW2SS11	12 / 12	11 / 12	--	1.6E+00	Yes	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.1	6.0E-06
	7440-47-3	Chromium	1.1E+01	J	5.62E+01	J	mg/kg	CGW2SS04	12 / 12	12 / 12	--	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0005	--
	7440-48-4	Cobalt	1.0E+01	J	5.12E+01	J	mg/kg	CGW2SS12	12 / 12	12 / 12	--	2.6E+01	Yes	2.3E+00	nc	No	3.7E+02	2.3E+01	23.73	95% Approximate Gamma	Surface Soil UCL	decreased iodine uptake	1.0	6.4E-08
	7440-62-2	Vanadium	6.7E+01	J	1.40E+02	J	mg/kg	CGW2SS07	12 / 12	12 / 12	--	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.4	--
	50-32-8	Benzo(a)pyrene	4.7E-02	J	5.35E-02	J	mg/kg	CGW2SS01	3 / 25	3 / 25	3.20E-03 - 4.20E-03	--	--	1.5E-02	ca	No	1.5E-02	--	--	--	Max	--	--	3.6E-06

Site Cumulative Risk	Max HI *	ELCR
Soil	1.0	1E-05
Groundwater	--	--
Total Risk	1.0	1E-05

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type KV.
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk

TABLE 2-4
Ecological Risk Assessment Screening Statistics for SWMU 2 Surface Soil - Plants and Invertebrates
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Cobalt	-- - --	12 / 12	10.3	51.2	18.0	11.3	23.8	13.0	8 / 12	3.94	26.0	1 / 12	0.69	1.97	1.83	1.38
Lead	-- - --	30 / 30	0.34	144	17.2	28.6	26.1	120	1 / 30	1.20	5.40	16 / 30	3.19	26.7	0.22	0.14
Selenium	0.17 - 0.17	11 / 12	0.18	0.63	0.35	0.16	0.43	0.52	2 / 12	1.21	0.51	2 / 12	0.68	1.23	0.83	0.67

TABLE 2-5
Summary of Norway Rat Exposure Doses - Screening and Baseline
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Lead	144	1.522	219.17	0.468	67.39	0	16.33	4.70	6.47	8.90	3.47	2.52	1.83
Selenium	0.63	1.340	0.84	3.012	1.89	0	0.44	0.20	0.26	0.33	2.21	1.72	1.34

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0398	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.980	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.020	= Proportion of diet composed of soil
WIR =	0.0516	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.168	= Body weight (kg wet weight)

TABLE 2-5
Summary of Norway Rat Exposure Doses - Screening and Baseline
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Lead	17.2	Regression	8.00	Regresson	1.31	0	0.49	4.70	6.47	8.90	0.10	0.08	0.05
Selenium	0.35	Regression	0.43	Regresson	0.16	0	0.03	0.20	0.26	0.33	0.15	0.11	0.09

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0207 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.020 = Proportion of diet composed of soil
WIR = 0.0242 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.209 = Body weight (kg wet weight)

TABLE 2-6
Summary of Indian Mongoose Exposure Doses - Screening and Baseline
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Lead	144	1.522	219.17	0.468	67.39	0.286	41.18	0	32.00	4.70	6.47	8.90	6.81	4.95	3.60
Selenium	0.63	1.340	0.84	3.012	1.89	1.263	0.79	0	0.12	0.20	0.26	0.33	0.61	0.48	0.37

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0460	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.972	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (terrestrial plants)
FCxi =	Chemical-specific	= Concentration of chemical in food item (small mammals, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (small mammals)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.028	= Proportion of diet composed of soil
WIR =	0.0933	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.312	= Body weight (kg wet weight)

TABLE 2-6
Summary of Indian Mongoose Exposure Doses - Screening and Baseline
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Lead	17.2	Regression	8.00	Regresson	1.31	Regresson	3.80	0	0.34	4.70	6.47	8.90	0.07	0.05	0.04

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0285 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.564 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.111 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.297 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0557 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.528 = Body weight (kg wet weight)

TABLE 2-7
Summary of Pearly-eyed Thrasher Exposure Doses - Screening and Baseline
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Lead	144	1.522	219.17	0.468	67.39	0	46.97	3.85	8.61	19.3	12.20	5.46	2.44
Selenium	0.63	1.340	0.84	3.012	1.89	0	0.18	0.44	0.81	1.50	0.41	0.22	0.12

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0174	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.954	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.046	= Proportion of diet composed of soil
WIR =	0.0157	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.080	= Body weight (kg wet weight)

TABLE 2-7
Summary of Pearly-eyed Thrasher Exposure Doses - Screening and Baseline
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Lead	17.2	Regression	8.00	Regresson	1.31	0	0.84	3.85	8.61	19.3	0.22	0.10	0.04

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0123 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.754 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.200 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.046 = Proportion of diet composed of soil
WIR = 0.0129 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.104 = Body weight (kg wet weight)

TABLE 2-8
Summary of Red-tailed Hawk Exposure Doses - Screening
SWMU 2
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Lead	144	1.522	219.17	0.468	67.39	0.286	41.18	0	1.70	3.85	8.61	19.3	0.44	0.20	0.09
Selenium	0.63	1.340	0.84	3.012	1.89	1.263	0.79	0	0.03	0.44	0.81	1.50	0.07	0.04	0.02

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0395 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.000 = Proportion of diet composed of soil
WIR = 0.0680 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.957 = Body weight (kg wet weight)

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Legend

- SWMU 2 Area as identified in the EBS, 2003
- PA/SI Subsurface Soil Sample Location
- PA/SI Surface Soil Sample Location
- Ship Support Bollard

Each sampling location shown is preceded by "CGW2"
(e.g. SS-01 = CGW2SS01 and SB-01 = CGW2SB01)

N W E S

0 400 800 Feet

FIGURE 2-1
1959 Aerial Photograph of the SWMU 2 Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

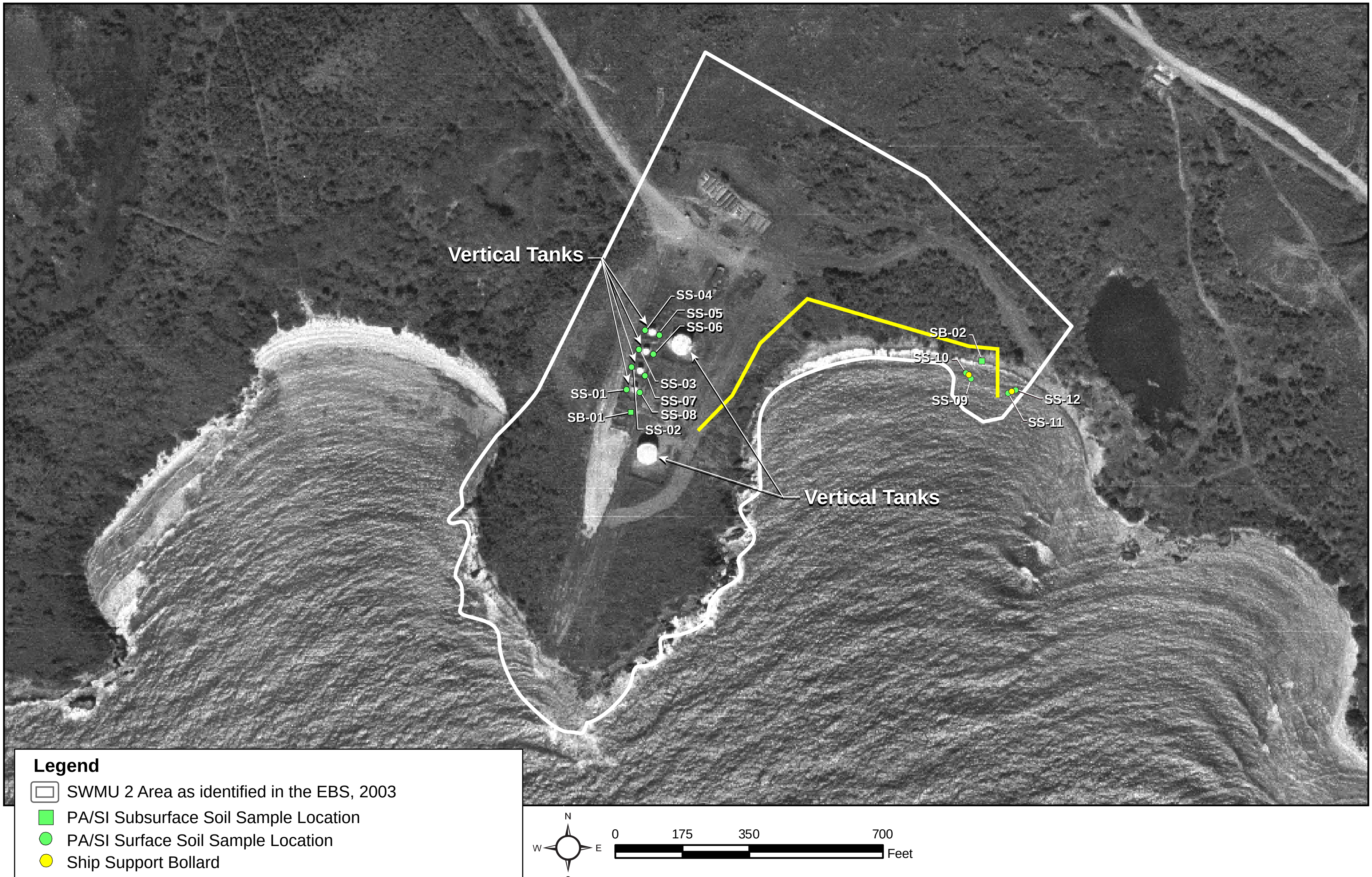
Legend

- SWMU 2 Area as identified in the EBS, 2003
- PA/SI Subsurface Soil Sample Location
- PA/SI Surface Soil Sample Location
- Ship Support Bollard
- Estimated Location of Pipeline, reproduced from hand-drawn NAVFAC Drawing No. 4041627, dated October 29, 1979

Each sampling location shown is preceded by "CGW2" (e.g. SS-01 = CGW2SS01 and SB-01 = CGW2SB01)

FIGURE 2-2
1962 Aerial Photograph of the SWMU 2 Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

- SWMU 2 Area as identified in the EBS, 2003
- PA/SI Subsurface Soil Sample Location
- PA/SI Surface Soil Sample Location
- Ship Support Bollard
- Estimated Location of Pipeline, reproduced from hand-drawn NAVFAC Drawing No. 4041627, dated October 29, 1979

Each sampling location shown is preceded by "CGW2"
(e.g. SS-01 = CGW2SS01 and SB-01 = CGW2SB01)

FIGURE 2-3
1964 Aerial Photograph of the SWMU 2 Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

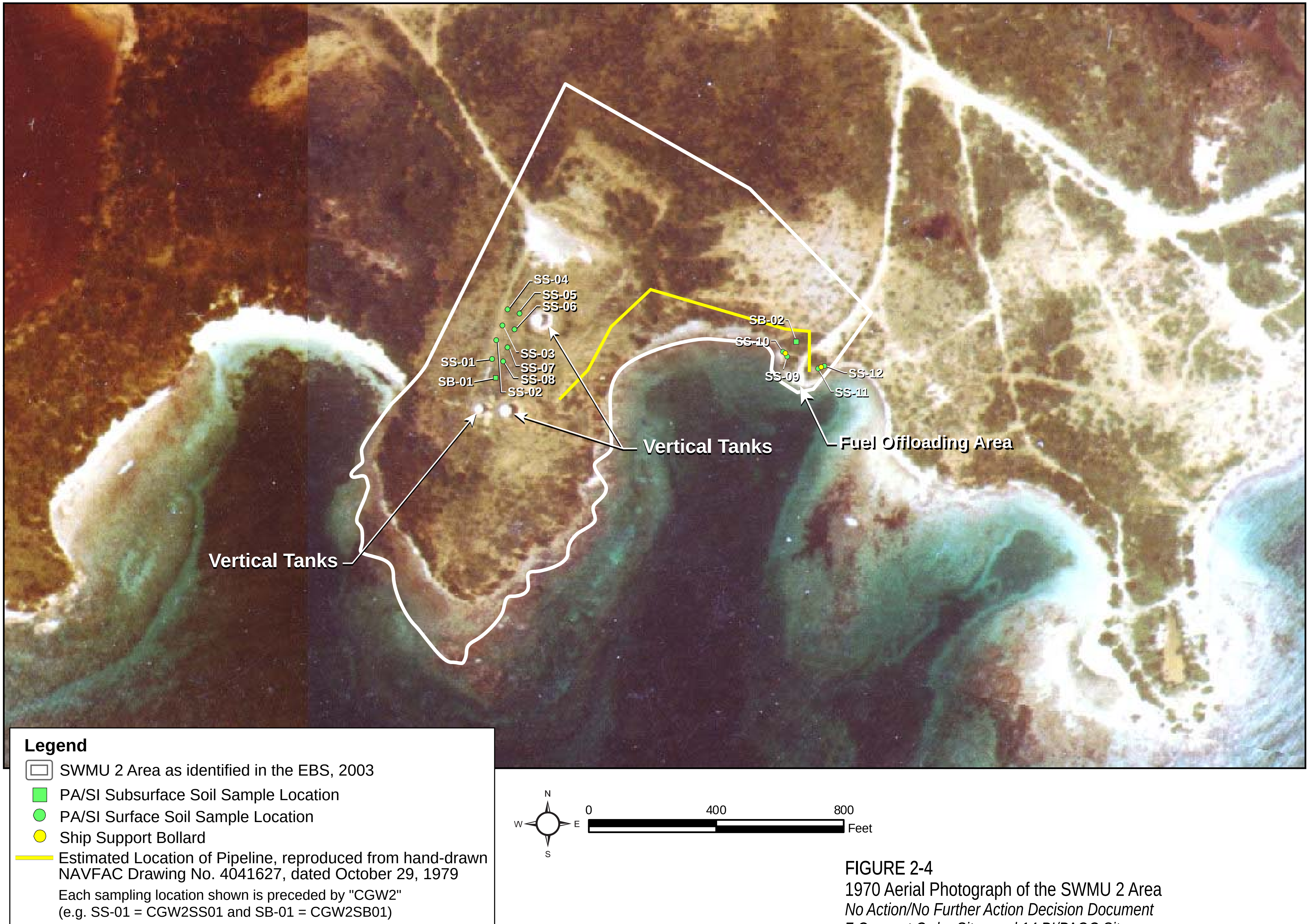


FIGURE 2-4
1970 Aerial Photograph of the SWMU 2 Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Photograph taken February 3, 2000

FIGURE 2-5
SWMU 2 Fuel Offloading Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

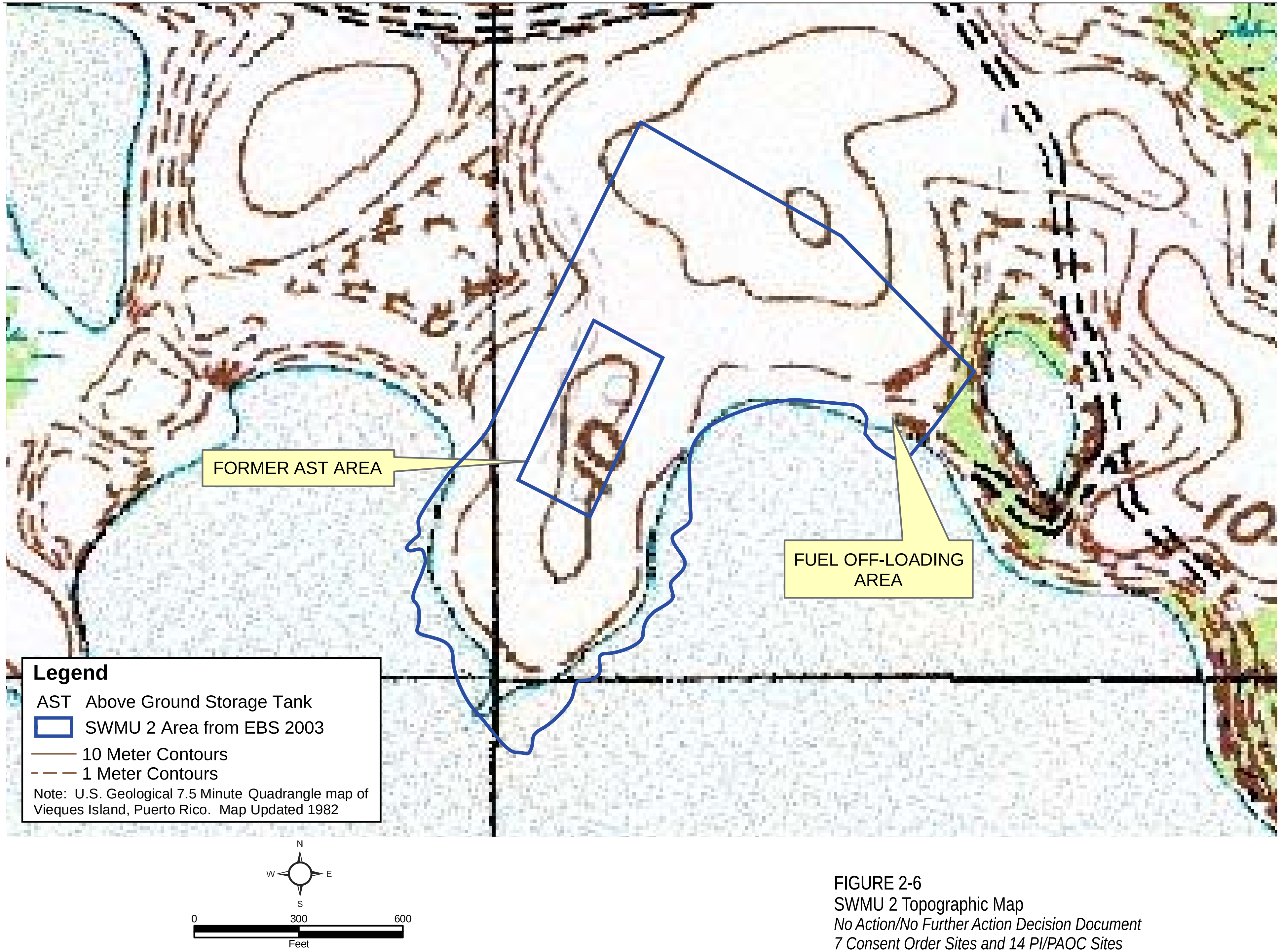
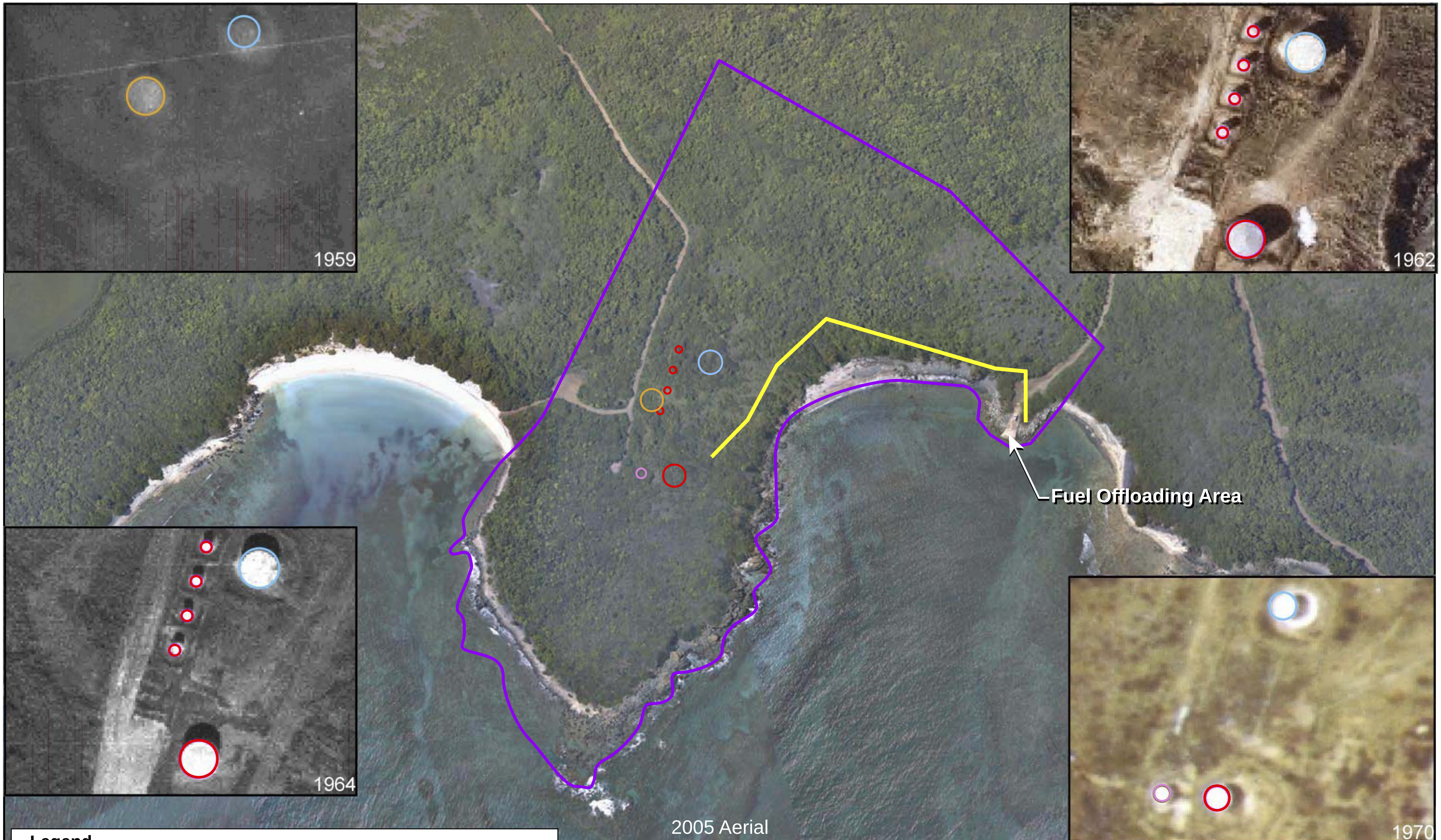


FIGURE 2-6
SWMU 2 Topographic Map
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

- Former Vertical Tank Location - 1959
- Former Vertical Tank Location - 1970
- Former Vertical Tank Location - 1959, 1962, 1964, and 1970
- Former Vertical Tank Location - 1962, 1964, and1970
- SWMU, AOC Sites
- Estimated Location of Pipeline, reproduced from hand-drawn NAVFAC Drawing No. 4041627, dated October 29, 1979

N W E S

0 175 350 700 Feet

FIGURE 2-7
2005 Aerial Photograph of the SWMU 2 Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Legend

- Former Vertical Tank Location - 1959
- Former Vertical Tank Location - 1970
- Former Vertical Tank Location - 1959, 1962, 1964, and 1970
- Former Vertical Tank Location - 1962, 1964, and1970
- SWMU 2 Boundaries
- Estimated Location of Pipeline, reproduced from hand-drawn NAVFAC Drawing No. 4041627, dated October 29, 1979
- Limits of Geophysical Surveys
- SI/ESI Surface Soil Sample Location
- SI/ESI Surface and Subsurface Soil Sample Location
- SI/ESI Surface and Subsurface Soil Sample Location, collected, but not tested
- PA/SI Subsurface Soil Sample Locatioon
- PA/SI Surface Soil Sample Location
- Ship Support Bollard

N W E S

0 50 100 Feet

FIGURE 2-8
SWMU 2 Surface and Subsurface Soil Sample Locations
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

ES051310153702TPA F2-8 SWMU 2 SS and SB Locations.ai mstuart

CH2MHILL

SECTION 3

SWMU 4—Waste Areas of Building 303 (Camp García)

This section presents a summary of the pertinent historical information and rationale for the no action determination for SWMU 4. A more detailed discussion of the SWMU 4 evaluation is presented in the Final PA/SI Report (CH2M HILL, 2008).

3.1 Conceptual Site Model

3.1.1 Site Description and Potential Sources of Release

The SWMU 4 former waste areas were located at Building 303 within the Camp Garcia compound area (**Figure 1-2**) and comprised a spent battery accumulation area, a catch basin for hydraulic oil, a cleaning/degreasing basin, and a storage area for waste rags, absorbent material, and grease (**Figure 3-1**). Building 303 was established as a storage area for batteries when it was erected in the 1960s. Per the classifications in the 1988 and 1995 RFA reports, the oil catch basin, cleaning/degreasing basin, and storage area for rags, absorbent material, and grease were designated as AOCs C, D, and E, respectively (Kearney, 1988; PREQB, 1995). The sites were combined and re-named SWMU 4 in the January 2000 RCRA Consent Order. Building 303 is currently being used by USFWS as a storage facility for property maintenance equipment. The catch basin for hydraulic oil consisted of a metal gutter approximately 5 ft long and 6 inches wide, located beneath several containers of hydraulic oil on a rack. The gutter was designed to catch drips that occurred when hydraulic oil was removed from the drums. The unit was located inside Building 303 and was placed above the concrete floor, which was flat and continuous throughout the entire building. No sign of release was observed during the 1988 RFA (Kearney, 1988).

The cleaning basin was a square metal container, approximately 24 inches long, 18 inches wide, and 12 inches deep, used to hold solvents for the cleaning and degreasing of parts. The unit was formerly located inside Building 303 (Kearney, 1988).

The rags, absorbent, and grease storage area was originally located inside Building 303 and consisted of a small area of the shop where several barrels of grease, rags, and adsorbent generated during cleanup of spills within Building 303 were stored. Facility personnel stated that this was also the approximate area where spent batteries were originally stored. No visual signs of a release or spill to the floor were observed during the 1988 RFA (Kearney, 1988). The 1988 RFA report recommended NFA for all four areas included as SWMU 4.

The 1995 RFA (PREQB, 1995) addressed the spent battery accumulation area, catch basin for hydraulic oil, and the rags, adsorbent, and grease storage area in Building 303. The conclusion for the Spent Battery Accumulation Area was that the potential for migration of waste or accumulated liquids to the soil, groundwater or surface water was very low. According to the 1995 RFA, no batteries or acid were present at the former corrosive materials storage building, nor were there visible signs of acid leakage on the concrete floor from previous storage of these materials. No evidence of release was found and the exposure potential from this SWMU was deemed minimal. NFA was recommended (PREQB, 1995).

A site inspection was conducted in February 2000 to visually assess potential releases at SWMU 4. Like previous inspections, no staining or signs of releases were observed on the concrete floor during the 2000 site inspection. As noted in the Current Conditions Report (CH2M HILL, 2001), an additional building adjacent to Building 303 was identified. This building was used as a battery accumulation area and consisted of a small building adjacent to Building 303 designated as "Corrosive Materials Storage." In the past, it contained spent batteries and battery acid, which were disposed offsite at the former NSRR (now referred to as NAPR). Also noted in the Current Conditions Report was an additional area identified as a storage location for rags, adsorbent material, and grease contained in barrels. This area was described as a small building located adjacent to Building 303 and designated as "Flammable Storage." Both small buildings were reported to have concrete floors.

Figure 3-1 illustrates the locations of the Corrosive Materials Storage building and the Flammable Materials Storage building at SWMU 4**. Figure 3-2** is a photograph of the Corrosive Materials Storage building, and **Figure 3-3** is a photograph of the Flammable Materials Storage building. Both the battery accumulation area and the rags, absorbent material, and grease areas were originally located inside building 303 as described in the 1988 RFA (Kearney, 1988) and the 1995 Revised RFA (PREQB, 1995). The observations made during the RFAs were during a time when the building was being used by the Seabees, who reportedly moved items around frequently. These two areas were moved to the outside sheds (Corrosive Materials Storage Building and Flammable Materials Storage Building) shown in **Figures 3-1, 3-2, and 3-3** sometime between 1995 and 2000, prior to the February 2000 site inspection.

Jay Gonzalez, an employee of the DOI USFWS, stated in a January 2004 interview that Building 303 was cleared of all its contents and that the concrete floor was washed with a high pressure hose. He further stated that there were no floor drains, sumps, or cracks in the concrete floor.

Although none of the areas that make up what became SWMU 4 were recommended for further action in the RFA Reports (Kearney, 1988; PREQB, 1995), the site was investigated during the 2000 Phase I Environmental Site Assessment and again during the 2004 PA/SI to determine whether there was evidence of historical releases. Based on the site history information summarized above, three areas were identified as potential source areas: (1) catch/cleaning/degreasing basin, (2) Corrosive Materials Storage building, and (3) Flammable Materials Storage building. Releases from these potential source areas would have been to the ground surface. However, as shown in **Figures 3-2 and 3-3**, the storage was intended for small quantities of material and the materials were stored in covered buildings intended to protect their contents, rather than in an open area.

3.1.2 Investigation History

A Phase I Environmental Assessment was conducted in June 2000 as part of the transfer of Navy Public Works operations from west Vieques to east Vieques. As shown in **Figure 3-1**, five surface soil samples were collected around the Flammable Materials Storage building, five surface soil samples were collected around the Corrosive Materials Storage building, and two surface soil samples were collected adjacent to the catch basin and cleaning/degreasing basin. All 12 surface soil samples were analyzed for Appendix IX VOCs, SVOCs, pesticides, herbicides, PCBs, and metals.

In accordance with the Phase I RFI Work Plan (CH2M HILL, 2003c), one subsurface soil sample was collected adjacent to the catch basin and cleaning/degreasing basin, as shown in **Figure 3-1**. The SWMU 4 soil boring (CGW4SB01) was advanced to 6 ft bls and soil samples were screened continuously with an OVA. No elevated OVA readings were observed. Therefore, the subsurface soil sample for analysis was collected from the 4-to-6-ft interval. The sample was analyzed for Appendix IX VOCs and SVOCs.

To confirm that from the sites within the eastern half of Camp Garcia (including SWMU 4) there have not been releases that have adversely affected groundwater quality, two monitoring wells were installed just south of the eastern half of Camp Garcia during the SI/ESI. Of these wells, MW01 was installed to represent groundwater conditions downgradient of several sites, including SWMU 4 (Figure 3-4). Groundwater samples were collected from this well and analyzed for TCL VOCs, SVOCs, pesticides, PCBs, and TAL total and dissolved inorganics.

Table 3-1 summarizes the constituents detected in SWMU 4 surface soil samples collected during the Phase I Environmental Assessment and identifies screening criteria exceedances. Similarly, **Table 3-2** summarizes the constituents detected in the SWMU 4 subsurface soil sample collected during the PA/SI. **Table 3-3 s**ummarizes the constituents detected in regional groundwater monitoring well MW01 collected during the SI/ESI. The tables also identify screening criteria exceedances.

3.1.3 Physical Setting

Building 303 sits in the southeastern portion of the area referred to as the Camp Garcia compound. This building has the Camp Garcia perimeter fence on its east and south sides. To the north is a gravel parking area and to the west is an open grassy field periodically cut and maintained. The topography of the area surrounding Building 303 is flat, at an elevation of approximately 60 ft amsl. The subsurface geology is plutonic igneous rock. Groundwater occurs within the fractured bedrock and is presumed to flow in a southerly direction toward the coast. There are no surface water bodies at or immediately adjacent to the site. The closest surface water bodies topographically downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, less than 1 mile to the south and southeast, respectively.

3.2 SWMU 4 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 3-1, 3-2, and 3-3**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was used to store waste materials that were potentially hazardous or contained hazardous constituents. Although there was no evidence of releases observed during the various site visits, the potential presence of hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2000 Phase I Environmental Assessment and 2004 PA/SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Phase I Environmental Assessment (2000) and Phase I RFI (2004)

Appendix N, Section N.4 of the Final PA/SI Report (CH2M HILL 2008) discusses the evaluation of the SWMU 4 data quality. As detailed in Section N.4, the SWMU 4 data are acceptable for use in evaluating aspects of environmental conditions at SWMU 4, which is done in Steps 3 and 7 below.

ESI (2009)

As detailed in Appendix M of the Final SI/ESI report (CH2M HILL 2010), 100 percent of the SI/ESI analytical data for this site are usable for the intended purpose. Therefore, the regional groundwater data are acceptable for use in evaluating whether regional groundwater has been impacted by a CERCLA-related release and, if so, whether there is a source of contamination with the Camp Garcia boundary that warrants further investigation.

Step 3: Were any inorganics above the background upper tolerance level (UTL) detected or were any non-inorganics detected?

For the samples collected during the Phase I Environmental Assessment and PA/SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Surface Soil

- VOCs: 2-hexanone, dibromomethane, m-, p-, and total xylenes, toluene
- SVOCs: acetophenone, anthracene, benzyl alcohol, bis(2-ethylhexyl)phthalate, di-n-octylphthalate, fluoranthene, phenanthrene, pyrene
- Pesticides: 4,4'-DDE, 4,4'-DDT
- Herbicides: 2,4-D
- PCBs: none detected
- Inorganics above background UTLs: arsenic, beryllium, cobalt, copper, lead, mercury, nickel, selenium, tin, zinc

Subsurface Soil

- VOCs: none detected
- SVOCs: bis(2-ethylhexyl)phthalate, di-n-butylphthalate

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

Based on the potential contaminant sources identified at the site, the presence of VOCs, SVOCs, and inorganics may be attributable to historic CERCLA-related releases at the site. Therefore, these constituents are further evaluated in the decision analysis process. The presence of the pesticides and herbicide is likely due to normal use, not a CERCLA-related release, especially because its detected concentrations are similar to those found at multiple sites across Vieques (see *Pesticides and Herbicides* under Section 1.1.1 for a detailed discussion of pesticides). Consequently, pesticides and herbicides are not considered further in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 3 are compared to the screening criteria described in Section 1 and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Surface Soil

- VOCs: no exceedances
- SVOCs: no exceedances
- Arsenic: five detections (samples SS01through SS05) at concentrations (1.7 mg/kg to 2.5 mg/kg) above the RSL (0.39 mg/kg), SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Cobalt: two detections (samples SS01, SS03) at concentrations (19.1 mg/kg and 16.4 mg/kg respectively) above the ecological screening value (13 mg/kg), the adjusted RSL (2.3 mg/kg), SSL at a DAF of 1 (0.49 mg/kg), and background UTL (16 mg/kg)
- Copper: four detections (samples SS01, SS03, SS04, SS05) at concentrations (66.3 mg/kg to 76.9 mg/kg) above the SSL at a DAF of 1 (46 mg/kg), ecological screening value (70 mg/kg; by SS01, SS04, and SS05), and background UTL (66 mg/kg)
- Lead: one detection (sample SS05) at a concentration (30 mg/kg) above the SSL at a DAF 1 (27 mg/kg), and background UTL (5.4 mg/kg)
- Selenium: twelve detections (SS01 through SS12) at concentrations (0.57 mg/kg to 1.1 mg/kg) above the ecological screening value (0.52 mg/kg), the SSL at a DAF 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)
- Zinc: six detections (samples SS01, SS02, SS04,SS05, SS11, and SS12) above the ecological screening value (120 mg/kg) and background UTL (32 mg/kg)

Subsurface Soil

- SVOCs: no exceedances

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at SWMU 4. The site is approximately 0.8 acre in size, which is the approximate size of a hypothetical residential lot. No chemicals in soil were detected above background at concentrations exceeding 100 times the RSLs (see Table 3-4), and therefore no hot spots were identified. All soil data were merged in the residential evaluation.

Two inorganic constituents were detected in surface soil above human health screening levels and background UTLs (see **Table 3-4**).

- Arsenic was detected in 10 of 12 surface soil samples above background and its RSL (0.39 mg/kg), at a maximum concentration of 2.5 mg/kg. Based on the maximum detected concentration, the excess lifetime cancer risk (ELCR) is 6×10^{-6} and the hazard quotient (HQ) is 0.1, which are within EPA acceptable levels and arsenic would not be identified as a risk driver. It is also notable that although the arsenic background UTL is 1.6 mg/kg, arsenic concentrations up to 5 mg/kg were detected during the east Vieques background soil inorganics investigation (CH2M HILL, 2007b). Although concentrations above 1.6 mg/kg were considered outliers for the purposes of establishing a background UTL, concentrations up to 5 mg/kg may very well be representative of true background arsenic concentrations.

- Cobalt was detected in 12 of 12 surface soil samples above its adjusted RSL (2.3 mg/kg), at a maximum concentration of 19 mg/kg. Based on the maximum detected concentration, the ELCR is 5×10^{-8} and the HQ is 0.8, which are within EPA acceptable levels, and cobalt would not be identified as a risk driver. Further, all concentrations were similar to the background UTL (i.e., 16 mg/kg) and only two detections were above both the adjusted RSL and background UTL.

Two additional constituents (chromium and vanadium) were detected in surface soil above human health screening levels but below background UTLs. Based on the historical sources of potential release identified at the site (see Section 3.0) and the environmental conditions on Vieques (see Appendix A of the SI/ESI), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on maximum detected concentrations of the arsenic, cobalt, and the two additional constituents, the cumulative ELCR is 6×10^{-6} and the maximum target organ-specific hazard index (HI) is 0.8 (see **Table 3-4**), which are within EPA's acceptable levels.

Consequently, there is not a concern for potential cumulative effects from multiple chemicals in site soil.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. This health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 1×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Four inorganics (cobalt, copper, selenium, and zinc) exceed ecological soil screening values and background UTLs in at least one surface soil sample (see **Table 3-5**). None of these constituents poses an unacceptable risk to ecological receptors on a site-wide basis based upon the following:

- The area evaluated is immediately adjacent to buildings, is very small, and provides very limited habitat, especially considering the area is maintained by periodic mowing. Thus, the potential exposures to ecological receptors are minimal.
- Cobalt concentrations exceed the ecological screening value and background UTL in 2 of 12 samples. Exceedances of the background UTL are at a maximum ratio of 1.19, indicating that exposures are near background levels and, therefore, are not likely to be significant ecologically. Further, the mean cobalt concentration (11.9 mg/kg) is lower than the ecological screening value (13 mg/kg).
- Copper concentrations exceed the ecological screening value and background in 3 of 12 samples. Exceedances of the background UTL are at a maximum ratio of 1.17, indicating that exposures are near background levels and, therefore, are not likely to be significant ecologically. Further, the mean soil copper concentration (51.2 mg/kg) is less than the ecological screening value (70 mg/kg), which is based on potential impacts to plants. The site consists of periodically maintained grass, so plant endpoints are not appropriately representative of ecological exposures. All concentrations are less than soil screening values based upon other receptors (e.g., 80 mg/kg for soil invertebrates).
- Selenium concentrations exceed the ecological screening value and background UTL in 11 of 12 samples. The site consists of periodically maintained grass, so plant endpoints are not appropriately representative of ecological exposures. All concentrations are less

than soil screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates).

- Zinc concentrations exceed the ecological screening value and background in 6 of the 12 samples. The mean concentration (134 mg/kg) is comparable to the screening value (120 mg/kg). Thus, zinc has a low potential for unacceptable risk to ecological receptors on a site-wide basis. In addition, zinc is not elevated relative to the screening value in the five samples (SS-06 through SS-10) collected adjacent to the battery accumulation area. Other battery-related metals (such as nickel and cadmium) are not elevated in these samples either, indicating that a release from that area has not likely occurred.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Five inorganics (arsenic, cobalt, copper, lead, and selenium) were detected above their respective SSLs at a DAF of 1 in surface soil. However, due to the small area where these constituents were detected above the SSLs and background UTLs (i.e., primarily around the Flammable Materials Storage building), an SSL at a higher DAF is likely to be more realistic. This supposition is supported by data from sites such as PI 7, PAOC J, PAOC K, and PAOC L (also located in the KTd zone), where SSLs at a DAF of 1 are shown to be likely unrealistic predictors of leaching to groundwater. Further, as shown in Table 3-3, arsenic, cobalt, lead, and selenium were not detected in downgradient regional well MW01 and the concentrations of copper in downgradient regional well MW01 are more than an order of magnitude below MCLs and tap water RSLs.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases at SWMU 4 are the former spent battery accumulation area, the former catch basin for hydraulic oil and cleaning/degreasing basin, the former storage area for waste rags (absorbent material and grease). Based on this information, multiple soil samples were collected at or adjacent to each of these areas, the spatial distribution and resulting data of which indicate they likely have been sufficiently characterized.

3.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-related release at SWMU 4 or, if a relese occurred, it has not resulted in soil or groundwater contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Small quantities of materials were stored at the site, in covered buildings. Any releases from these potential sources would have been to the ground surface and soil samples were collected throughout these areas. Although several constituents were detected in surface and subsurface soil, their concentrations are below human health and ecological exposure estimates for unacceptable effects. Further, pesticide and herbicide detections at the site are consistent with normal pesticide and herbicide application associated with maintenance of the historical facilities present at the site. Therefore, no action is warranted for SWMU 4.

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Table 3-1
Surface Soil Detection and Exceedance Results
SWMU 4
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Eco (E)	CGSWMU4SS001	CGSWMU4SS002	CGSWMU4SS003	CGSWMU4SS004	CGSWMU4SS005	CGSWMU4SS006	CGSWMU4SS007	CGSWMU4SS008	CGSWMU4SS009	CGSWMU4SS010	CGSWMU4SS011	CGSWMU4SS012	
Sample ID			NDD021	NDD022	NDD023	NDD024	NDD025	NDD026	NDD027	NDD028	NDD029	NDD030	NDD031	NDD032	NDD033FD1
Sample Date			6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00	6/13/00
Chemical Name															
Volatile Organic Compounds (UG/KG)															
2-Hexanone	--	--	62 UJ	52 UJ	50 UJ	59 UJ	55 UJ	60 U	61 UJ	58 UJ	64 U	50 U	72 UJ	2.0 J	51 U
Dibromomethane	--	--	6.0 UJ	5.0 UJ	5.0 UJ	0.60 J	6.0 UJ	6.0 U	6.0 UJ	6.0 UJ	6.0 U	5.0 U	7.0 UJ	5.0 UJ	5.0 U
m- and p-Xylene	--	2,400	0.60 J	5.0 UJ	5.0 UJ	0.60 J	6.0 UJ	2.0 J	6.0 UJ	6.0 UJ	0.90 J	5.0 U	7.0 UJ	5.0 UJ	5.0 U
Toluene	--	40,000	6.0 UJ	5.0 UJ	5.0 UJ	6.0 UJ	6.0 UJ	6.0 U	6.0 UJ	6.0 UJ	6.0 U	5.0 U	8.0 J	5.0 UJ	5.0 U
Xylene, total	--	2,400	0.60 J	5.0 UJ	5.0 UJ	0.60 J	6.0 UJ	2.0 J	6.0 UJ	6.0 UJ	0.90 J	5.0 U	7.0 UJ	5.0 UJ	5.0 U
Semivolatile Organic Compounds (UG/KG)															
Acetophenone	--	--	412 UJ	644 UJ	528 UJ	473 UJ	402 UJ	461 UJ	456 UJ	433 UJ	355 J	549 UJ	391 UJ	543 UJ	504 UJ
Anthracene	--	--	412 UJ	105 J	528 UJ	473 UJ	402 UJ	461 UJ	456 UJ	433 UJ	423 UJ	549 UJ	391 UJ	543 UJ	504 UJ
Benzyl alcohol	--	--	825 UJ	1,290 UJ	1,060 UJ	946 UJ	804 UJ	921 UJ	912 UJ	866 UJ	65 J	1,100 UJ	782 UJ	1,090 UJ	1,010 UJ
bis(2-Ethylhexyl)phthalate	--	30,000	412 UJ	644 UJ	55 J	473 UJ	402 UJ	461 UJ	456 UJ	433 UJ	423 UJ	549 UJ	391 UJ	543 UJ	504 UJ
Di-n-octylphthalate	--	30,000	412 UJ	644 UJ	528 UJ	473 UJ	402 UJ	36 J	456 UJ	433 UJ	423 UJ	549 UJ	391 UJ	543 UJ	504 UJ
Fluoranthene	--	--	412 UJ	123 J	528 UJ	473 UJ	402 UJ	461 UJ	456 UJ	433 UJ	423 UJ	549 UJ	391 UJ	543 UJ	504 UJ
Phenanthrene	--	--	412 UJ	105 J	528 UJ	473 UJ	402 UJ	461 UJ	456 UJ	433 UJ	423 UJ	549 UJ	391 UJ	543 UJ	504 UJ
Pyrene	--	--	412 UJ	67 J	528 UJ	473 UJ	402 UJ	461 UJ	456 UJ	433 UJ	423 UJ	549 UJ	391 UJ	543 UJ	504 UJ
PAH HMW (Total)		18000	0 U	67	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PAH LMW (Total)		29000	0 U	333	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Pesticide/Polychlorinated Biphenyls (UG/KG)															
4,4'-DDE	--	114	1.1 J	17 UJ	4.3 J	18 UJ	16 UJ	1.8 UJ	2.3 J	3.2 J	4.5 J	3.8 J	1.9 UJ	1.9 UJ	2.0 UJ
4,4'-DDT	--	100	1.2 J	34 UJ	2.2 J	36 UJ	4.1 J	4.3 J	0.59 J	1.8 J	3.4 J	0.66 J	3.9 UJ	3.8 UJ	3.9 UJ
Herbicides (UG/KG)															
2,4-D	--	--	14 J	3,780 UJ	397 UJ	393 UJ	354 UJ	392 UJ	345 UJ	345 UJ	351 UJ	418 UJ	420 UJ	408 UJ	431 UJ
Total Metals (MG/KG)															
Antimony[1]	5.8	78	0.83 J	0.81 J	0.68 J	0.95 J	0.54 UJ	0.60 UJ	0.53 UJ	0.53 UJ	0.54 UJ	0.63 UJ	0.65 UJ	0.63 UJ	0.65 UJ
Arsenic	1.6	18	**2.5**	**2.3**	**1.8**	**2.1**	**1.7**	0.60 U	0.62 J	0.80 J	0.64 J	0.89 J	0.68 J	0.63 U	0.65 U
Barium	147	330	63	72	60	70	64	63	65	65	74	76	68	56	53
Beryllium	0.27	40	**0.30**	**0.28**	**0.37**	**0.29**	0.22	0.17 J	0.17 J	0.20 J	0.23	0.23 J	0.21 J	0.20 J	0.19 J
Cadmium	2.2	32	1.0	1.5	0.69	1.1	0.52	0.12 U	0.11 U	0.11 U	0.11 U	0.13 U	0.13 U	0.13 U	0.13 U
Chromium	72	64	41	23	23	26	24	4.1	12	7.7	8.2	8.6	7.6	6.0	4.9
Cobalt	16	13	**19**	11	**16**	16	15	8.0	10	8.5	8.6	9.8	11	9.7	9.0
Copper	66	70	**72.9**	58.1	**66.3**	**76.9**	**76.3**	32.4	50.2	34.5	37.1	41.9	38.1	30.2	22.4
Lead	5.4	120	**20**	**27**	**17**	**25**	**30**	2.7	**5.9**	**7.6**	3.6	5.1	**6.4**	4.5	3.5
Mercury	0.057	0.10	0.010 U	0.044 J	0.034 J	**0.062 J**	0.025 J	0.010 U	0.010 U	0.020 J	0.021 J	0.021 J	0.020 U	0.020 U	0.020 U
Nickel	22	38	**23**	8.8	9.9	10	15	2.0 J	5.9	3.1 J	3.7 J	3.7 J	2.9 J	2.7 J	2.3 J
Selenium	0.51	0.52	**0.91 J**	**0.57 U**	**0.64 J**	**1.0 J**	**0.94 J**	**0.81 J**	**0.98 J**	**0.86 J**	**1.1 J**	**0.86 J**	**1.1 J**	**0.68 J**	**0.82 J**
Tin	--	--	1.0 J	1.0 J	1.0 J	1.2 J	0.70 J	0.60 U	0.53 U	0.58 J	0.54 U	0.63 U	0.65 U	0.63 U	0.65 U
Vanadium	144	130	105	76	95	83	90	50	71	62	63	73	80	60	57
Zinc	32	120	**355 J**	**165 J**	**100 J**	**139 J**	**127 J**	**46 J**	**65 J**	**45 J**	**42 J**	**105 J**	**231 J**	**184 J**	**151 J**

Notes:

Exceeds Background UTL
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SS

-- Not part of background data set
-- Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram
[1] Background value used is the maximum value detected from the EPA split samples from the East Vieques Background Soil Inorganics Investigation Report (CH2M HILL, October 2007)

Table 3-2
Subsurface Soil Detection and Exceedance Results
SWMU 4
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	CGW4SB01	
Sample ID				CGW4SB01-R01-5	CGW4FD01P-R01-5
Sample Date				1/21/04	1/21/04
Chemical Name					
Volatile Organic Compounds (UG/KG)					
No Detections	--	--	--	ND	ND
Semivolatile Organic Compounds (UG/KG)					
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	161 J	159 J
Di-n-butylphthalate	--	610,000	9,200	109 J	105 J

Notes:
ND - Not Detected
-- Not part of background data set
-- Regulatory standard not promulgated
J - Result may be estimated
UG/KG - Micrograms per kilogram

Table 3-3
Camp Garcia Regional Groundwater Study Detection and Exceedance Results
SWMU - 4
No Action No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	PAOC-N EPAN-MW02 Background	Adjusted RSL for Tapwater	MCL - Groundwater	VECG-MW01	VECG-MW01
Sample ID				VECG-MW01-0409	VECG-MW01P-0409
Sample Date				04/01/09	04/01/09
Chemical Name					
Volatile Organic Compounds (UG/L)					
No Detections				ND	ND
Semivolatile Organic Compounds (UG/L)					
Chrysene	--	3	--	0.082 J	0.19 U
Indeno(1,2,3-cd)pyrene	--	0.03	--	**0.19 J**	0.19 U
Pyrene	--	110	--	0.063 J	0.19 U
Pesticide/Polychlorinated Biphenyls (UG/L)					
No Detections				ND	ND
Total Metals (UG/L)					
Barium	200	730	2,000	20	20
Calcium	144,000	--	--	46,100	43,700
Chromium	3.6 J	0.043	100	3.0 U	**4.7**
Copper	25 U	150	1,300	**0.93 J**	**1.2**
Magnesium	75,600	--	--	30,200	30,400
Manganese	8.0 J	88	--	**26**	**23**
Nickel	2.4 J	73	--	1.2 J	**2.6 J**
Potassium	1,780 J	--	--	1,630	1,520
Sodium	323,000	--	--	159,000	156,000
Vanadium	50 U	18	--	**24**	**23**
Dissolved Metals (UG/L)					
Barium, Dissolved	200 U	730	2,000	**20**	**21**
Calcium, Dissolved	139,000	--	--	44,000	43,400
Copper, Dissolved	25 U	150	1,300	**0.83 J**	**0.85 J**
Magnesium, Dissolved	73,400	--	--	30,900	30,600
Manganese, Dissolved	15 U	88	--	**17**	**17**
Nickel, Dissolved	40 U	73	--	**1.1**	**1.1**
Potassium, Dissolved	1,710 J	--	--	1,540	1,510
Sodium, Dissolved	311,000	--	--	152,000	153,000
Vanadium, Dissolved	50 U	18	--	**24**	**23**
Zinc, Dissolved	60 U	1,100	--	10 U	**11**
Wet Chemistry (MG/L)					
Chloride	NA	--	--	83	NA
Total dissolved solids (TDS)	1,490	--	--	730	NA

Notes:

Exceeds Background

Exceeds Background and Adjusted RSL for Tapwater

NA - Not Analyzed
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/L - Milligrams per liter
UG/L - Micrograms per liter

TABLE 3-4
HHRA COPC SUMMARY TABLE
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: SWMU-4
Media: Surface Soil
Historical Function: Waste Areas of Building 303 (Camp Garcia)

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
SWMU-4	7440-38-2	Arsenic	6.2E-01	J	2.5E+00		mg/kg	CGSWMU4SS001	10 / 12	10 / 12	-	1.6E+00	Yes	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.1	6.4E-06
Surface Soil	7440-47-3	Chromium	4.1E+00		4.1E+01		mg/kg	CGSWMU4SS001	12 / 12	12 / 12	-	7.2E+01	No	2.9E-01	ca	Yes	--	1.2E+05	--	--	Max	No Observed Effects	0.0003	--
	7440-48-4	Cobalt	8.0E+00		1.9E+01		mg/kg	CGSWMU4SS001	12 / 12	12 / 12	-	1.6E+01	Yes	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.8	5.2E-08
	7440-62-2	Vanadium	5.0E+01		1.1E+02		mg/kg	CGSWMU4SS001	12 / 12	12 / 12	-	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.3	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.8	6E-06
Total Risk	0.8	6E-06

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

* - Max HI is the highest HI associated with any target organ or critical effect.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk

TABLE 3-5
Ecological Risk Assessment Screening Statistics for SWMU 4 Surface Soil
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Cobalt	-- - --	12 / 12	8.0	19	11.9	3.71	13.83	13	4 / 12	1.47	16.0	2 / 12	0.74	1.19	1.06	0.92
Copper	-- - --	12 / 12	30.2	77	51.2	18.01	60.58	70	3 / 12	1.10	66.0	4 / 12	0.78	1.17	0.87	0.73
Selenium	0.57 - 0.57	11 / 12	0.6	1.1	0.9	0.22	0.97	0.52	11 / 12	2.12	0.5	11 / 12	1.68	2.16	1.87	1.65
Zinc	-- - --	12 / 12	41.9	355.0	133.7	91.74	181.3	120.00	6 / 12	2.96	32.0	12 / 12	4.18	11.09	1.51	1.11

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Legend

- Phase I Environmental Assessment Surface Soil Sample Location
- PA/SI Subsurface Soil Sample Location

Surface soil sample designations are preceded by "CGSWMU4" (e.g. SS-01 = CGWMU4SS001)

Subsurface soil sample designations are preceded by "CGW4" (e.g. SB-01 = CGW4SB01)

North

0 25 50 100 Feet

FIGURE 3-1
2005 Aerial Photograph of the SWMU 4 Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Photograph taken February 3, 2000

FIGURE 3-2
Corrosive Materials Storage Building, SWMU 4
(Spent battery accumulation area)
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Photograph taken February 3, 2000

FIGURE 3-3
Flammable Materials Storage Building, SWMU 4
(Area of rags, absorbent material, and grease)
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

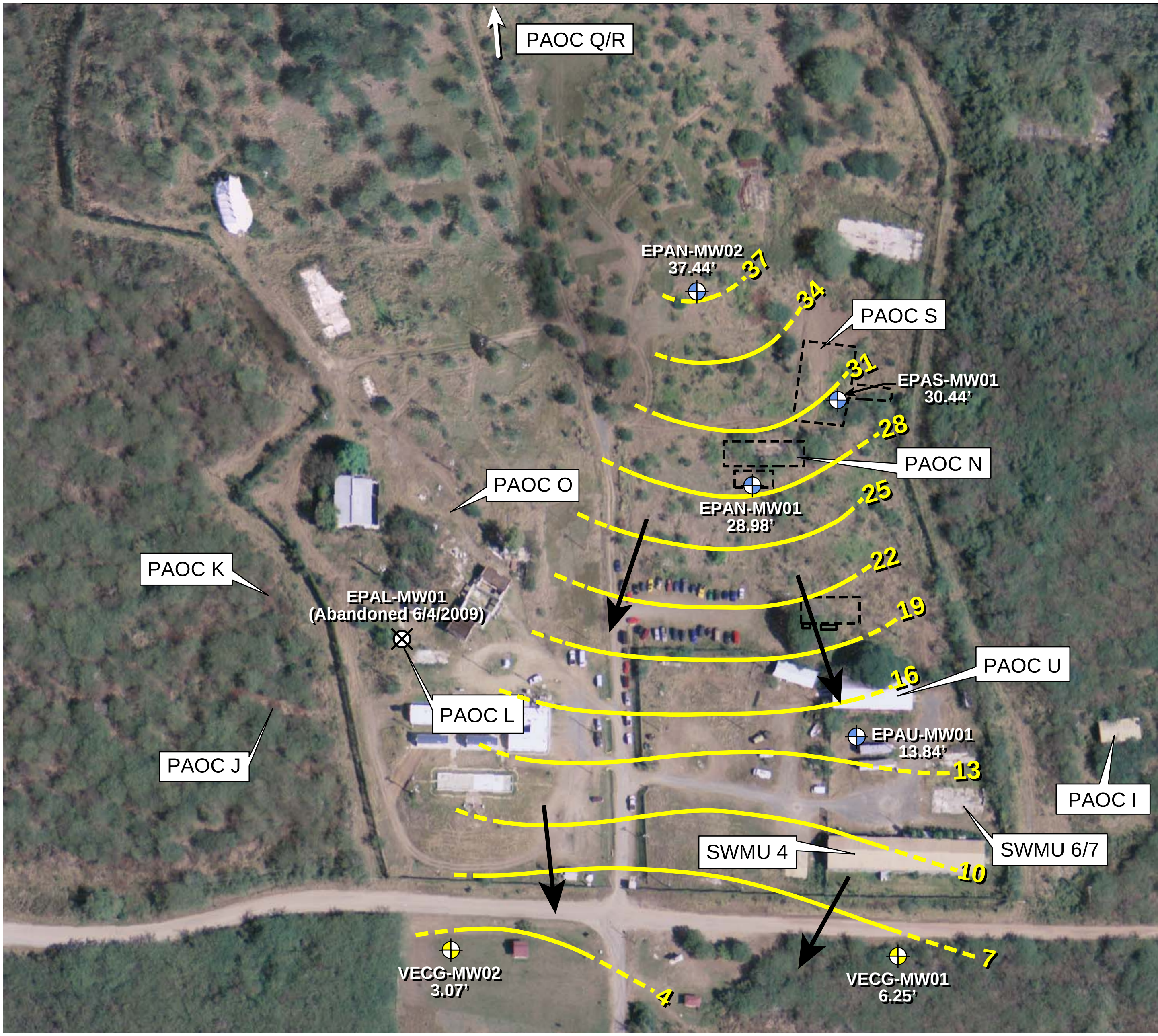
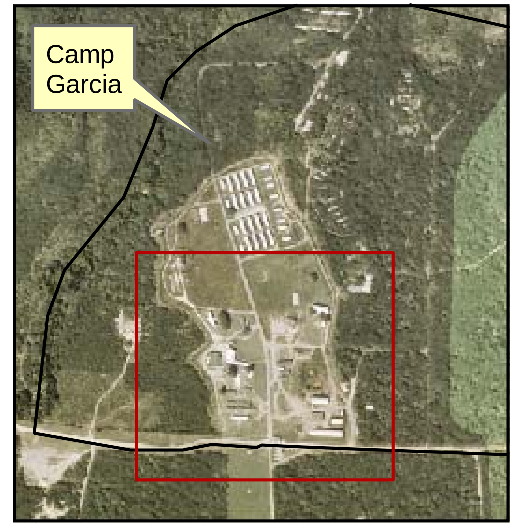


PHOTO DATE: 2007

PHOTO DATE 1983



LEGEND

- SI/ESI Monitoring Well Location
- PA/SI Monitoring Well Location
- Abandonded Well
- Groundwater Flow Direction
- Estimated Potentiometric Contour
- Dashed Where Estimated
- 37 Potentiometric Contour in Feet Above Mean Sea Level
- 37.44' Feet of Water Above Mean Sea Level (6/12/09)

North

0 150 300 Feet

FIGURE 3-4
Potentiometric Surface Map of Camp Garcia
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 4

SWMU 6 and 7—Waste Oil and Paint Accumulation Areas (Seabees Area, Camp Garcia)

This section presents a summary of the pertinent historical information and rationale for the no action determination at both SWMU 6 and 7. The detailed evaluation of SWMUs 6 and 7 presented below is from the Final SI/ESI Report (CH2M HILL, 2010).

4.1 Conceptual Site Model

SWMUs 6 and 7 are located on the north side of Building 303 in the Camp Garcia Compound (**Figures 1-2 and 4-1**). Historical information suggests the co-located sites, consisting of a concrete pad, were used to store waste oil and paint (**Figure 4-1**). A chain-link cage was located on a portion of the pad (**Figure 4-2**). The area became active in approximately 1978 and continued in operation until at least 1995. During interviews with Navy employees in February 2000, it was confirmed that SWMU 6 and SWMU 7 were located adjacent to each other, and, therefore, were investigated as one contiguous unit (CH2M HILL, 2001). More detailed information about SWMUs 6/7 is provided below.

4.1.1 Site Description and Potential Sources of Release

SWMU 6

According to the 1988 RFA report (Kearney, 1988), the SWMU 6 area was used by the Navy Construction Group (Seabees) as a storage area for waste oil and paint. The waste oil was containerized in 55-gallon drums and potentially other containers, and the paint was housed in small containers. During the RFA, tires and two drums of lubricating oil were present at the site. The waste oil and tires were stored on a grassy area until they were later shipped offsite to the former NSRR (now referred to as NAPR). The RFA Report stated that this area became active in approximately 1978 and was still active in 1988 (Kearney, 1988). During the 1995 RFA (PREQB, 1995), staining from oil leakage from the drums onto the adjacent soil surface was visible, and no release controls were present at the site. During the February 2000 site visit, which was done with the EPA to observe the Consent Order sites, a small chain-link cage was present at the site, but it had been moved from the concrete pad by the June 2000 sampling event. During the same visit, no drums or waste materials were present at SWMU 6, but a minor amount of soil staining (approximately 4-square feet [ft^2]) was observed off the edge of the concrete pad. During the January 2004 site visit performed during the PA/SI and the January 2009 multi-agency site visit performed during the ESI, no staining was observed.

SWMU 7

SWMU 7 was used by the U.S. Marine Corps (USMC) for 3 months per year during training exercises. During these 3 months, Marines conducted training exercises at the EMA, and used the waste oil accumulation area at SWMU 7 to store waste oil from maintenance of their vehicles. During the 1988 RFA, one open-top 55-gallon drum, a 25-gallon trash can, and two empty drums cut in half were present at SWMU 7. It was reported that the soil in the waste oil accumulation area was stained with oil, likely from spillage during vehicle maintenance operations. Once the USMC completed their training, the stained soil was excavated and mixed with sand, containerized in 55-gallon drums, and shipped to the former NSRR. Based on the above information, both the 1988 RFA Report (Kearney, 1988) and the 1995 RFA Report (PREQB, 1995) stated that "no sampling and analyses were suggested at this time. A general cleanup of the area, however, would help reduce the potential for release. It was suggested that an area with release controls for storage of the waste materials be established and that procedures be developed to minimize spillage of product."

Based on the historical site information, the potential source areas at SWMUs 6 and 7 were determined to be the drums and small containers used to store waste oil and paint. Releases from these SWMUs would have been to the concrete surface, with potential to runoff onto the ground surface. Therefore in 2000, surface soil sampling was conducted at SWMU 6/7 as part of the transfer of Navy Public Works operations from west Vieques to east Vieques.

4.1.2 Investigation History

Ten surface soil samples (SS -01 through SS -10) were collected around the concrete pad as part of the Phase I Environmental Assessment (**Figure 4-1**). The results of the screening of the SI data are presented in Section 7 of the Final PA/SI Report (CH2M HILL, 2008). In summary, the presence of VOCs, SVOCs, and certain metals above background (e.g., zinc) in surface soil suggested a CERCLA-related release occurred at SWMU 6 and/or 7, but that concentrations would not pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. However, no subsurface soil samples were collected around the former pad in 2000, so the vertical extent of the source area was not ascertained. Therefore, although the surface soil data suggested no action may be warranted, due to the nature of VOCs, surface soil samples may not have been sufficient to characterize the potential source area where waste oil and paint were stored. It was determined an ESI was necessary to determine if the CERCLA-related release warrants further investigation or action.

An ESI was conducted to determine if the concentrations of VOCs, SVOCs, and inorganics detected in the surface soil samples in 2000 are still present in surface soil and to determine if the current surface and subsurface soil concentrations suggest no further investigation or action is warranted for the sites. Six soil borings (SO11 through SO16) were installed around the perimeter of the concrete pad (**Figure 4-1**) at SWMU 6/7. All samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics.

To help determine if there have been releases to groundwater at sites within the eastern half of Camp Garcia (including SWMUs 6/7), a monitoring well (VECG-MW01) was installed south of the eastern half of Camp Garcia, as shown in **Figure 4-1**. Evaluation of the data from this well is presented in Section 24 of the Final SI/ESI Report (CH2M HILL, 2010).

Table 4-1 summarizes the constituents detected in SWMU 6/7 surface soil samples collected during Phase I Environmental Assessment (2000) as well as those detected in surface soil samples collected as part of the ESI (2009). Table 4-2 summarizes the constituents detected in SWMU 6/7 subsurface soil samples collected during the ESI . The tables also identify screening criteria exceedances.

4.1.3 Physical Setting

The area around these two sites is currently open and contains a concrete pad. The concrete pad is surrounded by grass and gravel in a flat area that sits at an elevation of approximately 60 ft amsl. The land slopes very gently to the south, and is cleared periodically as part of routine maintenance activities. The soil overlying the bedrock found in borings at SWMU 6/7 consists mostly of sands, silts, silty sands and sandy silts with some gravel at the surface. The site resides within igneous rocks composed largely of granodiorite and quartz diorite. Groundwater exists within the fractured bedrock and flows in a southerly direction toward the coast. There are no surface water bodies at or immediately adjacent to the site. The closest surface water bodies topographically downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, approximately 1 mile to the south and southeast, respectively.

4.2 SWMU 6/7 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 4-1 through 4-2**). Because the Phase I Environmental Assessment data are approximately 9 years old, and because surface soil samples were re-collected around the concrete pad during the ESI, the historical surface soil data are discussed qualitatively in Step 6 below to demonstrate how the constituent concentrations have changed with time; however, they are not used beyond Step 4 of the decision analysis process.

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests SWMU 6/7 was used to store waste oil and paint. Historical activities, staining observed during site visits, and the presence of hazardous substances found in soil samples collected during the Phase I Environmental Assessment (2000) suggest a CERCLA-related release occurred at SWMU 6 and/or 7. Although the historical surface soil data suggested no action may be warranted, due to the nature of VOCs, it was determined surface soil samples may not be sufficient to characterize the potential source area where waste oil and paint were stored. Therefore, additional sample collection took place during the 2009 ESI. The decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Phase I Environmental Assessment (2000)

Appendix N, Section N.7 of the PA/SI Report (CH2M HILL, 2008) discusses the evaluation of the SWMU 6/7 data quality, for those samples collected as part of the Phase I Environmental Assessment (2000). As detailed in Section N.7 of the PA/SI Report, the

SWMU 6/7 data are acceptable for use in evaluating aspects of environmental conditions at SWMU 6/7.

ESI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the Phase I Environmental Assessment (2000) and the ESI (2009), the following inorganics above the background UTLs and non-inorganics were detected by sample event and by medium:

Phase I Environmental Assessment (2000) Surface Soil

- VOCs: 1,2-dichloroethane, 1,2,3-trichloropropane, 1,4-dichlorobenzene, 2-hexanone, dibromomethane, m- and p-xylene, methylene chloride, vinyl acetate, total xylene
- SVOCs: bis(2-ethylhexyl)phthalate, butylbenzlphalate
- Pesticides: 4,4′-DDD, 4,4-DDE, 4,4′-DDT, chlordane, delta-BHC, heptachlor
- Herbicides: none detected
- PCBs: none detected
- Explosives: none detected
- Inorganics above background UTLs: arsenic, cadmium, copper, lead, selenium, silver, tin, zinc

ESI (2009) Surface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, chrysene, di-n-butylphthalate, fluoranthene, phenanthrene, pyrene
- Inorganics above background UTLs: aluminum, arsenic, calcium, copper, iron, lead, magnesium, zinc

ESI (2009) Subsurface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene
- Inorganics above background UTLs: aluminum, beryllium, calcium, copper, iron, magnesium, potassium, vanadium, zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

For the samples collected during the Phase I Environmental Assessment (2000), the presence of the pesticides is likely due to normal use, not a CERCLA-related release, especially because their detected concentrations (see **Table 4-1**) are similar to those found at multiple sites across Vieques (see Table O-1, of the Final SI/ESI Report (CH2M HILL, 2010)). For example, 4,4′-DDD, 4,4′-DDE, and 4,4′-DDT, were detected in SWMU 6/7 surface soil samples at concentrations between 6.6 μg/kg and 26 μg/kg (4,4′-DDD), 3.2 μg/kg and 136 μg/kg (4,4′-DDE), and 0.81 μg/kg and 146 μg/kg (4,4′-DDT), which are similar to the concentrations detected at other sites across east Vieques (i.e., 0.16 μg/kg to 26 μg/kg for 4,4′-DDD; 0.08 μg/kg to 1,200 μg/kg for 4,4′-DDE; and 0.30 μg/kg to 990 μg/kg for 4,4′-DDT). This was recognized during scoping of the ESI and, therefore, pesticides were not included in the ESI sampling protocol. Consequently, pesticides are not considered further in the decision analysis process.

Nine VOCs were detected in surface soil collected during the Phase I Environmental Assessment (2000). However, as shown in **Table 4-1**, all detections were low (i.e., estimated concentrations below the instrument reporting limit). **Table 4-1** shows that no VOCs were detected in the soil samples collected during the 2009 ESI from approximately the same locations as those collected during the Phase I Environmental Assessment. Five of the nine VOCs detected in 2000 were analyzed for, but not detected, in 2009 soil samples, nor were they detected in downgradient groundwater (see regional groundwater monitoring well MW01 in Table 24-1 of the Final SI/ESI Report (CH2M HILL, 2010)). Although the remaining four VOCs detected in 2000 were not part of the analytical protocol in 2009, the pattern observed for the other five VOCs (i.e., detected at low, estimated concentrations in 2000, but not detected in 2009) is likely applicable to these four VOCs given that they were detected at comparable concentrations. The above information, and the absence of VOCs in the subsurface soil (**Table 4-2**), suggests the low concentrations of VOCs detected in 2000 have degraded. Therefore, the Phase I Environmental Assessment VOC data are not representative of current site conditions. As such, VOCs detected in samples SS-01 through SS-10 are not further considered in the decision analysis process. However, based on the potential source areas at SWMU 6/7 (i.e., former waste oil and paint storage), all other constituent groups (i.e., SVOCs and inorganics) are potentially attributable to CERCLA-related releases of waste oil and paint, and are therefore further evaluated in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by sample event and by medium.

Phase I Environmental Assessment (2000) Surface Soil

- SVOCs: no exceedances

- Arsenic: five detections (samples SS02, SS06 through SS09) at concentrations (1.8 mg/kg to 2.8 mg/kg) above the RSL (0.39 mg/kg), SSL at a DAF 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Cadmium: one detection (sample SS10) at a concentration (4.4 mg/kg) above the SSL at a DAF 1 (0.38 mg/kg) and background UTL (2.2 mg/kg)
- Copper: three detections (samples SS01, SS04, SS08) at concentrations (67 mg/kg, 69 mg/kg, and 86 mg/kg, respectively) above the ecological screening value (70 mg/kg; by SS08 only), SSL at a DAF 1 (46 mg/kg) and background UTL (66 mg/kg)
- Lead: two detections (samples SS08 and SS10) at concentrations (57 and 48 mg/kg, respectively) above the SSL at a DAF 1 (27 mg/kg) and background UTL (5.4 mg/kg)
- Selenium: eight detections (samples SS01, SS02, SS04 through SS07, SS09, and SS10) at concentrations (0.55 mg/kg to 1.1 mg/kg) above the ecological screening value (0.52 mg/kg), the SSL at a DAF 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)
- Zinc: seven detections (samples SS01, SS02, SS05 through SS08, and SS10) at concentrations (129 mg/kg to 587 mg/kg) above the ecological screening value (120 mg/kg) and the background UTL (32 mg/kg)

ESI (2009) Surface Soil

- SVOCs: no exceedances
- Aluminum: one detection (samples SS12) at a concentration (38,400 mg/kg) above the adjusted RSL (7,700 mg/kg) and background UTL (35,000 mg/kg)
- Arsenic: two detections (samples SS12 and SS16) at concentrations (3.3 and 2.6 mg/kg, respectively) above the RSL (0.39 mg/kg), SSL at a DAF 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Copper: two detections (samples SS13 and SS16) at concentrations (87 and 68 mg/kg, respectively) above the ecological screening value (70 mg/kg; by SS16 only), SSL at a DAF 1 (46 mg/kg), and background UTL (66 mg/kg)
- Iron: one detection (samples SS13) at a concentration (42,900 mg/kg) above the adjusted RSL (5,500 mg/kg), SSL at a DAF 1 (640 mg/kg), and background UTL (38,100 mg/kg)
- Lead: two detections (samples SS14 and SS16) at concentrations (48 and 29 mg/kg, respectively) above the SSL at a DAF 1 (27 mg/kg) and background UTL (5.4 mg/kg)
- Zinc: three detections (samples SS12, SS15, and SS16) at concentrations (142, 152, and 310 mg/kg, respectively) above the ecological screening value (120 mg/kg) and background UTL (32 mg/kg)

ESI (2009) Subsurface Soil

- SVOCs: no exceedances
- Aluminum: one detection (sample SB14) at a concentration (37,000 mg/kg) above the adjusted RSL (7,700 mg/kg) and background UTL (35,000 mg/kg)

- Copper: one detection (sample SB14) at a concentration (69 mg/kg) above the SSL at a DAF 1 (46 mg/kg) and background UTL (66 mg/kg)
- Iron: one detection (sample SB12) at a concentration (44,700 mg/kg) above the adjusted RSL (5,500 mg/kg), SSL at a DAF 1 (640 mg/kg), and background UTL (38,100 mg/kg)
- Vanadium: two detections (samples SB12 and SB13) at concentrations (180 and 145 mg/kg, respectively) above the adjusted RSL (39 mg/kg) and background UTL (144 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at SWMU 6 and 7. The site is approximately 0.1 acre in size whereas a residential lot may be approximately ¾ acre. No chemicals were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 4-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a constituent of potential concern (COPC) in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% upper confidence limit [UCL] on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the hazard quotient (HQ) and excess lifetime cancer risk (ELCR). This conservative approach was used to provide upper-end risk estimates for the site.

Four constituents (aluminum, arsenic, iron, and vanadium) were detected in surface or subsurface soil samples above the human health screening levels and background.

- Aluminum was detected in 1 of 6 surface soil samples (38,400 mg/kg) and 1 of 6 subsurface soil samples (37,000 mg/kg) above both the background UTL and the adjusted RSL (7,700 mg/kg). Based on the maximum detected concentration, the HI is 0.5 (see **Table 4-3**), which is within EPA acceptable levels, and aluminum would not be identified as a risk driver.
- Arsenic was detected in 7 of 16 surface soil samples above its background UTL and RSL (0.39 mg/kg), at a maximum concentration of 3.3 mg/kg. Based on the maximum detected concentration, the HI is 0.2 and the ELCR is 9×10^{-6} (see **Table 4-3**), which are within EPA acceptable levels, and arsenic would not be identified as a risk driver.

- Iron was detected in 1 of 6 surface soil samples (42,900 mg/kg) and 1 of 6 subsurface soil samples (44,700 mg/kg) above both the background UTL and the adjusted RSL (5,500 mg/kg). Based on the maximum detected concentration, the HI is 0.8 (see **Table 4-3**), which is within EPA acceptable levels, and iron would not be identified as a risk driver.
- Vanadium was detected in 2 of 6 subsurface soil samples (145 and 180 mg/kg) above both the background UTL and the adjusted RSL (39 mg/kg). Based on the maximum detected concentration, the HI is 0.5 (see **Table 4-3**), which is within the EPA acceptable level, and vanadium would not be identified as a risk driver.

Three additional constituents (chromium, cobalt, and manganese) were detected in soil above human health screening levels but below background UTLs. Based on the maximum detected concentrations of aluminum, arsenic, iron, vanadium, and the three additional constituents, the cumulative maximum target organ-specific HI is 0.9 and the ELCR is 9×10^{-6} (see **Table 4-3**). Based on the historical source of potential releases identified at the site and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Consequently, there is not a concern for potential cumulative effects from multiple constituents in soil.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 1×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Three inorganics (copper, selenium, and zinc) exceeded ecological screening values and background UTLs in at least one surface soil sample collected at the site (**Table 4-1**). None of these constituents likely poses an unacceptable risk to ecological receptors based upon the following:

- The area evaluated is immediately adjacent to a concrete pad, is very small in size, and provides very limited habitat. Thus, the potential exposures to ecological receptors are likely minimal.

- Copper exceeded the background UTL in 5 of 16 samples at a maximum ratio of 1.32, indicating that exposures are near background levels and are therefore not likely to be significant ecologically (**Table 4-4**). Two of the five UTL exceedances are above the ecological screening value and by a small amount (HQ of 1.24); the mean HQ is less than 1 (HQ of 0.88).
- Selenium exceeds the ecological screening value in 8 of 16 samples at a maximum HQ of 2.12; however, the mean HQ (0.91) is less than 1 (**Table 4-4**). Additionally, the screening value (0.52 mg/kg) is based upon potential impacts to plants. The site consists of concrete, gravel, and scrub grass, so plant endpoints are not likely representative of actual exposures. Concentrations are less than soil screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates).
- Zinc concentrations exceed ecological screening value in 10 of 16 samples (**Table 4-4**). Although the maximum HQ is 4.89, the mean HQ is 1.44 and zinc has a low potential for unacceptable risks given the low potential for exposures.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Six inorganics (arsenic, cadmium, copper, iron, lead, and selenium) were detected in surface soil at concentrations above SSLs at a DAF of 1 and background UTLs. However, only copper and iron were detected in subsurface soil at concentrations above SSLs at a DAF of 1 and background. SWMU 6/7 is small (approximately 75 ft x 50 ft) and soil/groundwater data evaluations presented for various sites in this SI/ESI Report suggest SSLs at a DAF of 1 are not representative predictors of leaching to groundwater (e.g., PI 4, SWMU 10, etc.). Further, arsenic, cadmium, iron, lead, and selenium were not detected in groundwater downgradient of SWMU 6/7 (i.e., well VECG-MW01, as shown in **Figure 4-1** and Table 24-1 of the Final SI/ESI Report (CH2M HILL, 2010). Copper was detected, but at a concentration two orders of magnitude or more below its MCL and adjusted tap water RSL.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely source of CERCLA-related releases is the storage area for waste oil and paint. Based on this information, multiple surface and subsurface soil samples were collected around the perimeter of the concrete pad, just off the edge of the pad in the most likely areas where releases would have contacted soil. Based on this information, the spatial distribution of the samples collected during the SI and ESI and the resulting data indicate the potential source area has been sufficiently characterized.

4.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at SWMU 6/7 that has resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Therefore, no action is warranted for SWMUs 6 and 7.

Table 4-1
Surface Soil Detection and Exceedance Results
SWMU 6/7
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	CGSWMU6/7SS001	CGSWMU6/7SS002	CGSWMU6/7SS003	CGSWMU6/7SS004	CGSWMU6/7SS005	CGSWMU6/7SS006		CGSWMU6/7SS007	CGSWMU6/7SS008	CGSWMU6/7SS009	CGSWMU6/7SS010	VEW6/7-SO11
Sample ID					NDD034	NDD035	NDD036	NDD037	NDD038	NDD039	NDD043FD1	NDD058	NDD040	NDD041	NDD042	VEW6/7-SS11-01-0209
Sample Date					06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	02/24/09
Chemical Name																
Volatile Organic Compounds (UG/KG)																
1,2-Dichloroethane	--	430	2,190	1.4	5.0 U	5.0 UJ	8.0 U	6.0 U	6.0 U	**3.0 J**	5.0 U	6.0 U	6.0 UJ	0.30 UJ	6.0 UJ	5.0 U
1,2,3-Trichloropropane	--	5	--	0.0003	5.0 U	5.0 UJ	8.0 U	6.0 U	6.0 U	**4.0 J**	5.0 U	6.0 U	6.0 UJ	6.0 UJ	6.0 UJ	NA
1,4-Dichlorobenzene	--	2,400	1,280	72	0.30 J	2.0 UJ	3.0 U	3.0 U	2.0 U	0.30 J	2.0 U	2.0 U	3.0 UJ	2.0 UJ	0.20 UJ	5.0 U
2-Hexanone	--	21,000	--	11	54 U	50 UJ	79 U	64 U	61 U	2.0 J	55 U	57 U	64 UJ	55 UJ	55 UJ	23 U
Dibromomethane	--	2,500	--	2	0.50 J	5.0 UJ	0.60 J	6.0 U	6.0 U	0.50 J	5.0 U	6.0 U	0.50 J	0.40 UJ	6.0 UJ	NA
m- and p-Xylene	--	63,000	2,400	9,800	0.40 J	0.30 J	2.0 J	0.40 J	0.40 J	6.0 U	0.40 J	1.0 J	0.50 J	0.30 J	0.70 J	10 U
Methylene chloride	--	11,000	1,250	1.3	**3.0 J**	5.0 UJ	**4.0 J**	6.0 U	6.0 U	6.0 U	5.0 U	6.0 U	6.0 UJ	6.0 UJ	6.0 UJ	23 U
Vinyl acetate	--	98,000	--	88	5.0 U	5.0 UJ	8.0 U	6.0 U	6.0 U	2.0 J	5.0 U	6.0 U	6.0 UJ	6.0 UJ	6.0 UJ	NA
Xylene, total	--	63,000	2,400	9,800	0.40 J	0.30 J	2.0 J	0.40 J	0.40 J	6.0 U	0.40 J	1.0 J	0.50 J	0.30 J	0.70 J	NA
Semivolatile Organic Compounds (UG/KG)																
Benzo(a)anthracene	--	150	--	10	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	22 UJ
Benzo(a)pyrene	--	15	--	240	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	22 UJ
Benzo(g,h,i)perylene	--	170,000	--	120,000	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	22 UJ
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	481 UJ	49 J	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	110 UJ
Butylbenzylphthalate	--	260,000	30,000	510	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	40 J	333 UJ	2,340 UJ	360 U
Chrysene	--	15,000	--	1,100	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	22 UJ
Di-n-butylphthalate	--	610,000	40,000	9,200	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	110 UJ
Fluoranthene	--	230,000	--	160,000	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	2.7 J
PAH HMW (Total)	--	--	18,000	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	3.2
PAH LMW (Total)	--	--	29,000	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	2.7
Phenanthrene	--	1,700,000	--	360,000	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	22 UJ
Pyrene	--	170,000	--	120,000	481 UJ	496 UJ	538 UJ	781 UJ	526 UJ	570 UJ	3,140 UJ	2,500 UJ	580 UJ	333 UJ	2,340 UJ	3.2 J
Pesticide/Polychlorinated Biphenyls (UG/KG)																
4,4'-DDD	--	2,000	583	66	3.2 U	3.2 U	3.4 U	3.9 U	3.3 U	3.8 UJ	6.6 J	3.2 U	3.8 U	3.1 U	26 J	NA
4,4'-DDE	--	1,400	114	47	**98**	22	**136**	3.3	5.7	6.1 J	31 J	8.2	3.2	22	3.5	NA
4,4'-DDT	--	1,700	100	67	24	7.5	**146**	0.81 J	4.8	3.2 J	54 J	4.8 J	3.8 U	3.1	3.1 U	NA
Chlordane	--	1,600	11	140	14 U	14 U	15 U	17 U	14 U	17 U	17 U	14 U	17 U	14 U	**14**	NA
delta-BHC	--	270	226	0.22	1.6 UJ	1.6 UJ	1.7 UJ	2.0 UJ	1.6 UJ	**0.84 J**	1.9 UJ	1.6 UJ	1.9 UJ	1.6 UJ	1.6 UJ	NA
Heptachlor	--	110	52.9	33	1.6 U	1.6 U	1.7 U	2.0 U	1.6 U	1.9 U	1.9 U	1.6 U	1.9 U	1.6 U	0.76 J	NA
Herbicides (UG/KG)																
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Explosives (UG/KG)																
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA

Notes:
Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 4-1
Surface Soil Detection and Exceedance Results
SWMU 6/7
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	CGSWMU6/7SS001	CGSWMU6/7SS002	CGSWMU6/7SS003	CGSWMU6/7SS004	CGSWMU6/7SS005	CGSWMU6/7SS006		CGSWMU6/7SS007	CGSWMU6/7SS008	CGSWMU6/7SS009	CGSWMU6/7SS010	VEW6/7-SO11
Sample ID					NDD034	NDD035	NDD036	NDD037	NDD038	NDD039	NDD043FD1	NDD058	NDD040	NDD041	NDD042	VEW6/7-SS11-01-0209
Sample Date					06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	06/13/00	02/24/09
Chemical Name																
Total Metals (MG/KG)																
Aluminum	35,000	7,700	--	55,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15,200
Antimony	5.8	3.1	78	0.27	0.53 UJ	0.54 UJ	0.57 UJ	0.68 J	0.54 UJ	0.64 UJ	0.64 UJ	0.53 UJ	0.74 J	1.1 J	0.54 J	0.27 J
Arsenic	1.6	0.39	18	0.29	1.3	**2.7**	1.2	1.5	1.5	**1.9**	0.64 U	**2.8**	**2.8**	**1.8**	1.4	0.99
Barium	147	1,500	330	82	71 J	106 J	71 J	76 J	70 J	73 J	60 J	66 J	88 J	75 J	45 J	56
Beryllium	0.27	16	40	3.2	0.18 J	0.18 J	0.21 J	0.22 J	0.21 J	0.18 J	0.14 J	0.25	0.17 J	0.24	0.10 U	0.18
Cadmium	2.2	7.0	32	0.38	0.11 U	0.71	0.11 U	0.24	0.35	0.89	0.11 U	0.51	1.2	0.64	**4.4**	0.33
Calcium	8,840	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**16,100**
Chromium	72	0.29	64	0.00083	21	24	17	18	22	22	19	20	32	23	21	20
Cobalt	16	2.3	13	0.49	12	15	11	15	13	13	9.8	12	15	14	9.2	12
Copper	66	310	70	46	**67**	59	50	**69**	57	63	41	63	**86**	59	48	46
Iron	38,100	5,500	--	640	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	29,900
Lead	5.4	400	120	27	**10**	**14**	**6.5**	**8.2**	**11**	**13**	**5.9**	**21**	**57**	**24**	**48**	**12**
Magnesium	3,710	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4,440**
Manganese	1,630	180	220	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	557
Mercury	0.057	0.78	0.10	0.57	0.015 J	0.010 U	0.031 J	0.010 U	0.010 U	0.028 J	0.010 U	0.010 U	0.043 J	0.010 U	0.010 U	0.020 J
Nickel	22	160	38	48	13	12	6.4	6.3 J	8.2	7.7	4.7 J	6.9	8.7	8.1	8.2	8.0
Potassium	5,270	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,100 J
Selenium	0.51	39	0.52	0.26	**0.64 J**	**0.59 J**	0.57 U	**0.78 J**	**0.57 J**	**1.1 J**	**0.85 J**	**0.63 J**	0.64 U	**0.57 J**	**0.55 J**	0.30 J
Silver	0.22	39	560	1.6	0.12 J	0.11 U	0.13 J	0.13 U	0.12 J	0.18 J	0.15 J	0.18 J	0.21 J	0.17 J	**0.28 J**	0.030 J
Sodium	1,590	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	257
Tin	--	4,700	--	5,500	1.6 J	0.76 J	0.61 J	0.81 J	0.93 J	1.2 J	0.64 U	0.81 J	1.9 J	0.93 J	0.69 J	NA
Vanadium	144	39	130	180	91	79	82	84	87	100	91	90	83	88	66	107
Zinc	32	2,400	120	680	**239 J**	**587 J**	**92 J**	**104 J**	**144 J**	**129 J**	29 J	**164 J**	**232 J**	**82 J**	**205 J**	**62**

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 4-1
Surface Soil Detection and Exceedance Results
SWMU 6/7
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VEW6/7-SO12		VEW6/7-SO13	VEW6/7-SO14	VEW6/7-SO15	VEW6/7-SO16
Sample ID					VEW6/7-SS12-01-0209	VEW6/7-SS12P-01-0209	VEW6/7-SS13-01-0209	VEW6/7-SS14-01-0209	VEW6/7-SS15-01-0209	VEW6/7-SS16-01-0209
Sample Date					02/24/09	02/24/09	02/24/09	02/27/09	02/27/09	02/27/09
Chemical Name										
Volatile Organic Compounds (UG/KG)										
1,2-Dichloroethane	--	430	2,190	1.4	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2,3-Trichloropropane	--	5	--	0.0003	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	--	2,400	1,280	72	5.0 U	5.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U
2-Hexanone	--	21,000	--	11	24 U	24 U	27 UJ	26 U	26 U	24 U
Dibromomethane	--	2,500	--	2	NA	NA	NA	NA	NA	NA
m- and p-Xylene	--	63,000	2,400	9,800	11 U	11 U	12 UJ	11 U	11 U	11 U
Methylene chloride	--	11,000	1,250	1.3	24 U	24 U	27 U	26 U	26 U	24 U
Vinyl acetate	--	98,000	--	88	NA	NA	NA	NA	NA	NA
Xylene, total	--	63,000	2,400	9,800	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)										
Benzo(a)anthracene	--	150	--	10	7.2 J	6.6 J	25 UJ	22 UJ	2.3 J	22 UJ
Benzo(a)pyrene	--	15	--	240	6.4 J	6.7 J	25 UJ	22 U	22 U	22 U
Benzo(g,h,i)perylene	--	170,000	--	120,000	24 UJ	23 UJ	25 UJ	3.1 J	3.8 J	5.6 J
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	50 J	55 J	130 UJ	73 J	66 J	71 J
Butylbenzylphthalate	--	260,000	30,000	510	390 U	390 U	420 U	370 U	370 U	360 U
Chrysene	--	15,000	--	1,100	10 J	8.5 J	25 UJ	3.0 J	4.1 J	3.5 J
Di-n-butylphthalate	--	610,000	40,000	9,200	120 UJ	120 UJ	130 UJ	81 J	23 J	19 J
Fluoranthene	--	230,000	--	160,000	16 J	9.8 J	2.3 J	5.0 J	9.0 J	5.1 J
PAH HMW (Total)	--	--	18,000	--	43	35	3.5	6.1	14	13
PAH LMW (Total)	--	--	29,000	--	20	12	2.3	5.0	12	5.1
Phenanthrene	--	1,700,000	--	360,000	4.4 J	2.6 J	25 UJ	22 UJ	2.8 J	22 UJ
Pyrene	--	170,000	--	120,000	19 J	13 J	3.5 J	22 U	4.2 J	3.4 J
Pesticide/Polychlorinated Biphenyls (UG/KG)										
4,4'-DDD	--	2,000	583	66	NA	NA	NA	NA	NA	NA
4,4'-DDE	--	1,400	114	47	NA	NA	NA	NA	NA	NA
4,4'-DDT	--	1,700	100	67	NA	NA	NA	NA	NA	NA
Chlordane	--	1,600	11	140	NA	NA	NA	NA	NA	NA
delta-BHC	--	270	226	0.22	NA	NA	NA	NA	NA	NA
Heptachlor	--	110	52.9	33	NA	NA	NA	NA	NA	NA
Herbicides (UG/KG)										
No Detections	--	--	--	--	NA	NA	NA	NA	NA	NA
Explosives (UG/KG)										
No Detections	--	--	--	--	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
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-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
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UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 4-1
Surface Soil Detection and Exceedance Results
SWMU 6/7
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VEW6/7-SO12		VEW6/7-SO13	VEW6/7-SO14	VEW6/7-SO15	VEW6/7-SO16
Sample ID					VEW6/7-SS12-01-0209	VEW6/7-SS12P-01-0209	VEW6/7-SS13-01-0209	VEW6/7-SS14-01-0209	VEW6/7-SS15-01-0209	VEW6/7-SS16-01-0209
Sample Date					02/24/09	02/24/09	02/24/09	02/27/09	02/27/09	02/27/09
Chemical Name										
Total Metals (MG/KG)										
Aluminum	35,000	7,700	--	55,000	22,300	25,400	**38,400**	20,100	18,400	22,000
Antimony	5.8	3.1	78	0.27	0.35 J	1.8 J	0.11 UJ	0.40 J	0.34 J	0.45 J
Arsenic	1.6	0.39	18	0.29	1.6 J	**3.3 J**	0.58	1.2	1.6	**2.6**
Barium	147	1,500	330	82	72	71	76	69	65	67
Beryllium	0.27	16	40	3.2	0.22	0.20	0.25	0.20	0.21	0.23
Cadmium	2.2	7.0	32	0.38	0.58 J	2.2 J	0.050 J	0.43	0.45	0.77
Calcium	8,840	--	--	--	**13,000**	**26,700**	4,990	**9,310**	**13,100**	**29,700**
Chromium	72	0.29	64	0.00083	21 J	33 J	26	27	21	26
Cobalt	16	2.3	13	0.49	13	15	11	11	11	14
Copper	66	310	70	46	64	63	**87**	54	52	**68**
Iron	38,100	5,500	--	640	32,200	34,000	**42,900**	28,200	30,800	32,600
Lead	5.4	400	120	27	**11 J**	**18 J**	1.8	**48**	**13**	**29**
Magnesium	3,710	--	--	--	**4,990 J**	**9,550 J**	**4,300**	**4,530**	**5,100**	**7,600**
Manganese	1,630	180	220	57	589	647	520	535	487	535
Mercury	0.057	0.78	0.10	0.57	0.038 U	0.010 J	0.038 U	0.010 J	0.032 U	0.035 U
Nickel	22	160	38	48	9.4 J	16 J	9.7	8.0	10	13
Potassium	5,270	--	--	--	1,520 J	1,340 J	1,860 J	1,120 J	1,180 J	1,170 J
Selenium	0.51	39	0.52	0.26	0.16 J	0.26 J	0.56 U	0.49 U	0.50 U	0.44 U
Silver	0.22	39	560	1.6	0.040 J	0.040 J	0.11 U	0.097 U	0.10 U	0.089 U
Sodium	1,590	--	--	--	208 J	315 J	187	202	216	374
Tin	--	4,700	--	5,500	NA	NA	NA	NA	NA	NA
Vanadium	144	39	130	180	109	105	144	98	96	102
Zinc	32	2,400	120	680	**121**	**142**	31	**86**	**152**	**310**

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

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J - Analyte present, value may or may not be accurate or precise
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UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 4-2
Subsurface Soil Detection and Exceedance Results
SWMU 6/7
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	VEW6/7-SO11	VEW6/7-SO12	VEW6/7-SO13	VEW6/7-SO14		VEW6/7-SO15	VEW6/7-SO16
Sample ID				VEW6/7-SB11-46-0209	VEW6/7-SB12-46-0209	VEW6/7-SB13-46-0209	VEW6/7-SB14-46-0209	VEW6/7-SB14P-46-0209	VEW6/7-SB15-46-0209	VEW6/7-SB16-46-0209
Sample Date				02/24/09	02/24/09	02/24/09	02/27/09	02/27/09	02/27/09	02/27/09
Chemical Name										
Volatile Organic Compounds (UG/KG)										
No Detections	--	--	--	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)										
Benzo(a)anthracene	--	150	10	21 UJ	22 UJ	21 U	24 UJ	3.5 J	22 UJ	22 UJ
Benzo(g,h,i)perylene	--	170,000	120,000	21 UJ	22 UJ	21 UJ	24 U	3.5 J	22 U	22 U
Benzo(k)fluoranthene	--	1,500	350	21 UJ	22 UJ	21 UJ	24 UJ	4.2 J	22 UJ	22 UJ
Carbazole	--	24,000	--	21 UJ	22 UJ	21 UJ	24 UJ	2.2 J	22 UJ	22 UJ
Chrysene	--	15,000	1,100	21 UJ	22 UJ	21 U	24 U	4.8 J	22 U	22 U
Fluoranthene	--	230,000	160,000	21 UJ	22 UJ	21 UJ	2.8 J	6.2 J	2.6 J	22 U
Indeno(1,2,3-cd)pyrene	--	150	120	21 UJ	22 UJ	21 UJ	24 U	4.4 J	22 U	22 U
Pyrene	--	170,000	120,000	21 UJ	22 UJ	2.6 J	24 U	3.2 J	22 U	22 U
Total Metals (MG/KG)										
Aluminum	35,000	7,700	55,000	10,100	12,600	12,600	34,200	**37,000**	15,900	15,100
Antimony	5.8	3.1	0.27	0.082 UJ	0.10 UJ	0.10 UJ	0.050 J	0.040 J	0.030 J	0.030 J
Arsenic	1.6	0.39	0.29	0.52	0.84	0.54	0.75	0.64	0.45	0.46
Barium	147	1,500	82	48	36	41	124	108	48	43
Beryllium	0.27	16	3.2	0.10	0.12	0.13	**0.32**	**0.28**	0.15	0.14
Cadmium	2.2	7.0	0.38	0.020 J	0.020 J	0.040 J	0.097 U	0.11 U	0.074 U	0.076 U
Calcium	8,840	--	--	3,160	3,800	4,700	**18,800 J**	**31,800 J**	3,440	3,370
Chromium	72	0.29	0.00083	18	29	22	24	25	20	14
Cobalt	16	2.3	0.49	7.2	7.5	8.7	14 J	9.7 J	8.1	9.9
Copper	66	310	46	53	55	63	**69**	65	62	58
Iron	38,100	5,500	640	30,200	**44,700**	34,200	35,800	35,000	35,300	28,500
Lead	3.3	400	27	0.80	1.3	0.93	2.2	1.8	0.92	0.90
Magnesium	3,710	--	--	2,280	2,490	2,700	**6,510**	**7,050**	2,890	2,490
Manganese	1,630	180	57	308	300	321	674 J	384 J	307	285
Nickel	22	160	48	4.8	6.4	6.2	12	9.2	6.0	5.3
Potassium	2,000	--	--	541 J	825 J	613 J	**2,160 J**	**2,440 J**	820 J	715 J
Sodium	2,250	--	--	236	232	365	331	359	213	214
Vanadium	144	39	180	122	**180**	**145**	108	99	141	110
Zinc	32	2,400	680	13	17	19	**33**	**34**	17	16

Notes:

Exceeds Background UTL

Exceeds Background UTL and Adjusted RSL for Residential Soil

Exceeds Background UTL and SSL (DAF=1)

Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

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UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 4-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: SWMU-6/7
Media: Surface Soil, Subsurface Soil
Historical Function: Waste Oil and paint Accumulation Area (Seabees Area, Camp Garcia)

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)	Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
SWMU-6/7	7429-90-5	Aluminum	1.52E+04	3.84E+04	mg/kg	VEW6/7-SO13	6 / 6	6 / 6	2.16E+00 - 4.42E+00	3.5E+04	Yes	7.7E+03 nc	No	--	7.7E+04	--	--	Max	CNS	0.5	--
Surface Soil	7440-38-2	Arsenic	5.80E-01	3.30E+00 J	mg/kg	VEW6/7-SO12	16 / 16	16 / 16	1.30E-01 - 1.70E-01	1.6E+00	Yes	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.2	8.5E-06
	7440-47-3	Chromium	1.73E+01	3.30E+01 J	mg/kg	VEW6/7-SO12	16 / 16	16 / 16	8.00E-02 - 1.10E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0003	--
	7440-48-4	Cobalt	9.20E+00	1.54E+01	mg/kg	VEW6/7-SO12	16 / 16	16 / 16	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.7	4.2E-08
	7439-89-6	Iron	2.82E+04	4.29E+04	mg/kg	VEW6/7-SO13	6 / 6	6 / 6	5.90E-01 - 1.20E+00	3.8E+04	Yes	5.5E+03 nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	4.87E+02	6.47E+02	mg/kg	VEW6/7-SO12	6 / 6	6 / 6	3.50E-01 - 4.50E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	6.61E+01	1.44E+02	mg/kg	VEW6/7-SO13	16 / 16	16 / 16	6.00E-02 - 7.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
SWMU-6/7	7429-90-5	Aluminum	1.0E+04	3.7E+04	mg/kg	VEW6/7-SO14	6 / 6	6 / 6	1.82E+00 - 4.72E+00	3.5E+04	Yes	7.7E+03 nc	No	--	7.7E+04	--	--	--	CNS	--	--
Subsurface Soil	7440-38-2	Arsenic	4.5E-01	8.4E-01	mg/kg	VEW6/7-SO12	6 / 6	6 / 6	1.10E-01 - 1.60E-01	1.6E+00	No	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	1.4E+01	2.9E+01	mg/kg	VEW6/7-SO12	6 / 6	6 / 6	7.00E-02 - 1.00E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	7.2E+00	1.4E+01 J	mg/kg	VEW6/7-SO14	6 / 6	6 / 6	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	2.9E+04	4.5E+04	mg/kg	VEW6/7-SO12	6 / 6	6 / 6	4.90E-01 - 1.28E+00	3.8E+04	Yes	5.5E+03 nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.8	--
	7439-96-5	Manganese	2.9E+02	6.7E+02 J	mg/kg	VEW6/7-SO14	6 / 6	6 / 6	2.90E-01 - 4.20E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	Max	CNS	0.4	--
	7440-62-2	Vanadium	1.1E+02	1.8E+02	mg/kg	VEW6/7-SO12	6 / 6	6 / 6	5.00E-02 - 7.00E-02	1.4E+02	Yes	3.9E+01 nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.5	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.9	9E-06
Groundwater	--	--
Total Risk	0.9	9E-06

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 4-4
Ecological Risk Assessment Screening Statistics for SWMU 6/7 Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Copper	-- - --	16 / 16	45.6000	86.80	61.94	11.98	67.19	70.0	2 / 16	1.24	66.0	5 / 16	0.94	1.32	0.96	0.88
Selenium	0.44 - 0.64	10 / 16	0.260	1.10	0.47	0.25	0.58	0.52	8 / 16	2.12	0.51	8 / 16	0.93	2.16	1.12	0.91
Zinc	-- - --	16 / 16	31.3	587.0	172.5	132.4	230.6	120.0	10 / 16	4.89	32.0	15 / 16	5.39	18.34	1.92	1.44

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Legend

- Phase I Environmental Assessment Surface Soil Sample Location
- SI/ESI Surface and Subsurface Soil Sample Location
- SI/ESI Monitoring Well

Phase 1 Surface soil sample designations are preceded by "CGSWMU4" (e.g. SS-01 = CGWMU4SS001)

Phase 1 Subsurface soil sample designations are preceded by "CGW4" (e.g. SB-01 = CGW4SB01)

N
W E
S

0 25 50 100
Feet

FIGURE 4-1
Surface and Subsurface Soil Sample
Locations at SWMU 6 and 7
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Photograph taken February 3, 2000

FIGURE 4-2
Waste Oil and Paint Accumulation Area, SWMU 6 & 7
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 5

SWMU 10—Sewage Treatment Lagoons

This section presents a summary of the pertinent historical information and rationale for the no action determination for SWMU 10, the sewage treatment lagoons for Camp Garcia. The detailed evaluation of SWMU 10 presented below is from the Final SI/ESI Report (CH2M HILL, 2010).

5.1 Conceptual Site Model

5.1.1 Site Description and Potential Sources of Release

SWMU 10 is located approximately ½ mile southeast of the main Camp Garcia Compound (**Figure 1-2**). The original domestic sewage treatment lagoons for Camp Garcia went into service in the early 1950s. The facility originally consisted of four unlined lagoons: two of them serving as receiving/equalization lagoons, and the other two providing polishing treatment (**Figures 5-1 and 5-2**). Historically, the raw wastewater discharge to the lagoon system originated from the Camp Garcia area. This consisted of a steel pipe approximately 6 inches in diameter that ran into the northeastern-most lagoon, approximately 80 ft from the berm, as shown on **Figure 5-2**. Effluent from the final two polishing lagoons was then chlorinated in a chlorine contact chamber (now part of AOC G). The 1988 and 1995 RFAs indicated that the effluent from the final lagoons was discharged to the land (Kearney, 1988; PREQB, 1995). ERI (2000) noted probable piping leading from the chlorination building to a series of linear ground scars and ditches (**Figure 5-1**). However, the Current Conditions Report indicates effluent from the final polishing lagoons was chlorinated in the chlorine contact chamber and then discharged to the sea (CH2M HILL, 2001). Although it is possible that wastewater was discharged to the ground surface following chlorination, no historical evidence has been found that wastewater was discharged to the land south of the lagoons. This information was corroborated by an interview with the former Water Program Manager, NAPR Environmental Division.

In 1974, after the level of activity and associated domestic wastewater generation rate significantly decreased at Camp Garcia, the treatment lagoons were lined using a 2-ft compacted clay and plastic liner to create a no-discharge system. The lagoons were then utilized as evaporation lagoons until the new no-discharge lagoon was constructed in September 2000 immediately northwest from the old lagoons as shown in **Figure 5-3**. During the February 2000 site inspection in which the EPA and Navy inspected the consent order sites, it was noted that the four old lagoons were not active (CH2M HILL, 2001). No historical information has been found that suggests the lagoons were covered with soil fill once they became inactive. The new lagoon encompassed an area of approximately 40,000 ft^2, and was constructed with a clay and plastic liner and used only as an evaporation lagoon. This lagoon received only liquid sanitary waste; solids were removed in a settling tank prior to effluent discharge to the lagoon. The new lagoon was decommissioned and the area filled in with soil from the berms when the property transfer occurred in May 2003, and all sanitary effluent was discontinued from Camp Garcia at that time.

The potential sources of a CERCLA-related release at SWMU 2 were determined to be the former lagoons.

5.1.2 Investigation History

Phase I Environmental Assessment

In June 2000, as part of the Phase I Environmental Assessment (2000), four surface soil samples and four subsurface soil samples were collected in each of the four original lagoons (samples SS/SB-01 through SS/SB-04, as shown in **Figure 5-4**). The samples were analyzed for toxicity characteristic leaching procedure (TCLP) VOCs, SVOCs, and inorganics. The subsurface soil samples were also analyzed for those Appendix IX VOCS, SVOCs, and inorganics that are on the TCLP list, as well as TPH. The TCLP analytical results for these samples are presented in **Tables 5-1** (surface soil) **and 5-2** (subsurface soil), which show that none of the constituent concentrations exceeds its corresponding TCLP limit. Further, no TCLP VOCs or SVOCs were detected. Therefore, the material would not have been classified as a characteristic hazardous waste.

Additionally, one water sample (including a duplicate) was collected from a crack in the rusted pipe leading to the northeastern-most lined basin (presumably the influent pipe to the facility). **Table 5-3** summarizes the constituents detected in the water sample collected from the rusted pipe. During the 2004 Phase I RFI, no water was dripping from the rusted pipe.

Phase I RFI

In January 2004, as presented in the Phase I RFI Work Plan (CH2M HILL, 2003b), a soil sampling location was established in each quadrant of each lagoon, for a total of four soil sampling locations per lagoon (i.e., 16 total soil sampling locations, as shown in **Figure 5-4**). At each location, a surface soil and subsurface soil sample were collected. The surface soil samples were collected from the lagoon sludge material at a depth interval of approximately 0 to 8 inches bgs (i.e., the approximate length of a hand auger bucket), and subsurface soil samples were collected immediately below the liner to determine if there was contamination below the liner. The depths of the subsurface soil samples were dependent on the depth to the liner and varied by location from approximately 0.5 ft to 3.6 ft bgs. The black plastic liner was encountered in all 16 soil boring locations, identified by small pieces brought up in the hand auger cuttings. Once the samples were collected, the soil borings were grouted with a cement grout to eliminate the openings made in the liner.

All Phase I RFI soil samples were analyzed for Appendix IX VOCs, SVOCs, pesticides, herbicides, PCBs, and inorganics; and explosives, including perchlorate. Seven of the surface soil samples (SS06, SS07, SS10, SS11, SS13, SS15, and SS19) and four of the subsurface soil samples (SS06, SS11, SS13, and SS19) were also analyzed for cyanide, sulfide, and dioxins. Although historical information for SWMU 10 did not indicate munitions or explosives-related constituents would be related to potential releases at the site, explosives were included in the sample analyses to confirm this supposition. **Tables 5-4 and 5-5** summarize the constituents detected in SWMU 10 surface soil samples and subsurface soil samples, respectively, collected during the Phase I RFI (2004) and identify screening criteria exceedances. **Table 5-5** also summarizes the VOC and metals data for the subsurface soil samples collected during the 2000 Phase I Environmental Assessment.

Five monitoring wells were installed at SMWU 10 during the Phase I RFI (2004). One monitoring well (MW01) was installed in the presumed upgradient direction of the lagoons and four wells were installed within the bermed area of the four lagoons, as shown in **Figure 5-2**. Refer to Section 2 of the Final PA/SI Report (CH2M HILL 2008) for well construction, development, and sampling details. As noted in Section 9.1.2 of the Final PA/SI Report (CH2M HILL 2008), groundwater-level measurements collected during the Phase I RFI indicated the presence of an apparent radial groundwater flow pattern in the vicinity of the lagoons. Although an outward radial flow was not observed during the ESI, it is assumed that at some periods of time, well MW01 is not likely upgradient and may not be representative of background conditions. Therefore, as a conservative measure, SWMU 10 well MW01 is included with the other site wells for the purposes of screening. The background well at PAOC N (MW02), which is hydraulically upgradient of SWMU 10, is used as the background well for SWMU 10 comparison purposes.

All Phase I RFI groundwater samples were analyzed for Appendix IX VOCs, SVOCs, pesticides, herbicides, PCBs, and metals; and explosives, including perchlorate. Two samples (from wells MW04 and MW05) were also analyzed for cyanide, sulfide, and dioxins. **Table 5-6** summarizes the constituents detected in SWMU 10 groundwater samples collected during the Phase I RFI (2004) and identifies screening criteria exceedances. Raw analytical data for all samples collected at SWMU 10 as part of the Phase I RFI are provided in Appendix O of the PA/SI Report (CH2M HILL, 2008).

The Phase I RFI data are evaluated in the PA/SI Report (CH2M HILL, 2008). This evaluation suggested the spatial coverage, data quantity, and data quality were sufficient to draw the conclusion that no CERCLA-related release occurred or, if a CERCLA-related release occurred, it did not warrant further action, with one exception. Many of the thallium concentrations were elevated with respect to background, leaching, human health, and/or ecological screening values. It was recognized, however, that the thallium concentrations reported for samples collected during the Phase I RFI utilized a method that, although standard at the time, tended to provide falsely elevated results (see Section 1 of the PA/SI Report [CH2M HILL, 2008]). Therefore, an ESI was deemed necessary to verify the thallium concentrations at the site.

During the January 2004 Phase I RFI field effort, it was noted that the new lagoon area was abandoned and no sign of the lagoon was present. No known releases of hazardous constituents have occurred at this site (PREQB, 1995). The action recommended by both RFA reports (Kearney, 1988; PREQB, 1995) was stated as follows:

> "Further review of facility practices or sampling and analysis of the waste should be conducted to determine if hazardous constituents may be present in the waste. Additional sampling and analyses of soil, etc. may be suggested based upon review of this information."

ESI

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), two surface soil samples per lagoon (SS21 through SS28, as shown in **Figure 5-4**) were collected and the existing monitoring wells were re-sampled. All samples were analyzed for thallium only (total and dissolved for groundwater), to determine if the thallium concentrations in the Phase I RFI samples were likely falsely elevated.

Because the objective of ESI soil sampling was to confirm whether the historical thallium concentrations in the lagoon material were falsely elevated, all subsurface soil samples were to be collected just above the bottom of the lagoon material, if it could be visually distinguished from the native material. However, at all eight borings the 3-mm plastic liner was identified at approximately 1 ft bgs and was underlain by a silty sand; no organic material indicative of historic sludge material was encountered below the liner. Therefore, no subsurface soil samples were collected, and the surface soil samples (collected from 0 to 1 foot bgs) are representative of the lagoon material. No PID readings above 0.0 ppm were observed in the soil borings.

A round of groundwater samples was collected during the ESI at each of the five groundwater monitoring wells, MW01 through MW05, as shown in **Figure 5-4**.

During the ESI scoping, the ERP Technical Subcommittee concurred that the previous findings for the new lagoon and that sampling there is not warranted.

Tables 5-4 and 5-5 summarize the constituents detected in the SWMU 10 surface soil samples and subsurface soil samples, respectively, collected during the ESI (together with the Phase I RFI soil data) and identify screening criteria exceedances. **Table 5-6** summarizes the constituents detected in SWMU 10 groundwater samples collected during the ESI (together with the Phase I RFI groundwater data).

5.1.3 Physical Setting

The SWMU 10 site consists of four former lagoons with a former chlorine contact chamber located on the southwest corner of the lagoons. The site is situated at approximately 26 ft amsl and the topography slopes gently to the southeast. Soils consist of poorly graded sand and poorly graded sand with clay. Lean clays and poorly graded sands were encountered beneath the liner. The geology consists of igneous rocks, largely granodiorite and quartz diorite. Bedrock occurs at approximately 20 to 25 ft bgs. Groundwater occurs at approximately between 32 and 39 ft bgs in the bedrock and appears to be under semi-confined conditions. The plastic liner may locally influence groundwater levels, creating a low in the piezometric surface beneath the liner and radial flow toward the lagoons. There are no surface water bodies at or adjacent to the site.

5.2 SWMU 10 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 5-4 through 5-6**). Although the SAP indicated the new thallium data would be substituted into the historical dataset and re-evaluated in Step 6 of the decision analysis process, the historical dataset (with the new thallium data substituted for the historical thallium data) are evaluated below using the entire 7-step process as a conservative measure to ensure the decision analysis process also accounts for any changes in screening criteria since the PA/SI Report was prepared.

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was former sewage treatment lagoons. Based on the nature of historical activities, the potential presence of hazardous substances could not be confidently ruled out without sample collection. Sample collection took place during the Phase I Environmental Site Assessment (2000), the Phase I RFI (2004), and the ESI (2009). Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Phase I Environmental Assessment (2000) and Phase I RFI (2004)

Appendix N, Section N.9 of the Final PA/SI Report (CH2M HILL 2008) discusses the evaluation of the SWMU 10 data quality. As detailed in Section N.9, historical SWMU 10 data are acceptable (with the exception of thallium) for use in evaluating whether a release of hazardous waste or hazardous constituents warranting further investigation or action occurred at SWMU 10.

ESI (2009)

Appendix M of the Final SI/ESI Report (CH2M HILL, 2010) discusses the evaluation of the SWMU10 ESI thallium data quality. As detailed in Appendix M, the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site, therefore the SWMU 10 ESI thallium data are acceptable for use as described above. The uncertainty associated with the historical thallium data is obviated by substituting the thallium data from the ESI for the historical thallium data to produce a dataset that is sufficient for making the aforementioned determination.

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the Phase I Environmental Assessment (2000), Phase I RFI (2004), and the ESI (2009), the following inorganics above the background UTLs and non-inorganics were detected by sampling event and by medium:

Phase I RFI (2004) Surface Soil

- VOCs: none detected
- SVOCs: 4-bromophenyl-phenylether, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, di-n-butylphthalate, fluoranthene, pyrene
- Pesticides: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin
- Herbicides: none detected
- PCBs: none detected
- Dioxins: 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, 1,2,3,6,7,8-hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-hexachlorodibenzo-p-dioxin, octachlorodibenzo-p-dioxin, total

heptachlorodibenzo-p-dioxin, total hexachlorodibenzo-p-dioxin, total pentachlorodibenzo-p-dioxin, total tetrachlorodibenzo-p-dioxin

- Explosives: none detected
- Inorganics above background UTLs: cyanide, lead, mercury, selenium, silver, thallium, and zinc

Phase I Environmental Assessment (2000) and Phase I RFI (2004) Subsurface Soil

- VOCs: m- and p-xylenes, total xylenes, toluene
- SVOCs: bis(2-ethylhexyl)phthalate, di-n-buylphthalate
- Pesticides: 4,4'-DDE, 4,4'-DDT
- Herbicides: none detected
- PCBs: none detected
- Dioxins: 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, octachlorodibenzo-p-dioxin, total heptachlorodibenzo-p-dioxin, total hexachlorodibenzo-p-dioxin, total tetrachlorodibenzo-p-dioxin
- Explosives: none detected
- Total petroleum hydrocarbons (TPH)
- Inorganics above background UTLs: arsenic, barium, beryllium, copper, lead, selenium, thallium, vanadium, zinc

Phase I RFI (2004) Groundwater

- VOCs: toluene
- SVOCs: none detected
- Pesticides: none detected
- Herbicides: none detected
- PCBs: none detected
- Dioxins: none detected
- Explosives: none detected
- Inorganics above background well (EPAN-MW02): antimony, arsenic, barium, chromium, cobalt, copper, mercury, nickel, selenium, silver, thallium, vanadium, zinc

ESI (2009) Surface Soil

- Thallium: none detected

ESI (2009) Groundwater

- Thallium: none detected

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

Because there are no known records of exactly what was in the sewage discharged to the SWMU-10 lagoons, it is possible that the VOCs, SVOCs, and inorganics detected in SWMU-10 media are attributable to historic CECRLA-related releases. Therefore, these constituents are considered further in the decision analysis process.

The pesticides detected at this site are the same pesticides and of similar concentrations (**Table 5-4**) detected at other sites across east Vieques (see Table O-1 of the Final SI/ESI Report) (CH2M HILL, 2010). For example, 4,4′-DDD, 4,4′-DDE, and 4,4′-DDT were detected in SWMU 10 surface soil samples at concentrations between 0.19 µg/kg and 11 µg/kg (4,4′-DDD), 4.8 µg/kg and 120 µg/kg (4,4′-DDE), and 0.3 µg/kg, 0.84 µg/kg (4,4′-DDT), which are similar to the concentrations detected at other sites across east Vieques (i.e., 0.16 µg/kg to 26 µg/kg for 4,4′-DDD; 0.08 µg/kg to 1,200 µg/kg for 4,4′-DDE; and 0.30 µg/kg to 990 µg/kg for 4,4′-DDT). This information, coupled with the history of the site, suggests the pesticides are present due to normal pesticide use, not a CERCLA-related release (see Appendix O and *Pesticides and Herbicides* under Section 1.1.1 of the Final SI/ESI Report (CH2M HILL, 2010)). Therefore, pesticides are not considered further in the decision analysis process.

Similarly, dioxins are not likely associated with sewage. Further, as shown in Tables O-3o through O-3y of the Final SI/ESI Report (CH2M HILL, 2010), the highest dioxin concentration at SWMU 10 (in TEQ) is approximately 2.7 ppt, which is an order of magnitude or more below the 72 ppt (TEQ) starting point concentration for developing cleanup levels for residential soil, and 950 ppt (TEQ) starting point for developing cleanup levels for commercial/industrial soil, proposed by EPA in the “Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites” (EPA, 2009. The other dioxin concentrations at SWMU 10 are even lower. Therefore, dioxins are not considered further in the decision analysis process.

In addition, the thallium concentrations reported for samples collected during the Phase I RFI utilized a method that, although standard at the time, tended to provide falsely elevated results (see Section 1). The thallium data collected at SWMU 10 support this assertion. **Tables 5-4 and 5-6** show that no thallium was detected in any of the surface soil or groundwater samples collected during the ESI. Based on this, and in accordance with the procedure defined in the SAP (CH2M HILL, 2008) the thallium results from the ESI are substituted for the historical thallium results in the remainder of the decision analysis process.

Step 5: For potentially complete exposure pathways, are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 and shown on the detection tables. Those constituents that exceed one or more criteria (and background for lead) are listed below by medium.

Phase I RFI (2004) Surface Soil

- 4-Bromophenyl-phenylether: one detection (sample SS05) at a concentration (348 μg/kg) above the SSL at a DAF 1 (0.12 μg/kg)
- Benzo(a)anthracene: one detection (sample SS06) at a concentration (69 μg/kg) above the SSL at a DAF 1 (10 μg/kg)
- Benzo(a)pyrene: two detections (samples SS05 and SS06) at concentrations (51 and 45 μg/kg, respectively) above the RSL (15 μg/kg)
- Selenium: seven detections (samples SS05, SS08, SS10, SS16 to SS18, SS20) at concentrations (0.52 mg/kg to 1.0 mg/kg) above the ecological soil screening value for plants and invertebrates (0.52 mg/kg), the SSL at a DAF 1 (0.26 mg/kg), and background UTL (0.51 mg/kg). Selenium also exceeded background and the ecological soil screening value for birds and mammals (0.63 mg/kg) in five samples.
- Zinc: six detections (samples SS05, and SS08 to SS12) at concentrations (135 mg/kg to 281 mg/kg) above the ecological soil screening value for plants and invertebrates (120 mg/kg) and background UTL (32 mg/kg). Zinc also exceeded background and the ecological soil screening value for birds and mammals (46 mg/kg) in eight samples.

Phase I Environmental Assessment (2000) and Phase I RFI (2004) Subsurface Soil

- VOCs: no exceedances
- SVOCs: no exceedances
- Arsenic: one detection (sample SB03) at a concentration (2.9 mg/kg) above the RSL (0.39 mg/kg), SSL at a DAF 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Barium: four detections (samples SB01 to SB04) at concentrations (167 mg/kg to 241 mg/kg) above SSL at a DAF 1 (82 mg/kg) and background UTL (147 mg/kg)
- Copper: three detections (samples SB02 to SB04) at concentrations (72 mg/kg to 74 mg/kg) above the SSL at a DAF 1 (46 mg/kg) and background UTL (66 mg/kg)
- Selenium: eight detections (samples SB01 to SB05, SB12, SB16, SB20) at concentrations (0.52 mg/kg to 1.3 mg/kg) above the SSL at a DAF 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)
- Vanadium: one detection (sample SB15) at a concentration (157 mg/kg) above the adjusted RSL (39 mg/kg) and background UTL (144 mg/kg)

Phase I RFI (2004) Groundwater

- Antimony (dissolved): two detections (wells MW04 and MW05) at concentrations (3.3 μg/L and 2.7 μg/L, respectively) above the adjusted tap water RSL (1.5 μg/L)

- Arsenic (total): one detection (well MW02) at a concentration (12 µg/L) above the tap water RSL (0.045 µg/L) and MCL (10 µg/L)
- Chromium (total): one detection (MW01) a concentration (10 µg/L) above the tap water RSL (0.043 µg/L)
- Chromium (dissolved): five detections (MW01 to MW05) at concentrations (0.66 µg/L to 3.1 µg/L) above the tap water RSL (0.043 µg/L)
- Cobalt (total): two detections (wells MW01 and MW02) at concentrations (1.8 and 6.6 µg/L) above the adjusted tap water RSL (1.1 µg/L)
- Cobalt (dissolved): one detection (well MW02) at a concentration (7.9 µg/L) above the adjusted tap water RSL (1.1 µg/L)
- Mercury (total): one detection (MW02) a concentration (0.45 µg/L) above the adjusted tap water RSL (0.37 µg/L)
- Selenium (dissolved): one detection (MW02) at a concentration (19 µg/L) above the adjusted tap water RSL (18 µg/L).

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis proceeds to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

Soil

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at SWMU 10. The site is approximately 0.2 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 5-7**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil (or both "total" and "dissolved" groundwater), the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Three constituents were detected in surface or subsurface soil above human health screening levels and background levels (**Table 5-7**).

- Benzo(a)pyrene (B[a]P) was detected in 2 of 16 surface soil samples above its RSL (15 µg/kg). Based on the maximum detected concentration (51 µg/kg), the ELCR is 3 x 10^{-6}, which is within the EPA acceptable range and B(a)P would not be identified as a risk driver.
- Arsenic was detected in one subsurface soil sample above background and its RSL (0.39 mg/kg). Based on the maximum detected concentration (2.9 mg/kg), the HQ is 0.1 and the ELCR is 7 x 10^{-6}, which are within EPA acceptable levels and arsenic would not be identified as a risk driver. It is also notable that although the arsenic background UTL is 1.6 mg/kg, arsenic concentrations up to 5 mg/kg were detected during the east Vieques background soil inorganics investigation (CH2M HILL, 2007b). Although concentrations above 1.6 mg/kg were considered outliers for the purposes of establishing a background UTL, concentrations up to 5 mg/kg may very well be representative of true background arsenic concentrations.
- Vanadium was detected in one subsurface soil sample above background and its adjusted RSL (39 mg/kg). Based on the maximum detected concentration (157 mg/kg), the HQ is 0.4, which is within EPA acceptable levels and vanadium would not be identified as a risk driver.

Two additional constituents (cobalt and chromium) were detected in surface or subsurface soil above human health screening levels but below background UTLs. Based on the historical source of potential releases identified at the site and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report) (CH2M HILL, 2010), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on maximum detected concentrations of B(a)P, arsenic, vanadium, and these two additional constituents, the cumulative ELCR is 1 x 10^{-5} and the maximum target organ-specific HI is 0.6 (see **Table 5-7**). Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil.

Groundwater

For a chemical identified as a COPC in both “total” and “dissolved” groundwater, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Five constituents (antimony, arsenic, chromium, cobalt, and selenium) were detected in groundwater at concentrations above human health screening levels and background (see **Table 5-7**).

- Antimony (dissolved) was detected in two of five wells above its adjusted RSL (1.5 µg/L). The “total” antimony concentrations were below the RSL. Based on the maximum detected “dissolved” concentration (3.26 µg/L), the HQ is 0.2, which is within EPA acceptable levels and antimony would not be identified as a risk driver. Most importantly, all antimony concentrations detected in soil were below the background UTL. Therefore, the presence of antimony in groundwater is attributable to background.

- Arsenic (total) was detected in only one of five wells and the concentration was above its RSL (0.045 μg/L) and its MCL (10μg/L). However, arsenic was not detected in the dissolved fraction. Based on the maximum detected concentration (12 μg/L), the ELCR is 3×10^{-4} and the HQ is 1.1, which exceed EPA's target risk levels. However, because arsenic was not detected in the dissolved fraction and was not detected in all other wells at the site, arsenic is not present in groundwater as the result of a release. Further, the soil data for arsenic suggest its presence in soil at SWMU 10 is likely attributable to background. Therefore, arsenic was not identified as a risk driver.
- Chromium was detected above its RSL (0.043 μg/L) in one of five wells (based on "total" results) and all five wells (based on dissolved results). All detected concentrations are less than the MCL (100 μg/L). Based on the maximum "total" concentration (10 μg/L) and the expected form of chromium (Cr^{3+}) at the site, the HI is 0.0002, which is within the EPA acceptable level, and chromium would not be identified as a risk driver. Additionally, all chromium detections in soil are below the background UTL, which indicates that the presence of chromium in groundwater is attributable to background.
- Cobalt was detected above its adjusted RSL (1.1 μg/L) in two of five wells based on "total results" and one of five wells based on dissolved results. Based on the maximum "total" concentration (6.6 μg/L), the HQ is 0.6, which is within EPA's acceptable level, and cobalt would not be identified as a risk driver. Further, the cobalt detections in soil are below the background UTL, indicating that the presence of cobalt in groundwater is attributable to background.
- Selenium was detected above its adjusted RSL (18 μg/L) in one of five wells (based on dissolved results). Based on the maximum detected concentration (19 μg/L), the HQ is 0.1, which is within EPA acceptable levels, and selenium would not be identified as a risk driver.

Based on maximum detected concentrations of the five constituents above, the cumulative ELCR is 3×10^{-4} and the maximum target organ-specific HI is 1.1 (see **Table 5-7**), which are above EPA acceptable levels. However, as indicated above, the elevated risk estimates are due to arsenic in groundwater, which is below the MCL and is attributable to background.

Cumulative Soil and Groundwater

Potential cumulative risks from both residential soil and groundwater exposures were evaluated. As indicated on **Table 5-7**, the cumulative ELCR is 3×10^{-4} (due to arsenic in groundwater, which is attributable to background) and the maximum target organ-specific HI is 1.2 (due to arsenic in groundwater, which is within background). Therefore, there is not a concern for cumulative effects from soil and groundwater exposures.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 3 x 10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

The concentrations of two inorganics (selenium and zinc) exceeded ecological screening values and background UTLs in at least one surface soil sample (**Table 5-1**). Based on site size and habitat characteristics, exposure of bioaccumulative chemicals to upper trophic level receptors (birds and mammals) was considered in addition to direct exposure of all detected chemicals to soil organisms (plants and invertebrates). Accordingly, the results of screening value exceedances for each of these receptor groups are evaluated.

Selenium and zinc exceeded soil screening values for soil organisms (plants and invertebrates). None of these constituents poses an unacceptable risk to plants and invertebrates based upon the following:

- The site is overgrown with vegetation, with no signs of stressed vegetation.
- Selenium exceeded the ecological screening value in 7 of 16 samples at a maximum HQ of 2.00 (**Table 5-8**). However, the mean HQ (0.96) was less than 1. Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the East Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at SWMU 10 (maximum of 1.04 mg/kg) may be within the range of background. Further, the screening value (0.52 mg/kg) is based upon potential impacts to plants. The site is heavily vegetated, with no apparent impacts to the terrestrial plant community. Maximum concentrations are less than soil screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates).
- Zinc concentrations exceeded ecological screening values in 6 of 16 surface soil samples with a maximum HQ of 2.34 (**Table 5-8**). However, the HQ based upon the mean zinc concentration (0.83) is less than 1. Thus, zinc has a low potential for unacceptable risks on a site-wide basis.

Selenium and zinc exceeded screening values (Eco SSLs) protective of upper trophic level organisms. None of these constituents poses an unacceptable risk to birds and mammals based upon the following:

- Selenium exceeded background and the Eco SSL for mammals (0.63 mg/kg) in 5 of 16 samples. Food web HQs (and calculations) based upon maximum (screening) and mean (baseline) selenium exposure doses for each target receptor are listed in **Tables 5-9 through 5-12**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat and Indian mongoose. However, the mean exposure dose HQs were less than one for all receptors. Therefore, selenium does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- Zinc exceeded background and the Eco SSL for birds (46 mg/kg) in 8 of 16 samples. Food web HQs and calculations for each target receptor are listed in **Tables 5-9 through 5-12**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. The mean exposure dose HQ was less than one for the Norway rat and Indian mongoose. For the pearly-eyed thrasher the mean exposure dose compared to the NOAEL resulted in an HQ greater than one (1.24); however, the MATC HQ was less than one. Therefore, zinc does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Two organics (4-bromophenyl-phenylether and benzo(a)anthracene) were detected in surface soil at concentrations above the SSL at a DAF of 1. However, neither of these constituents was detected in subsurface soil or groundwater. Selenium was the only other constituent detected in surface soil above its SSL at a DAF of 1 and background UTL. It was also detected in subsurface soil above its SSL at a DAF of 1 and background UTL. However, selenium was not detected in groundwater above its tap water RSL (180 μg/L) or MCL (50 μg/L). Arsenic, barium, and copper concentrations exceeded the SSL at a DAF of 1 and background UTL in at least one subsurface soil sample. However, neither barium nor copper was detected in groundwater above its respective RSL or MCL. In addition, arsenic was detected in only one groundwater sample above its RSL and MCL. However, the result was for the "total metals" analysis. Dissolved arsenic was not detected in groundwater. Based on the above information, the SSLs at a DAF of 1 are not representative predictors of leaching to groundwater.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the former sewage treatment lagoons. Based on this information, multiple surface and subsurface soil samples and groundwater samples were collected within the former lagoons. The spatial distribution of the samples collected during the ESI and historical investigations and the resulting data indicate the potential source areas have been sufficiently characterized.

5.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not likely been a CERCLA-Related release at SWMU 10 or, if a release occurred, it has not resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors, leaching concern for groundwater, or MCL exceedance. This evaluation applies to a domestic sewage treatment lagoon system that operated for nearly 50 years, approximately 20 years of which were as unlined lagoons. Anything that discharged to a potential former discharge area would have come from the lagoons. Therefore, the aforementioned conclusion also applies to the potential discharge area south of the lagoons.

For a similar rationale, the no-discharge lagoon constructed in 2000 does not warrant sampling. The purpose of and origin of waste for the no-discharge lagoon constructed in 2000 was essentially the same as those of the previous lagoons. Because the previous lagoons operated for approximately 50 years and the sampling data from them suggest no releases resulted in contamination that would pose potentially unacceptable risks, it is very likely the same is true for the no-discharge lagoon that operated for less than 3 years.

In addition to the above, pesticide detections at the site are consistent with normal pesticide application associated with human occupancy of the historical facilities present at the site. Similarly, dioxin detections at the site are not likely associated with potential CERCLA-related releases and are nevertheless below risk-based screening levels. Further, the historical thallium concentrations likely represent falsely elevated levels, as confirmed during the ESI.

Therefore, no action is warranted for SWMU 10.

Table 5-1
Surface Soil TCLP Raw Analytical Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	TCLP Criteria	CGWWTPSS001	CGWWTPSS002	CGWWTPSS003	CGWWTPSS004
Sample ID		NDD001	NDD002	NDD003	NDD004
Sample Date		06/07/00	06/07/00	06/07/00	06/07/00
Chemical Name					
TCLP Volatile Organic Compounds (MG/L)					
No Detections	--	ND	ND	ND	ND
TCLP Semi-volatile Organic Compounds (MG/L)					
No Detections	--	ND	ND	ND	ND
TCLP Metals (MG/L)					
Arsenic	5.0	0.050 U	0.050 U	0.050 U	0.050 U
Barium	100	0.58 J	1.3 J	1.6 J	0.90 J
Cadmium	1.0	0.010 U	0.010 U	0.010 U	0.010 U
Chromium	5.0	0.020 U	0.020 U	0.020 U	0.020 U
Lead	5.0	0.025 J	0.020 U	0.020 U	0.020 U
Mercury	0.20	0.002 U	0.002 U	0.002 U	0.002 U
Selenium	1.0	0.050 U	0.050 U	0.050 U	0.050 U
Silver	5.0	0.010 U	0.010 U	0.010 U	0.010 U

Notes:
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/L - Milligrams per Liter

Table 5-2
Subsurface Soil TCLP Raw Analytical Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**TCLP Criteria**	CGWWTPSB001	CGWWTPSB002	CGWWTPSB003	CGWWTPSB004
Sample ID		NDD005	NDD006	NDD008	NDD007
Sample Date		06/07/00	06/07/00	06/07/00	06/07/00
Chemical Name					
TCLP Volatile Organic Compounds (MG/L)					
No Detections	--	ND	ND	ND	ND
TCLP Semi-volatile Organic Compounds (MG/L)					
No Detections	--	ND	ND	ND	ND
TCLP Metals (MG/L)					
Arsenic	5.0	0.050 U	0.050 U	0.050 U	0.050 U
Barium	100	1.4 J	1.2 J	1.9 J	1.8 J
Cadmium	1.0	0.010 U	0.010 U	0.010 U	0.010 U
Chromium	5.0	0.020 U	0.020 U	0.020 U	0.020 U
Lead	5.0	0.020 U	0.020 U	0.020 U	0.020 U
Mercury	0.20	0.002 U	0.002 U	0.002 U	0.002 U
Selenium	1.0	0.050 U	0.050 U	0.050 U	0.050 U
Silver	5.0	0.010 U	0.010 U	0.010 U	0.010 U

Notes:
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/L - Milligrams per Liter

Table 5-3
Water Detection Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	CGWWTPWW001	CGWWTPWW001
Sample ID	NDD016	NDD017FD1
Sample Date	6/7/00	6/7/00
Chemical Name		
Volatile Organic Compounds (UG/L)		
Toluene	2.0	1.0
Semivolatile Organic Compounds (UG/L)		
No Detections	ND	ND
Total Metals (UG/L)		
Barium	55 J	49 J
Copper	13 J	10 J
Cyanide	12	10 U
Lead	2.0 U	2.6 J
Zinc	77 J	57 J
Wet Chemistry (MG/L)[1]		
Nitrate/Nitrite	0.11	0.10 U
Sulfate	23	18
Sulfide	3.3	3.5
Total Petroleum Hydrocarbons (MG/L)		
Petroleum hydrocarbons	3.9 J	3.9

Notes:

ND - None Detected

J - Analyte present; reported value may or may not be accurate or precise

U - Analyte not detected

MG/L - Milligrams per Liter

UG/L - Micrograms per Liter

[1] Wet Chemistry includes nitrate/nitrite, sulfate/sulfide, and cyanide

Table 5-4
Surface Soil Detection and Exceedance Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	CGW10SS05	CGW10SS06	CGW10SS07	CGW10SS08	CGW10SS09	CGW10SS10	CGW10SS11	CGW10SS12		CGW10SS13	CGW10SS14	CGW10SS15
Sample ID					CGW10SS05-R01	CGW10SS06-R01	CGW10SS07-R01	CGW10SS08-R01	CGW10SS09-R01	CGW10SS10-R01	CGW10SS11-R01	CGW10FD01P-R01	CGW10SS12-R01	CGW10SS13-R01	CGW10SS14-R01	CGW10SS15-R01
Sample Date					01/22/04	01/20/04	01/20/04	01/22/04	01/20/04	01/20/04	01/20/04	01/20/04	01/20/04	01/20/04	01/20/04	01/20/04
Chemical Name																
Volatile Organic Compounds (UG/KG)																
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)																
4-Bromophenyl-phenylether	--	4,600	--	0.12	**348 J**	400 U	392 U	401 U	375 U	404 U	374 U	363 U	361 U	376 U	382 U	379 U
Benzo(a)anthracene	--	150	--	10	372 U	**69 J**	392 U	401 U	375 U	404 U	374 U	363 U	361 U	376 U	382 U	379 U
Benzo(a)pyrene	--	15	--	240	**51 J**	**45 J**	392 U	401 U	375 U	404 U	374 U	363 U	361 U	376 U	382 U	379 U
Benzo(k)fluoranthene	--	1,500	--	350	372 U	48 J	392 U	401 U	375 U	404 U	374 U	363 U	361 U	376 U	382 U	379 U
Chrysene	--	15,000	--	1,100	372 U	77 J	392 U	401 U	375 U	404 U	374 U	363 U	361 U	376 U	382 U	379 U
Di-n-butylphthalate	--	610,000	40,000	9,200	100 J	400 U	392 U	401 U	375 U	404 U	374 U	363 U	361 U	391	330 J	238 J
Fluoranthene	--	230,000	--	160,000	372 U	48 J	392 U	401 U	375 U	404 U	374 U	363 U	361 U	376 U	382 U	379 U
PAH HMW (Total)	--	--	1,100	--	51	293	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PAH LMW (Total)	--	--	29,000	--	0 U	48	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Pyrene	--	170,000	--	120,000	372 U	54 J	392 U	401 U	375 U	404 U	374 U	363 U	361 U	376 U	382 U	379 U
Pesticide/Polychlorinated Biphenyls (UG/KG)																
4,4'-DDD	--	2,000	21	66	0.26 J	0.19 J	3.9 U	0.30 J	11 J	0.44 J	0.50 J	0.56 J	0.60 J	3.8 U	3.8 U	0.23 J
4,4'-DDE	--	1,400	21	47	**110 J**	**74 J**	**28 J**	**47 J**	**120 J**	**70 J**	**100 J**	20 J	**40 J**	5.8 J	12 J	17 J
4,4'-DDT	--	1,700	21	67	0.92 J	0.97 J	3.9 U	4.0 U	3.8 U	4.0 U	3.7 U	3.6 U	3.6 U	3.8 U	3.8 U	3.8 U
Dieldrin	--	30	4.9	0.170	3.7 U	4.0 U	3.9 U	4.0 U	**0.37 J**	4.0 U	3.7 U	3.6 U	**0.74 J**	3.8 U	3.8 U	3.8 U
Herbicides (UG/KG)																
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dioxin/Furans (PG/G)																
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	NA	50	71	NA	NA	154	67	NA	NA	2.6	NA	45
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	2.5 U	2.5 U	NA	NA	3.1	2.5 U	NA	NA	2.5 U	NA	2.5 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	2.5 U	2.5 U	NA	NA	4.0	2.7	NA	NA	2.5 U	NA	2.5 U
Octachlorodibenzo-p-dioxin	--	--	--	--	NA	464	838	NA	NA	1,410	687	NA	NA	23	NA	435
Total heptachlorodibenzo-p-dioxin	--	--	--	--	NA	97	160	NA	NA	364	147	NA	NA	5.4	NA	91
Total hexachlorodibenzo-p-dioxin	--	--	--	--	NA	15	24	NA	NA	51	26	NA	NA	2.5 U	NA	18
Total pentachlorodibenzo-p-dioxin	--	--	--	--	NA	3.0	1.0 U	NA	NA	2.0	5.0	NA	NA	1.0 U	NA	1.0
Total tetrachlorodibenzo-p-dioxin	--	--	--	--	NA	7.0	1.0 U	NA	NA	81	25	NA	NA	1.0 U	NA	4.0
Explosives (UG/KG)																
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Metals (MG/KG)																
Antimony	35,000	3.1	0.27	0.27	0.44 J	0.95 J	0.83 J	0.35 J	0.90 J	1.2 J	1.0 J	0.89 J	0.78 J	0.47 J	0.59 J	0.73 J
Arsenic	1.6	0.39	18	0.29	0.24 J	0.53 J	0.36 J	0.21 J	0.37 J	0.36 J	0.40 J	0.40 J	0.37 J	0.48 J	0.43 J	0.46 J
Barium	147	1,500	330	82	71	52	54	83	94	93	70	68.60	62	60	72	104
Beryllium	0.27	16	21	3.2	0.19 J	0.23 J	0.24 J	0.24 J	0.25 J	**0.27 J**	0.23 J	0.17 J	0.16 J	0.23 J	0.26 J	0.24 J
Cadmium	2.2	7.0	0.36	0.38	0.23 J	0.011 U	0.038 J	0.57 J	0.30 J	0.35 J	0.10 J	0.20 J	0.18 J	0.010 U	0.010 U	0.009 U
Chromium	72	0.29	26	0.00083	14 J	14	15	16 J	17	19	16	20	15	16	17	16
Cobalt	16	2.3	13	0.49	9.3 J	9.2	9.5	11 J	10	12	10	8.4	8.1	9.3	11	11
Copper	66	310	28	46	40	36	39	49	51	60	44	38	37	48	51	45
Cyanide	0.33	160	15.8	2.0	NA	0.16 U	0.16 U	NA	NA	0.16 U	0.15 U	NA	NA	**0.38 J**	NA	0.15 U
Lead	5.4	400	11	27	**10**	4.2	3.8	**7.6**	**5.9**	**7.5**	5.0	**8.3**	**8.0**	1.3	2.1	2.2
Mercury	0.057	0.78	0.10	0.57	0.040	0.033 J	0.017 J	0.043	**0.065**	0.052	0.040	0.051	**0.060**	0.011 J	0.011 J	0.011 J
Nickel	22	160	38	48	5.2 J	5.0 J	5.4 J	6.1 J	6.3 J	7.5 J	6.0 J	5.7 J	5.4 J	6.4 J	6.9 J	6.2 J
Selenium	0.51	39	0.52	0.26	**0.74 J**	0.18 J	0.27 J	**1.0**	0.35 J	**0.76**	0.38 J	0.17 J	0.41 J	0.34 J	0.31 J	0.34 J
Silver	0.22	39	4.2	1.6	**0.25 J**	0.10 J	0.16 J	**0.29 J**	**0.26 J**	**0.39 J**	**0.25 J**	**0.49 J**	**0.51 J**	0.057 J	0.061 J	0.084 J
Thallium	0.13	--	1.0	0.14	0.13 U	**0.80 J**	**0.76 J**	0.13 U	**0.70 J**	**1.0 J**	**0.77 J**	**0.56 J**	**0.71 J**	**0.76 J**	**0.73 J**	**0.79 J**
Tin	--	4,700	--	5,500	4.9 J	2.1 J	2.6 J	9.2	6.2 J	9.5	4.5 J	9.4	9.4	0.27 J	0.36 J	0.57 J
Vanadium	144	39	7.8	180	75	77	84	85	79	99	91	82	77	93	99	87
Zinc	32	2,400	46	680	**137**	**55**	**91**	**234**	**206**	**281**	**135**	**216**	**204**	25	32	**33**

Notes:
Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 5-4
Surface Soil Detection and Exceedance Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	CGW10SS16	CGW10SS17	CGW10SS18	CGW10SS19	CGW10SS20	VEW10-SO21	VEW10-SO22	VEW10-SO23	VEW10-SO24	
Sample ID					CGW10SS16-R01	CGW10SS17-R01	CGW10SS18-R01	CGW10SS19-R01	CGW10SS20-R01	VEW10-SS21-01-0209	VEW10-SS22-01-0209	VEW10-SS23-01-0209	VEW10-SS24-01-0209	VEW10-SS24P-01-0209
Sample Date					01/22/04	01/22/04	01/22/04	01/20/04	01/22/04	02/10/09	02/10/09	02/10/09	02/10/09	02/10/09
Chemical Name														
Volatile Organic Compounds (UG/KG)														
No Detections	--	--	--	--	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)														
4-Bromophenyl-phenylether	--	4,600	--	0.12	387 U	390 U	391 U	384 U	371 U	NA	NA	NA	NA	NA
Benzo(a)anthracene	--	150	--	10	387 U	390 U	391 U	384 U	371 U	NA	NA	NA	NA	NA
Benzo(a)pyrene	--	15	--	240	387 U	390 U	391 U	384 U	371 U	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	--	1,500	--	350	387 U	390 U	391 U	384 U	371 U	NA	NA	NA	NA	NA
Chrysene	--	15,000	--	1,100	387 U	390 U	391 U	384 U	371 U	NA	NA	NA	NA	NA
Di-n-butylphthalate	--	610,000	40,000	9,200	90 J	81 J	77 J	384 U	72 J	NA	NA	NA	NA	NA
Fluoranthene	--	230,000	--	160,000	387 U	390 U	391 U	384 U	371 U	NA	NA	NA	NA	NA
PAH HMW (Total)	--	--	1,100	--	0 U	0 U	0 U	0 U	0 U	NA	NA	NA	NA	NA
PAH LMW (Total)	--	--	29,000	--	0 U	0 U	0 U	0 U	0 U	NA	NA	NA	NA	NA
Pyrene	--	170,000	--	120,000	387 U	390 U	391 U	384 U	371 U	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/KG)														
4,4'-DDD	--	2,000	21	66	3.8 U	10 J	0.16 J	0.54 J	0.33 J	NA	NA	NA	NA	NA
4,4'-DDE	--	1,400	21	47	4.8 J	**73 J**	19 J	**66 J**	20 J	NA	NA	NA	NA	NA
4,4'-DDT	--	1,700	21	67	0.30 J	**84**	0.39 J	3.8 U	0.44 J	NA	NA	NA	NA	NA
Dieldrin	--	30	4.9	0.170	3.8 U	3.8 U	3.9 U	3.8 U	3.7 U	NA	NA	NA	NA	NA
Herbicides (UG/KG)														
No Detections	--	--	--	--	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
Dioxin/Furans (PG/G)														
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	33	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	2.5 U	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	2.5 U	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	381	NA	NA	NA	NA	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	107	NA	NA	NA	NA	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	14	NA	NA	NA	NA	NA	NA
Total pentachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	1.0	NA	NA	NA	NA	NA	NA
Total tetrachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	3.0	NA	NA	NA	NA	NA	NA
Explosives (UG/KG)														
No Detections	--	--	--	--	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
Total Metals (MG/KG)														
Antimony	35,000	3.1	0.27	0.27	0.25 J	0.49 J	0.51 J	0.76 J	0.65 J	NA	NA	NA	NA	NA
Arsenic	1.6	0.39	18	0.29	0.38 J	0.40 J	0.46 J	0.51 J	0.59 J	NA	NA	NA	NA	NA
Barium	147	1,500	330	82	66	49	62	58	63	NA	NA	NA	NA	NA
Beryllium	0.27	16	21	3.2	0.23 J	0.17 J	0.23 J	0.20 J	0.24 J	NA	NA	NA	NA	NA
Cadmium	2.2	7.0	0.36	0.38	0.15 J	0.16 J	0.20 J	0.009 U	0.26 J	NA	NA	NA	NA	NA
Chromium	72	0.29	26	0.00083	15 J	12 J	14 J	15	13 J	NA	NA	NA	NA	NA
Cobalt	16	2.3	13	0.49	11 J	6.6 J	8.4 J	8.7	9.3 J	NA	NA	NA	NA	NA
Copper	66	310	28	46	47	29	34	41	36	NA	NA	NA	NA	NA
Cyanide	0.33	160	15.8	2.0	NA	NA	NA	0.16 U	NA	NA	NA	NA	NA	NA
Lead	5.4	400	11	27	3.5	5.4	5.1	4.6	**6.2**	NA	NA	NA	NA	NA
Mercury	0.057	0.78	0.10	0.57	0.012 J	0.015 J	0.017 J	0.016 J	0.017 J	NA	NA	NA	NA	NA
Nickel	22	160	38	48	6.0 J	3.5 J	4.5 J	5.1 J	4.7 J	NA	NA	NA	NA	NA
Selenium	0.51	39	0.52	0.26	**0.55 J**	**0.52 J**	**0.70 J**	0.23 J	**0.83 J**	NA	NA	NA	NA	NA
Silver	0.22	39	4.2	1.6	0.023 U	0.041 J	0.067 J	0.050 J	0.082 J	NA	NA	NA	NA	NA
Thallium	0.13	--	1.0	0.14	0.12 U	0.13 U	0.12 U	**0.30 J**	0.13 U	0.10 U	0.097 U	0.10 U	0.11 U	0.099 U
Tin	--	4,700	--	5,500	0.216 U	0.63 J	1.1 J	0.35 J	0.79 J	NA	NA	NA	NA	NA
Vanadium	144	39	7.8	180	86	59	66	77	66	NA	NA	NA	NA	NA
Zinc	32	2,400	46	680	19	31	**43**	**32**	**33**	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 5-4
Surface Soil Detection and Exceedance Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VEW10-SO25	VEW10-SO26	VEW10-SO27	VEW10-SO28
Sample ID					VEW10-SS25-01-0209	VEW10-SS26-01-0209	VEW10-SS27-01-0209	VEW10-SS28-01-0209
Sample Date					02/10/09	02/10/09	02/10/09	02/10/09
Chemical Name								
Volatile Organic Compounds (UG/KG)								
No Detections	--	--	--	--	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)								
4-Bromophenyl-phenylether	--	4,600	--	0.12	NA	NA	NA	NA
Benzo(a)anthracene	--	150	--	10	NA	NA	NA	NA
Benzo(a)pyrene	--	15	--	240	NA	NA	NA	NA
Benzo(k)fluoranthene	--	1,500	--	350	NA	NA	NA	NA
Chrysene	--	15,000	--	1,100	NA	NA	NA	NA
Di-n-butylphthalate	--	610,000	40,000	9,200	NA	NA	NA	NA
Fluoranthene	--	230,000	--	160,000	NA	NA	NA	NA
PAH HMW (Total)	--	--	1,100	--	NA	NA	NA	NA
PAH LMW (Total)	--	--	29,000	--	NA	NA	NA	NA
Pyrene	--	170,000	--	120,000	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/KG)								
4,4'-DDD	--	2,000	21	66	NA	NA	NA	NA
4,4'-DDE	--	1,400	21	47	NA	NA	NA	NA
4,4'-DDT	--	1,700	21	67	NA	NA	NA	NA
Dieldrin	--	30	4.9	0.170	NA	NA	NA	NA
Herbicides (UG/KG)								
No Detections	--	--	--	--	NA	NA	NA	NA
Dioxin/Furans (PG/G)								
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
Total pentachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
Total tetrachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA
Explosives (UG/KG)								
No Detections	--	--	--	--	NA	NA	NA	NA
Total Metals (MG/KG)								
Antimony	35,000	3.1	0.27	0.27	NA	NA	NA	NA
Arsenic	1.6	0.39	18	0.29	NA	NA	NA	NA
Barium	147	1,500	330	82	NA	NA	NA	NA
Beryllium	0.27	16	21	3.2	NA	NA	NA	NA
Cadmium	2.2	7.0	0.36	0.38	NA	NA	NA	NA
Chromium	72	0.29	26	0.00083	NA	NA	NA	NA
Cobalt	16	2.3	13	0.49	NA	NA	NA	NA
Copper	66	310	28	46	NA	NA	NA	NA
Cyanide	0.33	160	15.8	2.0	NA	NA	NA	NA
Lead	5.4	400	11	27	NA	NA	NA	NA
Mercury	0.057	0.78	0.10	0.57	NA	NA	NA	NA
Nickel	22	160	38	48	NA	NA	NA	NA
Selenium	0.51	39	0.52	0.26	NA	NA	NA	NA
Silver	0.22	39	4.2	1.6	NA	NA	NA	NA
Thallium	0.13	--	1.0	0.14	0.097 U	0.099 U	0.088 U	0.097 U
Tin	--	4,700	--	5,500	NA	NA	NA	NA
Vanadium	144	39	7.8	180	NA	NA	NA	NA
Zinc	32	2,400	46	680	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 5-5
Subsurface Soil Detection and Exceedance Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	PREQB Corrective Action Level	CGWWTPSB001	CGWWTPSB002	CGWWTPSB003		CGWWTPSB004	CGW10SB05	CGW10SB06	CGW10SB07	CGW10SB08
Sample ID					NDD009	NDD010	NDD012	NDD013FD1	NDD011	CGW10SB05-R01-5	CGW10SB06-R01-5	CGW10SB07-R01-5	CGW10SB08-R01-5
Sample Date					6/7/00	6/7/00	6/7/00	6/7/00	6/7/00	1/22/04	1/20/04	1/20/04	1/22/04
Chemical Name													
Volatile Organic Compounds (UG/KG)													
m- and p-Xylene	--	63,000	9,800	10,000	1.0 J	0.40 J	2.0 UJ	2.0 U	2.0 U	NA	NA	NA	NA
Toluene	--	500,000	690	10,000	1.0 U	0.50 J	1.0 UJ	1.0 U	1.0 U	11 U	9.2 U	9.3 U	10 U
Xylene, total	--	63,000	9,800	10,000	1.0 J	0.40 J	2.0 UJ	2.0 U	2.0 U	11 U	9.2 U	9.3 U	10 U
Semivolatile Organic Compounds (UG/KG)													
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	--	NA	NA	NA	NA	NA	402 U	174 J	386 U	118 J
Di-n-butylphthalate	--	610,000	9,200	--	NA	NA	NA	NA	NA	402 U	383 U	386 U	86 J
Pesticide/Polychlorinated Biphenyls (UG/KG)													
4,4'-DDE	--	1,400	47	--	NA	NA	NA	NA	NA	**140 J**	2.9 J	12 J	6.1 J
4,4'-DDT	--	1,700	67	--	NA	NA	NA	NA	NA	44 U	3.8 U	3.9 U	3.9 UJ
Herbicides (UG/KG)													
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dioxin/Furans (PG/G)													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA	NA	NA	2.5 U	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA	NA	NA	12	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA	NA	NA	3.2	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA	NA	NA	2.5 U	NA	NA
Total tetrachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	NA	NA	NA	1.0 U	NA	NA
Explosives (UG/KG)													
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Metals (MG/KG)													
Antimony	5.8	3.1	0.27	--	NA	NA	NA	NA	NA	0.085 UJ	0.69 J	0.53 J	0.14 J
Arsenic	1.6	0.39	0.29	--	0.56 UJ	0.54 U	**2.9**	0.89 J	0.69 J	0.32 J	0.25 J	0.34 J	0.19 J
Barium	147	1,500	82	--	**171**	**167**	**241**	100	**168 J**	85	99 J	95 J	49
Beryllium	0.27	16	3.2	--	NA	NA	NA	NA	NA	**0.29 J**	0.21 J	0.22 J	0.24 J
Cadmium	2.2	7.0	0.38	--	0.11 U	0.11 U	0.11 U	0.14 U	0.11 U	0.14 J	0.009 U	0.010 U	0.077 J
Chromium	72	0.29	0.00083	--	19	24	19	16	17	14 J	14	16	12 J
Cobalt	16	2.3	0.49	--	NA	NA	NA	NA	NA	11 J	11	8.4	5.9 J
Copper	66	310	46	--	61	**74**	**74**	**72**	**72**	48	66	39	33
Lead	0.89	400	27	50	**1.5**	**1.1**	**2.4**	**1.2**	**1.4**	**2.8**	0.84	**2.2**	**1.9**
Mercury	0.057	0.78	0.57	--	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.024 J	0.009 J	0.021 J	0.012 J
Nickel	22	160	48	--	8.2 J	9.0	14	8.0 J	7.8 J	6.1 J	8.3 J	5.6 J	4.3 J
Selenium	0.51	39	0.26	--	**1.1**	**1.1 J**	**1.0 J**	**1.3 J**	**0.87 J**	**0.82**	0.24 J	0.29 J	0.23 J
Silver	0.22	39	1.6	--	0.11 U	0.11 U	0.11 U	0.14 U	0.11 U	0.045 J	0.018 U	0.089 J	0.057 J
Thallium	0.13	--	0.14	--	NA	NA	NA	NA	NA	0.11 U	**0.73 J**	**0.73 J**	0.11 U
Tin	--	4,700	5,500	--	NA	NA	NA	NA	NA	0.20 U	0.31 J	1.3 J	0.61 J
Vanadium	144	39	180	--	NA	NA	NA	NA	NA	81	84	75	53
Zinc	32	2,400	680	--	**93 J**	**92 J**	**92 J**	**90 J**	**96 J**	22	27	**62**	28
Total Petroleum Hydrocarbons (UG/KG)													
Petroleum hydrocarbons	--	--	--	100	4.4 UJ	4.2 U	4.4 UJ	27 J	4.3 U	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 5-5
Subsurface Soil Detection and Exceedance Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	CGW10SB09	CGW10SB10	CGW10SB11	CGW10SB12	CGW10SB13	CGW10SB14	CGW10SB15	CGW10SB16	
Sample ID				CGW10SB09-R01-5	CGW10SB10-R01-5	CGW10SB11-R01-5	CGW10SB12-R01-5	CGW10SB13-R01-5	CGW10SB14-R01-5	CGW10SB15-R01-5	CGW10SB16-R01-5	CGW10FD02P-R01
Sample Date				1/20/04	1/20/04	1/20/04	1/20/04	1/20/04	1/20/04	1/20/04	1/22/04	1/22/04
Chemical Name												
Volatile Organic Compounds (UG/KG)												
m- and p-Xylene	--	63,000	9,800	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	--	500,000	690	10 U	9.4 U	9.6 U	9.8 U	10 U	9.0 U	9.1 U	12 U	9.4 U
Xylene, total	--	63,000	9,800	10 U	9.4 U	9.6 U	9.8 U	10 U	9.0 U	9.1 U	12 U	9.4 U
Semivolatile Organic Compounds (UG/KG)												
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	376 U	382 U	373 U	383 U	394 U	365 U	369 U	386 U	146 J
Di-n-butylphthalate	--	610,000	9,200	376 U	382 U	373 U	383 U	394 U	365 U	369 U	386 U	96 J
Pesticide/Polychlorinated Biphenyls (UG/KG)												
4,4'-DDE	--	1,400	47	13 J	18 J	2.4 J	9.4 J	0.076 J	2.0 J	1.4 J	2.5 J	0.21 J
4,4'-DDT	--	1,700	67	3.8 U	3.8 U	3.7 U	3.8 U	4.0 U	3.6 U	3.7 U	41 U	4.0 U
Herbicides (UG/KG)												
No Detections	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dioxin/Furans (PG/G)												
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	NA	NA	7.4	NA	2.5 U	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	NA	NA	76	NA	5.0 U	NA	NA	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	NA	NA	17	NA	2.5 U	NA	NA	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	NA	NA	2.8	NA	2.5 U	NA	NA	NA	NA
Total tetrachlorodibenzo-p-dioxin	--	--	--	NA	NA	2.0	NA	1.0 U	NA	NA	NA	NA
Explosives (UG/KG)												
No Detections	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Metals (MG/KG)												
Antimony	5.8	3.1	0.27	0.64 J	1.0 J	0.45 J	0.61 J	0.46 J	0.51 J	0.79 J	0.099 J	0.089 UJ
Arsenic	1.6	0.39	0.29	0.33 J	0.46 J	0.23 J	0.43 J	0.42 J	0.37 J	0.18 J	0.14 U	0.39 J
Barium	147	1,500	82	71 J	64 J	58 J	78 J	96 J	109 J	56 J	91	89
Beryllium	0.27	16	3.2	0.21 J	0.26 J	0.20 J	0.22 J	**0.31 J**	0.16 J	0.18 J	**0.28 J**	**0.28 J**
Cadmium	2.2	7.0	0.38	0.010 U	0.010 U	0.010 U	0.010 U	0.011 U	0.009 U	0.009 U	0.012 U	0.085 J
Chromium	72	0.29	0.00083	15	19	16	18	23	14	25	17 J	12 J
Cobalt	16	2.3	0.49	11	9.8	8.2	9.8	11	8.7	9.9	14 J	14 J
Copper	66	310	46	38	45	34	41	44	34	44	48	37
Lead	0.89	400	27	**1.2**	**2.1**	**1.2**	**1.4**	**1.9**	**0.91**	0.13 U	**2.2**	**2.3**
Mercury	0.057	0.78	0.57	0.013 J	0.017 J	0.010 J	0.010 J	0.002 J	0.004 J	0.002 J	0.002 U	0.002 U
Nickel	22	160	48	5.7 J	6.6 J	5.4 J	6.4 J	7.3 J	6.1 J	6.6 J	7.5	6.3 J
Selenium	0.51	39	0.26	0.31 J	0.24 J	0.24 J	**0.52 J**	0.17 U	0.20 J	0.14 U	0.44 J	**0.63 J**
Silver	0.22	39	1.6	0.058 J	0.082 J	0.059 J	0.041 J	0.066 J	0.028 J	0.032 J	0.063 J	0.034 J
Thallium	0.13	--	0.14	**0.93 J**	**1.3 J**	**0.88 J**	**1.2 J**	**1.3 J**	**1.3**	**1.6**	0.12 U	0.11 U
Tin	--	4,700	5,500	0.17 U	1.2 J	0.60 J	0.31 J	0.19 U	0.17 U	0.16 U	0.31 J	0.21 U
Vanadium	144	39	180	87	89	81	88	104	85	**157**	103	81
Zinc	32	2,400	680	20	**47**	29	23	**32**	16	21	22	16
Total Petroleum Hydrocarbons (UG/KG)												
Petroleum hydrocarbons	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 5-5
Subsurface Soil Detection and Exceedance Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	CGW10SB17	CGW10SB18	CGW10SB19	CGW10SB20	
Sample ID				CGW10SB17-R01-5	CGW10SB18-R01-5	CGW10SB19-R01-5	CGW10SB20-R01-5	CGW10FD04P-R01
Sample Date				1/22/04	1/22/04	1/20/04	1/22/04	1/22/04
Chemical Name								
Volatile Organic Compounds (UG/KG)								
m- and p-Xylene	--	63,000	9,800	NA	NA	NA	NA	NA
Toluene	--	500,000	690	9.1 U	9.5 U	8.6 U	8.9 U	8.6 U
Xylene, total	--	63,000	9,800	9.1 U	9.5 U	8.6 U	8.9 U	8.6 U
Semivolatile Organic Compounds (UG/KG)								
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	132 J	353 U	479	380 U	146 J
Di-n-butylphthalate	--	610,000	9,200	102 J	73 J	367 U	83 J	95 J
Pesticide/Polychlorinated Biphenyls (UG/KG)								
4,4'-DDE	--	1,400	47	4.6 J	4.5 J	2.2 J	0.87 J	1.5 J
4,4'-DDT	--	1,700	67	0.31 J	3.7 U	3.7 U	3.8 U	3.8 UJ
Herbicides (UG/KG)								
No Detections	--	--	--	ND	ND	ND	ND	ND
Dioxin/Furans (PG/G)								
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	NA	NA	2.9	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	NA	NA	29	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	NA	NA	6.0	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	NA	NA	2.5 U	NA	NA
Total tetrachlorodibenzo-p-dioxin	--	--	--	NA	NA	1.0 U	NA	NA
Explosives (UG/KG)								
No Detections	--	--	--	ND	ND	ND	ND	ND
Total Metals (MG/KG)								
Antimony	5.8	3.1	0.27	0.18 J	0.21 J	0.52 J	0.082 UJ	0.082 UJ
Arsenic	1.6	0.39	0.29	0.49 J	0.16 J	0.30 J	0.45 J	0.25 J
Barium	147	1,500	82	99	76	78 J	82	75
Beryllium	0.27	16	3.2	0.27 J	0.14 J	0.21 J	0.22 J	0.21 J
Cadmium	2.2	7.0	0.38	0.14 J	0.011 U	0.009 U	0.16 J	0.13 J
Chromium	72	0.29	0.00083	15 J	9.8 J	14	12 J	13 J
Cobalt	16	2.3	0.49	11 J	8.4 J	9.1	10 J	9.1 J
Copper	66	310	46	44	38	37	38	41
Lead	0.89	400	27	**2.0**	**1.8**	**1.1**	**1.8**	**1.7**
Mercury	0.057	0.78	0.57	0.007 J	0.005 J	0.004 J	0.003 J	0.002 U
Nickel	22	160	48	5.9	4.4 J	5.5 J	5.6 J	5.5 J
Selenium	0.51	39	0.26	0.44 J	0.17 U	0.42 J	0.39 J	**0.54 J**
Silver	0.22	39	1.6	0.041 J	0.024 J	0.018 U	0.021 U	0.026 J
Thallium	0.13	--	0.14	0.10 U	0.10 U	**0.97 J**	0.10 U	0.10 U
Tin	--	4,700	5,500	0.19 U	0.19 U	0.16 U	0.19 U	0.19 U
Vanadium	144	39	180	108	69	90	77	78
Zinc	32	2,400	680	18	21	19	18	19
Total Petroleum Hydrocarbons (UG/KG)								
Petroleum hydrocarbons	--	--	--	NA	NA	NA	NA	NA

Notes:
Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 5-6
Groundwater Detection and Exceedance Results
SWMU 10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	PAOC-N EPAN-MW02 Background	Adjusted RSL for Tapwater	MCL - Groundwater	CGW10MW01			CGW10MW02		CGW10MW03		CGW10MW04		CGW10MW05		
Sample ID				CGW10FD03P-R01	CGW10GW01-R01	VEW10-MW01-0409	CGW10GW02-R01	VEW10-MW02-0309	CGW10GW03-R01	VEW10-MW03-0309	CGW10GW04-R01	VEW10-MW04-0309	CGW10GW05-R01	VEW10-MW05-0309	VEW10-MW05P-0309
Sample Date				02/11/04	02/11/04	04/03/09	02/10/04	03/30/09	02/10/04	03/27/09	02/09/04	03/31/09	02/09/04	03/30/09	03/30/09
Chemical Name															
Volatile Organic Compounds (UG/L)															
Toluene	--	230	1,000	0.51 J	0.52 J	NA	0.26 J	NA	1.0 U	NA	1.0 U	NA	1.0 U	NA	NA
Semivolatile Organic Compounds (UG/L)															
No Detections	--	--	--	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)															
No Detections	--	--	--	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA
Herbicides (UG/L)															
No Detections	--	--	--	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA
Dioxin/Furans (NG/L)															
No Detections	--	--	--	NA	NA	NA	NA	NA	NA	NA	ND	NA	ND	NA	NA
Explosives (UG/L)															
No Detections	--	--	--	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA
Total Metals (UG/L)															
Arsenic	10 U	0.045	10	2.0 U	2.0 U	NA	**12 J**	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	NA
Barium	200	730	2,000	**365**	**364**	NA	**204 J**	NA	146 J	NA	**372**	NA	**405**	NA	NA
Chromium	3.6 J	0.043	100	**7.3 J**	**10**	NA	3.0 J	NA	3.1 J	NA	1.1 J	NA	2.2 J	NA	NA
Cobalt	50 U	1.1	--	**1.4 J**	**1.8 J**	NA	**6.6 J**	NA	0.57 U	NA	0.57 U	NA	**0.71 J**	NA	NA
Copper	25 U	150	1,300	**5.0 J**	**5.6 J**	NA	**6.3 J**	NA	**1.9 J**	NA	**2.4 J**	NA	1.2 U	NA	NA
Cyanide	10 U	73	200	NA	NA	NA	NA	NA	NA	NA	3.7 U	NA	**4.8 J**	NA	NA
Mercury	0.20 U	0.37	2.0	0.016 U	0.016 U	NA	**0.45**	NA	0.016 U	NA	0.016 U	NA	0.016 U	NA	NA
Nickel	2.4 J	73	--	**9.9 J**	**11 J**	NA	**8.8 J**	NA	**6.0 J**	NA	**4.4 J**	NA	**5.0 J**	NA	NA
Selenium	35 U	18	50	2.1 U	**4.1 J**	NA	**11 J**	NA	**4.4 J**	NA	**2.6 J**	NA	**2.5 J**	NA	NA
Thallium	1.0 U	--	2.0	REP	REP	1.0 U	REP	1.0 U	REP	1.0 U	REP	1.0 U	REP	1.0 U	1.0 U
Vanadium	50 U	18	--	**14 J**	**15 J**	NA	**3.1 J**	NA	**17 J**	NA	**10 J**	NA	**13 J**	NA	NA
Dissolved Metals (UG/L)															
Antimony, Dissolved	60 U	1.5	6.0	2.5 U	2.5 U	NA	13 U	NA	2.5 U	NA	**3.3 J**	NA	**2.7 J**	NA	NA
Barium, Dissolved	200 U	730	2,000	**359**	**357**	NA	**203 J**	NA	**139 J**	NA	**367**	NA	**416**	NA	NA
Chromium, Dissolved	10 U	0.043	100	**2.4 J**	**2.8 J**	NA	**3.1 J**	NA	**1.3 J**	NA	**0.66 J**	NA	**1.9 J**	NA	NA
Cobalt, Dissolved	50 U	1.1	--	**0.70 J**	**0.92 J**	NA	**7.9 J**	NA	0.57 U	NA	0.57 U	NA	0.57 U	NA	NA
Copper, Dissolved	25 U	150	1,300	**3.6 J**	**3.7 J**	NA	5.9 U	NA	**2.2 J**	NA	**3.0 J**	NA	**1.3 J**	NA	NA
Mercury, Dissolved	0.20 U	0.37	2.0	0.016 U	0.016 U	NA	**0.25**	NA	0.016 U	NA	**0.022 J**	NA	0.016 U	NA	NA
Nickel, Dissolved	40 U	73	--	**7.9 J**	**7.6 J**	NA	**8.3 J**	NA	**6.5 J**	NA	**3.9 J**	NA	**4.5 J**	NA	NA
Selenium, Dissolved	35 U	18	50	**2.2 J**	2.1 U	NA	**19 J**	NA	**2.6 J**	NA	**3.5 J**	NA	**3.8 J**	NA	NA
Silver, Dissolved	10 U	18	--	0.47 U	0.47 U	NA	2.4 U	NA	0.47 U	NA	0.47 U	NA	**0.59 J**	NA	NA
Thallium, Dissolved	1.0 U	--	2.0	REP	REP	1.0 U	REP	1.0 U	REP	1.0 U	REP	1.0 U	REP	1.0 U	1.0 U
Tin, Dissolved	NA	2,200	--	0.99 U	0.99 U	NA	5.0 J	NA	5.0 U	NA	0.99 U	NA	0.99 U	NA	NA
Vanadium, Dissolved	50 U	18	--	**10 J**	**11 J**	NA	**4.1 J**	NA	**16 J**	NA	**9.5 J**	NA	**12 J**	NA	NA
Zinc, Dissolved	60 U	1,100	--	2.0 U	2.0 U	NA	2.0 U	NA	**0.61 J**	NA	0.41 U	NA	0.41 U	NA	NA
Wet Chemistry (MG/L)															
Chloride	NA	--	--	NA	NA	1,500	NA	7,100	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS)	1,490	--	--	NA	NA	**2,900**	NA	**14,000**	NA	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background
Exceeds Background and Adjusted RSL for Tapwater
Exceeds Background, Adjusted RSL for Tapwater and MCL - Groundwater

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
REP- All 2004 Thallium surface soil samples will not be evaluated, and the 2009 Thallium data will be used instead.
MG/L - Milligrams per liter
NG/L - Nanograms per liter
UG/L - Micrograms per liter

Table 5-7
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

BSWMU-10
BSurface Soil, Subsurface Soil, Groundwater
BSewage Treatment Lagoons

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	PAOC-N GW2		December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
SWMU-10 Surface Soil	7440-38-2	Arsenic	2.1E-01	J	5.87E-01	J	mg/kg	CGW10SS20	16 / 16	10 / 16	-	1.6E+00	No	--	--	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	1.2E+01	J	1.98E+01		mg/kg	CGW10SS12	16 / 16	16 / 16	-	7.2E+01	No	--	--	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	6.6E+00	J	1.21E+01		mg/kg	CGW10SS10	16 / 16	16 / 16	-	1.6E+01	No	--	--	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7440-62-2	Vanadium	5.9E+01		9.91E+01		mg/kg	CGW10SS14	16 / 16	16 / 16	-	1.4E+02	No	--	--	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
	50-32-8	Benzo(a)pyrene	4.5E-02	J	5.07E-02	J	mg/kg	CGW10SS05	2 / 16	2 / 16	-	--	--	--	--	1.5E-02	ca	No	1.5E-02	--	--	--	Max	--	--	3.4E-06
SWMU-10 Subsurface Soil	7440-38-2	Arsenic	1.6E-01	J	2.9E+00		mg/kg	CGWWTPSB003	18 / 20	7 / 20	-	1.6E+00	Yes	--	--	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.1	7.4E-06
	7440-47-3	Chromium	9.8E+00	J	2.5E+01		mg/kg	CGW10SB15	20 / 20	20 / 20	-	7.2E+01	No	--	--	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	5.9E+00	J	1.4E+01	J	mg/kg	CGW10SB16	16 / 16	16 / 16	-	1.6E+01	No	--	--	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.6	3.8E-08
	7440-62-2	Vanadium	5.3E+01		1.6E+02		mg/kg	CGW10SB15	16 / 16	16 / 16	-	1.4E+02	Yes	--	--	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.4	--
SWMU-10 Groundwater	7440-36-0_D	Antimony, Dissolved	2.7E+00	J	3.3E+00	J	ug/L	CGW10MW04	2 / 5	2 / 5	-	--	--	6.0E+01	U	1.5E+00	nc	No	--	1.5E+01	--	--	Max	Longevity, blood	0.2	--
	7440-47-3_D	Chromium, Dissolved	6.6E-01	J	3.1E+00	J	ug/L	CGW10MW02	5 / 5	5 / 5	-	--	--	1.0E+01	U	4.3E-02	ca	No	--	5.5E+04	--	--	--	No Observed Effects	--	--
	7440-48-4_D	Cobalt, Dissolved	9.2E-01	J	7.9E+00	J	ug/L	CGW10MW02	2 / 5	1 / 5	-	--	--	5.0E+01	U	1.1E+00	nc	No	--	1.1E+01	--	--	--	decreased iodine uptake	--	--
	7782-49-2_D	Selenium, Dissolved	2.2E+00	J	1.9E+01	J	ug/L	CGW10MW02	5 / 5	1 / 5	-	--	--	3.5E+01	U	1.8E+01	nc	No	--	1.8E+02	--	--	Max	Clinical selenosis	0.1	--
	7440-38-2	Arsenic	1.2E+01	J	1.2E+01	J	ug/L	CGW10MW02	1 / 5	1 / 5	-	--	--	1.0E+01	U	4.5E-02	ca	Yes	4.5E-02	1.1E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	1.1	2.7E-04
	7440-47-3	Chromium	1.1E+00	J	1.0E+01		ug/L	CGW10MW01	5 / 5	5 / 5	-	--	--	3.6E+00	J	4.3E-02	ca	Yes	--	5.5E+04	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	7.1E-01	J	6.6E+00	J	ug/L	CGW10MW02	3 / 5	2 / 5	-	--	--	5.0E+01	U	1.1E+00	nc	No	--	1.1E+01	--	--	Max	decreased iodine uptake	0.6	--
	7439-97-6	Mercury	4.5E-01		4.5E-01		ug/L	CGW10MW02	1 / 5	1 / 5	-	--	--	2.0E-01	U	3.7E-01	nc	No	--	3.7E+00	--	--	Max	CNS	0.1	--

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

Site Cumulative Risk	Max HI *	ELCR
Soil	0.6	1E-05
Groundwater	1.1	3E-04
Total Risk	1.2	3E-04

* - Max HI is the highest HI associated with any target organ or critical effect.

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Methyl Mercury' was used as the adjusted SL for Mercury.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk

TABLE 5-8
Ecological Risk Assessment Screening Statistics for SWMU 10 Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Selenium	-- - --	16 / 16	0.18	1.04	0.50	0.25	0.61	0.52	7 / 16	2.00	0.51	8 / 16	0.98	2.04	1.17	0.96
Zinc	-- - --	16 / 16	19.2	281	100	88.9	139	120	6 / 16	2.34	32.0	7 / 16	3.13	8.78	1.16	0.83

TABLE 5-9
Summary of Norway Rat Exposure Doses - SWMU 10-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Selenium	1.04	1.340	1.39	3.012	3.13	0	0.73	0.20	0.26	0.33	3.66	2.85	2.22
Zinc	281	12.89	3620.69	1.820	511.42	0	120.07	75.4	169	377	1.59	0.71	0.32

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0398 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.980 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.020 = Proportion of diet composed of soil
WIR = 0.0516 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.168 = Body weight (kg wet weight)

TABLE 5-9
Summary of Norway Rat Exposure Doses - SWMU 10-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Selenium	0.50	Regression	0.56	Regresson	0.24	0	0.06	0.20	0.26	0.33	0.28	0.22	0.17
Zinc	100	Regression	387.57	Regresson	62.28	0	14.93	75.4	169	377	0.20	0.09	0.04

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0207 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.020 = Proportion of diet composed of soil
WIR = 0.0242 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.209 = Body weight (kg wet weight)

TABLE 5-10
Summary of Indian Mongoose Exposure Doses - SWMU 10-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Selenium	1.04	1.340	1.39	3.012	3.13	1.263	1.31	0	0.20	0.20	0.26	0.33	1.02	0.79	0.62
Zinc	281	12.89	3620.69	1.820	511.42	2.782	781.79	0	520.01	75.4	169	377	6.90	3.08	1.38

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0460 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.972 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0933 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.312 = Body weight (kg wet weight)

TABLE 5-10
Summary of Indian Mongoose Exposure Doses - SWMU 10-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Selenium	0.50	Regression	0.56	Regresson	0.24	Regresson	0.51	0	0.08	0.20	0.26	0.33	0.41	0.32	0.25
Zinc	100	Regression	387.57	Regresson	62.28	Regresson	122.89	0	55.95	75.4	169	377	0.74	0.33	0.15

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0285 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.564 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.111 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.297 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0557 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.528 = Body weight (kg wet weight)

TABLE 5-11
Summary of Pearly-eyed Thrasher Exposure Doses - SWMU 10-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Selenium	1.04	1.340	1.39	3.012	3.13	0	0.30	0.44	0.81	1.50	0.68	0.37	0.20
Zinc	281	12.89	3620.69	1.820	511.42	0	754.88	66.1	148	331	11.42	5.11	2.28

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0174 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.954 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.046 = Proportion of diet composed of soil
WIR = 0.0157 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.080 = Body weight (kg wet weight)

TABLE 5-11
Summary of Pearly-eyed Thrasher Exposure Doses - SWMU 10-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Zinc	100	Regression	387.57	Regresson	62.28	0	81.51	66.1	148	331	1.23	0.55	0.25

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0123	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.754	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.200	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.046	= Proportion of diet composed of soil
WIR =	0.0129	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.104	= Body weight (kg wet weight)

TABLE 5-12
Summary of Red-tailed Hawk Exposure Doses - SWMU 10-Screening
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Selenium	1.04	1.340	1.39	3.012	3.13	1.263	1.31	0	0.05	0.44	0.81	1.50	0.12	0.07	0.04
Zinc	281	12.89	3620.69	1.820	511.42	2.782	781.79	0	32.28	66.1	148	331	0.49	0.22	0.10

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0395 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.000 = Proportion of diet composed of soil
WIR = 0.0680 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.957 = Body weight (kg wet weight)

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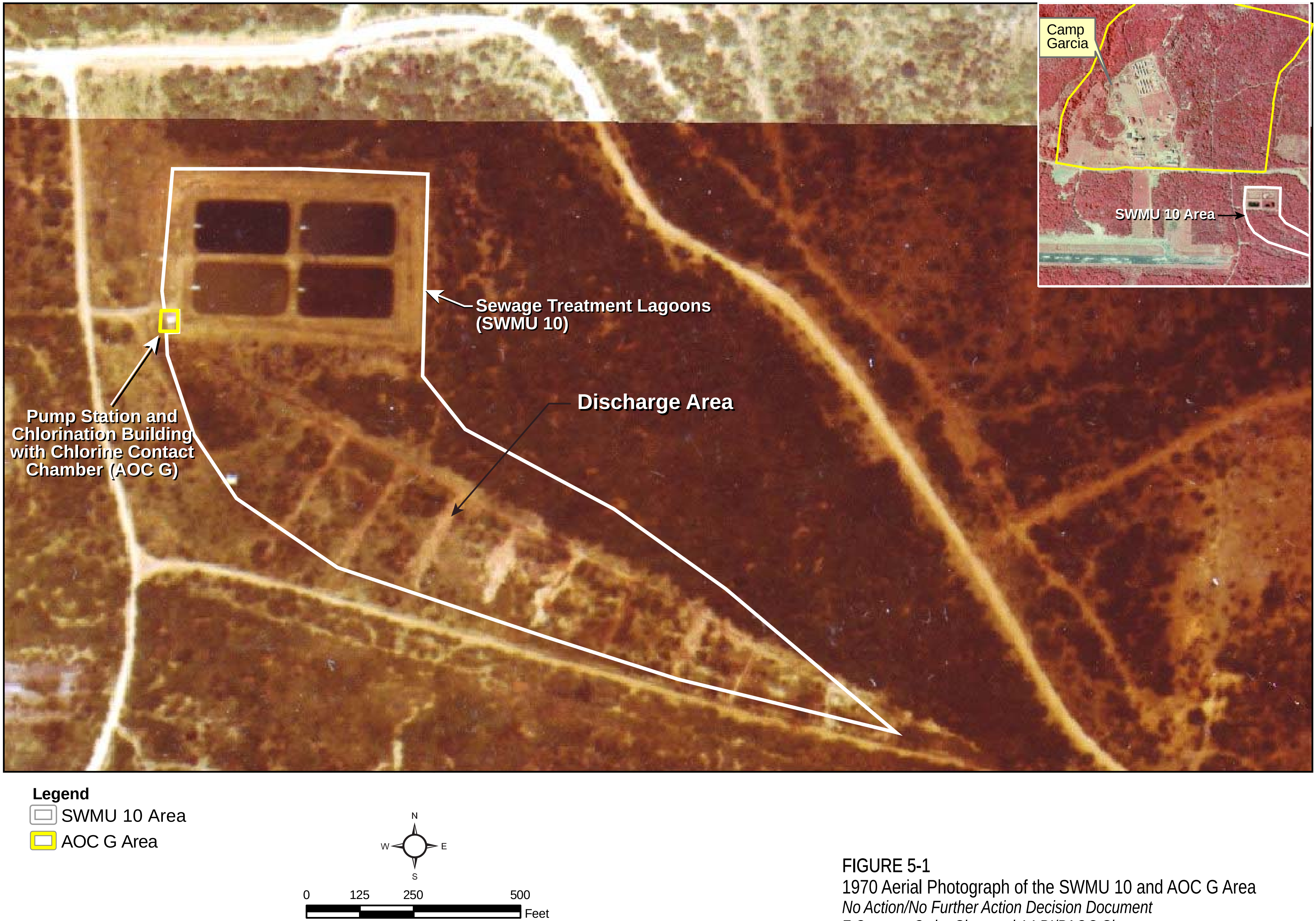

FIGURE 5-1
1970 Aerial Photograph of the SWMU 10 and AOC G Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

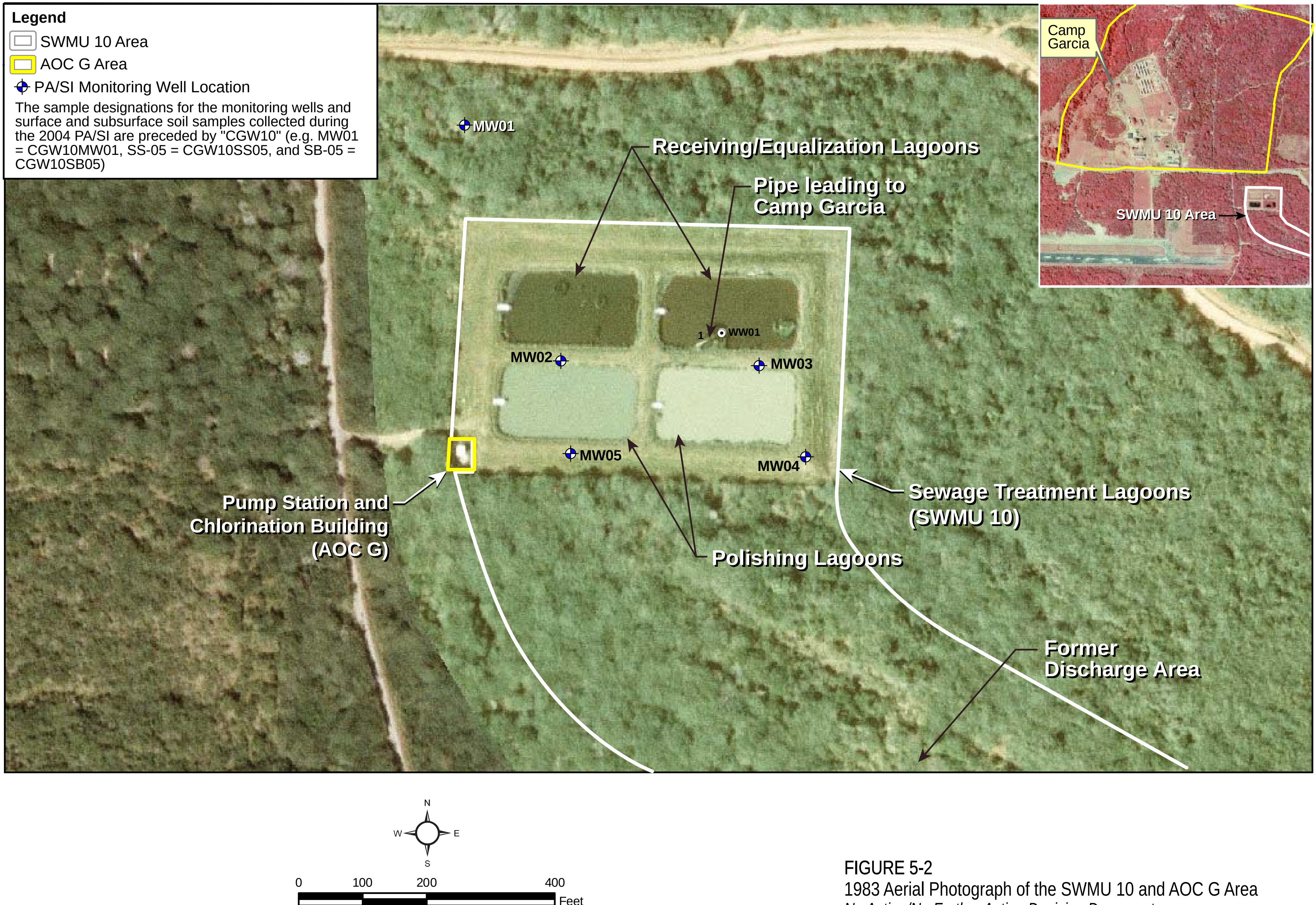

FIGURE 5-2
1983 Aerial Photograph of the SWMU 10 and AOC G Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

FIGURE 5-3
2000 Aerial Photograph of the SWMU 10 and AOC G Areas and No Discharge Lagoon
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

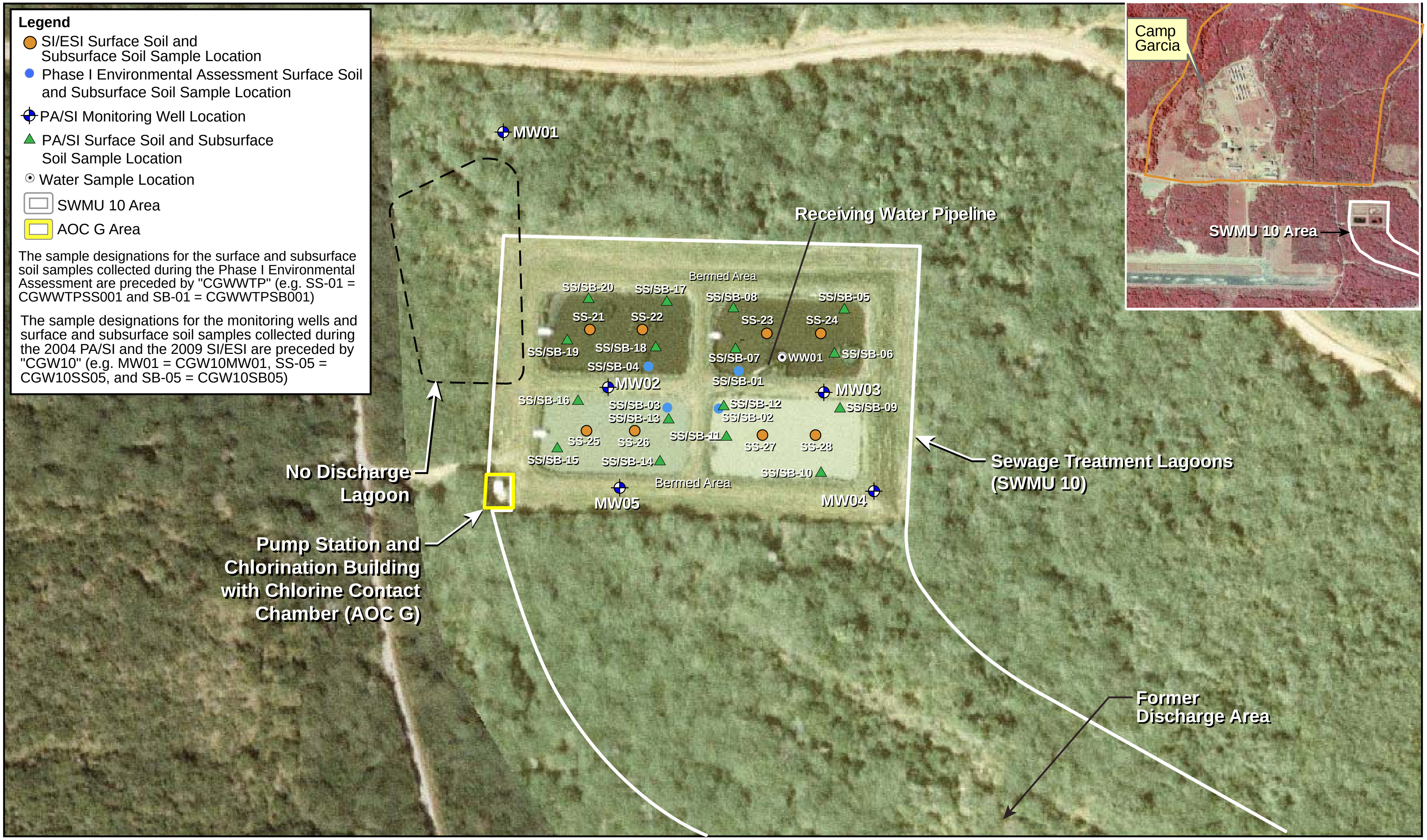

Photo: 1983

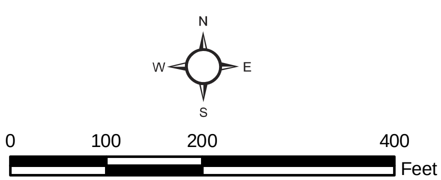

FIGURE 5-4
SWMU 10 Surface and Subsurface Soil Locations
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 6

AOC A— Diesel Fuel Fill Pipe Area

This section presents a summary of the pertinent historical information and rationale for the no action determination for AOC A—Diesel Fuel Fill Pipe Area at OP-1 on the former VNTR. The detailed evaluation of AOC A presented below is from the Final SI/ESI Report (CH2M HILL, 2010).

6.1 Conceptual Site Model

6.1.1 Site Description and Potential Sources of Release

AOC A is located in the SIA at OP-1 on the southeast corner of a fenced area that surrounds OP-1 (**Figure 1-2 and 6-1**). According to the 1988 RFA Report (Kearney, 1988), this area contained the fuel fill pipe for the 15,000-gallon diesel fuel UST located at OP-1 in the Cerro Matías area of the former VNTR. The UST was located southwest and downgradient of the fill pipe.

The UST and fuel fill pipe entered service in approximately 1978. The 1995 RFA Report (PREQB, 1995) stated that the soil surrounding the fill pipe was stained, apparently as a result of fuel releases that had occurred during tank refueling. The total stained area was observed to be approximately 6 ft by 6 ft. However, ongoing fuel releases from leakage were observed, but no release controls were found at this site (PREQB, 1995). The 1995 RFA Report stated the following:

> *"Given the limited amount of fuel spilled to the soil, sampling and analysis of soil is not suggested at this time. A general cleanup of the area, however, would help reduce the potential of a release."*

6.1.2 Investigation History

The 15,000-gallon diesel fuel UST, associated piping including the fill pipe, and some surrounding soil were excavated and removed for disposal in 1997. After removal of the UST and surrounding soil, four confirmatory soil samples were collected from the excavation and analyzed for petroleum-related constituents (benzene, ethylbenzene, toluene, and xylenes [BTEX] and total recoverable petroleum hydrocarbons [TRPH]). No petroleum-related constituents were detected in any of the four soil samples. The closure report indicated that the four samples were collected after the lines and tank were removed, but does not include sample collection depths or actual collection locations. The closure report was finalized in April 2000 after comments were received from PREQB (IT, 2000).

A new UST was installed in 1997 following removal of the existing UST. The UST installed in 1997 was removed in 2003 in response to the closure of VNTR and the transfer the property to the DOI. Following the removal of the UST in 2003, confirmatory soil samples were collected from ten locations: six samples around the former tank (two at the bottom of the excavation and one on each of the four sides of the excavation) and four samples along the length of the bottom of the former fuel line that connected the UST to a generator (Figure 11-1 of the Final PA/SI Report (CH2M HILL, 2008)).

The samples were analyzed for BTEX, MTBE, TPH-DRO, naphthalene, and lead. The data are presented and discussed in Section 11 of the Final PA/SI Report (CH2M HILL, 2008). Lead (above background), xylenes, and TPH-DRO were detected. However, the lead and xylene concentrations were below screening levels. TPH-DRO concentrations were identified in soil along the former fuel fill pipe above the PREQB Land Pollution Control Corrective Action Levels. No other BTEX constituents, MTBE, or naphthalene were detected.

Although concentrations of TPH-DRO above the PREQB Land Pollution Control Corrective Action Levels were identified in confirmatory soil samples directly below the former fill pipe, the extent of contaminated soil was likely spatially limited based on the UST piping configuration, previous removal activities, and confirmatory sampling results. Consistent with actions conducted under the PREQB UST program, incidental soil removal and additional confirmatory soil sampling were warranted to confirm this supposition.

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), during the ESI, samples were collected at the locations illustrated on **Figure 6-1**. The objective of the ESI was to determine if sufficient soil contaminated with TPH-DRO above the Land Pollution Control Corrective Action Level criterion (100 milligrams per kilogram [mg/kg]) along the length of the former pipeline has been removed to warrant no further action at AOC A. The sampling was conducted as follows.

A trench was excavated, approximately 43 ft long, 11.5 ft wide, and 3.25 ft deep, running the length of the former pipeline between Building 1005 and the former 15,000 gallon diesel UST (**Figure 6-2**). No staining or elevated PID readings were observed in either the native or non-native (i.e., previous backfill) soils. Therefore, in accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), confirmatory soil samples were collected along the side-walls and bottom of the excavation (approximately every 5 lineal feet [lf]), as shown in **Figure 6-1**.

Nine soil transects (SO11 through SO19, as shown in **Figure 6-1**), aligned perpendicular to the length of the excavation, were collected. Samples SB11A through SB19A were collected 0 to 6 inches below the bottom of the excavation. Samples SB11B through SB19B were collected from 0 to 1 ft below the depth of the base of the backfill material along the northwest sidewall. Samples SB12C through SB19C were collected from 0 to 1 ft below the depth of the base of the backfill material along the southeast sidewall. Due to the presence of the foundation of Building 1005, no sample was collected at SB11C, as shown in **Figure 6-1**. Samples were analyzed for TPH-DRO and compared against the PREQB Land Pollution Control Corrective Action Level. The samples were collected at the depths defined in the SAP (see Worksheet 11 of CH2M HILL [2009b]).

Approximately 1,600 cubic feet of soil were removed and stockpiled on plastic for testing to determine suitability for re-use as backfill versus offsite disposal. This stockpiled soil was composite-sampled such that four locations for approximately every 7 lf of trench excavation were combined into one composite sample. Based on this, a total of six composite soil samples were collected of the stockpiled material (SO01 through SO06). These samples were analyzed for TPH-DRO and compared against the PREQB Land Pollution Control

Corrective Action Level. Following evaluation of both the confirmatory soil sample data and the stockpile soil data (see Section 6.1 below), and in concurrence with EPA and PREQB, the stockpiled soil was used to backfill the excavation.

Tables 6-1 and 6-2 summarize the constituents detected in AOC A 2009 confirmatory soil and composite stockpile soil samples, respectively, collected during the ESI. **Tables 6-1 and 6-2** also identify screening criterion exceedances.

6.1.3 Physical Setting

The site resides on a relatively flat area situated at an elevation of approximately 453 ft amsl. Directly to the south of the site there is a near-vertical cliff, with an elevation change of approximately 240 ft. The site is overgrown with high grass, though the area surrounding the site is cleared routinely for safety reasons. Soil consists of well-graded sand with silt and gravel. The bedrock appears to be very shallow since it outcrops around the site, and comprises sandstone, siltstone, conglomerates, lava, tuff, and tuffaceous breccias. Groundwater is estimated to occur at beneath 100 feet bgs. No surface water bodies are present at the site.

6.2 AOC A Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 6-1 and 6-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a diesel UST and associated fuel fill pipe. While petroleum constituents are generally exempt from CERCLA and RCRA, the site was identified in the Consent Order and sampled as part of the UST removal. Further, the Navy, EPA, and EQB agreed to address the site under CERCLA for programmatic efficiency. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the ESI, the following were detected:

2009 Confirmatory Subsurface Soil

- Total Petroleum Hydrocarbons: TPH-DRO

2009 Composite Fill (Stockpile) Soil

- Total Petroleum Hydrocarbons: TPH-DRO

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

As noted previously, petroleum hydrocarbons are exempt from CERCLA. However, because the site was included in the Consent Order and agreed upon by the Navy, EPA, and EQB to address under RCRA (now CERCLA in accordance with the NPL listing of Vieques), the constituents detected as part of the ESI are considered to be associated with CERCLA-related releases and are therefore considered further in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criterion described in Section 1 of the Final SI/ESI Report (CH2M HILL 2010) and shown on the detection tables. Those constituents that exceed the PREQB Land Pollution Control Corrective Action Level are listed below.

2009 Confirmatory Subsurface Soil

- TPH-DRO: four detections (SB11A, SB13C, SB16A and SB17C) at concentrations (110 to 350 mg/kg) above the PREQB Land Pollution Control Corrective Action Level (100 mg/kg)

2009 Composite Fill (Stockpile) Soil

- TPH-DRO: three detections (SO02, SO03 and SO06) at concentrations (190 mg/kg, 160 mg/kg, and 120 mg/kg, respectively) above the PREQB Land Pollution Control Corrective Action Level (100 mg/kg)

As shown above, there are exceedances of the Land Pollution Control Corrective Action Level. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Of the 28 confirmatory soil samples collected within the excavation, only 4 contained TPH-DRO concentrations above the Land Pollution Control Corrective Action Level of 100 mg/kg, and 3 of the 4 sample concentrations were relatively close to 100 mg/kg. The sample containing the highest TPH-DRO concentration (i.e., SB17C) had adjacent samples that contained only 11 mg/kg TPH-DRO. TPH-DRO concentrations detected in the six fill composite soil samples were comparable to those of the confirmatory soil samples. Therefore, the TPH-DRO concentrations detected in the confirmatory and fill samples represent more than an order-of-magnitude reduction in the TPH-DRO concentrations from the maximum detected during the tank/pipe removal in 2003 (i.e., over 2,000 mg/kg).

In addition to the above, it is noted that the 100 mg/kg Land Pollution Control Corrective Action Level is based on leaching to groundwater which, at AOC A, is likely more than 100 feet bgs because the site is at an elevation of 453 ft amsl.

Finally, the 95 percent upper confidence limit (UCL) of the mean TPH-DRO concentration in the confirmatory soil samples is 74 mg/kg and the 95 percent UCL of the mean TPH-DRO concentration in the fill (stockpile) soil samples is 89 mg/kg, both of which are below the 100 mg/kg Land Pollution Control Corrective Action Level. Therefore, the confirmatory data suggest no further excavation or action is warranted for the site and the fill soil data suggest the stockpiled soil is appropriate to use as backfill at the site.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the former diesel UST and fuel fill pipeline. Historical data suggested the former fuel fill pipeline trench may have contained TPH-DRO concentrations warranting further action. Based on this information, the former pipeline trench was excavated and confirmatory and stockpile soil samples were collected. The spatial distribution of the samples collected during the ESI and resulting data indicate the potential source area has been sufficiently characterized.

6.3 Conclusions and No Action Determination

The decision analysis process described above indicates that previous and current actions at AOC A (i.e., UST, fuel fill pipe, contaminated soil removal) were sufficient for addressing potential sources of releases and resulting contamination. Therefore, based on the above information, no further action is warranted for AOC A.

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Table 6-1
2009 Confirmatory Subsurface Soil Samples
AOC A
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (Kv)	Adjusted RSL for Residential Soil	SSL (DAF=1)	PREQB Corrective Action Level	VEAA-SO11		VEAA-SO12				VEAA-SO13		
Sample ID					VEAA-SB11B-34-0209	VEAA-SB11A-3H4-0209	VEAA-SB12B-34-0209	VEAA-SB12C-34-0209	VEAA-SB12A-3H4-0209	VEAA-SB12AP-3H4-0209	VEAA-SB13B-34-0209	VEAA-SB13C-34-0209	VEAA-SB13A-3H4-0209
Sample Date					02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09
Chemical Name													
Total Petroleum Hydrocarbons (MG/KG)													
TPH-diesel range	--	--	--	100	32	**170**	13	33	58 J	100 J	9.0	**110**	25

Notes:
Exceeds PREQB Corrective Action Level
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UG/KG - Micrograms per kilogram

Table 6-1
2009 Confirmatory Subsurface Soil Samples
AOC A
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (Kv)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	**PREQB Corrective Action Level**	VEAA-SO14				VEAA-SO15			VEAA-SO16		
Sample ID					VEAA-SB14B-34-0209	VEAA-SB14C-34-0209	VEAA-SB14CP-34-0209	VEAA-SB14A-3H4-0209	VEAA-SB15B-34-0209	VEAA-SB15C-34-0209	VEAA-SB15A-3H4-0209	VEAA-SB16B-34-0209	VEAA-SB16C-34-0209	VEAA-SB16A-3H4-0209
Sample Date					02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09
Chemical Name														
Total Petroleum Hydrocarbons (MG/KG)														
TPH-diesel range	--	--	--	100	12	5.3 U	5.3 U	5.4	26	21	21	5.4 U	11	**130**

Notes:
Exceeds PREQB Corrective Action Level
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UG/KG - Micrograms per kilogram

Table 6-1
2009 Confirmatory Subsurface Soil Samples
AOC A
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (Kv)	Adjusted RSL for Residential Soil	SSL (DAF=1)	PREQB Corrective Action Level	VEAA-SO17			VEAA-SO18			VEAA-SO19		
Sample ID					VEAA-SB17B-34-0209	VEAA-SB17C-34-0209	VEAA-SB17A-3H4-0209	VEAA-SB18B-34-0209	VEAA-SB18C-34-0209	VEAA-SB18A-3H4-0209	VEAA-SB19B-34-0209	VEAA-SB19C-34-0209	VEAA-SB19A-3H4-0209
Sample Date					02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09
Chemical Name													
Total Petroleum Hydrocarbons (MG/KG)													
TPH-diesel range	--	--	--	100	56	**350**	100	34	11	15	54	5.1 U	5.1 U

Notes:
Exceeds PREQB Corrective Action Level
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UG/KG - Micrograms per kilogram

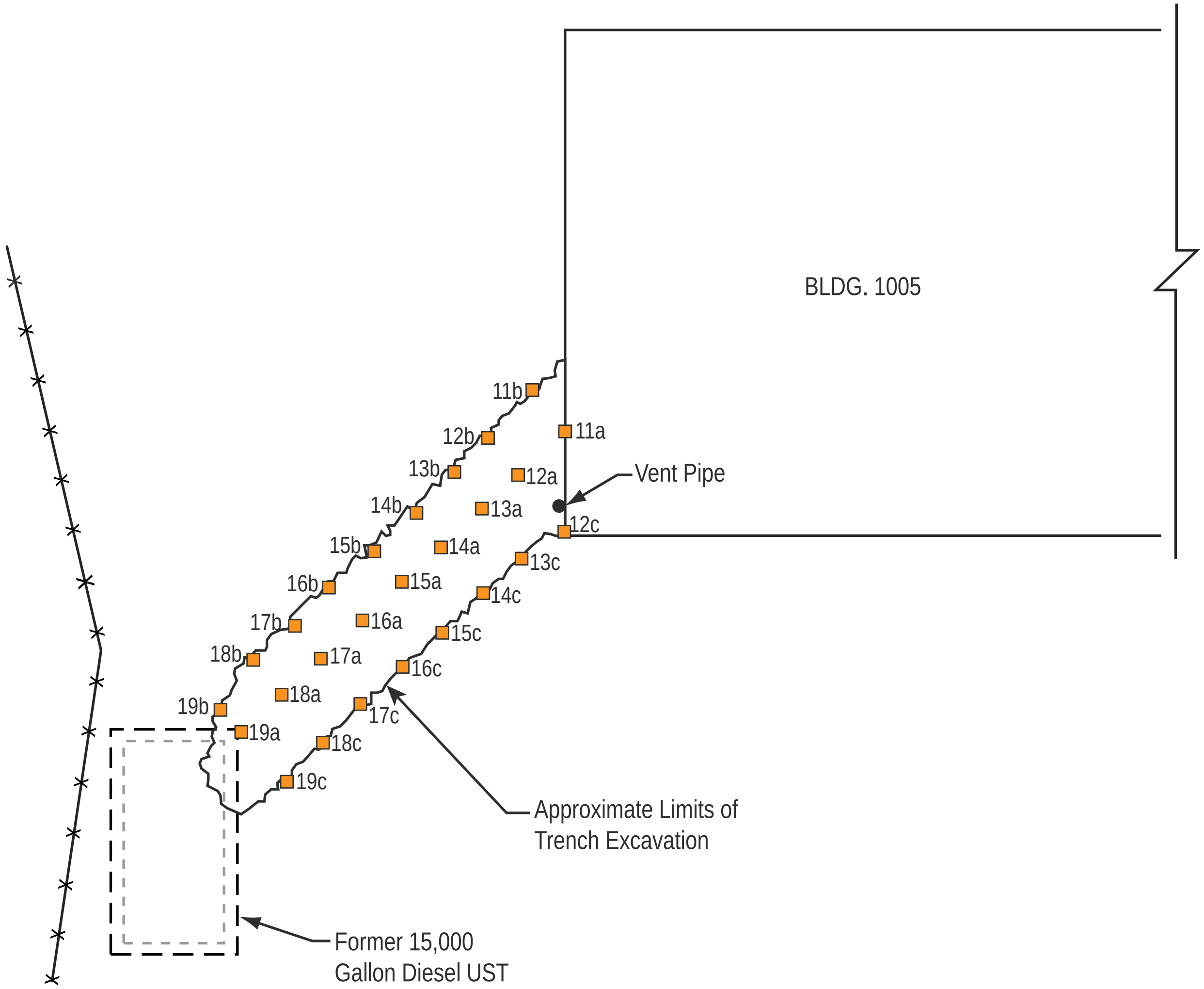
Table 6-2
2009 Fill Composite Soil Samples
AOC A
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (Kv)	Adjusted RSL for Residential Soil	SSL (DAF=1)	PREQB Corrective Action Level	VEAA-SO01		VEAA-SO02	VEAA-SO03	VEAA-SO04	VEAA-SO05	VEAA-SO06
Sample ID					VEAA-SO01-0209	VEAA-SO01P-0209	VEAA-SO02-0209	VEAA-SO03-0209	VEAA-SO04-0209	VEAA-SO05-0209	VEAA-SO06-0209
Sample Date					02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09	02/23/09
Chemical Name											
Total Petroleum Hydrocarbons (MG/KG)											
TPH-diesel range	--	--	--	100	78	88	**190**	**160**	50	88	**120**

Notes:
Exceeds PREQB Corrective Action Level
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
UG/KG - Micrograms per kilogram

AOC A Area

Location Photo



LEGEND

11b	Subsurface Soil Sample Location (SI/ESI)
	Former 15,000 Gal. UST
	Apporoximate Limits of UST Excavation
	Fence

The sample designations for all soil samples collected during the 2009 SI/ESI are proceeded by "VEAA-SB" (e.g. 17a = VEAA-SB17a)

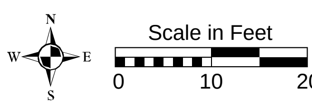


FIGURE 6-1
AOC A Approximate Excavation Boundaries and Confirmation Samples Locations
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

(A) Site prior to excavation

(B) Excavation of Trenches A, B, C and D

(C) Excavated soil placed on plastic and covered

(D) Staging soil on plastic liner

(E) Trench cross section

(F) Staked and flagged sample locations

(G) Sample locations flagged in excavated soil

(H) Backfilling trench

(I) Backfilling completed

FIGURE 6-2
AOC A Site Photographs
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 7

AOC G—Pump Station and Chlorination Building at Sewage Lagoons

This section presents a summary of the pertinent historical information and rationale for the no action determination for AOC G—Pump Station and Chlorination Building at Sewage Lagoons on the former VNTR. The detailed evaluation of AOC G presented below is from the Final SI/ESI Report (CH2M HILL, 2010).

7.1 Conceptual Site Model

7.1.1 Site Description and Potential Sources of Release

AOC G is located adjacent to the sewage treatment lagoons (SWMU 10) at VNTR (**Figures 1-2, and 7-1**). The site consists of a building that housed a pump station and chlorination equipment used for the chlorination of the lagoon system effluent. These facilities were placed into operation in the 1950s. Operations ceased in 1978, but the building that housed the pump station and the chlorination contact chamber are still present at the site. The pump station and chlorination contact chamber are shown in **Figure 7-2**.

The building is constructed of concrete, and was built partially below grade. During the 1988 RFA, stains were reportedly visible on the concrete floor in the building, indicating that wastewater might have overflowed. However, no signs of vegetation stress or staining were apparent in the grassy area surrounding the building at the time of the RFA. The 1988 and 1995 RFA reports both recommended NFA for this site (Kearney, 1988; PREQB, 1995).

In February 2000, EPA and the Navy inspected AOC G as part of site visits made to the Consent Order sites. During this visit, no staining was observed in the chlorination building, and the site was inactive and overgrown with vegetation. Site conditions during the January 2004 PA/SI sampling event (Phase I RFI) were the same as those observed in February 2000.

7.1.2 Investigation History

Phase I RFI Soil Sampling

Five surface soil samples were collected in the area of the chlorination building and the nearby chlorine contact chamber, as shown in **Figure 7-3**. All soil samples were analyzed for Appendix IX VOCs, SVOCS, metals, pesticides, herbicides, and PCBs; and explosives, including perchlorate. One sample, collected from station CGAGSS04, was also analyzed for cyanide, sulfide, and dioxins. Although historical information for AOC G did not indicate munitions or explosives-related constituents would be related to potential releases at the site, explosives were included in the sample analyses to confirm that supposition.

The conclusion of the Final PA/SI Report (CH2M HILL 2008) was that the spatial distribution and results of the screening suggested that, other than where pump maintenance fluids may have been spilled or discharged, the soil at the site (i.e., around the perimeter of the building and contact chamber) was sufficiently characterized. However, because there were pumps inside the building that surely underwent periodic maintenance during the roughly 20 years of operations, it is possible that fluids generated during the maintenance operations were spilled or discharged adjacent to the building (although there is no record of this taking place). Conceptually, these fluids could have been carried out through the building door and discharged to the ground surface. Based on this, the ERP Technical Subcommittee performed a site visit in January 2009 and concurred upon locations to collect surface and subsurface soil samples adjacent to the pump station door.

ESI Soil Sampling

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), during the ESI, samples were collected at the locations concurred upon during the January 2009 ERP Technical Subcommittee site visit and illustrated on **Figure 7-3**. The objective of the ESI was to determine if pump maintenance fluids were released adjacent to the pump house and, if so, whether that release would warrant further investigation or action at AOC G. Two co-located surface/subsurface soil samples (SS/SB-06 and SS/SB-07) were collected near the building door in an area where fluids would most likely have been spilled or otherwise discharged. No PID readings above 0.0 ppm or visible evidence of contamination were observed; therefore, all samples were collected at the default depths outlined in the work plan. All soil samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics.

Based on the above information, the potential sources of a CERCLA-related release were determined to be the chlorination contact chamber and historical pump maintenance fluids that could have been discharged to the ground surface adjacent to the pump house.

Tables 7-1 and 7-2 summarize the constituents detected in AOC G surface soil and subsurface soil samples, respectively, collected during the Phase I RFI (2004) and ESI (2009). The tables also identify screening criteria exceedances.

7.1.3 Physical Setting

The site consists of the pump station building and a contact chamber adjacent to the building that contained concrete partitions to slow down the water flow and increase the retention time that water could be treated. The site is currently overgrown with trees and tall grass. The site sits at approximately 26 ft amsl, and the topography slopes gently to the southeast. The soil beneath the site consists primarily of sand and silty sands. The bedrock consists of igneous rocks, primarily granodiorite and quartz diorite. Groundwater in the vicinity of AOC G occurs at approximately 35 ft bgs in the fractured bedrock and flows in a southerly direction toward the coast. There are no surface water bodies at or adjacent to the site.

7.2 AOC G Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 7-1 and 7-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former pump house and chlorination tank for sanitary sewage. There are no records of past releases adjacent to the building at the AOC G pump station, and the evaluation presented in the Final PA/SI Report (CH2M HILL 2008) indicated there likely was not a CERCLA-related release at the site that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater in the areas sampled during the Phase I RFI (i.e., building and chlorination tank perimeter). However, an ESI was deemed warranted to determine if a CERCLA-related release(s) of pump maintenance fluids occurred outside the doorway of the pump station and, if so, whether it warrants further investigation or action. Additional sample collection took place during the 2009 ESI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Phase I RFI (2004)

Appendix N, Section N.13 of the Final PA/SI Report (CH2M HILL, 2008) discusses the evaluation of the AOC G data quality for data collected as part of the Phase I RFI (2004). As detailed in Section N.13, the Phase I RFI data are acceptable for use in evaluating whether a CERCLA-related release of contaminants warranting further investigation or action occurred at AOC G. Although that evaluation was presented in the PA/SI Report (CH2M HILL, 2008), the data are re-evaluated in Steps 3 through 7 herein to account for any potential updates to regulatory screening criteria.

ESI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected as part of the Phase I RFI (2004) as well as those collected during the ESI (2009), the following inorganics above the background UTLs and non-inorganics were detected by sampling event and by medium:

Phase I RFI (2004) Surface Soil

- VOCs: none detected
- SVOCs: benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, kepone, pyrene
- Pesticides: 4,4′-DDD, 4,4′-DDE, 4,4′-DDT
- Herbicides: none detected

- Dioxins: 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, 1,2,3,6,7,8-hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-hexachlorodibenzo-p-dioxin, octachlorodibenzo-p-dioxin, total heptachlorodibenzo-p-dioxin, total hexachlorodibenzo-p-dioxin, total pentachlorodibenzo-p-dioxin
- PCBs: none detected
- Explosives: none detected
- Inorganics above background UTLs: copper, lead, mercury, selenium, and zinc

ESI (2009) Surface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene, chrysene, fluoranthene, and indeno(1,2,3-cd)pyrene
- Inorganics above background UTLs: calcium, lead, magnesium, and zinc

ESI (2009) Subsurface Soil

- VOCs: none detected
- SVOCs: none detected
- Inorganics above background UTLs: barium, beryllium, calcium, copper, magnesium, potassium, selenium, sodium, and zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

Although there are no known records of a release from AOC G, because the unit was a pump house, it is assumed that the SVOCs and inorganics are potentially attributable to CERCLA-related releases at the site and are, therefore, further evaluated in the decision analysis process.

Dioxins are not likely associated with the former pump house and chlorination unit, especially considering no waste incineration occurred at the site. Further, as shown in Table O-3b of the Final SI/ESI Report (CH2M HILL 2010), the highest dioxin concentration at AOC G (in TEQ) is approximately 2.3 ppt, which is an order of magnitude or more below the 72 ppt (TEQ) starting point concentration for developing cleanup levels for residential soil, and 950 ppt (TEQ) starting point for developing cleanup levels for commercial/industrial soil, proposed by EPA in the “Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites” (EPA, 2009). Therefore, dioxins are not considered further in the decision analysis process.

The pesticides detected in the surface soil samples are the same pesticides and of similar concentrations (**Table 7-1**) detected at other sites across east Vieques (see Table O-1 of the Final SI/ESI Report (CH2M HILL 2010)). For example, 4,4’-DDD, 4,4’-DDE, and 4,4’-DDT were detected in AOC G surface soil samples at concentrations between 0.17 µg/kg and 0.93 µg/kg (4,4’-DDD), 5.8 µg/kg and 31 µg/kg (4,4’-DDE), and 0.96 µg/kg and 2.4 µg/kg (4,4’-DDT), which are similar to the concentrations detected at other sites across east Vieques (i.e., 0.16 µg/kg to 26 µg/kg for 4,4’-DDD; 0.08 µg/kg to 1,200 µg/kg for 4,4’-DDE; and 0.30

μg/kg to 990 μg/kg for 4,4′-DDT). Consequently, these pesticides are likely attributable to normal pesticide use when the facility was active, not to a CERCLA-related release (see Appendix O and *Pesticides and Herbicides* under Section 1.1.1 of the Final SI/ESI Report (CH2M HILL, 2010) and are, therefore, not considered further in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Phase I RFI (2004) Surface Soil

- Benzo(a)pyrene: one detection (sample SS02) at a concentration (37 μg/kg) above the RSL (15 μg/kg)
- Benzo(b)fluoranthene: one detection (sample SS02) at a concentration (89 μg/kg) above the SSL at a DAF 1 (35 μg /kg)
- Kepone: one detection (sample SS01) at a concentration (956 μg/kg) above the RSL (49 μg/kg) and the SSL at a DAF 1 (0.15 μg /kg)
- Copper: one detection (sample SS04) at a concentration (71 mg/kg) above the ecological screening value (70 mg/kg), SSL at a DAF 1 (46 mg/kg), and background UTL (66 mg/kg)
- Mercury: two detections (samples SS02 and SS05) at concentrations (0.14 mg/kg and 0.11 mg/kg, respectively) above the ecological screening value (0.10 mg/kg) and background UTL (0.057 mg/kg)
- Selenium: four detections (samples SS01, SS02, SS04, SS05) at concentrations (0.59 mg/kg to 0.76 mg/kg) above the ecological screening value (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg), and background UTL (0.51 mg/kg)

ESI (2009) Surface Soil

- SVOCs: no exceedances
- Inorganics above background UTLs: no exceedances

ESI (2009) Subsurface Soil

- Barium: one detection (sample SB07) at a concentration (190 mg/kg) above the SSL at a DAF 1 (82 mg/kg) and background UTL (147 mg/kg)
- Copper: two detections (samples SB06 and SB07) at concentrations (111 and 70 mg/kg, respectively) above the SSL at a DAF 1 (46 mg/kg) and background UTL (66 mg/kg)
- Selenium: one detection (sample SB06) at a concentration (0.68 mg/kg) above the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at AOC G. The site is approximately 0.006 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 7-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Two constituents were detected in surface soil samples (and none in subsurface soil) above the human health screening levels: benzo(a)pyrene (B[a]P) and kepone. B(a)P was detected in one of seven surface soil samples above its RSL (15 µg/kg), at a concentration of 37 µg/kg. B(a)P was not detected in any other surface or subsurface soil sample. Based on the maximum detected concentration that would be used in residential risk calculations, the ELCR is 3×10^{-6}, which is within the EPA acceptable range, and B(a)P would not be identified as a risk driver (see **Table 7-3**).

Kepone was detected in one of five surface soil samples above its RSL (49 µg/kg), at a concentration of 956 µg/kg. Based on the maximum detected concentration that would be used in risk calculations, the HI is 0.05 and the ELCR is 2×10^{-5}, which are within EPA acceptable levels, and kepone would not be identified as a risk driver (see **Table 7-3**).

Seven additional constituents (aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium) were detected in soil above human health screening criteria but below background UTLs. Based on the historical source of potential releases identified at the site (see Section 7.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels.

Based on the maximum detected concentrations of B(a)P, kepone, and the seven additional constituents, the cumulative maximum target organ-specific HI is 1.0 and the ELCR is 3×10^{-5} (see **Table 7-3**), which are within EPA's acceptable risk levels. Therefore, potential cumulative effects from multiple chemicals in soil are not a concern.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 9×10^{-5}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Three inorganics (copper, mercury, and selenium) exceeded ecological soil screening values and background UTLs in at least one surface soil sample collected at the site (**Table 7-1**). None of these constituents poses an unacceptable risk to ecological receptors based upon the following:

- The site is overgrown with vegetation, with no signs of stressed vegetation.
- Copper exceeded the ecological screening value in one of seven samples at a maximum HQ of 1.01 (**Table 7-4**). The mean HQ (0.75) was less than 1.
- Mercury exceeded the ecological screening value in two of seven samples (the field duplicate of one of these samples was less than the ecological screening value) at a maximum HQ of 1.40 (**Table 7-4**). However, the mean HQ (0.70) was less than 1.
- Selenium exceeded the ecological screening value in four of seven samples (the field duplicate of one of these samples was less than the ecological screening value) at a maximum HQ of 1.47 (**Table 7-4**). However, the mean HQ (0.95) was less than 1. Further, although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the East Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007). This suggests that the selenium concentrations detected at AOC G (maximum of 0.76 mg/kg) may be within the range of background. Further, the screening value (0.52 mg/kg) is based upon potential impacts to plants. The site is heavily vegetated, with no apparent impacts to the terrestrial plant community. Maximum concentrations are less than soil screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates).

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Benzo(b)fluoranthene, kepone, copper, and, selenium were detected in surface soil at concentrations above the SSLs at a DAF of 1 and background UTLs (for the inorganics). Barium, copper, and selenium were detected in subsurface soil above the SSL at a DAF of 1 and background UTL. No SVOCs were detected in subsurface soil samples. The former pump house and chlorination unit (i.e., potential source area) is relatively small (approximately 25 ft x 10 ft) and soil/groundwater data evaluations presented for various sites in this SI/ESI Report suggest SSLs at a DAF of 1 are not representative predictors of leaching to groundwater (e.g., PI 4, SWMU 10, etc.). Therefore, SSLs at a higher DAF are likely to be more realistic, as discussed in Section 1.1.2 of the Final SI/ESI Report (CH2M HILL, 2010).

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the former pump house and chlorination contact basin areas. Based on this information, multiple soil samples were collected, the spatial distribution and resulting data of which indicate the potential source area has been sufficiently characterized.

7.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not likely been a CERCLA-related release at AOC G that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Further, pesticide detections at the site are consistent with normal pesticide application associated with maintenance of the historical facilities present at the site. Additionally, the dioxins present are not likely associated with potential CERCLA-related releases at the site and are nevertheless below the risk-based screening level. Therefore, no action is warranted for AOC G.

Table 7-1
Surface Soil Detection and Exceedance Results
AOC G
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	CGAGSS01	CGAGSS02	CGAGSS03	CGAGSS04	CGAGSS05		VEAG-SO06	VEAG-SO07	
Sample ID					CGAGSS01-R01	CGAGSS02-R01	CGAGSS03-R01	CGAGSS04-R01	CGAGSS05-R01	CGAGSSFD01P-R01	VEAG-SS06-01-0209	VEAG-SS07-01-0209	VEAG-SS07P-01-0209
Sample Date					01/22/04	01/22/04	01/22/04	01/22/04	01/22/04	01/22/04	02/25/09	02/25/09	02/25/09
Chemical Name													
Volatile Organic Compounds (UG/KG)													
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)													
Benzo(a)anthracene	--	150	--	10	367 U	370 U	402 U	382 U	376 UJ	387 U	7.1 J	22 UJ	27 UJ
Benzo(a)pyrene	--	15	--	240	367 U	**37 J**	402 U	382 U	376 UJ	387 U	24 U	22 UJ	27 UJ
Benzo(b)fluoranthene	--	150	--	35	367 U	**89 J**	402 U	382 U	376 UJ	387 U	24 U	22 UJ	27 UJ
Benzo(g,h,i)perylene	--	170,000	--	120,000	367 U	40 J	402 U	382 U	376 UJ	387 U	24 U	22 UJ	27 UJ
Benzo(k)fluoranthene	--	1,500	--	350	367 U	59 J	402 U	382 U	376 UJ	387 U	24 UJ	22 UJ	27 UJ
Chrysene	--	15,000	--	1,100	367 U	58 J	402 U	382 U	376 UJ	387 U	4.8 J	2.3 J	27 UJ
Fluoranthene	--	230,000	--	160,000	367 U	370 U	402 U	382 U	376 UJ	387 U	4.9 J	22 UJ	27 UJ
Indeno(1,2,3-cd)pyrene	--	150	--	120	367 U	43 J	402 U	382 U	376 UJ	387 U	13 J	22 UJ	27 UJ
Kepone	--	49	--	0.240	**956**	370 U	402 U	382 U	376 UJ	387 U	NA	NA	NA
PAH HMW (Total)	--	--	18,000	--	0 U	369	0 U	0 U	0 U	0 U	25	2.0	0 U
PAH LMW (Total)	--	--	29,000	--	0 U	0 U	0 U	0 U	0 U	0 U	5.0	0 U	0 U
Pyrene	--	170,000	--	120,000	367 U	43 J	402 U	382 U	376 UJ	387 U	24 UJ	22 UJ	27 UJ
Pesticide/Polychlorinated Biphenyls (UG/KG)													
4,4'-DDD	--	2,000	583	66	0.17 J	0.31 J	0.33 J	0.93 J	0.72 J	0.56 J	NA	NA	NA
4,4'-DDE	--	1,400	114	47	13 J	5.8 J	9.2 J	31 J	12 J	15 J	NA	NA	NA
4,4'-DDT	--	1,700	100	67	2.4 J	1.4 J	1.4 J	2.0 J	1.2 J	0.96 J	NA	NA	NA
Herbicides (UG/KG)													
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	NA	NA	NA
Dioxin/Furans (PG/G)													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	123	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	3.1	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	3.6	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	1,400	NA	NA	NA	NA	NA
Total heptachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	257	NA	NA	NA	NA	NA
Total hexachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	40	NA	NA	NA	NA	NA
Total pentachlorodibenzo-p-dioxin	--	--	--	--	NA	NA	NA	2.0	NA	NA	NA	NA	NA
Explosives (UG/KG)													
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 7-1
Surface Soil Detection and Exceedance Results
AOC G
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	CGAGSS01	CGAGSS02	CGAGSS03	CGAGSS04	CGAGSS05		VEAG-SO06	VEAG-SO07	
Sample ID					CGAGSS01-R01	CGAGSS02-R01	CGAGSS03-R01	CGAGSS04-R01	CGAGSS05-R01	CGAGSSFD01P-R01	VEAG-SS06-01-0209	VEAG-SS07-01-0209	VEAG-SS07P-01-0209
Sample Date					01/22/04	01/22/04	01/22/04	01/22/04	01/22/04	01/22/04	02/25/09	02/25/09	02/25/09
Chemical Name													
Total Metals (MG/KG)													
Aluminum	35,000	7,700	--	55,000	NA	NA	NA	NA	NA	NA	22,000	15,400 J	21,500 J
Antimony	5.8	3.1	78	0.27	0.36 J	0.11 J	0.29 J	0.29 J	0.25 J	0.37 J	0.14 J	0.11 J	0.16 J
Arsenic	1.6	0.39	18	0.29	0.94 J	0.77 J	0.70 J	0.94 J	0.72 J	0.46 J	1.1	1.0	1.2
Barium	147	1,500	330	82	63	60	76	83	110	66	74 J	56 J	138 J
Beryllium	0.27	16	40	3.2	0.21 J	0.20 J	0.22 J	0.25 J	0.23 J	0.21 J	0.18	0.14	0.17
Cadmium	2.2	7.0	32	0.38	0.36 J	0.27 J	0.37 J	0.36 J	0.33 J	0.20 J	0.12	0.14	0.14
Calcium	8,840	--	--	--	NA	NA	NA	NA	NA	NA	**29,500 J**	**35,100 J**	**44,700 J**
Chromium	72	0.29	64	0.00083	13 J	13 J	14 J	15 J	14 J	18 J	21 J	14 J	18 J
Cobalt	16	2.3	13	0.49	9.6 J	8.5 J	9.1 J	13 J	13 J	11 J	10	9.4 J	13 J
Copper	66	310	70	46	51	42	41	**71**	42	45	60 J	43 J	56 J
Cyanide	0.33	160	15.8	2.0	NA	NA	NA	0.31 J	NA	NA	0.79 U	0.66 U	0.73 U
Iron	38,100	5,500	--	640	NA	NA	NA	NA	NA	NA	26,300	20,800	26,500
Lead	5.4	400	120	27	**11**	**12**	5.0	**8.2**	**6.3**	**6.1**	**7.3**	**7.2**	**7.2**
Magnesium	3,710	--	--	--	NA	NA	NA	NA	NA	NA	**5,660**	**6,210**	**6,820**
Manganese	1,630	180	220	57	NA	NA	NA	NA	NA	NA	548 J	432 J	1020 J
Mercury	0.057	0.78	0.10	0.57	**0.095**	**0.14**	0.026	0.024	**0.11**	**0.090**	0.050	0.040	0.030 J
Nickel	22	160	38	48	6.0 J	5.1 J	5.6 J	6.7 J	6.0 J	5.9 J	7.9 J	6.4 J	11 J
Potassium	5,270	--	--	--	NA	NA	NA	NA	NA	NA	2,010 J	1,290 J	1,780 J
Selenium	0.51	39	0.52	0.26	**0.59 J**	**0.61 J**	0.20 J	**0.73 J**	**0.76 J**	0.41 J	0.25 J	0.23 J	0.32 J
Silver	0.22	39	560	1.6	0.039 J	0.025 U	0.053 J	0.029 J	0.031 J	0.052 J	0.11 U	0.094 U	0.13 U
Sodium	1,590	--	--	--	NA	NA	NA	NA	NA	NA	451 J	346 J	470 J
Tin	--	4,700	--	5,500	0.48 J	0.31 J	0.21 U	0.54 J	0.53 J	0.29 J	NA	NA	NA
Vanadium	144	39	130	180	72	67	76	84	80	86	93	70	90
Zinc	32	2,400	120	680	**76**	**88**	**41**	**59**	**80**	**82**	**51 J**	**53 J**	**64 J**

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PG/G - Picograms per gram
UG/KG - Micrograms per kilogram

Table 7-2
Subsurface Soil Detection and Exceedance Results
AOC G
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	VEAG-SO06	VEAG-SO07
Sample ID				VEAG-SB06-46-0209	VEAG-SB07-46-0209
Sample Date				02/25/09	02/25/09
Chemical Name					
Volatile Organic Compounds (UG/KG)					
No Detections	--	--	--	ND	ND
Semivolatile Organic Compounds (UG/KG)					
No Detections	--	--	--	ND	ND
Total Metals (MG/KG)					
Aluminum	35,000	7,700	55,000	25,000	30,300
Antimony	5.8	3.1	0.27	0.050 J	0.050 J
Arsenic	1.6	0.39	0.29	0.80	0.84
Barium	147	1,500	82	91 J	**190 J**
Beryllium	0.27	16	3.2	**0.48**	0.23
Cadmium	2.2	7.0	0.38	0.020 J	0.040 J
Calcium	8,840	--	--	3,110 J	**23,800 J**
Chromium	72	0.29	0.00083	20 J	27 J
Cobalt	16	2.3	0.49	10	14
Copper	66	310	46	**111 J**	**70 J**
Iron	38,100	5,500	640	34,600	37,100
Lead	3.3	400	27	0.99	1.8
Magnesium	3,710	--	--	**6,260**	**7,740**
Manganese	1,630	180	57	857 J	574 J
Nickel	22	160	48	20 J	11 J
Potassium	2,000	--	--	736 J	**2,510 J**
Selenium	0.51	39	0.26	**0.68**	0.15 J
Sodium	2,250	--	--	**2,330 J**	1,460 J
Vanadium	144	39	180	142	124
Zinc	32	2,400	680	27 J	**34 J**

Notes:

Exceeds Background UTL

Exceeds Background UTL and SSL (DAF=1)

ND - Not Detected

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated

J - Analyte present, value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 7-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: AOC-G
Media: Surface Soil, Subsurface Soil
Historical Function: Pump Station and Chlorination Building at Sewage Lagoons

Exposure Point	CAS Number	Chemical	Minimum Concentration	Qualifier	Maximum Concentration	Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
AOC-G	7429-90-5	Aluminum	2.2E+04	J	2.20E+04		mg/kg	VEAG-SO06	2 / 2	2 / 2	4.98E+00 - 5.67E+00	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	7440-38-2	Arsenic	7.0E-01	J	1.20E+00		mg/kg	VEAG-SO07	7 / 7	7 / 7	1.70E-01 - 1.90E-01	1.6E+00	No	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.05	3.1E-06
	7440-47-3	Chromium	1.3E+01	J	2.05E+01	J	mg/kg	VEAG-SO06	7 / 7	7 / 7	1.00E-01 - 1.20E-01	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	8.5E+00	J	1.34E+01	J	mg/kg	VEAG-SO07	7 / 7	7 / 7	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	2.6E+04		2.65E+04		mg/kg	VEAG-SO07	2 / 2	2 / 2	1.35E+00 - 1.54E+00	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	5.5E+02	J	1.02E+03	J	mg/kg	VEAG-SO07	2 / 2	2 / 2	4.40E-01 - 5.00E-01	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	Max	CNS	0.6	--
	7440-62-2	Vanadium	6.7E+01		9.34E+01		mg/kg	VEAG-SO06	7 / 7	7 / 7	7.00E-02 - 8.00E-02	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
	50-32-8	Benzo(a)pyrene	3.7E-02	J	3.73E-02	J	mg/kg	CGAGSS02	1 / 7	1 / 7	4.00E-03 - 4.40E-03	--	--	1.5E-02	ca	No	1.5E-02	--	--	--	Max	--	--	2.5E-06
	143-50-0	Kepone	9.6E-01		9.56E-01		mg/kg	CGAGSS01	1 / 5	1 / 5	--	--	--	4.9E-02	ca	No	4.9E-02	1.8E+01	--	--	Max	Renal lesions	0.05	2.0E-05
AOC-G	7429-90-5	Aluminum	2.5E+04		3.0E+04		mg/kg	VEAG-SO07	2 / 2	2 / 2	4.72E+00 - 4.95E+00	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	Max	CNS	0.4	--
Subsurface Soil	7440-38-2	Arsenic	8.0E-01		8.4E-01		mg/kg	VEAG-SO07	2 / 2	2 / 2	1.60E-01 - 1.70E-01	1.6E+00	No	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	2.0E+01	J	2.7E+01	J	mg/kg	VEAG-SO07	2 / 2	2 / 2	1.00E-01 - 1.00E-01	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	1.0E+01		1.4E+01		mg/kg	VEAG-SO07	2 / 2	2 / 2	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.6	3.7E-08
	7439-89-6	Iron	3.5E+04		3.7E+04		mg/kg	VEAG-SO07	2 / 2	2 / 2	1.28E+00 - 1.34E+00	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.7	--
	7439-96-5	Manganese	5.7E+02	J	8.6E+02	J	mg/kg	VEAG-SO06	2 / 2	2 / 2	4.20E-01 - 4.40E-01	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	1.2E+02		1.4E+02		mg/kg	VEAG-SO06	2 / 2	2 / 2	7.00E-02 - 7.00E-02	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.4	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.96	3E-05
Groundwater	--	--
Total Risk	0.96	3E-05

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 7-4
Ecological Risk Assessment Screening Statistics for AOC G Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Copper	-- - --	7 / 7	40.7	70.7	52.2	10.74	60.1	70.0	1 / 7	1.01	66.0	1 / 7	0.79	1.07	0.86	0.75
Mercury	-- - --	7 / 7	0.0235	0.14	0.07	0.046	0.10	0.10	2 / 7	1.40	0.057	3 / 7	1.22	2.46	1.04	0.70
Selenium	-- - --	7 / 7	0.201	0.763	0.49	0.23	0.67	0.52	4 / 7	1.47	0.51	4 / 7	0.97	1.50	1.28	0.95

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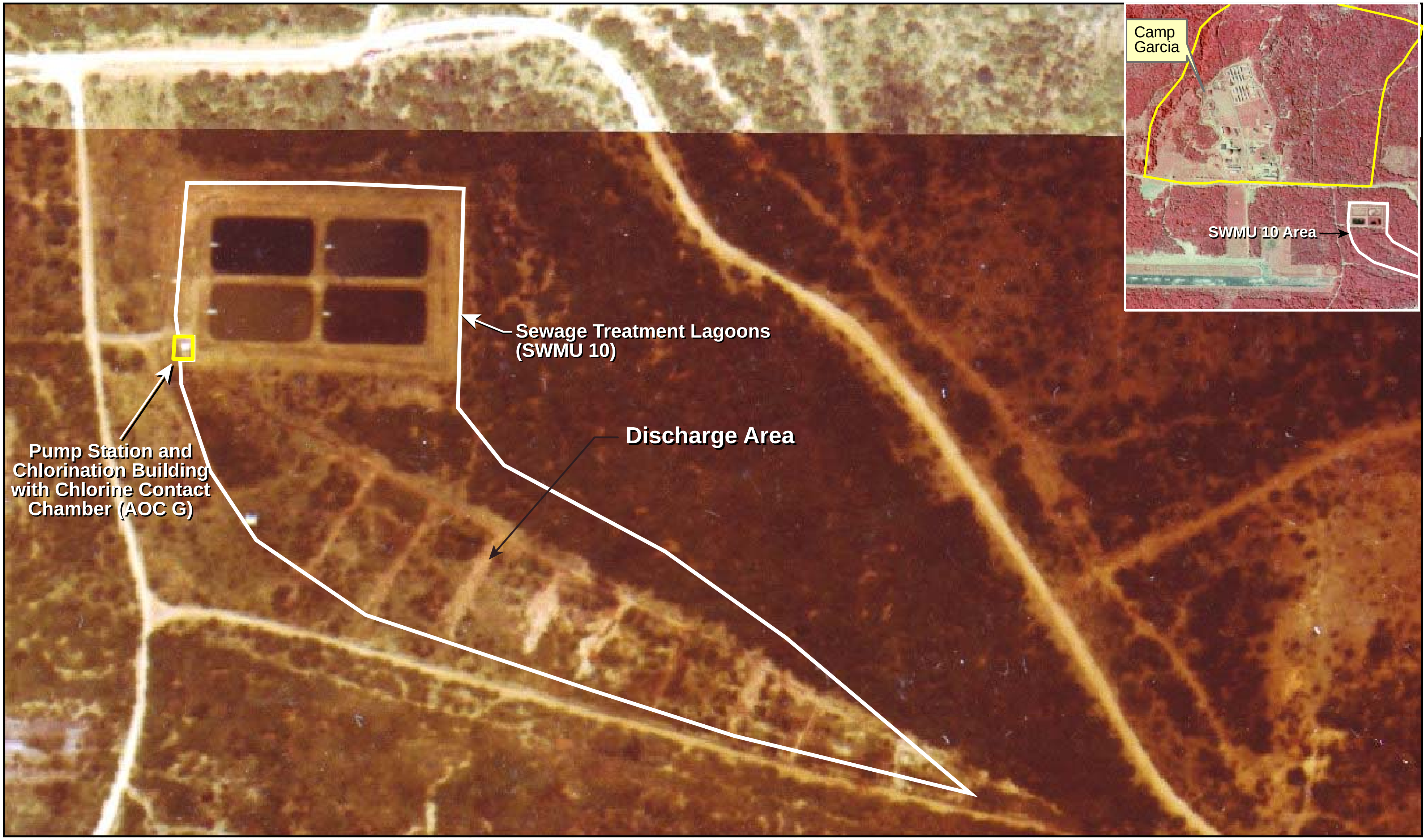

Legend
SWMU 10 Area
AOC G Area

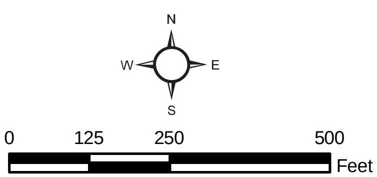

FIGURE 7-1
1970 Aerial Photograph of the SWMU 10 and AOC G Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Photographs taken February 3, 2000

FIGURE 7-2
AOC G Chlorination Contact Chamber and Building
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

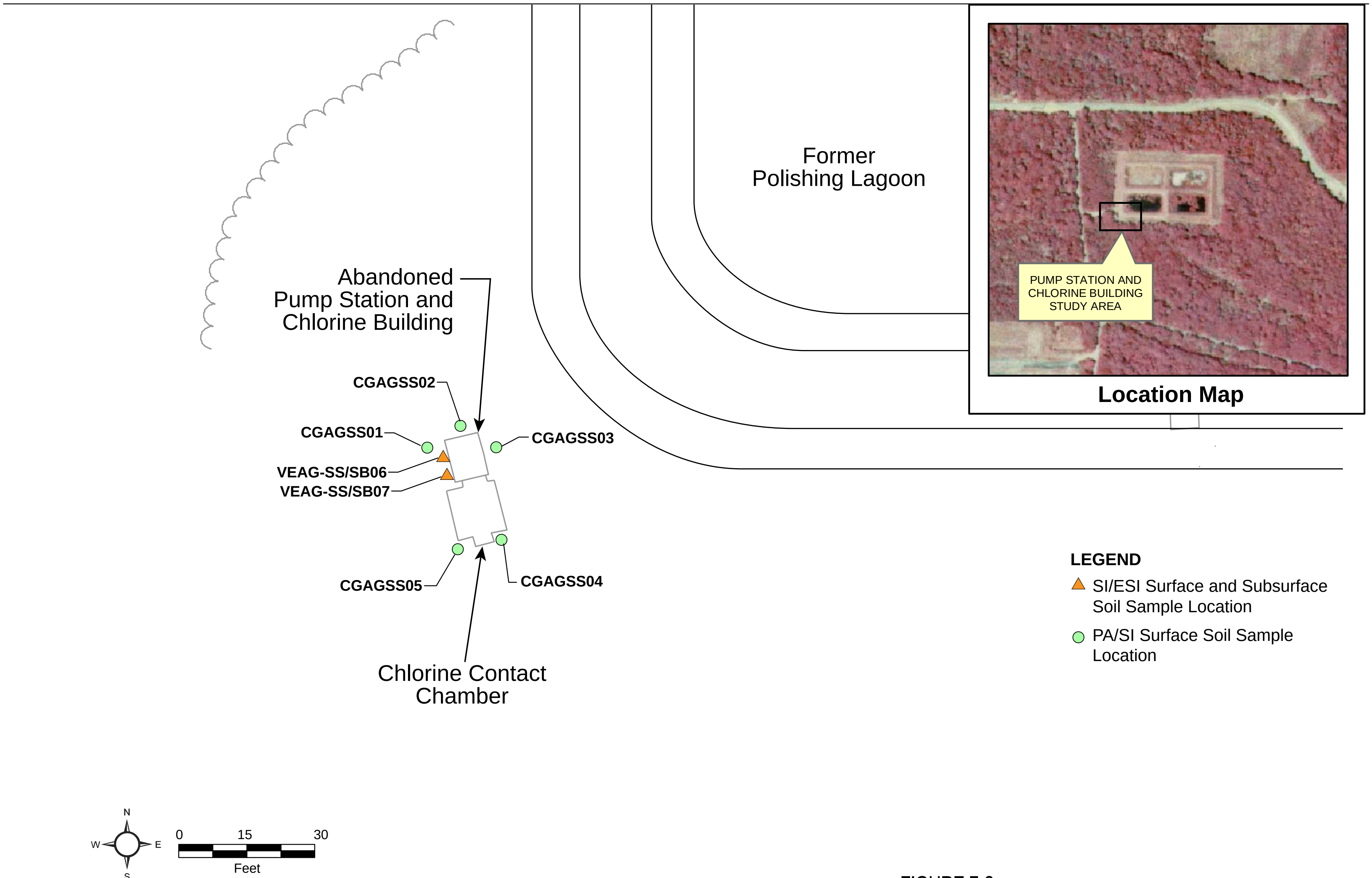

FIGURE 7-3
AOC G Surface and Subsurface Soil Sample Locations
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 8

PI 5—Former Airfield and Associated Ditches

This section presents a summary of the pertinent historical information and rationale for the no action determination for PI 5—Former Airfield and Associated Ditches at the Former VNTR. A more detailed discussion of the PI 5 evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

8.1 Conceptual Site Model

8.1.1 Site Description and Potential Sources of Release

Records indicate that PI 5 was an airfield and associated drainage ditches, and was also the historical location of the fire department and temporary tents. PI 5 is shown in a series of aerial photographs taken in 1959, 1962, 1964, and 2005 (**Figures 8-1 through 8-5**), including identification of features observed in aerial photographs, during site visits, or during the 2009 SI.

Analysis of the historical aerial photographs from 1959, 1962, and 1964 was conducted by ERI in 2000 (ERI, 2000). ERI did not specifically label any of the features on the aerial photographs. Therefore, the locations of features labeled on **Figures 8-1 through 8-4** are best professional judgment based on the descriptions provided in the ERI report. The general observation made by ERI for PI 5 was that the site comprised ditches from the airfield that led to cleared areas and a possible fill area near and into Puerto Ferro.

It is important to note that features identified by ERI on the aerial photographs are not necessarily accurate because ERI did not perform a site visit to substantiate the features they noted in the aerial photographs, and their photographic analysis was done many years after the aerial photographs were taken. For example, ERI identified "airfield staining," an "excavation with liquid," and a "cleared area" in the 1959 aerial photograph. Because these features were not field-verified, the "staining" may have been simply darker areas on the photograph, areas of vegetation, or darker colored soil, or some other feature not associated with a release, as the term "staining" might suggest. Additionally, the feature identified as an "excavation with liquid" was very likely part of the runway surface water runoff diversion ditches or a borrow pit used for runway construction, not an area where liquid was deposited (other than precipitation runoff during rain events). The "cleared areas" are likely erosional areas and salt flats around the bay (i.e., not man-made clearings or fill areas). Observations made during the ERP Technical Subcommittee site visit in January 2009 tend to support this supposition. The 2005 aerial photograph (**Figure 8-5**) shows the only remaining visible features are the runway and open areas to the south.

During a site inspection performed in 2001, no evidence of past releases, soil staining, or stressed vegetation was observed. The site visit performed during the EBS (2002) found large rolled-up piles of beach matting at PI 5. The site visit also identified a gravel pile overgrown with grass next to the runway (**Figure 8-5**). During the 2002 EBS, two samples of the beach matting were collected and analyzed for asbestos. No asbestos was detected.

The ditches south of the runway identified during the 2000 ERI are actually ephemeral streams that have, whether naturally or by design, been providing drainage from the airfield. Additionally, it appears that when the airfield and road leading to Camp Garcia were constructed, drainage for the ditch leading from PI 8 (**Figure 8-2**), as well as for the ephemeral streams draining the former airfield, was facilitated by the installation of culverts.

Although there is no historical information suggesting release(s) of hazardous waste or hazardous constituents occurred at PI 5, based on the above information, the potential sources of a CERCLA-related release are areas of apparent staining on the former runway. If the apparent staining observed in aerial photographs represents areas of contamination, contaminants may have been transported via runoff into and along the ephemeral streams.

8.1.2 Investigation History

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), eight soil borings were installed at PI 5 at the locations selected during the ERP Technical Subcommittee site visit in January 2009 (**Figure 8-3**). The objective of the sample locations was to evaluate depositional areas near the runway, as well as further downstream along the drainage pathways (i.e., ephemeral streams).

One co-located surface soil and subsurface soil sample (SO08) was collected to determine if the area of apparent staining observed in the 1959 aerial photograph on the former airfield represents an area of contamination. At SO08, uniform, but very low PID readings (i.e., 0.3 to 0.5 ppm) were observed throughout the boring. Because these readings were so close to 0 ppm and uniform throughout the boring, they were not believed to have been caused by contamination (this is supported by the analytical results for the surface and subsurface soil samples at this boring location, as shown in **Tables 8-1 and 8-2**). Therefore, the subsurface soil sample was collected at the default depth in accordance with the work plan.

To determine if runoff from the former airfield resulted in contamination of adjacent areas, six soil borings (SO01 through SO06) were installed in the adjacent ditches and ephemeral streams, and one boring (SO07) was installed in the open area at the terminus of the main south-trending ephemeral stream, just into the discharge point onto the salt flat (**Figure 8-3**). Sample locations SO03 and SO04 specifically targeted areas where land crab burrows were observed during the ERP Technical Subcommittee site visit in January 2009.

For borings collected in the ditches and ephemeral streams, co-located surface soil and subsurface soil samples were collected at SO02, SO05, and SO06. No PID readings above 0 ppm were observed in any of these boring, so the subsurface soil samples were collected at the default depth at SO05 and SO06 in accordance with the work plan. At SO02, the boring encountered refusal at 4 ft bgs; therefore, the subsurface soil sample was collected in the 2 to 4 ft bgs interval. At SO01 and SO07, groundwater was encountered at approximately 1 foot bgs; therefore, the surface soil samples were collected from 0 to 1 ft bgs and no subsurface soil samples were collected at these two locations. At SO03 and SO04, the surface soil samples were collected from 0 to 2 ft bgs due to the presence of land crabs. Neither boring contained an additional 2-ft interval between the bottom of the surface soil interval and the groundwater (and groundwater filled the boreholes to within approximately 6 inches of ground surface relatively soon after the cores were extracted); therefore, no subsurface soil samples were collected at these two locations.

All samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics. **Tables 8-1 and 8-2** summarize the constituents detected in PI 5 surface soil and subsurface soil samples, respectively, collected during the SI. The tables also identify screening criteria exceedances.

8.1.3 Physical Setting

The land including and north of the former airfield is generally flat, relatively open, and unmaintained. The land to the south of the airfield is heavily vegetated and slopes in a southward direction to Puerto Ferro and contains several ephemeral streams that serve as drainage along the former airstrip. The site has a maximum elevation of approximately 16 ft amsl. The soil consists mostly of sands, silts, silty sands, and sandy silts. The subsurface geology comprises alluvial deposits such as sand, silt, clay, gravel flood plain deposits, terrace deposits, and piedmont fan deposits. Groundwater occurs within the unconsolidated material closer to the ocean and the fractured igneous bedrock and flows in a southerly direction toward the coast. No surface water bodies were present at the time of the ESI and the ephemeral streams were dry.

8.2 PI 5 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 8-1 and 8-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former airfield and associated ditches. Although there are no records of past releases at the site, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2009 SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Surface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene, bis(2-ethylhexyl)phthalate
- Inorganics above background UTLs: arsenic, beryllium, calcium, lead, selenium, sodium and zinc

Subsurface Soil

- VOCs: none detected
- SVOCs: bis(2-ethylhexyl)phthalate, carbazole
- Inorganics above background UTLs: beryllium, calcium, copper, and zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records of past releases at PI 5. However, based on the potential source areas at PI 5 (i.e., former airfield and associated ditches), it is assumed that the detected constituent groups (i.e., SVOCs, inorganics) are potentially attributable to CERCLA-related releases from the former airfield because they are potentially associated with activities that took place there. Therefore, constituents detected as part of the SI are further considered in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Surface Soil

- SVOCs: no exceedances
- Arsenic: one detection (sample SS06) at a concentration (2.9 mg/kg) above the RSL (0.39 mg/kg), the SSL at a DAF of 1 (0.29 mg/kg) and background UTL (1.6 mg/kg)
- Selenium: one detection (sample SS03) at a concentration (0.56 mg/kg) above the ecological soil screening value for plants and invertebrates (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg), and background UTL (0.51 mg/kg)

Subsurface Soil

- SVOCs: no exceedances
- Copper: one detection (sample SB05) at a concentration (83 mg/kg) above the SSL at a DAF of 1 (46 mg/kg) and background UTL (53 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at PI 5. Although PI 5 is approximately 22 acres in size whereas a residential lot may be approximately ¾ acre, no chemicals were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 8-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Arsenic was detected in only one of eight surface soil samples (and none of the four subsurface soil samples) above background and its RSL (0.39 mg/kg), at a concentration of 2.9 mg/kg. Based on the maximum detected concentration, the residential ELCR for arsenic is 7×10^{-6} and the HI is 0.1, which are within EPA acceptable levels, and arsenic would not be identified as a risk driver (see **Table 8-3**).

Six additional constituents (aluminum, chromium, cobalt, iron, manganese, and vanadium) were detected in soil above human health screening levels but within background UTLs. Based on the EPC for arsenic identified above and the maximum detected concentrations of these six constituents, the cumulative maximum target organ-specific HI is 0.8 (see **Table 8-3**) and the ELCR is 7×10^{-6} (Cr^{3+} is the expected form of chromium at the site; see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)). Therefore, potential cumulative effects from multiple constituents in soil are not a concern.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 6×10^{-5}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Selenium exceeded the ecological screening value and background UTL in one surface soil sample collected at the site (**Table 8-1**). Based on site size and habitat characteristics, exposure of bioaccumulative chemicals to upper trophic level receptors (birds and mammals) was considered in addition to direct exposure of all detected chemicals to soil organisms (plants and invertebrates). No chemicals, however, were detected above ecological soil screening values for upper trophic level receptors, and no other bioaccumulative chemicals were detected above background, therefore a food web evaluation is not warranted.

Selenium exceeded the ecological soil screening values for soil organisms (plants and invertebrates). Selenium does not pose an unacceptable risk to plants and invertebrates based upon the following:

- Selenium exceeded the ecological screening value for soil organisms (0.52 mg/kg) in one of eight samples at a maximum HQ of 1.08 (**Table 8-4**). However, the mean HQ (0.44) was less than 1. Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the east Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at PI 5 (maximum of 0.56 mg/kg) are within the range of background. Further, all selenium concentrations are less than ecological screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates). Thus, selenium has a very low potential for unacceptable risks.

Per the SAP, available land crab data from the 2005 NOAA crab study were reviewed to determine if they were relevant to PI 5. The nearest NOAA crab sampling location is approximately 1,000 feet east of PI 5 at the northeastern corner of Puerto Ferro. However, this tissue sampling location was not near the terminus of the ephemeral stream that traverses the site and so does not likely have relevance. Land crabs are known to occur on PI 5 in the vicinity of samples SS03 and SS04 (**Figure 8-3**). There were no exceedances of ecological soil screening values in surface soil samples (sampled from 0 to 2 feet bgs to represent potential exposure to land crabs) at these two locations and only one exceedance of a background UTL (calcium at SS03). Thus, PI 5 does not pose an unacceptable risk to land crabs at PI 5, much less land crabs located further from the site.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

– depth of contamination with respect to estimated groundwater depth

– mobility of contaminant

– number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Two inorganics (arsenic and selenium) were detected in one surface soil sample each at concentrations above SSLs at a DAF of 1 and background UTLs. However, neither inorganic was detected in the subsurface soil sample at this location above the SSL at a DAF of 1 and background. Copper was detected in one subsurface soil sample above the SSL at a DAF of 1 and background. Soil/groundwater data evaluations presented for various sites in this SI/ESI Report suggest SSLs at a DAF of 1 are not representative predictors of leaching to groundwater (e.g., PI 4, SWMU 10, etc.). At a DAF of about 2, no copper or selenium concentrations exceed their respective SSL; at a DAF of 10, no arsenic concentrations exceed the SSL.

In addition to the more realistic evaluations of the data presented above, when the data in **Tables 8-1 and 8-2** are looked at holistically (i.e., big-picture perspective), the few detections of organics and the relatively low concentrations of inorganics throughout the site suggest either there was not a CERCLA-related release from the former airfield at PI 5 or if a release(s) occurred, it did not result in contamination distinguishable from background.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the apparent areas of staining at the former airfield. Based on this information, soil samples were collected within the stained area (which did not suggest the presence of a source area) and associated depositional areas for runoff from the former airfield. Therefore, the spatial distribution of the samples collected during the SI and resulting data indicate the potential source area (as well as associated depositional areas) has been sufficiently characterized.

8.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PI 5 or, if there was a release, it has not resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Therefore, no action is warranted for PI 5.

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Table 8-1
Surface Soil Detection and Exceedance Results
PI 5
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (Qa)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	VEP5-SO01	VEP5-SO02	VEP5-SO03	VEP5-SO04	VEP5-SO05	VEP5-SO06	VEP5-SO07		VEP5-SO08
Sample ID					VEP5-SS01-01-0209	VEP5-SS02-01-0209	VEP5-SS03-02-0209	VEP5-SS04-02-0209	VEP5-SS05-01-0309	VEP5-SS06-01-0309	VEP5-SS07-0H-0209	VEP5-SS07P-0H-0209	VEP5-SS08-01-0309
Sample Date					02/25/09	02/25/09	02/25/09	02/25/09	03/12/09	03/12/09	02/25/09	02/25/09	03/11/09
Chemical Name													
Volatile Organic Compounds (UG/KG)													
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)													
Benzo(a)anthracene	--	150	--	10	20 U	24 UJ	5.2 J	23 UJ	21 U	23 U	23 UJ	25 U	22 UJ
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	100 R	120 UJ	120 R	110 UJ	83 J	110 J	120 UJ	120 R	43 J
PAH HMW (Total)	--	--	1,100	--	0 U	0 U	5.0	0 U	0 U	0 U	0 U	0 U	0 U
PAH LMW (Total)	--	--	29,000	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Total Metals (MG/KG)													
Aluminum	35,000	7,700	--	55,000	7,930	8,500	6,250	11,400	10,500	25,900	7,900	7,710	13,400
Antimony	5.8	3.1	0.27	0.27	0.030 J	0.050 J	0.040 J	0.040 J	0.10 UJ	0.21 J	0.030 J	0.020 J	0.097 U
Arsenic	1.6	0.39	18	0.29	0.48	0.74	0.75	0.76	0.52 J	**2.9 J**	0.70	0.80	0.51
Barium	212	1,500	330	82	69 J	37 J	131 J	89 J	104	109	105 J	87 J	132
Beryllium	0.27	16	21	3.2	0.090	0.12	0.10	0.20	0.18	**0.32**	0.10 J	0.080 J	0.22
Cadmium	2.2	7.0	0.36	0.38	0.020 J	0.040 J	0.040 J	0.030 J	0.10 U	0.26	0.11 U	0.040 J	0.097 U
Calcium	11,900	--	--	--	9,630 J	**13,500 J**	**14,700 J**	8,660 J	5,360	**98,500**	11,200 J	10,800 J	10,900
Chromium	72	0.29	26	0.00083	8.8 J	11 J	3.5 J	6.2 J	4.0 J	16 J	4.4 J	4.6 J	4.0
Cobalt	16	2.3	13	0.49	4.6	6.3	6.7	6.7	6.0	8.0	5.6	5.5	6.2
Copper	53	310	28	46	18 J	25 J	21 J	40 J	36 J	51 J	25 J	22 J	43
Iron	38,100	5,500	--	640	16,400	28,600	10,900	20,400	14,500	25,100	10,800	12,600	14,600
Lead	5.4	400	11	27	2.5	2.1	1.2	2.3	1.6 J	**8.7 J**	1.7	1.4	2.4
Magnesium	22,200	--	--	--	2,160	2,580	2,630	3,620	2,070	14,100	3,540	3,680	3,120
Manganese	1,630	180	220	57	264 J	226 J	808 J	601 J	514 J	467 J	354 J	349 J	517
Mercury	0.057	0.78	0.10	0.57	0.029 U	0.038 U	0.032 U	0.036 U	0.032 R	0.010 J	0.032 U	0.037 U	0.035 U
Nickel	22	160	38	48	2.5 J	3.6 J	2.8 J	3.7 J	1.8 J	6.6 J	2.8 J	2.3 J	2.4
Potassium	5,270	--	--	--	639 J	896 J	512 J	1,330 J	962 J	2,260 J	1,060 J	1,070 J	699
Selenium	0.51	39	0.52	0.26	0.11 J	0.18 J	0.42 U	0.13 J	0.52 U	**0.56**	0.18 J	0.19 J	0.20 J
Sodium	1,590	--	--	--	165 J	310 J	446 J	1,470 J	210 UJ	316 J	**4,850 J**	**3,550 J**	153
Vanadium	144	39	7.8	180	63	104	42	64	46 J	80 J	42	43	44
Zinc	32	2,400	46	680	18 J	24 J	12 J	20 J	17	**42**	12 J	20 J	17

Notes:

Exceeds Background UTL
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 8-2
Subsurface Soil Detection and Exceedance Results
PI 5
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (Qa)	Adjusted RSL for Residential Soil	SSL (DAF=1)	VEP5-SO02	VEP5-SO05	VEP5-SO06	VEP5-SO08
Sample ID				VEP5-SB02-24-0309	VEP5-SB05-46-0309	VEP5-SB06-46-0309	VEP5-SB08-46-0309
Sample Date				03/12/09	03/12/09	03/12/09	03/11/09
Chemical Name							
Volatile Organic Compounds (UG/KG)							
No Detections	--	--	--	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)							
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	210	110 U	55 J	54 J
Carbazole	--	24,000	--	23 U	1.6 J	21 U	22 UJ
Total Metals (MG/KG)							
Aluminum	35,000	7,700	55,000	22,900	20,100	15,500	22,100
Arsenic	1.6	0.39	0.29	0.53 J	0.42 J	0.54 J	0.66
Barium	212	1,500	82	53	107	76	102
Beryllium	0.27	16	3.2	**0.29**	0.24	0.20	0.26
Cadmium	2.2	7.0	0.38	0.11 U	0.10 U	0.030 J	0.11 U
Calcium	11,900	--	--	2,580	3,710	**15,200**	**15,000**
Chromium	72	0.29	0.00083	7.6 J	6.3 J	5.3 J	5.5
Cobalt	16	2.3	0.49	8.8	8.1	4.0	4.3
Copper	53	310	46	50 J	**83 J**	31 J	53
Iron	38,100	5,500	640	27,200	25,500	15,200	22,500
Lead	3.3	400	27	2.5 J	2.7 J	2.3 J	2.3
Magnesium	22,200	--	--	4,340	4,350	3,260	4,630
Manganese	1,630	180	57	272 J	558 J	288 J	269
Nickel	22	160	48	3.2 J	2.2 J	2.0 J	2.5
Potassium	2,000	--	--	927 J	743 J	723 J	878
Selenium	0.51	39	0.26	0.53 U	0.50 U	0.47 U	0.17 J
Sodium	2,250	--	--	460 J	378 J	615 J	385
Vanadium	144	39	180	82 J	68 J	43 J	62
Zinc	32	2,400	680	27	**33**	17	21

Notes:

Exceeds Background UTL

Exceeds Background UTL and SSL (DAF=1)

ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 8-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PI-5
Media: Surface Soil
Historical Function: Former Airfield and Associated Ditches

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value Qa (1)	Max Exceeds Background Qa	December RSL Adjusted (2)	Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PI-5	7429-90-5	Aluminum	6.3E+03	2.59E+04	mg/kg	VEP5-SO06	8 / 8	7 / 8	3.60E+00 - 4.80E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	Max	CNS	0.3	--
Surface Soil	7440-38-2	Arsenic	4.8E-01	2.90E+00 J	mg/kg	VEP5-SO06	8 / 8	8 / 8	1.20E-01 - 1.60E-01	1.6E+00	Yes	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.1	7.4E-06
	7440-47-3	Chromium	3.5E+00 J	1.64E+01 J	mg/kg	VEP5-SO06	8 / 8	8 / 8	4.00E-02 - 1.00E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0001	--
	7440-48-4	Cobalt	4.6E+00	8.00E+00	mg/kg	VEP5-SO06	8 / 8	8 / 8	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	1.1E+04	2.86E+04	mg/kg	VEP5-SO02	8 / 8	8 / 8	9.80E-01 - 1.30E+00	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.5	--
	7439-96-5	Manganese	2.3E+02 J	8.08E+02 J	mg/kg	VEP5-SO03	8 / 8	8 / 8	3.20E-01 - 4.30E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	Max	CNS	0.4	--
	7440-62-2	Vanadium	4.2E+01	1.04E+02	mg/kg	VEP5-SO02	8 / 8	8 / 8	5.00E-02 - 7.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.3	--
PI-5	7429-90-5	Aluminum	1.6E+04	2.3E+04	mg/kg	VEP5-SO02	4 / 4	4 / 4	4.18E+00 - 4.85E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	--	CNS	--	--
Subsurface Soil	7440-38-2	Arsenic	4.2E-01 J	6.6E-01	mg/kg	VEP5-SO08	4 / 4	4 / 4	1.40E-01 - 1.60E-01	1.6E+00	No	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	5.3E+00 J	7.6E+00 J	mg/kg	VEP5-SO02	4 / 4	4 / 4	5.00E-02 - 1.00E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	4.0E+00	8.8E+00	mg/kg	VEP5-SO02	4 / 4	4 / 4	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.4	2.4E-08
	7439-89-6	Iron	1.5E+04	2.7E+04	mg/kg	VEP5-SO02	4 / 4	4 / 4	1.14E+00 - 1.32E+00	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	2.7E+02	5.6E+02 J	mg/kg	VEP5-SO05	4 / 4	4 / 4	3.70E-01 - 4.30E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	4.3E+01 J	8.2E+01 J	mg/kg	VEP5-SO02	4 / 4	4 / 4	6.00E-02 - 7.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.8	7E-06
Groundwater	--	--
Total Risk	0.8	7E-06

Note:
(1) East Vieques Soil Type Qa.
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

* - Max HI is the highest HI associated with any target organ or critical effect.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 8-4

Ecological Risk Assessment Screening Statistics for PI 5 Surface Soil - Plants and Invertebrates

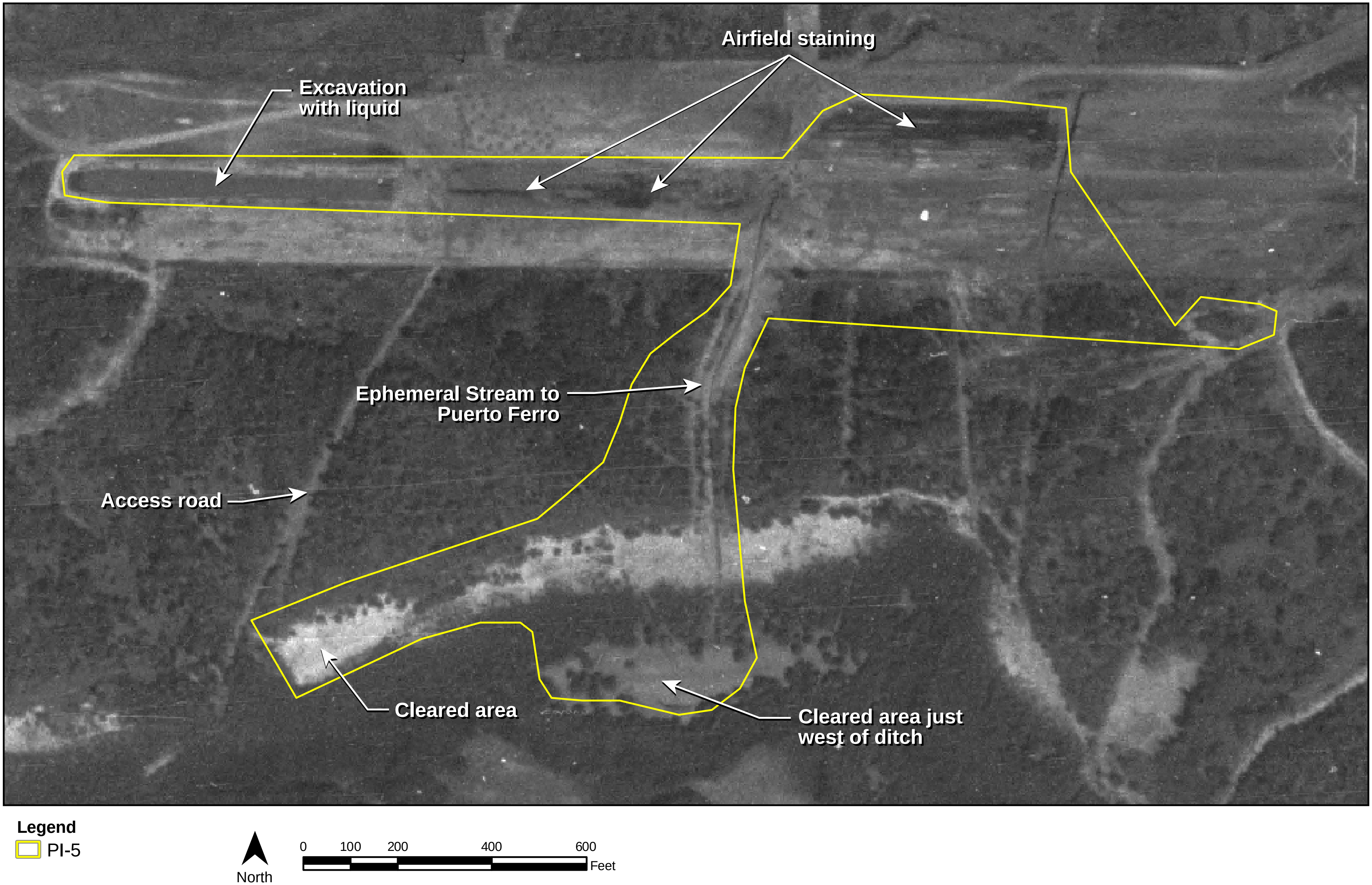
Former NASD, Vieques, Puerto Rico

No Action/No Further Action Decision Document

7 Consent Order Sites and 14 PI/PAOC Sites

Vieques, Puerto Rico

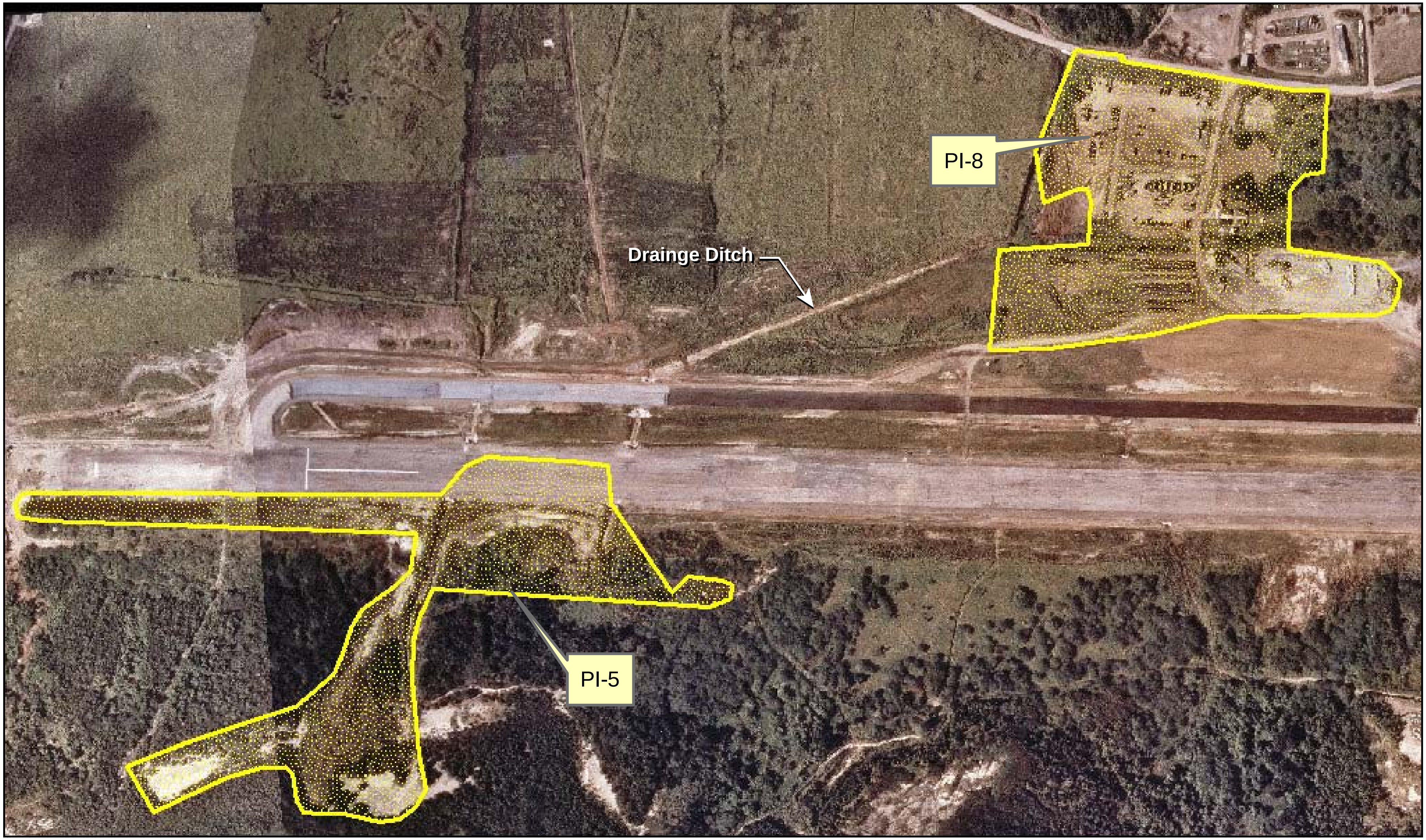
Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Selenium	0.42 - 0.52	6 / 8	0.11	0.56	0.23	0.14	0.32	0.52	1 / 8	1.08	0.51	1 / 8	0.45	1.10	0.62	0.44



Note:
Features labeled in figure are based on and use terminology from ERI (2000)

FIGURE 8-1
PI-5 1959 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

PI-5 and PI-8

North

0 250 500 1,000 Feet

FIGURE 8-2
PI-5 and PI-8 1962 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Legend

PI-5

Surface and Subsurface Soil Sampling Locations

Surface Soil Sampling Locations

North

0 100 200 400 600 Feet

FIGURE 8-3
PI-5 Sample Locations 1962 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Legend

PI-5

North

0 100 200 400 600 Feet

FIGURE 8-4
PI-5 1964 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Legend

PI-5

North

0 100 200 400 600 Feet

FIGURE 8-5
PI-5 2005 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 9

PI 6—Former PCB Storage Pad and Vehicle Wash Pad

This section presents a summary of the pertinent historical information and rationale for the no action determination for PI 6—Former PCB Storage Pad and Vehicle Wash Pad at the Former VNTR. A more detailed discussion of the PI 6 evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

9.1 Conceptual Site Model

9.1.1 Site Description and Potential Sources of Release

Records indicate that PI 6, formerly located at VNTR, was a probable water treatment plant with a large fresh water impoundment, vehicle wash pad, UST, and concrete pad potentially used to store PCBs. Additionally, PI 6 was historically a bivouac area for the 65th Infantry Division of the U.S. Marine Corps during training exercises. PI 6 is shown in a series of aerial photographs taken in 1959, 1962, 1964, 1983, 1985, 1994, 2005 and 2007 (**Figures 9-1 through 9-8**), including identification of features observed in aerial photographs and locations of historical samples.

In 2000, ERI conducted an analysis of the 1959, 1962, 1964, 1985, and 1994 aerial photographs (ERI, 2000). The general observation made by ERI for PI 6 was that the site comprised vertical tanks, a large surface impoundment, and a pump house at a probable water treatment plant. Specifically, in the 1959 aerial photograph, ERI identified a probable treatment plant which included an impoundment with liquid, vertical tanks and six buildings, one of which appeared to be a pump house.

RFI (2001) and EBS (2002) site visits found five abandoned steel ASTs with piping, pump house, 20,000-gallon UST sitting at grade, an electric meter station, concrete pad (potentially used to store PCBs), vehicle wash pad, and partially buried piping. Records indicate these ASTs were likely used for drinking water storage, electric pumps were used at the site, and no fuel was ever stored at the site. The first historical map (General Site Plan) presented in Appendix G of the EBS (NAVFACENGCOM, 2003) shows the impoundment was used to store fresh water.

During the 2007 SI scoping session site visit by the ERP Technical Subcommittee, a concrete pad (adjacent to the pump house) on which the PCBs were potentially stored was noted to have a concrete berm around it. However, there were small openings in the berm on the east side of the pad. In addition, the pad had a central trough that led to a sump within the pump house. The sump contained an unknown thickness of soil/leaf litter. It was concluded that any release on the concrete pad would likely have been directed to the sump via the central trough. However, it was recognized that possible contaminants could have runoff through the openings along the east berm.

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), the general condition of the sump located within the pump house was assessed and photographs were taken, as shown in **Figure 9-9**. The sump was observed to have a concrete bottom and contained leaf litter and approximately 2 inches of soil (**Figure 9-9[A]**). After the soil sample was collected from the sump, the sump was cleared of debris and remainder of the photographs shown in **Figure 9-9** taken. The observations made are summarized below.

The total sump dimensions are approximately 1.4-ft high, 2.0-ft wide and 9.9-ft long. The sump has three sections. The first (main) section is approximately 1.4-ft high, 2.0-ft wide, and 4.4-ft long, and is where the central trough from the outside concrete pads would have discharged (**Figure 9-9[B]**). Vertical and horizontal cracks and live root material were observed in this section of the sump (**Figures 9-9[B] and 9-9[C**]). The second section is covered, possibly to permit foot-traffic through the pump house (**Figures 9-9[D] and 9-9[E**]). The dimensions beneath the cover within this section are approximately 1.5-ft wide, 1.2-ft high, and 3.4-ft long. The third section (**Figures 9-9[E] and 9-9[F]**) is open, with approximate dimensions of 1.4-ft high, 1.5-ft wide, and 2.2-ft long. An electrical motor was lying in the third section of the sump.

9.1.2 Investigation History

EBS Soil and Wipe Sampling

Based on observations made during the EBS site visit, six wipe samples, PBC1 through PBC6, (**Figures 9-4 and 9-6**) were collected from the concrete pad and pump house. No PCBs were detected on the wipe samples. Additionally, three surface soil samples, PI6-1 through PI6-3) were collected near the above-ground UST (**Figures 9-4 and 9-6**). The surface soil samples were analyzed for VOCs, SVOCs, pesticides, herbicides, PCBs, inorganics, TPH-DRO, and TPH-GRO.

SI Soil Sampling

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), during the SI one surface soil sample (SS04 on **Figures 9-4 and 9-6**) was collected within the sump and was analyzed for TCL PCBs. Because the sump had a concrete bottom and contained only about 2 inches of soil, only a surface soil sample was collected within the sump.

Additionally, to determine if there has been a release from the concrete pad through the openings along the east berm, two co-located surface soil and subsurface soil samples (SS/SB05 and SS/SB06 on **Figures 9-4 to 9-6**) were collected just outside the east side of the pad berm, immediately adjacent to the openings in the berm. These samples were analyzed for TCL PCBs.

To determine if there were releases during vehicle washing activities, one co-located surface soil and subsurface soil sample (SS/SB07) was collected at the location of the former vehicle wash pad. The samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics, as these are the constituents likely associated with potential releases from the vehicle washing activities.

No PID readings above 0.0 ppm were observed at PI 6; therefore, all soil samples were collected at default depths in accordance with the SAP. **Tables 9-1 and 9-2** summarize the constituents detected in PI 6 surface soil and subsurface soil samples, respectively, collected during the EBS (2002) and SI (2009). The tables also identify screening criteria exceedances. Raw analytical data for the EBS (2002) samples are provided in Appendix F of the Environmental Baseline Survey Report (NAVFACENGCOM, 2003). Raw analytical data for the SI (2009) samples are provided in Appendix K of the Final SI/ESI Report (CH2M HILL, 2010).

9.1.3 Physical Setting

The site slopes very gently to the south/southeast, with the highest elevation at approximately 68 ft amsl. The land is heavily vegetated and not maintained. The soil consists mostly of sands, silty sands, sandy silts, and clayey sand. The subsurface geology consists of igneous rocks, primarily granodiorite and quartz diorite. Groundwater likely occurs within the fractured bedrock and flows in a southerly direction toward the coast. No surface water is present at the site.

9.2 PI 6 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-4**) with reference to the detection tables (**Tables 9-1 and 9-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a probable water treatment plant with a large impoundment, vehicle wash pad, UST, and concrete pad potentially used to store PCBs. Historical data collected around the UST, as well as its unlikely use for fuel storage at the site, suggest the UST is not a potential source of a CERCLA-related release at PI 6 (see below). However, based on the CSM, the potential sources of a CERCLA-related release are the concrete pad used to store PCBs, the vehicle wash pad, and the UST. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visits, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2002 EBS and 2009 SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

EBS (2002)

Although EBS data were not subject to third-party validation, the data still underwent some validation processes. The results of laboratory QA/QC samples were compared to limits specified by the analytical methodology and/or laboratory SOPs. At a minimum, these QA/QC samples included blanks, calibrations, and MS/MSDs. No QA/QC exceedances were noted. These historical data are available for used as reported.

SI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the EBS (2002) and the SI (2009), the following inorganics above the background UTLs and non-inorganics were detected by sampling event and by medium:

EBS (2002) Surface Soil

- VOCs: none detected
- SVOCs: none detected
- Herbicides: 2,4,5-trichlorophenoxyacetic acid, 2,4,5-TP (Silvex)
- Pesticides: DDE
- PCBs: non detected
- Inorganics above background UTLs: arsenic, lead, mercury, selenium, thallium, and zinc

SI (2009) Surface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene, chrysene, fluoranthene, pyrene
- PCBs: none detected
- Inorganics above background UTLs: lead

SI (2009) Subsurface Soil

- VOCs: none detected
- SVOCs: di-n-butylphthalate
- PCBs: none detected
- Inorganics above background UTLs: none detected

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

As discussed above, there were three potential source areas considered for PI 6: (1) concrete pad and sump associated with potential PCB storage, (2) former vehicle wash rack, and (3) UST. The UST was identified as a potential source only during the EBS. When the ERP Technical Subcommittee performed the SI scoping, it was recognized, based on historical records and historical sample data collected in the vicinity of the UST, that the UST was not a likely source of release and, consequently, was not considered for further sampling as part of the SI. However, as a conservative measure, the EBS soil inorganics data above background UTLs from this area are considered further in the decision analysis process.

No VOCs or SVOCs were detected in the EBS samples and the concentrations of pesticide and herbicides detected in those samples are the same pesticides and of similar concentrations (see **Table 9-1**) detected at other sites across east Vieques (see Table O-1 of the Final SI/ESI Report (CH2M HILL, 2010)). For example, 4,4'-DDE was detected in PI 6 surface soil samples at concentrations between 5.9 µg/kg and 7.3 µg/kg, which is similar to the concentrations detected at other sites across east Vieques (i.e., 0.08 µg/kg to 1,200 µg/kg). Therefore, pesticides are not considered further in the decision analysis process. In addition, the thallium concentrations reported for samples collected during the EBS utilized a method that, although standard at the time, tended to provide falsely elevated results (see Section 1 of the Final SI/ESI Report (CH2M HILL, 2010)). **Table 9-1** (PI 8) shows that no thallium was detected in the 10 surface soil samples collected during the SI, including the two samples immediately adjacent to samples where thallium concentrations of approximately 1 mg/kg were detected during the EBS. In addition, there is no likely source of thallium at PI 6. Therefore, the thallium results from the EBS samples are not considered further in the decision analysis process for PI 6.

With respect to the SI soil data collected at the concrete pad/sump and former vehicle wash rack, no PCBs were detected. However, because of the nature of activities at the former vehicle wash rack, the SVOCs and inorganics detected in the soil samples collected there are considered further in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

EBS (2002) Surface Soil

- Arsenic: one detection (sample PI6-1) at a concentration (2.1 mg/kg) above the RSL (0.39 mg/kg), SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Mercury: one detection (sample PI6-2) at a concentration (0.31 mg/kg) above the ecological screening value (0.10 mg/kg) and background UTL (0.057 mg/kg)
- Selenium: two detections (samples PI6-2 and PI6-3) at concentrations (1.3 mg/kg and 1.2 mg/kg, respectively) above the ecological screening value (0.52 mg/kg), SSL at a DAF of 1 (0.26 mg/kg), and background UTL (0.51 mg/kg)
- Zinc: one detection (sample PI6-3) at a concentration (131 mg/kg) above the ecological screening value (120 mg/kg) and background UTL (32 mg/kg)

SI (2009) Surface Soil

- SVOCs: no exceedances
- Inorganics above background UTLs: no exceedances

SI (2009) Subsurface Soil

- SVOCs: no exceedances

As shown above, there are exceedances of the most conservative screening values in surface soil. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at PI 6. Although PI 6 is approximately 18 acres in size, whereas a residential lot may be approximately ¾ acre, no chemicals were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 9-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Arsenic was detected in two of four surface soil samples above background and its RSL (0.39 mg/kg), at a maximum concentration of 2.1 mg/kg. Based on the maximum detected concentration, the residential ELCR is 5×10^{-6} and the HI is 0.1, which are within EPA acceptable levels, and arsenic would not be identified as a risk driver (see **Table 9-3**).

Six additional constituents (aluminum, chromium, cobalt, iron, manganese, and vanadium) were detected in soil above human health screening levels but below background UTLs. Based on the maximum detected concentrations of arsenic and these six additional constituents, the cumulative maximum target organ-specific HI is 0.4 and the ELCR is 5×10^{-6} (see **Table 9-3**). Based on the historical source of potential releases identified at the site (see Section 9.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Therefore, potential cumulative effects from multiple chemicals in soil are not a concern.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 2×10^{-5}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Three inorganics (mercury, selenium, and zinc) exceeded ecological screening values and background UTLs in at least one surface soil sample collected at the site (**Table 9-1**). None of these constituents likely pose an unacceptable risk to ecological receptors based upon the following:

- Mercury exceeded the ecological screening value in one of four samples at a maximum HQ of 3.10 (**Table 9-4**). However, the mean HQ (0.99) was less than 1.
- Selenium exceeded the ecological screening value in two of four samples at a maximum HQ of 2.50 (**Table 9-4**). The screening value (0.52 mg/kg), however, is based upon potential impacts to plants. The area where the exceedances occurred is heavily vegetated, with no apparent impacts to the terrestrial plant community. Concentrations are less than soil screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates).
- Zinc exceeded the ecological screening value in one of four samples at a maximum HQ of 1.09 (**Table 9-4**). However, the HQ was less than 1 in the field duplicate of this sample. In addition, the mean HQ (0.58) was also less than 1.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Two inorganics (arsenic and selenium) were detected at concentrations above their respective SSLs at a DAF of 1 and background UTLs. The UST area is small (several feet long and wide) and soil/groundwater data evaluations presented for various sites in this SI/ESI Report suggest SSLs at a DAF of 1 are not representative predictors of leaching to groundwater (e.g., PI 4, SWMU 10, etc.). No arsenic concentrations exceed the SSL at a DAF of 8; no selenium concentrations exceed the SSL at a DAF of 5.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the former PCB storage pad and vehicle wash pad. Based on historical information regarding most or all tank usage at the site (i.e., for water) and the soil data collected in the vicinity of the UST, the ERP Technical Subcommittee determined that the UST was not a likely source of a CERCLA-related release and, therefore, did not include it in potential source area identification for the SI. Because no PCBs were detected on the concrete pad wipe samples, or in the soil adjacent to the concrete pad, or in the main portion of the sump, additional sampling within or beneath the sump is not warranted. In addition, a co-located surface and subsurface soil sample was collected at the location of the former vehicle wash pad. Based on this information, the spatial distribution of the samples collected during the SI and resulting data indicate the potential source areas have been sufficiently characterized.

9.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PI 6 that has resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Further, the data collected around the former PCB storage pad and associated sump suggest PCBs were not released in this area. Therefore, no action is warranted for PI 6.

Table 9-1
Surface Soil Detection and Exceedance Results
PI 6
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	VNTR-PI6-1	VNTR-PI6-2	VNTR-PI6-3		VEP6-SO04	VEP6-SO05	VEP6-SO06	VEP6-SO07
Sample ID					VNTR-PI6-1	VNTR-PI6-2	VNTR-PI6-3	VNTR-PI6-3D	VEP6-SS04-0H-0309	VEP6-SS05-01-0309	VEP6-SS06-01-0309	VEP6-SS07-01-0309
Sample Date					12/12/02	12/12/2002	12/12/2002	12/12/2002	03/05/09	03/11/09	03/11/09	03/05/09
Chemical Name												
Volatile Organic Compounds (UG/KG)												
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA	ND
Semivolatile Organic Compounds (UG/KG)												
Benzo(a)anthracene	--	150	--	10	333 U	333 U	333 U	333 U	NA	NA	NA	2.7 J
Chrysene	--	15,000	--	1,100	333 U	333 U	333 U	333 U	NA	NA	NA	4.4 J
Fluoranthene	--	230,000	--	160,000	333 U	333 U	333 U	333 U	NA	NA	NA	3.2 J
PAH HMW (Total)	--	--	18,000	--	0 U	0 U	0 U	0 U	NA	NA	NA	12
PAH LMW (Total)	--	--	29,000	--	0 U	0 U	0 U	0 U	NA	NA	NA	3.0
Pyrene	--	170,000	--	120,000	333 U	333 U	333 U	333 U	NA	NA	NA	5.2 J
Herbicides (UG/KG)												
2,4,5-Trichlorophenoxyacetic acid	--	61,000	--	150	10 U	13	27	27	NA	NA	NA	NA
2,4,5-TP (Silvex)	--	49,000	--	28	10 U	**60**	**87**	10 U	NA	NA	NA	NA
Pesticides (UG/KG)												
4,4'-DDE	--	1,400	114	47	3.3 U	5.9	6.9	7.3	NA	NA	NA	NA
Polychlorinated Biphenyls (UG/KG)												
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	NA
Total Metals (MG/KG)												
Aluminum	35,000	7,700	--	55,000	NA	NA	NA	NA	NA	NA	NA	12,200
Antimony	5.8	3.1	78	0.27	5.5 U	5.4 U	4.9 U	4.3 U	NA	NA	NA	0.39 J
Arsenic	1.6	0.39	18	0.29	**2.1**	0.89 U	0.82 U	0.71 U	NA	NA	NA	0.74
Barium	147	1,500	330	82	62	68	56	48	NA	NA	NA	78
Beryllium	0.27	16	40	3.2	0.46 U	0.45 U	0.41 U	0.36 U	NA	NA	NA	0.18
Cadmium	2.2	7.0	32	0.38	0.46 U	0.45 U	0.41 U	0.36 U	NA	NA	NA	0.48
Calcium	8,840	--	--	--	NA	NA	NA	NA	NA	NA	NA	7,430
Chromium	72	0.29	64	0.00083	4.8	3.2	4.9	3.4	NA	NA	NA	4.6
Cobalt	16	2.3	13	0.49	4.8	4.5 U	4.5	3.6 U	NA	NA	NA	5.2
Copper	66	310	70	46	37	31	45	37	NA	NA	NA	28
Iron	38,100	5,500	--	640	NA	NA	NA	NA	NA	NA	NA	12,500
Lead	5.4	400	120	27	4.1	2.6	**23**	**16**	NA	NA	NA	**11**
Magnesium	3,710	--	--	--	NA	NA	NA	NA	NA	NA	NA	1,630
Manganese	1,630	180	220	57	NA	NA	NA	NA	NA	NA	NA	466
Mercury	0.057	0.78	0.10	0.57	0.039 U	**0.31**	0.069 U	0.10 U	NA	NA	NA	0.020 J
Nickel	22	160	38	48	6.7	5.4	3.3 U	2.9 U	NA	NA	NA	2.0
Potassium	5,270	--	--	--	NA	NA	NA	NA	NA	NA	NA	822
Selenium	0.51	39	0.52	0.26	0.91 U	**1.3**	**1.2**	0.71 U	NA	NA	NA	0.53 U
Sodium	1,590	--	--	--	NA	NA	NA	NA	NA	NA	NA	133
Thallium	0.13	--	1.0	0.14	0.91 U	**0.98**	**1.1**	**0.84**	NA	NA	NA	0.11 U
Vanadium	144	39	130	180	31	33	31	25	NA	NA	NA	31
Zinc	32	2,400	120	680	**104**	13	**131**	**91**	NA	NA	NA	30
Total Petroleum Hydrocarbons (MG/KG)												
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 9-2
Subsurface Soil Detection and Exceedance Results
PI 6
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	VEP6-SO05		VEP6-SO06	VEP6-SO07	
Sample ID				VEP6-SB05-46-0309	VEP6-SB05P-46-0309	VEP6-SB06-46-0309	VEP6-SB07-46-0309	VEP6-SB07P-46-0309
Sample Date				03/11/09	03/11/09	03/11/09	03/05/09	03/05/09
Chemical Name								
Volatile Organic Compounds (UG/KG)								
No Detections	--	--	--	NA	NA	NA	ND	ND
Semivolatile Organic Compounds (UG/KG)								
Di-n-butylphthalate	--	610,000	9,200	NA	NA	NA	110 U	22 J
Pesticides (UG/KG)								
No Detections	--	--	--	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (UG/KG)								
No Detections	--	--	--	ND	ND	ND	NA	NA
Total Metals (MG/KG)								
Aluminum	35,000	7,700	55,000	NA	NA	NA	14,200	13,900
Arsenic	1.6	0.39	0.29	NA	NA	NA	0.62	0.56
Barium	147	1,500	82	NA	NA	NA	147	124
Beryllium	0.27	16	3.2	NA	NA	NA	0.20	0.20
Calcium	8,840	--	--	NA	NA	NA	2,000	2,000
Chromium	72	0.29	0.00083	NA	NA	NA	3.7	3.7
Cobalt	16	2.3	0.49	NA	NA	NA	4.8	4.2
Copper	66	310	46	NA	NA	NA	44	41
Iron	38,100	5,500	640	NA	NA	NA	16,000	15,000
Lead	3.3	400	27	NA	NA	NA	1.3	1.2
Magnesium	3,710	--	--	NA	NA	NA	1,920	1,860
Manganese	1,630	180	57	NA	NA	NA	453	390
Nickel	22	160	48	NA	NA	NA	1.7	1.5
Potassium	2,000	--	--	NA	NA	NA	719	727
Sodium	2,250	--	--	NA	NA	NA	178	169
Vanadium	144	39	180	NA	NA	NA	55	48
Zinc	32	2,400	680	NA	NA	NA	14	14

Notes:
NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 9-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PI-6
Media: Surface Soil, Subsurface Soil
Historical Function: Former PCB Storage Pad and Vehicle Wash Pad

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)	Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PI-6	7429-90-5	Aluminum	1.2E+04	1.22E+04	mg/kg	VEP6-SO07	1 / 1	1 / 1	4.72E+00 - 4.72E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	7440-38-2	Arsenic	7.4E-01	2.10E+00	mg/kg	VNTR-PI6-1	2 / 4	2 / 4	1.60E-01 - 1.60E-01	1.6E+00	Yes	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.1	5.4E-06
	7440-47-3	Chromium	3.2E+00	4.90E+00	mg/kg	VNTR-PI6-3	4 / 4	4 / 4	1.00E-01 - 1.00E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.00004	--
	7440-48-4	Cobalt	4.5E+00	5.20E+00	mg/kg	VEP6-SO07	3 / 4	3 / 4	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.2	1.4E-08
	7439-89-6	Iron	1.3E+04	1.25E+04	mg/kg	VEP6-SO07	1 / 1	1 / 1	1.28E+00 - 1.28E+00	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	4.7E+02	4.66E+02	mg/kg	VEP6-SO07	1 / 1	1 / 1	4.20E-01 - 4.20E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	Max	CNS	0.3	--
PI-6	7429-90-5	Aluminum	1.4E+04	1.4E+04	mg/kg	VEP6-SO07	1 / 1	1 / 1	3.78E+00 - 3.78E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	Max	CNS	0.2	--
Subsurface Soil	7440-38-2	Arsenic	6.2E-01	6.2E-01	mg/kg	VEP6-SO07	1 / 1	1 / 1	1.30E-01 - 1.30E-01	1.6E+00	No	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	3.7E+00	3.7E+00	mg/kg	VEP6-SO07	1 / 1	1 / 1	8.00E-02 - 8.00E-02	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	4.8E+00	4.8E+00	mg/kg	VEP6-SO07	1 / 1	1 / 1	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	1.6E+04	1.6E+04	mg/kg	VEP6-SO07	1 / 1	1 / 1	1.03E+00 - 1.03E+00	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.3	--
	7439-96-5	Manganese	4.5E+02	4.5E+02	mg/kg	VEP6-SO07	1 / 1	1 / 1	3.40E-01 - 3.40E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	5.5E+01	5.5E+01	mg/kg	VEP6-SO07	1 / 1	1 / 1	5.00E-02 - 5.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.1	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.4	5E-06
Groundwater	--	--
Total Risk	0.4	5E-06

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 9-4
Ecological Risk Assessment Screening Statistics for PI 6 Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Mercury	0.0392 - 0.1	2 / 4	0.0200	0.31	0.10	0.141	0.27	0.10	1 / 4	3.10	0.057	1 / 4	1.75	5.44	2.66	0.99900
Selenium	0.53 - 0.909	2 / 4	1.200	1.30	0.80	0.52	1.42	0.52	2 / 4	2.50	0.51	2 / 4	1.58	2.55	2.73	1.55
Zinc	-- - --	4 / 4	13.2	131.0	69.6	56.82	136.5	120.0	1 / 4	1.09	32.0	2 / 4	2.18	4.09	1.14	0.58

Legend

PI-6

ERI Notes:

- Probable treatment plant
- One of the buildings in southeast area may be a pump house

North

0 100 200 400 Feet

FIGURE 9-1
PI-6 1959 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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FIGURE 9-2
PI-6 1962 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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Legend

PI-6

North

0 100 200 400 Feet

FIGURE 9-3
PI-6 1964 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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Legend

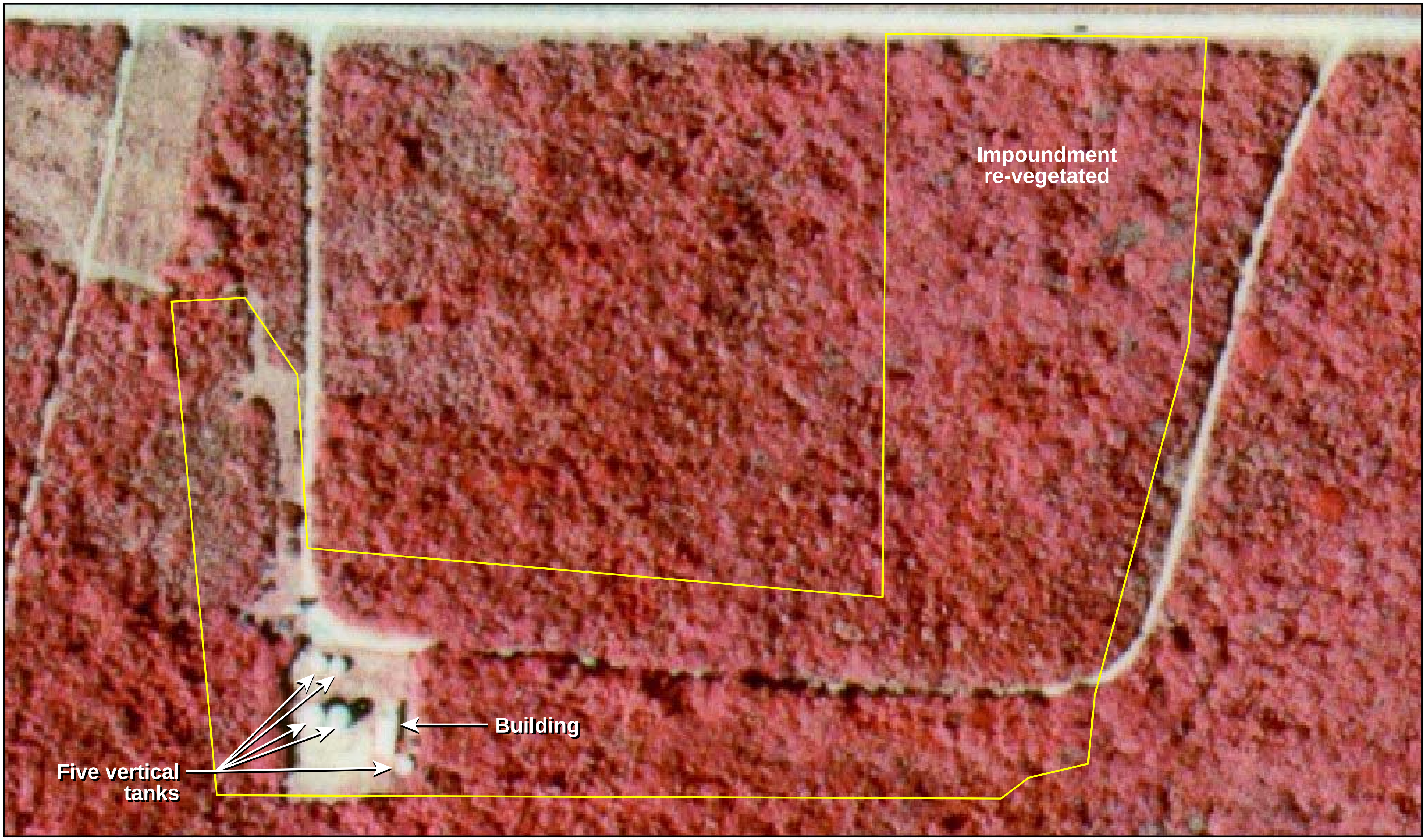
- PI-6
- SI/ESI Surface and Subsurface Soil Sampling Locations
- SI/ESI Surface Soil Sampling Locations
- EBS Surface Soil Sample Locations (PI6-1, 2, 3)
- EBS PCB Wipe Sample Locations (PBC1-6)

North

0 35 70 140 Feet

FIGURE 9-4
PI-6 Surface and Subsurface Soil Sample Locations
1983 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

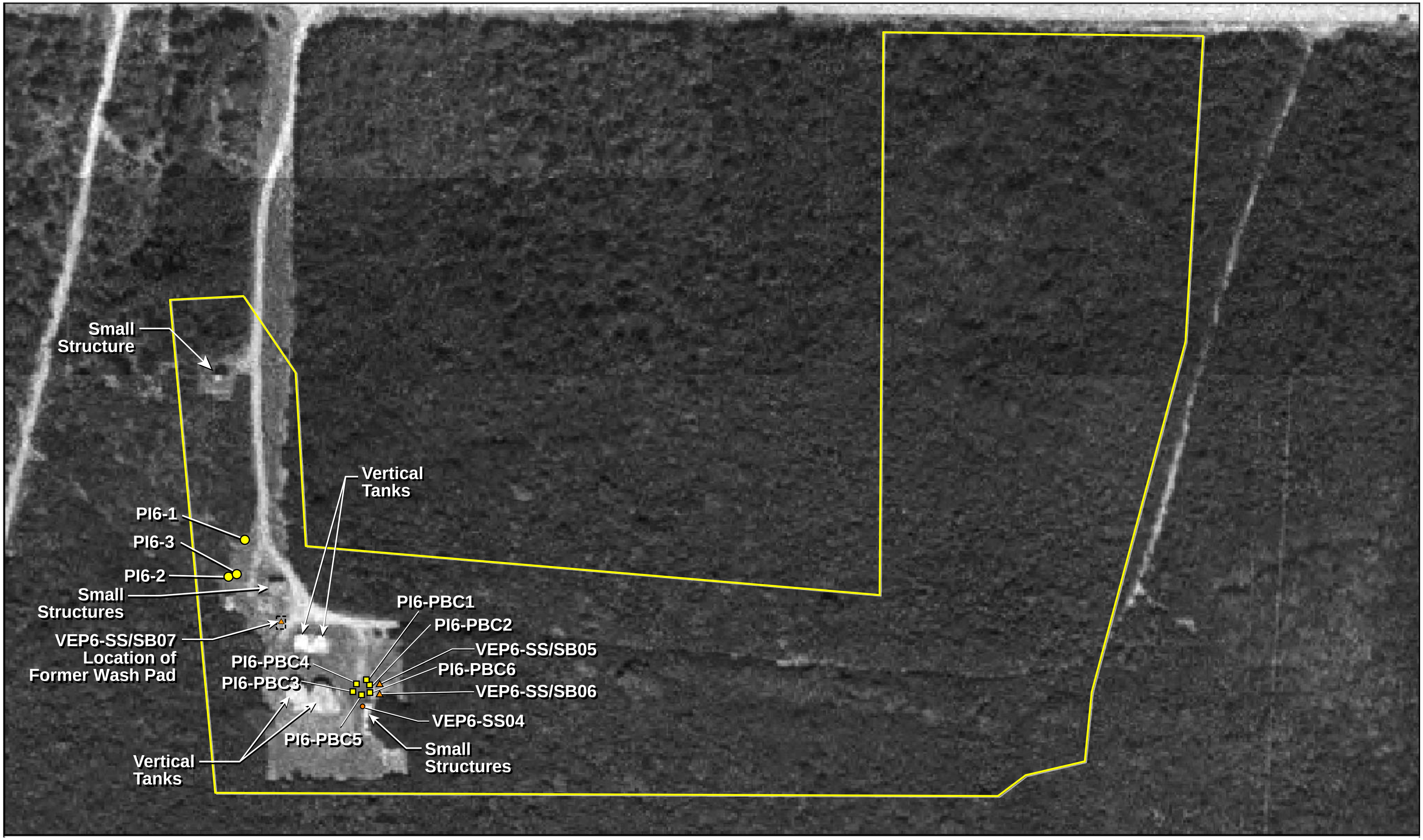
PI-6

North

0 100 200 400 Feet

FIGURE 9-5
PI-6 1985 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

- PI-6
- SI/ESI Surface and Subsurface Soil Sampling Locations
- SI/ESI Surface Soil Sampling Locations
- EBS Surface Soil Sample Locations (PI6-1, 2, 3)
- EBS PCB Wipe Sample Locations (PBC1-6)

North

0 100 200 400 Feet

FIGURE 9-6
PI-6 1994 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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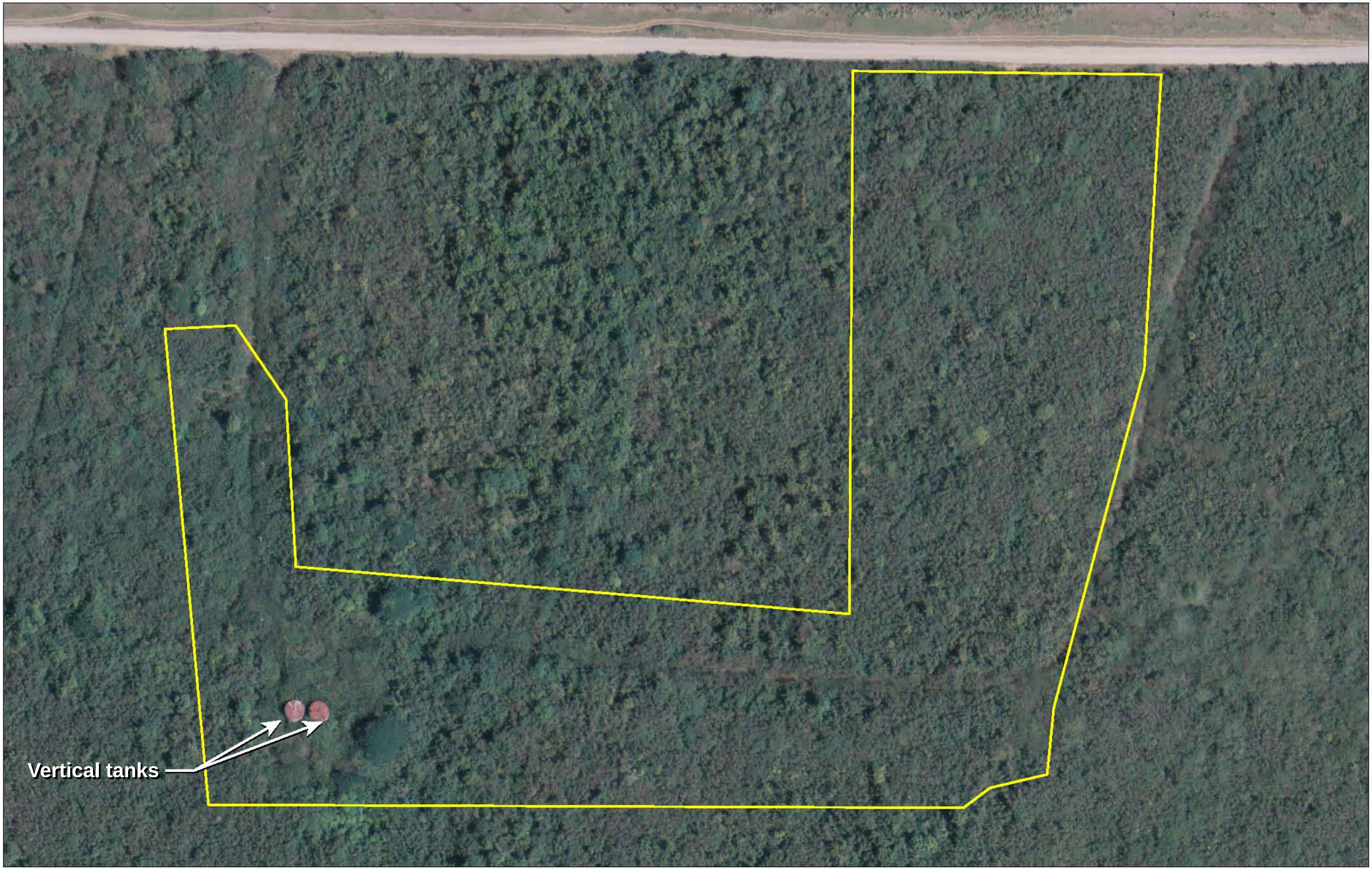
Legend

PI-6

0 100 200 400 Feet

FIGURE 9-7
PI-6 2005 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

PI-6

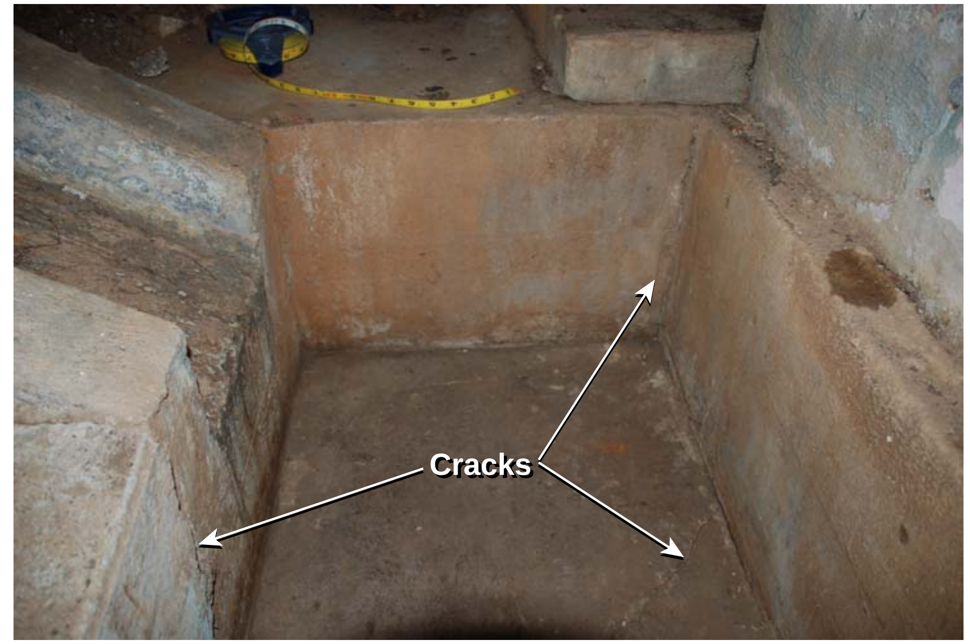
N
W
E
S

0 100 200 400
Feet

FIGURE 9-8
PI-6 2007 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

(A) Condition of pump house sump at time of sampling.



(B) First section, showing concrete trough on left, with cracks**.**

(C) Vertical crack with live root material.

(D) Second Section, showing leaf litter beneath cover.

(E) Second Section, (forward) covered. Third Section, with motors (back).

(F) Top view of third section, showing motor lodged within sump.

FIGURE 9-9
PI-6 Site Photographs
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

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SECTION 10

PI 8—Former Motor Pool Maintenance Area

This section presents a summary of the pertinent historical information and rationale for the no action determination for PI 8—Former Motor Pool Maintenance Area at the Former VNTR. A more detailed discussion of the PI 8 evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

10.1 Conceptual Site Model

10.1.1 Site Description and Potential Sources of Release

Records indicate that PI 8 was a motor pool maintenance area, car wash with water production well, oil drum storage and disposal area, drum storage area for asphalt emulsions (southwest portion of the site), and potentially an area for storage of hazardous materials and petroleum products. PI 8 is shown in a series of aerial photographs taken in 1959, 1962, 1964, 1970, 1985, 2005, and 2007 (**Figures 10-1 through 10-7**), including identification of features observed in aerial photographs, as reported by ERI (2000). Historical and SI sample locations are shown in **Figure 10-2**.

ERI conducted an analysis of the historical aerial photographs from 1959, 1962, 1964, 1970, and 1985 (ERI, 2000). ERI did not specifically label any of the features on the aerial photographs. Therefore, the locations of features labeled on them are best professional judgment based on the descriptions provided in the ERI report. The general observation made by ERI for PI 8 was that the site was used for vehicle and equipment maintenance and open storage of hazardous materials and petroleum products. Specifically, ERI identified open storage of vehicles, equipment, and multi-colored materials (some probably metallic). Additionally, several areas of staining were noted, as was light-toned material in the eastern portion of site. It is important to note that features identified by ERI on the aerial photographs are not necessarily accurate because ERI did not perform a site visit to substantiate those features, and their photographic analysis was done many years after the aerial photographs were taken. Further, site visits performed by the ERP Technical Subcommittee to various sites whose aerial photographs were reviewed by ERI did not confirm and, in some cases, refuted observations made by ERI (e.g., see the discussion of PI 20 in Section 7 of CH2M HILL [2009]).

During the EBS site visit (2002), dark colored soils were found in the center of the site, and a 5-ft by 8-ft area of construction debris, consisting of partially buried reinforced concrete, was also identified.

Two pipe valves were found during the ERP Technical Subcommittee site visit (January 2009). A 2.5-inch OD galvanized pipe was observed near the location of EBS sample PI8-2, and a second pipe valve structure was found west of SS/SB-11 when the Subcommittee team was walking back from SS-9 toward SS/SB-10. As noted previously, sample SS/SB08 was located immediately adjacent to the concrete structure around the observed valve near EBS sample PI8-2.

In accordance with the SAP, an attempt was made to ascertain the extent of the pipe and its probable past use. During the SI, the extent of the detectable piping starting from each valve location was obtained using a Schonstadt. From the vault adjacent to SS/SB08, a pipe runs east for about 21 ft, and another runs west for about 45 ft (**Figure 10-2**). At the other concrete pipe valve structure, one pipe runs north for about 65 ft, and a second pipe runs east for about 31 ft.

Photos were taken at each valve location and are included in **Figure 10-8**. The northernmost valve (adjacent to SS/SB-8) was imprinted with the words 'HAMMOND MADE IN USA 1 120 WSP 200WOG.' Photographic identification by a certified Professional Engineer concluded the valve was a 1-inch gate valve typically used for water service. The pipe material was identified as threaded galvanized steel, which is typically used for water service.

Based on the information presented above, the potential sources of a CERCLA-related release are the areas of potential staining associated with the motor pool maintenance area (central area of site), the potential drum storage area for asphalt emulsions (southwest portion of site), the area of probable metallic material (south-central portion of site), and the area of light-toned material and staining (southeast portion of site), as shown in **Figure 10-2**.

The location of the car wash and oil drum storage and disposal areas cannot be ascertained from historical aerial photographs, personnel interviews, or historical records review. However, their locations are likely consistent with the motor pool maintenance area or one of the other areas identified as a potential source area. Also, during periods of surface water runoff, any contamination released at the motor pool maintenance area may have been released to the adjacent drainage ditch that leads to PI 5 (**Figure 10-2**).

10.1.2 Investigation History

EBS Soil Sampling

During the EBS, four surface soil samples were collected (PI8-1 through PI8-4) in areas of the stained soil in the former motor pool maintenance area (**Figure 10-2**). The samples were analyzed for VOCs, SVOCs, pesticides, herbicides, PCBs, inorganics, TPH-DRO, and TPH-GRO.

SI Soil Sampling and Site Reconnaissance

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), five co-located surface soil and subsurface soil samples were collected in the central "stained" portion of the site (SS/SB05 through SS/SB08 and SS/SB14, as shown in **Figure 10-2**), including one (SS/SB14) immediately adjacent to EBS sample PI8-3 to verify the historical sample's VOC results and one (SS/SB08) adjacent to the concrete structure around the observed valve that has a metal pipe leading to it. All samples were analyzed for TCL VOCs, SVOCs, and PCBs; and TAL inorganics to determine if releases occurred in the "stained" areas of the motor pool maintenance areas observed in historic aerial photographs.

To determine if releases occurred from PI 8 to the adjacent drainage ditch that leads to PI 5, one surface soil sample was collected in the drainage ditch adjacent to the motor pool maintenance area (SS-09, as shown **in Figure 10-2**). The location of ditch sample SS-09 was placed during the ERP Technical Subcommittee site visit (2009) on the point bar (depositional) side at the bend in the ditch. The sample was analyzed for TCL VOCs, SVOCs, and PCBs; and TAL inorganics. No subsurface soil sample was collected at this location because refusal was reached at 2′ bgs.

To determine if there were releases from the area of probable metallic material observed in historic aerial photographs, two co-located surface soil and subsurface soil samples were collected in the south-central portion of the site (SS/SB10 and SS/SB11, as shown in **Figure 10-2**). These samples were analyzed for TAL inorganics.

Two co-located surface soil and subsurface soil samples were collected in the southeast portion of the site (SS/SB12 and SS/SB13, as shown in **Figure 10-2**). The samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics, to determine if there were releases in the area of light-toned material and staining observed in historic aerial photographs.

To determine if there were drums containing asphalt emulsion in the southwest portion of the site, the area show in **Figure 10-3** was traversed with a metal detector. No evidence of drums was found and, in accordance with the SAP, no samples were collected.

No PID readings above 0.0 ppm were observed in the soil borings; therefore, all subsurface soil samples were collected at default depths in accordance with the SAP. **Tables 10-1 and 10-2** summarize the constituents detected in PI 8 surface soil and subsurface soil samples, respectively, collected during the EBS (2002) and SI (2009). The tables also identify screening criteria exceedances.

10.1.3 Physical Setting

The site slopes very gently to the south, with the highest elevation at about 54 ft amsl, is heavily vegetated, and not maintained. The soil consists mostly of silty sands, sandy silts, sand, and gravels. The subsurface geology consists of alluvial deposits such as sand, silt, clay, gravel flood plain deposits, terrace deposits, and piedmont fan deposits, and igneous rocks composed primarily of granodiorite and quartz diorite. Groundwater likely exists with the fractured bedrock and flows in a southerly direction toward the coast. The closest water bodies topographically downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, approximately 0.75 miles to the south and southeast, respectively.

10.2 PI 8 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 10-1 and 10-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a motor pool maintenance area; car wash; oil drum storage and disposal area; and drum storage area for asphalt emulsions. Although surface soil samples were collected within the motor pool maintenance area during the EBS, the spatial distribution and depths were not sufficient to conclude no CERCLA-related release occurred or that a CERCLA-related release at this site has not resulted in contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Additional sample collection took place during the 2009 SI in accordance with the SI/ESI SAP. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

EBS (2002)

Although EBS data were not subject to third-party validation, the data still underwent some validation processes. The results of laboratory QA/QC samples were compared to limits specified by the analytical methodology and/or laboratory SOPs. At a minimum, these QA/QC samples included blanks, calibrations, and MS/MSDs. No QA/QC exceedances were noted. These historical data are available for used as reported.

SI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the EBS and SI, the following inorganics above the background UTLs and non-inorganics were detected by sampling event and by medium:

EBS (2002) Surface Soil

- VOCs: methylene chloride, toluene
- SVOCs: none detected
- Herbicides: 2,4,5-trichlorophenoxyacetic acid, 2,4,5-TP (Silvex)
- Pesticides: 4,4'-DDE, 4,4'-DDT, endrin
- PCBs : none detected
- Inorganics above background UTLs: arsenic, barium, chromium, cobalt, copper, lead, nickel, selenium, thallium, vanadium, and zinc
- TPHs: none detected

SI (2009) Surface Soil

- VOCs: none detected

- SVOCs: 2-methylnaphthalene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-Ethylhexyl)phthalate, carbazole, chrysene, dibenz(a,h)anthracene, di-n-butylphthalate, fluoranthene, indeno(1,2,3-cd)pyrene, pentachlorophenol, pyrene
- PCBs: aroclor-1260
- Inorganics above background UTLs: arsenic, calcium, cobalt, copper, lead, magnesium, selenium, thallium and zinc

SI (2009) Subsurface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, fluoranthene, pentachlorophenol
- PCBs: none detected
- Inorganics above background UTLs: calcium, cobalt, copper lead, magnesium, potassium and zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records of past releases PI 8. However, based on the potential source areas at PI 8 (e.g., former motor pool maintenance area, drum storage), it is assumed that the detected constituent groups other than pesticides/herbicides (i.e., VOCs, SVOCs, PCBs, and inorganics) are potentially attributable to CERCLA-related releases because they are all potentially associated with historical activities. During the EBS, several pesticides and herbicides were detected in the surface soil. However, the concentrations of the herbicides were low (with respect to human health and ecological screening values) and the concentrations of pesticides (**Table 10-1**) were comparable to concentrations of pesticides observed at other sites across east Vieques (Table O-1 of the Final SI/ESI Report (CH2M HILL, 2010)). For example, 4,4'-DDE and 4,4'-DDT were detected in PI 8 surface soil samples at concentrations between 62 μg/kg and 634 μg/kg (4,4'-DDE), and 57 μg/kg and 772 μg/kg (4,4'-DDT) which are similar to the concentrations detected at other sites across east Vieques (i.e., 0.08 μg/kg to 1,200 μg/kg for 4,4'-DDE; and 0.30 μg/kg to 990 μg/kg for 4,4'-DDT). This conclusion was concurred upon during the SI scoping process and, therefore, pesticide analysis was not conducted during the SI. Therefore, the EBS pesticide and herbicide data are not considered further in the decision analysis process. In addition, the thallium concentrations reported for samples collected during the EBS utilized a method that, although standard at the time, tended to provide falsely elevated results (see Section 1 of the Final SI/ESI Report (CH2M HILL, 2010)).The thallium data collected at PI 8 support this assertion. **Table 10-1** shows that no thallium was detected in the 10 surface soil samples collected during the SI, including the two samples immediately adjacent to EBS samples PI8-2 and PI8-3 (i.e., SS08 and SS14, respectively). Thallium concentrations of approximately 1 mg/kg were detected in all EBS samples. Based on this, the thallium results from the EBS are not considered further in the decision analysis process.

Based on the above, constituents (other than pesticides, herbicides, and thallium in EBS samples) detected as part of the EBS and SI are further considered in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by sampling event and medium.

EBS (2002) Surface Soil

- Methylene chloride: one detection (sample PI8-4) at a concentration (5.3 μg/kg) above the SSL at a DAF of 1 (1.3 μg/kg)
- Arsenic: one detection (sample PI8-1) at a concentration (1.7 mg/kg) above the RSL (0.39 mg/kg), the SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Lead: one detection (sample P18-2) at concentration (18 mg/kg) above the ecological soil screening value for birds and mammals (11 mg/kg) and background UTL (5.4 mg/kg).
- Selenium: four detections (samples PI8-1 through PI8-4) at concentrations (0.99 to 1.3 mg/kg) above the ecological soil screening value for plants and invertebrates (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg), and background UTL (0.51 mg/kg). Selenium also exceeded background and the ecological soil screening value for birds and mammals (0.63 mg/kg) at four stations (PI8-1 through PI8-4).

SI (2009) Surface Soil

- Benzo(a)anthracene: two detections (samples SS05 and SS08) at a concentrations (73 and 13 μg/kg, respectively) above the SSL at a DAF of 1 (10 μg/kg)
- Benzo(a)pyrene: one detection (sample SS05) at a concentration (120 μg/kg) above the RSL (15 μg/kg)
- Benzo(b)fluoranthene: one detection (sample SS05) at a concentration (390 μg/kg) above the RSL (150 μg/kg) and the SSL at a DAF of 1 (35 μg/kg)
- Dibenz(a,h)anthracene: one detection (sample SS05) at a concentration (80 μg/kg) above the RSL (15 μg/kg) and the SSL at a DAF of 1 (11 μg/kg)
- Indeno(1,2,3-cd)pyrene: one detection (sample SS05) at a concentration (480 μg/kg) above the RSL (150 μg/kg) and the SSL at a DAF of 1 (120 μg/kg)
- High molecular weight PAHs: one detection (sample SS05) at a concentration (1.503 μg/kg) above the ecological soil screening value for birds and mammals (1.10 μg/kg)
- Pentachlorophenol: one detection (sample SS05) at a concentration (60 μg/kg) above the SSL at a DAF of 1 (10 μg/kg)

- Aroclor-1260: one detection (sample SS06) at a concentration (53 µg/kg) above the SSL at a DAF of 1 (24 µg/kg). The detection of Aroclor 1260, which is considered bioaccumulative, is evaluated in Step 6 in the food web model for upper trophic level receptors.
- Arsenic: three detections (samples SS07, SS12 and SS13) at concentrations (2.3, 2.8 and 5.3 mg/kg, respectively) above the RSL (0.39 mg/kg), the SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Cobalt: one detection (Sample SS07) at a concentration (21 mg/kg) above the above the adjusted RSL (2.3 mg/kg), the ecological soil screening value for plants and invertebrates (13 mg/kg), the SSL at a DAF of 1 (0.49 mg/kg), and background UTL (16 mg/kg)
- Copper: three detections (samples SS06, SS07, SS10) at concentrations (73, 98, and 124 mg/kg, respectively) above the ecological soil screening value for birds and mammals (28 mg/kg), the SSL at a DAF of 1 (46 mg/kg), and background UTL (66 mg/kg). Copper also exceeded background and the ecological soil screening value for plants and invertebrates (70 mg/kg) in three samples (SS06, SS07, SS10).
- Lead: four detections (samples SS05, SS06, SS07 and SS11) at concentrations (34, 41, 77, and 15 mg/kg, respectively) above the ecological soil screening value for birds and mammals (11 mg/kg) and SSL at a DAF of 1 (27 mg/kg by SS05, SS06, SS07 only) and background UTL (5.4 mg/kg)
- Selenium: one detection (sample SS13) at a concentration (0.70 mg/kg) above the ecological soil screening value for plants and invertebrates (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg), and background UTL (0.51 mg/kg). Selenium also exceeded background and the ecological soil screening value for birds and mammals (0.63 mg/kg) at one station (SS13).
- Zinc: two detections (samples SS06 and SS07) at a concentrations (47 and 263 mg/kg) above the ecological soil screening value for birds and mammals (46 mg/kg) and background UTL (32 mg/kg). Zinc also exceeded background and the ecological soil screening value for plants and invertebrates (120 mg/kg) in one sample (SS07).

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- Pentachlorophenol: one detection (sample SB07) at a concentration (34 µg/kg) above the SSL at a DAF of 1 (10 µg/kg)
- Cobalt: one detection (sample SB12) at a concentration (17 mg/kg) above the adjusted RSL (2.3 mg/kg), the SSL at a DAF of 1 (0.49 mg/kg), and background UTL (16 mg/kg)
- Copper: two detections (samples SB08 and SB10) at concentrations (77 and 73 mg/kg, respectively) above the SSL at a DAF of 1 (46 mg/kg) and background (KTd) UTL (66 mg/kg). Additionally, two detections (samples SB12 and SB13) at concentrations (82 and 60 mg/kg, respectively) above the SSL at a DAF of 1 (46 mg/kg) and background (Qa) UTL (53 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at PI 8. The site is approximately 22 acres in size whereas a residential lot may be approximately ¾ acre. However, no chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 10-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Six constituents were detected in surface soil or subsurface soil samples above the human health screening levels and background (for inorganics): benzo(a)pyrene (B[a]P), benzo(b)fluoranthene (B[b]F), dibenz(a,h)anthracene (D[a,h]A), indeno(1,2,3-cd)pyrene (I[123-cd]P, arsenic, and cobalt (see **Table 10-3**).

- B(a)P was detected in 1 of 11 surface soil samples above its RSL (15 µg/kg), at a concentration of 120 µg /kg. B(a)P was not detected in any other surface or subsurface soil sample. Based on the maximum detected concentration, the ELCR is 8 x 10^{-6}, which is within the EPA acceptable range, and B(a)P would not be identified as a risk driver.
- B(b)F was detected in 1 of 11 surface soil samples above its RSL (150 µg /kg), at a concentration of 390 µg /kg. Based on the maximum detected concentration, the ELCR is 3 x 10^{-6}, which is within the EPA acceptable range, and B(b)F would not be identified as a risk driver.
- D(a,h)A was detected in 1 of 11 surface soil samples above its RSL (15 µg /kg), at a concentration of 80 µg /kg. Based on the maximum detected concentration, the ELCR is 5 x 10^{-6}, which is within the EPA acceptable range, and D(a,h)A would not be identified as a risk driver.
- I(123-cd)P was detected in 1 of 11 surface soil samples above its RSL (150 µg /kg), at a concentration of 480 µg /kg. Based on the maximum detected concentration, the ELCR is 3 x 10^{-6}, which is within the EPA acceptable range, and I(123-cd)P would not be identified as a risk driver.

- Arsenic was detected in 4 of 14 surface soil samples (and no subsurface soil samples) above its background UTL and RSL (0.39 mg/kg), at a maximum concentration of 5.3 mg/kg. Based on the maximum detected concentration, the ELCR is 1×10^{-5} and the HI is 0.2, which are within EPA acceptable levels, and arsenic would not be identified as a risk driver.
- Cobalt was detected in 1 of 14 surface soil samples and 1 of 9 subsurface soil samples above its background UTL and adjusted RSL (2.3 mg/kg), at a maximum concentration of 21 mg/kg. Based on the maximum detected concentration, the ELCR is 6×10^{-8} and the HI is 0.9, which are within EPA acceptable levels, and cobalt would not be identified as a risk driver.

Five additional constituents (aluminum, chromium, iron, manganese, and vanadium) were detected in soil above human health screening levels but below background UTLs. Based on the historical source of potential releases identified at the site (see Section 10.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. The maximum detected concentrations of B(a)A, B(b)F, D(a,h)A, I(1,2,3-cd)P, arsenic, cobalt, chromium, iron, and vanadium, and the 95 percent upper confidence limit (UCL) on the average concentrations of aluminum and manganese were used to calculate cumulative risk estimates. As an initial screening approach, the maximum detected concentrations of aluminum and manganese were used to calculate risk estimates; however, because the screening risk estimates exceeded EPA acceptable levels, 95 percent UCL calculations were used for these two constituents; UCL calculations are provided in Appendix S of the Final SI/ESI Report (CH2M HILL, 2010). The cumulative ELCR is 3×10^{-5} and the maximum target organ-specific HI is 0.9 (see **Table 10-3**). Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 1×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Based on site size and habitat characteristics, exposure of bioaccumulative chemicals to upper trophic level receptors (birds and mammals) was considered in addition to direct exposure of all detected chemicals to soil organisms (plants and invertebrates). Accordingly, the results of screening value exceedances for each of these receptor groups are evaluated. Five inorganics (cobalt, copper, lead, selenium, and zinc) exceeded ecological screening values and background UTLs in at least one surface soil sample collected at the site (**Table 10-1**). High molecular weight PAHs (HMW PAHs) were also detected above the screening value. Aroclor 1260 was detected below the screening value but is a bioaccumulative chemical that is retained for food web evaluation.

Cobalt, copper, selenium, and zinc exceeded soil screening values for soil organisms (plants and invertebrates). None of these constituents poses an unacceptable risk to plants and invertebrates based upon the following:

- Cobalt exceeds background and the ecological screening value for soil organisms in 1 of 14 samples across the site, at a maximum HQ of 1.63 (**Table 10-4**). The mean cobalt concentration (9.56 mg/kg) is less than the ecological screening value for soil organisms (13 mg/kg).
- Copper exceeds background and the ecological screening value for soil organisms in 3 of 14 samples across the site, with a maximum HQ of 1.77 (**Table 10-4**). However, the mean HQ (0.81) was less than 1.
- Selenium exceeded the ecological screening value for soil organisms in 5 of 14 samples at a maximum HQ of 2.50 (**Table 10-4**). Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the East Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at PI 8 (maximum of 1.3 mg/kg) may be within the range of background. Further, the screening value (0.52 mg/kg) is based upon potential impacts to plants. The site is heavily vegetated, with no apparent impacts to the terrestrial plant community. Concentrations are less than soil screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates).
- Zinc exceeded the ecological screening value in only 1 of 14 samples at a maximum HQ of 2.19 (**Table 10-4**). However, the mean HQ (0.38) was less than 1.

Copper, lead, selenium, zinc, and HWM PAHs exceeded soil screening values (Eco SSLs) protective of upper trophic level organisms. Aroclor 1260 is a detected bioaccumulative chemical which had no screening value for birds and mammals. None of these constituents poses an unacceptable risk to birds and mammals based upon the following:

- Copper exceeded the Eco SSL for birds (28 mg/kg) in 3 of 14 samples. Food web HQs (and calculations) based upon maximum (screening) and mean (baseline) chromium exposure doses for each target receptor are listed in **Tables 10-5 through 10-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Therefore, copper does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- Lead exceeded background and the Eco SSL for birds (11 mg/kg) in 5 of 14 samples. Food web HQs and calculations for each target receptor are listed in **Tables 10-5 through 10-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Therefore, lead does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- Selenium exceeded background and the Eco SSL for mammals (0.63 mg/kg) in 5 of 14 samples. Food web HQs and calculations for each target receptor are listed in **Tables 10-5 through 10-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat and Indian mongoose. However, the mean exposure dose HQs were less than one for all receptors. Therefore, selenium does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- Zinc exceeded background and the Eco SSL for birds (46 mg/kg) in 2 of 14 samples. Food web HQs and calculations for each target receptor are listed in **Tables 10-5 through 10-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Therefore, zinc does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- HMW PAHs exceeded the Eco SSL for mammals (1.10 mg/kg) in 1 of 12 samples. HMW PAHs consist of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene, each of which was evaluated in the food web models. Food web HQs and calculations for each target receptor are listed in **Tables 10-5 through 10-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs did not exceed one for any of the receptors. Therefore, HMW PAHs do not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- Aroclor 1260 was detected in 1 of 10 samples at a concentration of 53 µg/kg. Food web HQs and calculations for each target receptor are listed in **Tables 10-5 through 10-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs did not exceed one for any of the receptors. Therefore, Aroclor 1260 does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Seven organic constituents (methylene chloride (MC), benzo(a)anthracene (B[a]A), B[b]F, D[a,h]A, I[123cd]P, pentachlorophenol (PCP), and aroclor-1260) were detected in surface soil at concentrations above the SSL at a DAF of 1. Of these, only PCP was detected in subsurface soil above the SSL at a DAF of 1. Further, MC, D(a,h)A, I(123cd)P, and aroclor-1260 were not detected in subsurface soil. This suggests the SSL at a DAF of 1 is not an accurate predictor of leaching to groundwater, which is supported by soil/groundwater data collected at various east Vieques sites (e.g., see PI 4, SWMU 10, etc.). At a DAF of 9, neither of the PCP detections exceeds the SSL.

Five inorganics (arsenic, cobalt, copper, lead, and selenium) were detected in surface soil at concentrations above the SSLs at a DAF of 1 and background UTLs. However, of these, only cobalt and copper were detected in subsurface soil at concentrations above the SSL at a DAF of 1 and background. However, all of the cobalt concentrations, including the two cobalt concentrations (21 mg/kg in surface soil and 17 mg/kg in subsurface soil) above the SSL at a DAF of 1, are likely attributable to background (16 mg/kg). Further, none of the copper concentrations exceeds the SSL at a DAF of 3.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases include the areas of potential staining associated with the motor pool maintenance area, the area of probable metallic material, and the area of light-toned material and staining. The information also suggests runoff from the former motor pool maintenance area may have entered the drainage ditch along the western site boundary. Based on this information, soil samples were collected at each of these areas. Therefore, the spatial distribution of the samples collected during the SI and resulting data indicate the potential source area has been sufficiently characterized.

10.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PI 8 that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Further, the data for the sample collected within the ditch suggest it is unlikely contaminated runoff impacted the ditch (i.e., there were no screening value exceedances for this sample). Therefore, no action is warranted for PI 8.

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Table 10-1
Surface Soil Detection and Exceedance Results
PI 8
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd) †	Background UTL (Qa) †	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VNTR-PI8-1	VNTR-PI8-2	VNTR-PI8-3		VNTR-PI8-4	VEP8-SO05	VEP8-SO06	VEP8-SO07		VEP8-SO08	VEP8-SO09
Sample ID						VNTR-PI8-1	VNTR-PI8-2	VNTR-PI8-3	VNTR-PI8-3D	VNTR-PI8-4	VEP8-SS05-01-0209	VEP8-SS06-01-0209	VEP8-SS07-01-0209	VEP8-SS07P-01-0209	VEP8-SS08-01-0209	VEP8-SS09-01-0209
Sample Date						12/12/02	12/12/02	12/12/02	12/12/02	12/12/02	02/19/09	02/19/09	02/20/09	02/20/09	02/19/09	02/20/09
Chemical Name																
Volatile Organic Compounds (UG/KG)																
Methylene chloride	--	--	11,000	1,250	1.3	5.0 U	5.0 U	5.0 U	5.0 U	**5.3**	26 UJ	28 U	43 U	36 U	29 U	26 U
Toluene	--	--	500,000	40,000	690	6.9	5.0 U	22	13	7.1	5.0 U	6.0 UJ	9.0 UJ	7.0 U	6.0 U	5.0 UJ
Semivolatile Organic Compounds (UG/KG)																
2-Methylnaphthalene	--	--	31,000	--	750	666 U	333 U	333 U	333 U	333 U	22 UJ	8.2 J	28 U	27 U	26 UJ	21 U
Acenaphthylene	--	--	340,000	--	22,000	666 U	333 U	333 U	333 U	333 U	3.7 J	21 UJ	28 U	27 U	26 UJ	21 U
Anthracene	--	--	1,700,000	--	360,000	666 U	333 U	333 U	333 U	333 U	5.9 J	21 UJ	2.9 J	2.4 J	26 UJ	21 U
Benzo(a)anthracene	--	--	150	--	10	666 U	333 U	333 U	333 U	333 U	**73 J**	21 UJ	7.8 J	7.5 J	**13 J**	6.3 J
Benzo(a)pyrene	--	--	15	--	240	666 U	333 U	333 U	333 U	333 U	**120 J**	21 UJ	28 U	27 U	26 UJ	21 U
Benzo(b)fluoranthene	--	--	150	--	35	666 U	333 U	333 U	333 U	333 U	**390**	21 UJ	28 U	27 U	26 UJ	21 U
Benzo(g,h,i)perylene	--	--	170,000	--	120,000	666 U	333 U	333 U	333 U	333 U	110 J	21 UJ	14 J	12 J	26 UJ	21 UJ
Benzo(k)fluoranthene	--	--	1,500	--	350	666 U	333 U	333 U	333 U	333 U	98 J	21 UJ	28 UJ	27 UJ	26 UJ	21 UJ
bis(2-Ethylhexyl)phthalate	--	--	35,000	30,000	1,400	666 U	333 U	333 U	333 U	333 U	110 R	100 R	49 J	140 UJ	130 R	100 UJ
Carbazole	--	--	24,000	--	--	NA	NA	NA	NA	NA	4.6 J	21 UJ	28 UJ	27 UJ	5.0 J	21 UJ
Chrysene	--	--	15,000	--	1,100	666 U	333 U	333 U	333 U	333 U	80 J	21 UJ	4.8 J	5.4 J	26 UJ	3.4 J
Dibenz(a,h)anthracene	--	--	15	--	11	666 U	333 U	333 U	333 U	333 U	**80 J**	21 UJ	28 U	27 U	26 R	21 U
Di-n-butylphthalate	--	--	610,000	40,000	9,200	666 U	333 U	333 U	333 U	333 U	110 UJ	27 J	140 UJ	140 UJ	130 UJ	42 J
Fluoranthene	--	--	230,000	--	160,000	666 U	333 U	333 U	333 U	333 U	38 J	21 UJ	6.1 J	5.7 J	7.1 J	4.4 J
Indeno(1,2,3-cd)pyrene	--	--	150	--	120	666 U	333 U	333 U	333 U	333 U	**480**	21 UJ	28 U	27 U	26 R	10 J
PAH HMW (Total)	--	--	--	1,100	--	0 U	0 U	0 U	0 U	0 U	**1,503**	0 U	27	25	21	23
PAH LMW (Total)	--	--	--	29,000	--	0 U	0 U	0 U	0 U	0 U	48	8.0	9.0	8.0	7.0	4.0
Pentachlorophenol	--	--	3,000	2,100	10.0	1,666 U	833 U	833 U	833 U	833 U	**60 J**	100 R	140 UJ	140 UJ	130 R	100 UJ
Pyrene	--	--	170,000	--	120,000	666 U	333 U	333 U	333 U	333 U	72 J	21 UJ	28 UJ	27 UJ	7.8 J	3.2 J
Herbicides (UG/KG)																
2,4,5-Trichlorophenoxyacetic acid	--	--	61,000	--	150	23	10 U	10 U	57	10 U	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	--	--	49,000	--	28	**73**	10 U	10 U	10 U	10 U	NA	NA	NA	NA	NA	NA
Pesticides (UG/KG)																
4,4'-DDE	--	--	1,400	21	47	**363**	**634**	**159**	**62**	**147**	NA	NA	NA	NA	NA	NA
4,4'-DDT	--	--	1,700	21	67	**411**	**772**	**59**	**59**	**57**	NA	NA	NA	NA	NA	NA
Endrin	--	--	1,800	1.95	81	66 U	**112**	17 U	17 U	17 U	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (UG/KG)																
Aroclor-1260	--	--	220	8,000	24	33 U	33 U	33 U	33 U	33 U	18 U	**53 J**	24 U	23 U	22 U	18 U
Total Metals (MG/KG)																
Aluminum	35,000	35,000	7,700	--	55,000	NA	NA	NA	NA	NA	15,800	13,700	30,200	29,200	23,600	9,050
Antimony	5.8	5.8	3.1	0.27	0.27	40 U	5.8 U	4.6 U	4.5 U	5.3 U	0.56 J	0.19 J	0.94 J	0.93 J	0.21 J	0.060 J
Arsenic	1.6	1.6	0.39	18	0.29	**1.7**	0.96 U	0.76 U	0.75 U	0.88 U	1.2	1.1	**2.3**	**2.3**	0.64	0.50
Barium	147	212	1,500	330	82	44	61	67	63	59	56	53	97	88	61	30
Beryllium	0.27	0.27	16	21	3.2	0.40 U	0.48 U	0.38 U	0.37 U	0.44 U	0.16 J	0.14 J	0.26	0.25	0.20 J	0.10
Cadmium	2.2	2.2	7.0	0.36	0.38	0.40 U	0.48 U	0.38 U	0.37 U	0.44 U	0.28	0.56	0.74	0.66	0.11 U	0.061 U
Calcium	8,840	11,900	--	--	--	NA	NA	NA	NA	NA	**13,200**	**17,000**	**25,400**	**26,100**	**11,500**	7,470
Chromium	72	72	0.29	26	0.00083	11	16	15	15	12	17	12	25	26	19	12
Cobalt	16	16	2.3	13	0.49	7.6	9.2	10	8.1	7.6	12	11	**21**	**20**	11	6.9
Copper	66	53	310	28	46	49	53	51	47	43	60 J	**73 J**	**98 J**	**95 J**	63 J	30 J
Iron	38,100	38,100	5,500	--	640	NA	NA	NA	NA	NA	25,800	26,700	37,000	34,500	28,500	18,000
Lead	5.4	5.4	400	11	27	**9.9**	**18**	**9.1**	3.9	3.6	**34**	**41**	**77**	**70**	**7.1**	3.3
Magnesium	3,710	22,200	--	--	--	NA	NA	NA	NA	NA	**5,500**	**7,190**	**10,800**	**10,900**	**4,260**	2,890
Manganese	1,630	1,630	180	220	57	NA	NA	NA	NA	NA	483	436	779	731	526	246
Mercury	0.057	0.057	0.78	0.10	0.57	0.10 U	0.067 U	0.053 U	0.069 U	0.077 U	0.035 U	0.032 U	0.046 U	0.044 U	0.041 U	0.024 U
Nickel	22	22	160	38	48	7.0	7.4	6.0	6.0	5.1	7.6	5.4	14	14	9.6	3.8
Potassium	5,270	5,270	--	--	--	NA	NA	NA	NA	NA	1,640	831	2,660 J	2,560 J	1,320	961 J
Selenium	0.51	0.51	39	0.52	0.26	**0.99**	**1.3**	**1.2**	**1.0**	**1.1**	0.17 J	0.49 U	0.67 U	0.52 U	0.57 U	0.14 J
Silver	0.22	0.22	39	4.2	1.6	0.79 U	0.96 U	0.76 U	0.75 U	0.88 U	0.097 U	0.098 U	0.13 U	0.10 U	0.11 U	0.020 J
Sodium	1,590	1,590	--	--	--	NA	NA	NA	NA	NA	260	339	505 J	537 J	326	167 J
Thallium	0.13	0.13	--	1.0	0.14	**1.0**	**1.3**	**1.2**	**1.0**	**0.99**	0.19 U	0.20 U	0.13 U	0.10 U	0.22 U	0.061 U
Vanadium	144	144	39	7.8	180	68	78	83	81	71	82	77	116	111	89	68
Zinc	32	32	2,400	46	680	31	**41**	28	23	22	**45 J**	**47 J**	**263**	**223**	30 J	15
Total Petroleum Hydrocarbons (MG/KG)																
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram
† For Background (Surface) UTL KTd values were used for PI8-1 through PI1-4, SO05-SO11, and SO14; Qa values were used for SO12 and SO13.

Table 10-1
Surface Soil Detection and Exceedance Results
PI 8
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd) †	Background UTL (Qa) †	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VEP8-SO10	VEP8-SO11	VEP8-SO12	VEP8-SO13	VEP8-SO14
Sample ID						VEP8-SS10-01-0209	VEP8-SS11-01-0209	VEP8-SS12-01-0209	VEP8-SS13-01-0209	VEP8-SS14-01-0209
Sample Date						02/11/09	02/11/09	02/18/09	02/18/09	02/23/09
Chemical Name										
Volatile Organic Compounds (UG/KG)										
Methylene chloride	--	--	11,000	1,250	1.3	NA	NA	23 UJ	24 UJ	28 U
Toluene	--	--	500,000	40,000	690	NA	NA	5.0 U	5.0 U	6.0 U
Semivolatile Organic Compounds (UG/KG)										
2-Methylnaphthalene	--	--	31,000	--	750	NA	NA	21 UJ	22 UJ	21 U
Acenaphthylene	--	--	340,000	--	22,000	NA	NA	21 UJ	22 UJ	21 U
Anthracene	--	--	1,700,000	--	360,000	NA	NA	21 UJ	22 UJ	21 U
Benzo(a)anthracene	--	--	150	--	10	NA	NA	21 UJ	9.3 J	5.3 J
Benzo(a)pyrene	--	--	15	--	240	NA	NA	21 UJ	22 UJ	21 U
Benzo(b)fluoranthene	--	--	150	--	35	NA	NA	21 UJ	22 UJ	21 U
Benzo(g,h,i)perylene	--	--	170,000	--	120,000	NA	NA	21 UJ	22 UJ	4.7 J
Benzo(k)fluoranthene	--	--	1,500	--	350	NA	NA	21 UJ	22 UJ	21 UJ
bis(2-Ethylhexyl)phthalate	--	--	35,000	30,000	1,400	NA	NA	130 U	120 R	110 UJ
Carbazole	--	--	24,000	--	--	NA	NA	21 UJ	22 UJ	21 UJ
Chrysene	--	--	15,000	--	1,100	NA	NA	21 UJ	22 UJ	1.9 J
Dibenz(a,h)anthracene	--	--	15	--	11	NA	NA	21 UJ	22 UJ	21 U
Di-n-butylphthalate	--	--	610,000	40,000	9,200	NA	NA	100 UJ	110 UJ	110 UJ
Fluoranthene	--	--	230,000	--	160,000	NA	NA	21 UJ	22 UJ	20 U
Indeno(1,2,3-cd)pyrene	--	--	150	--	120	NA	NA	21 UJ	22 UJ	12 J
PAH HMW (Total)	--	--	--	1,100	--	NA	NA	0 U	9.0	24
PAH LMW (Total)	--	--	--	29,000	--	NA	NA	0 U	0 U	0 U
Pentachlorophenol	--	--	3,000	2,100	10.0	NA	NA	100 R	110 R	110 UJ
Pyrene	--	--	170,000	--	120,000	NA	NA	21 UJ	22 UJ	21 UJ
Herbicides (UG/KG)										
2,4,5-Trichlorophenoxyacetic acid	--	--	61,000	--	150	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	--	--	49,000	--	28	NA	NA	NA	NA	NA
Pesticides (UG/KG)										
4,4'-DDE	--	--	1,400	21	47	NA	NA	NA	NA	NA
4,4'-DDT	--	--	1,700	21	67	NA	NA	NA	NA	NA
Endrin	--	--	1,800	1.95	81	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (UG/KG)										
Aroclor-1260	--	--	220	8,000	24	NA	NA	NA	NA	18 U
Total Metals (MG/KG)										
Aluminum	35,000	35,000	7,700	--	55,000	23,100	19,700	10,100	11,400	11,800
Antimony	5.8	5.8	3.1	0.27	0.27	0.26	0.28	0.10 J	0.099 UJ	0.58 J
Arsenic	1.6	1.6	0.39	18	0.29	0.58	0.68	**2.8**	**5.3**	0.39
Barium	147	212	1,500	330	82	73	65	47	21	46
Beryllium	0.27	0.27	16	21	3.2	0.19	0.18	0.11 J	0.090 J	0.12
Cadmium	2.2	2.2	7.0	0.36	0.38	0.12	0.11	0.095 U	0.099 U	0.10
Calcium	8,840	11,900	--	--	--	8,390	**9,400**	**130,000**	**191,000**	**11,200**
Chromium	72	72	0.29	26	0.00083	21	21	12	15	15
Cobalt	16	16	2.3	13	0.49	11	11	5.1	3.4	8.6
Copper	66	53	310	28	46	**124**	59	42 J	16 J	31 J
Iron	38,100	38,100	5,500	--	640	31,000	26,600	14,200	10,900	19,000
Lead	5.4	5.4	400	11	27	**6.7 J**	**15 J**	3.2	1.2	**6.6**
Magnesium	3,710	22,200	--	--	--	**4,700**	**4,420**	**34,100**	**45,200**	2,430
Manganese	1,630	1,630	180	220	57	545	562	303	197	515
Mercury	0.057	0.057	0.78	0.10	0.57	0.010 J	0.043 U	0.033 U	0.033 U	0.025 U
Nickel	22	22	160	38	48	8.0	8.5	5.2	5.7	4.9
Potassium	5,270	5,270	--	--	--	1,530	1,520	1,110	1,200	829 J
Selenium	0.51	0.51	39	0.52	0.26	0.50 U	0.44 U	0.46 J	**0.70**	0.13 J
Silver	0.22	0.22	39	4.2	1.6	0.10 U	0.087 U	0.095 U	0.099 U	0.030 J
Sodium	1,590	1,590	--	--	--	212 J	235 J	270	252	139 J
Thallium	0.13	0.13	--	1.0	0.14	0.10 U	0.087 U	0.19 U	0.20 U	0.069 U
Vanadium	144	144	39	7.8	180	107	98	51	39	75
Zinc	32	32	2,400	46	680	**37**	**35**	18 J	13 J	22
Total Petroleum Hydrocarbons (MG/KG)										
No Detections	--	--	--	--	--	NA	NA	NA	NA	NA

Notes:

- Exceeds Background UTL
- Exceeds Background UTL and Adjusted RSL for Residential Soil
- Exceeds Background UTL and ECO (E)
- Exceeds Background UTL and SSL (DAF=1)
- Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
- Exceeds Background UTL, ECO (E) and SSL (DAF=1)
- Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram
† For Background (Surface) UTL KTd values were used for PI8-1 through PI1-4, SO05-SO11, and SO14; Qa values were used for SO12 and SO13.

Table 10-2
Subsurface Soil Detection and Exceedance Results
PI 8
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd) †	Background UTL (Qa) †	Adjusted RSL for Residential Soil	SSL (DAF=1)	VEP8-SO05	VEP8-SO06	VEP8-SO07	VEP8-SO08	VEP8-SO10		VEP8-SO11	VEP8-SO12	VEP8-SO13		VEP8-SO14
Sample ID					VEP8-SB05-46-0209	VEP8-SB06-46-0209	VEP8-SB07-46-0209	VEP8-SB08-46-0209	VEP8-SB10-46-0209	VEP8-SB10P-46-0209	VEP8-SB11-46-0209	VEP8-SB12-46-0209	VEP8-SB13-46-0209	VEP8-SB13P-46-0209	VEP8-SB14-46-0209
Sample Date					02/19/09	02/19/09	02/20/09	02/19/09	02/11/09	02/11/09	02/11/09	02/18/09	02/18/09	02/18/09	02/23/09
Chemical Name															
Volatile Organic Compounds (UG/KG)															
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)															
Benzo(a)anthracene	--	--	150	10	10 J	8.6 J	6.1 J	24 UJ	NA	NA	NA	22 UJ	22 UJ	24 UJ	24 U
Benzo(b)fluoranthene	--	--	150	35	11 J	21 UJ	25 U	24 UJ	NA	NA	NA	22 UJ	22 UJ	24 UJ	24 U
Benzo(g,h,i)perylene	--	--	170,000	120,000	11 J	21 UJ	3.0 J	24 UJ	NA	NA	NA	22 UJ	22 UJ	24 UJ	24 UJ
Fluoranthene	--	--	230,000	160,000	23 UJ	21 UJ	2.8 J	24 UJ	NA	NA	NA	22 UJ	22 UJ	24 UJ	24 UJ
Pentachlorophenol	--	--	3,000	10	110 R	100 R	**34 J**	120 R	NA	NA	NA	110 R	110 R	120 R	120 UJ
Pesticides (UG/KG)															
No Detections	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (UG/KG)															
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	ND
Total Metals (MG/KG)															
Aluminum	35,000	35,000	7,700	55,000	14,100	7,030	23,500	22,400	25,100	26,900	10,200	24,200	19,000	21,400	11,900
Antimony	5.8	5.8	3.1	0.27	0.11 UJ	0.088 UJ	0.37 J	0.16 J	0.040 J	0.060 J	0.030 J	0.10 UJ	0.096 UJ	0.10 UJ	0.050 J
Arsenic	1.6	1.6	0.39	0.29	0.52 J	0.25 J	0.77	0.70	0.56 J	0.45 J	1.1	0.57	1.3	1.5	0.46 J
Barium	147	212	1,500	82	47	31	68	83	76	92	42	107	84	84	94
Beryllium	0.27	0.27	16	3.2	0.13 J	0.080 J	0.18	0.21 J	0.22	0.22	0.098 U	0.24 J	0.18 J	0.20 J	0.13
Cadmium	2.2	2.2	7.0	0.38	0.14	0.088 U	0.42	0.12	0.13 U	0.10 U	0.098 U	0.10 U	0.10	0.18	0.10 U
Calcium	8,840	11,900	--	--	4,700	2,420	**19,100**	7,520	4,080	4,100	3,760	4,890	**71,800**	**79,000**	4,770
Chromium	72	72	0.29	0.00083	15	11	24	28	26	27	19	24	18	19	19
Cobalt	16	16	2.3	0.49	9.5	6.3	11	15	12	12	8.0	**17**	9.7	12	14
Copper	66	53	310	46	53 J	22 J	**66 J**	**77 J**	**72**	**73**	33	**82 J**	53 J	**60 J**	40 J
Cyanide	0.89	0.89	160	2.0	0.73 U	0.66 U	0.41 J	0.79 U	0.86 U	0.66 U	0.66 U	0.66 U	0.66 U	0.73 U	0.66 U
Iron	38,100	38,100	5,500	640	24,800	18,600	28,100	37,600	32,300	32,900	24,500	31,000	22,000	24,000	26,200
Lead	3.3	3.3	400	27	**5.4**	0.80	**25**	**8.0**	1.6 J	1.5 J	0.84 J	2.0	1.4	1.6	1.6
Magnesium	3,710	22,200	--	--	3,650	1,350	**4,820**	**5,260**	**4,520**	**4,630**	2,520	6,230	19,100	19,200	2,970
Manganese	1,630	1,630	180	57	342	229	525	722	658	670	285	1,190	561	623	645
Mercury	0.057	0.057	0.78	0.57	0.035 U	0.032 U	0.032 U	0.036 U	0.042 U	0.010 J	0.032 U	0.036 U	0.036 U	0.037 U	0.039 U
Nickel	22	22	160	48	6.1	4.0	8.3	11	11	10	5.5	14	8.4	9.4	6.3
Potassium	2,000	2,000	--	--	1,130	490	1,410 J	1,370	1,320	1,370	558	**2,360**	1,360	1,600	877 J
Selenium	0.51	0.51	39	0.26	0.56 U	0.44 U	0.48 U	0.53 U	0.65 U	0.50 U	0.13 J	0.50 U	0.18 J	0.32 J	0.52 U
Sodium	2,250	2,250	--	--	254	231	351 J	448	671	734	301 J	668	1,100	1,300	342 J
Vanadium	144	144	39	180	91	74	95	133	112	114	98	112	73	81	110
Zinc	32	32	2,400	680	25 J	9.9 J	**649**	**35 J**	32	**34**	16	**34 J**	24 J	26 J	18

Notes:

Exceeds Background UTL

Exceeds Background UTL and SSL (DAF=1)

Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

NA - Not Analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram
† For Background (Subsurface) UTL KTd values were used for SO05-SO11, and SO14; Qa values were used for SO12 and SO13

Table 10-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PI-8
Media: Surface Soil, Subsurface Soil
Historical Function: Former Motor Pool Maintenance Area

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value Qa (1)	Background Value KTd (2)	Max Exceeds Background Qa	Max Exceeds Background KTd	December RSL Adjusted (3)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (4)	Non-cancer Screening Toxicity Value (4)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PI-8	7429-90-5	Aluminum	9.1E+03	3.02E+04	mg/kg	VEP8-SO07	10 / 10	10 / 10	1.36E+00 - 4.47E+00	3.5E+04	3.5E+04	No	No	7.7E+03	nc	No	--	7.7E+04	20915	95% Student's T	Surface Soil UCL	CNS	0.3	--
Surface Soil	7440-38-2	Arsenic	3.9E-01	5.30E+00	mg/kg	VEP8-SO13	11 / 14	10 / 14	9.00E-02 - 2.00E-01	1.6E+00	1.6E+00	Yes	Yes	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.2	1.4E-05
	7440-47-3	Chromium	1.2E+01	2.60E+01	mg/kg	VEP8-SO07	14 / 14	14 / 14	4.00E-02 - 1.20E-01	7.2E+01	7.2E+01	No	No	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	3.4E+00	2.12E+01	mg/kg	VEP8-SO07	14 / 14	14 / 14	1.00E-02 - 1.00E-02	1.6E+01	1.6E+01	Yes	Yes	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.9	5.8E-08
	7439-89-6	Iron	1.1E+04	3.70E+04	mg/kg	VEP8-SO07	10 / 10	10 / 10	3.70E-01 - 1.21E+00	3.8E+04	3.8E+04	No	No	5.5E+03	nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	2.0E+02	7.79E+02	mg/kg	VEP8-SO07	10 / 10	10 / 10	1.90E-01 - 5.20E-01	1.6E+03	1.6E+03	No	No	1.8E+02	nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	3.9E+01	1.16E+02	mg/kg	VEP8-SO07	14 / 14	13 / 14	3.00E-02 - 9.00E-02	1.4E+02	1.4E+02	No	No	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
	50-32-8	Benzo(a)pyrene	1.2E-01 J	1.20E-01 J	mg/kg	VEP8-SO05	1 / 12	1 / 12	3.20E-03 - 4.60E-03	--	--	--	--	1.5E-02	ca	No	1.5E-02	--	--	--	Max	--	--	8.0E-06
	205-99-2	Benzo(b)fluoranthene	3.9E-01	3.90E-01	mg/kg	VEP8-SO05	1 / 12	1 / 12	2.50E-03 - 5.20E-03	--	--	--	--	1.5E-01	ca	No	1.5E-01	--	--	--	Max	--	--	2.6E-06
	53-70-3	Dibenz(a,h)anthracene	8.0E-02 J	8.00E-02 J	mg/kg	VEP8-SO05	1 / 11	1 / 11	1.90E-03 - 4.10E-03	--	--	--	--	1.5E-02	ca	No	1.5E-02	--	--	--	Max	--	--	5.3E-06
	193-39-5	Indeno(1,2,3-cd)pyrene	1.0E-02 J	4.80E-01	mg/kg	VEP8-SO05	3 / 11	1 / 11	2.00E-03 - 4.80E-03	--	--	--	--	1.5E-01	ca	No	1.5E-01	--	--	--	Max	--	--	3.2E-06
PI-8	7429-90-5	Aluminum	7.0E+03	2.7E+04	mg/kg	VEP8-SO10	9 / 9	8 / 9	1.95E+00 - 5.78E+00	3.5E+04	3.5E+04	No	No	7.7E+03	nc	No	--	7.7E+04	--	--	--	CNS	--	--
Subsurface Soil	7440-38-2	Arsenic	2.5E-01 J	1.5E+00	mg/kg	VEP8-SO13	9 / 9	8 / 9	1.30E-01 - 2.00E-01	1.6E+00	1.6E+00	No	No	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	1.1E+01	2.8E+01	mg/kg	VEP8-SO08	9 / 9	9 / 9	4.00E-02 - 1.20E-01	7.2E+01	7.2E+01	No	No	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	6.3E+00	1.7E+01	mg/kg	VEP8-SO12	9 / 9	9 / 9	1.00E-02 - 1.00E-02	1.6E+01	1.6E+01	Yes	Yes	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	1.9E+04	3.8E+04	mg/kg	VEP8-SO08	9 / 9	9 / 9	5.30E-01 - 1.57E+00	3.8E+04	3.8E+04	No	No	5.5E+03	nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.7	--
	7439-96-5	Manganese	2.3E+02	1.2E+03	mg/kg	VEP8-SO12	9 / 9	9 / 9	1.70E-01 - 5.10E-01	1.6E+03	1.6E+03	No	No	1.8E+02	nc	No	--	1.8E+03	611	95% Student's T	Total Soil UCL	CNS	0.3	--
	7440-62-2	Vanadium	7.4E+01	1.3E+02	mg/kg	VEP8-SO08	9 / 9	9 / 9	3.00E-02 - 8.00E-02	1.4E+02	1.4E+02	No	No	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.3	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.9	3E-05
Groundwater	--	--
Total Risk	0.9	3E-05

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type Qa.
(2) East Vieques Soil Type KTd
(3) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(4) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 10-4

Ecological Risk Assessment Screening Statistics for PI 8 Surface Soil - Plants and Invertebrates

Former NASD, Vieques, Puerto Rico

No Action / No Further Action Decision Document

7 Consent Order Sites and 14 PI/PAOC Sites

Former NASD, Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Cobalt	-- - --	14 / 14	3.40	21.2	9.56	4.10	11.5	13.0	1 / 14	1.63	16.0	1 / 14	0.60	1.33	0.88	0.74
Copper	-- - --	14 / 14	16.3	124	56.6	27.9	69.8	70.0	3 / 14	1.77	66.0	3 / 14	0.86	1.88	1.00	0.81
Lead	-- - --	14 / 14	1.20	77.1	16.9	21.0	26.8	120	0 / 14	0.64	--	-- - --	--	--	--	--
Selenium	0.44 - 0.67	9 / 14	0.13	1.30	0.54	0.43	0.74	0.52	5 / 14	2.50	0.51	5 / 14	1.05	2.55	1.43	1.03
Zinc	-- - --	14 / 14	13.4	263	46.0	63.4	76.0	120	1 / 14	2.19	32.0	6 / 14	1.44	8.22	0.63	0.38
Polychlorinated Biphenyls (UG/KG)																
Aroclor-1260	18.0 - 33.3	1 / 10	53.0	53.0	17.0	13.1	24.6	8,000	0 / 10	0.01	--	-- - --	--	--	--	--
Semivolatile Organic Compounds (UG/KG)																
PAH HMW (Total)	94.5 - 2,997	6 / 12	75.4	1,503	485	558	774	18,000	0 / 12	0.08	--	-- - --	--	--	--	--

TABLE 10-5
Summary of Norway Rat Exposure Doses - PI8-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	124	1.531	189.84	0.625	77.50	0	18.58	5.60	7.23	9.34	3.32	2.57	1.99
Lead	77.1	1.522	117.35	0.468	36.08	0	8.74	4.70	6.47	8.90	1.86	1.35	0.98
Selenium	1.30	1.340	1.74	3.012	3.92	0	0.92	0.20	0.26	0.33	4.58	3.56	2.77
Zinc	263	12.89	3388.76	1.820	478.66	0	112.38	75.4	169	377	1.49	0.67	0.30
Polychlorinated Biphenyls													
Aroclor-1260	0.053	15.91	0.84	0.105	0.01	0	0.00	0.136	0.30	0.68	0.01	0.01	0.00
Volatile/Semivolatile Organics													
Benzo(a)anthracene	0.073	1.590	0.12	Regresson	0.01	0	0.00	0.62	1.37	3.07	0.01	0.00	0.00
Benzo(a)pyrene	0.120	1.330	0.16	Regresson	0.02	0	0.00	0.62	1.37	3.07	0.01	0.00	0.00
Benzo(b)fluoranthene	0.390	2.600	1.01	0.310	0.12	0	0.03	0.62	1.37	3.07	0.05	0.02	0.01
Benzo(g,h,i)perylene	0.110	2.940	0.32	Regresson	0.03	0	0.01	0.62	1.37	3.07	0.01	0.01	0.00
Benzo(k)fluoranthene	0.098	2.600	0.25	Regresson	0.02	0	0.00	0.62	1.37	3.07	0.01	0.00	0.00
Chrysene	0.080	2.290	0.18	Regresson	0.01	0	0.00	0.62	1.37	3.07	0.01	0.00	0.00
Dibenz(a,h)anthracene	0.080	2.310	0.18	0.130	0.01	0	0.00	0.62	1.37	3.07	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0.480	2.860	1.37	0.110	0.05	0	0.01	0.62	1.37	3.07	0.02	0.01	0.00
Pyrene	0.072	1.750	0.13	0.720	0.05	0	0.01	0.62	1.37	3.07	0.02	0.01	0.00

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0398	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.980	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.020	= Proportion of diet composed of soil
WIR =	0.0516	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.168	= Body weight (kg wet weight)

TABLE 10-5
Summary of Norway Rat Exposure Doses - PI8-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	56.6	Regression	15.50	Regresson	9.58	0	1.33	5.60	7.23	9.34	0.24	0.18	0.14
Lead	16.9	Regression	7.87	Regresson	1.29	0	0.48	4.70	6.47	8.90	0.10	0.07	0.05
Selenium	0.54	Regression	0.59	Regresson	0.26	0	0.04	0.20	0.26	0.33	0.21	0.16	0.13
Zinc	46.0	Regression	300.38	Regresson	40.46	0	16.67	75.4	169	377	0.22	0.10	0.04

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0207 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.020 = Proportion of diet composed of soil
WIR = 0.0242 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.209 = Body weight (kg wet weight)

TABLE 10-6
Summary of Indian Mongoose Exposure Doses - PI8-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Copper	124	1.531	189.84	0.625	77.50	0.554	68.70	0	27.72	11.7	13.3	15.1	2.37	2.09	1.84
Lead	77.1	1.522	117.35	0.468	36.08	0.286	22.05	0	17.13	4.70	6.47	8.90	3.65	2.65	1.93
Selenium	1.30	1.340	1.74	3.012	3.92	1.263	1.64	0	0.25	0.20	0.26	0.33	1.27	0.99	0.77
Zinc	263	12.89	3388.76	1.820	478.66	2.782	731.71	0	486.70	75.4	169	377	6.45	2.89	1.29
Polychlorinated Biphenyls															
Aroclor-1260	0.053	15.91	0.84	0.105	0.01	See footnote	0.00	0	0.12	0.14	0.31	0.69	0.86	0.39	0.18
Volatile/Semivolatile Organics															
Benzo(a)anthracene	0.073	1.590	0.12	Regresson	0.01	0.000	0.00	0	0.02	0.62	1.37	3.07	0.03	0.01	0.01
Benzo(a)pyrene	0.120	1.330	0.16	Regresson	0.02	0.000	0.00	0	0.02	0.62	1.37	3.07	0.04	0.02	0.01
Benzo(b)fluoranthene	0.390	2.600	1.01	0.310	0.12	0.000	0.00	0	0.15	0.62	1.37	3.07	0.24	0.11	0.05
Benzo(g,h,i)perylene	0.110	2.940	0.32	Regresson	0.03	0.000	0.00	0	0.05	0.62	1.37	3.07	0.08	0.03	0.02
Benzo(k)fluoranthene	0.098	2.600	0.25	Regresson	0.02	0.000	0.00	0	0.04	0.62	1.37	3.07	0.06	0.03	0.01
Chrysene	0.080	2.290	0.18	Regresson	0.01	0.000	0.00	0	0.03	0.62	1.37	3.07	0.04	0.02	0.01
Dibenz(a,h)anthracene	0.080	2.310	0.18	0.130	0.01	0.000	0.00	0	0.03	0.62	1.37	3.07	0.04	0.02	0.01
Indeno(1,2,3-cd)pyrene	0.480	2.860	1.37	0.110	0.05	0.000	0.00	0	0.20	0.62	1.37	3.07	0.32	0.14	0.06
Pyrene	0.072	1.750	0.13	0.720	0.05	0.000	0.00	0	0.02	0.62	1.37	3.07	0.03	0.01	0.01

It was assumed that the concentration of each chemical in the small mammal's tissues was equal to the chemical concentration in its diet, that is, a diet to whole-body BAF (wet-weight basis) of 1.0 was assumed.

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0460 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.972 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0933 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.312 = Body weight (kg wet weight)

TABLE 10-6
Summary of Indian Mongoose Exposure Doses - PI8-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Copper	56.6	Regression	15.50	Regresson	9.58	Regresson	12.70	0	0.82	11.7	13.3	15.1	0.07	0.06	0.05
Lead	16.9	Regression	7.87	Regresson	1.29	Regresson	3.77	0	0.33	4.70	6.47	8.90	0.07	0.05	0.04
Selenium	0.54	Regression	0.59	Regresson	0.26	Regresson	0.52	0	0.03	0.20	0.26	0.33	0.14	0.11	0.09
Zinc	46.0	Regression	300.38	Regresson	40.46	Regresson	116.04	0	11.33	75.4	169	377	0.15	0.07	0.03

It was assumed that the concentration of each chemical in the small mammal's tissues was equal to the chemical concentration in its diet, that is, a diet to whole-body BAF (wet-weight basis) of 1.0 was assumed.

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0285 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.564 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.111 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.297 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0557 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.528 = Body weight (kg wet weight)

TABLE 10-7
Summary of Pearly-eyed Thrasher Exposure Doses - PI8-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	124	1.531	189.84	0.625	77.50	0	40.68	4.05	7.00	12.1	10.04	5.81	3.36
Lead	77.1	1.522	117.35	0.468	36.08	0	25.15	3.85	8.61	19.3	6.53	2.92	1.31
Selenium	1.30	1.340	1.74	3.012	3.92	0	0.37	0.44	0.81	1.50	0.85	0.46	0.25
Zinc	263	12.89	3388.76	1.820	478.66	0	706.53	66.1	148	331	10.69	4.78	2.14
Polychlorinated Biphenyls													
Aroclor-1260	0.053	15.91	0.84	0.105	0.01	0	0.18	0.41	0.92	2.05	0.43	0.19	0.09
Volatile/Semivolatile Organics													
Benzo(a)anthracene	0.073	1.590	0.12	Regresson	0.01	0	0.02	7.10	15.9	35.5	0.00	0.00	0.00
Benzo(a)pyrene	0.120	1.330	0.16	Regresson	0.02	0	0.03	7.10	15.9	35.5	0.00	0.00	0.00
Benzo(b)fluoranthene	0.390	2.600	1.01	0.310	0.12	0	0.21	7.10	15.9	35.5	0.03	0.01	0.01
Benzo(g,h,i)perylene	0.110	2.940	0.32	Regresson	0.03	0	0.07	7.10	15.9	35.5	0.01	0.00	0.00
Benzo(k)fluoranthene	0.098	2.600	0.25	Regresson	0.02	0	0.05	7.10	15.9	35.5	0.01	0.00	0.00
Chrysene	0.080	2.290	0.18	Regresson	0.01	0	0.04	7.10	15.9	35.5	0.01	0.00	0.00
Dibenz(a,h)anthracene	0.080	2.310	0.18	0.130	0.01	0	0.04	7.10	15.9	35.5	0.01	0.00	0.00
Indeno(1,2,3-cd)pyrene	0.480	2.860	1.37	0.110	0.05	0	0.29	7.10	15.9	35.5	0.04	0.02	0.01
Pyrene	0.072	1.750	0.13	0.720	0.05	0	0.03	7.10	15.9	35.5	0.00	0.00	0.00

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0174 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.954 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.046 = Proportion of diet composed of soil
WIR = 0.0157 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.080 = Body weight (kg wet weight)

TABLE 10-7
Summary of Pearly-eyed Thrasher Exposure Doses - PI8-Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	56.6	Regression	15.50	Regresson	9.58	0	1.92	4.05	7.00	12.1	0.47	0.27	0.16
Lead	16.9	Regression	7.87	Regresson	1.29	0	0.83	3.85	8.61	19.3	0.21	0.10	0.04
Zinc	46.0	Regression	300.38	Regresson	40.46	0	28.05	66.1	148	331	0.42	0.19	0.08

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0123 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.754 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.200 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.046 = Proportion of diet composed of soil
WIR = 0.0129 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.104 = Body weight (kg wet weight)

TABLE 10-8
Summary of Red-tailed Hawk Exposure Doses - PI8-Screening
Former NASD, Vieques, Puerto Rico
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Copper	124	1.531	189.84	0.625	77.50	0.554	68.70	0	2.84	4.05	7.00	12.1	0.70	0.41	0.23
Lead	77.1	1.522	117.35	0.468	36.08	0.286	22.05	0	0.91	3.85	8.61	19.3	0.24	0.11	0.05
Selenium	1.30	1.340	1.74	3.012	3.92	1.263	1.64	0	0.07	0.44	0.81	1.50	0.15	0.08	0.05
Zinc	263	12.89	3388.76	1.820	478.66	2.782	731.71	0	30.22	66.1	148	331	0.46	0.20	0.09
Polychlorinated Biphenyls															
Aroclor-1260	0.053	15.91	0.84	0.105	0.01	See footnote	0.00	0	0.00	0.41	0.92	2.05	<0.01	<0.01	<0.01
Volatile/Semivolatile Organics															
Benzo(a)anthracene	0.073	1.590	0.12	Regresson	0.01	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.120	1.330	0.16	Regresson	0.02	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	0.390	2.600	1.01	0.310	0.12	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	0.110	2.940	0.32	Regresson	0.03	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	0.098	2.600	0.25	Regresson	0.02	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Chrysene	0.080	2.290	0.18	Regresson	0.01	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	0.080	2.310	0.18	0.130	0.01	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.480	2.860	1.37	0.110	0.05	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01
Pyrene	0.072	1.750	0.13	0.720	0.05	0.000	0.00	0	0.00	7.10	15.9	35.5	<0.01	<0.01	<0.01

It was assumed that the concentration of each chemical in the small mammal's tissues was equal to the chemical concentration in its diet, that is, a diet to whole-body BAF (wet-weight basis) of 1.0 was assumed.

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0395 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.000 = Proportion of diet composed of soil
WIR = 0.0680 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.957 = Body weight (kg wet weight)

Legend

PI-8

ERI Notes:

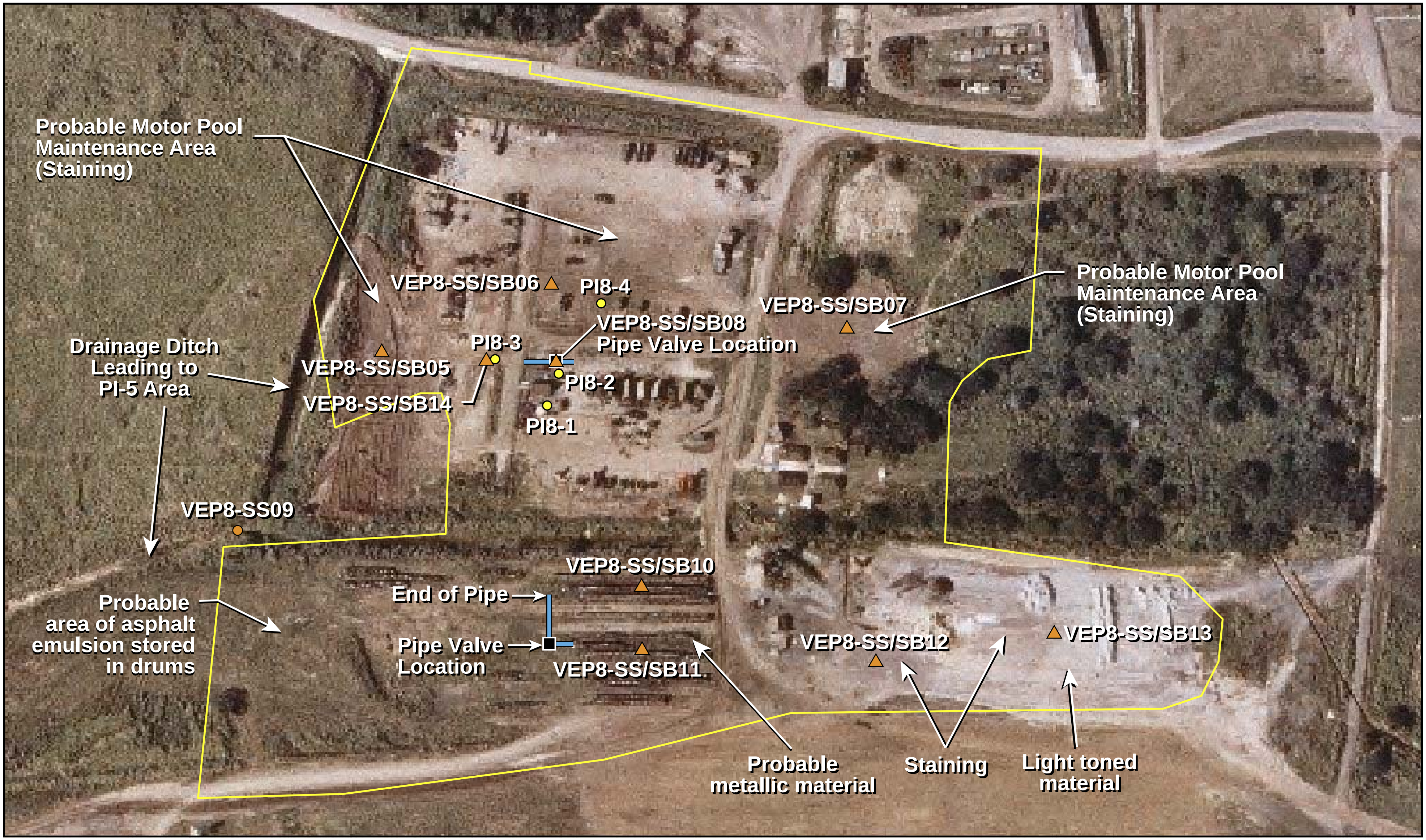
Vehicle and equipment storage, maintenance area, and staining

N
W E
S

0 100 200 400 Feet

FIGURE 10-1
PI-8 1959 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend
- PI-8
- EBS Surface Soil Sample Locations
- SI/ESI Surface and Subsurface Sampling Locations
- SI/ESI Surface Soil Sample Location
- Pipe
- Valve Box

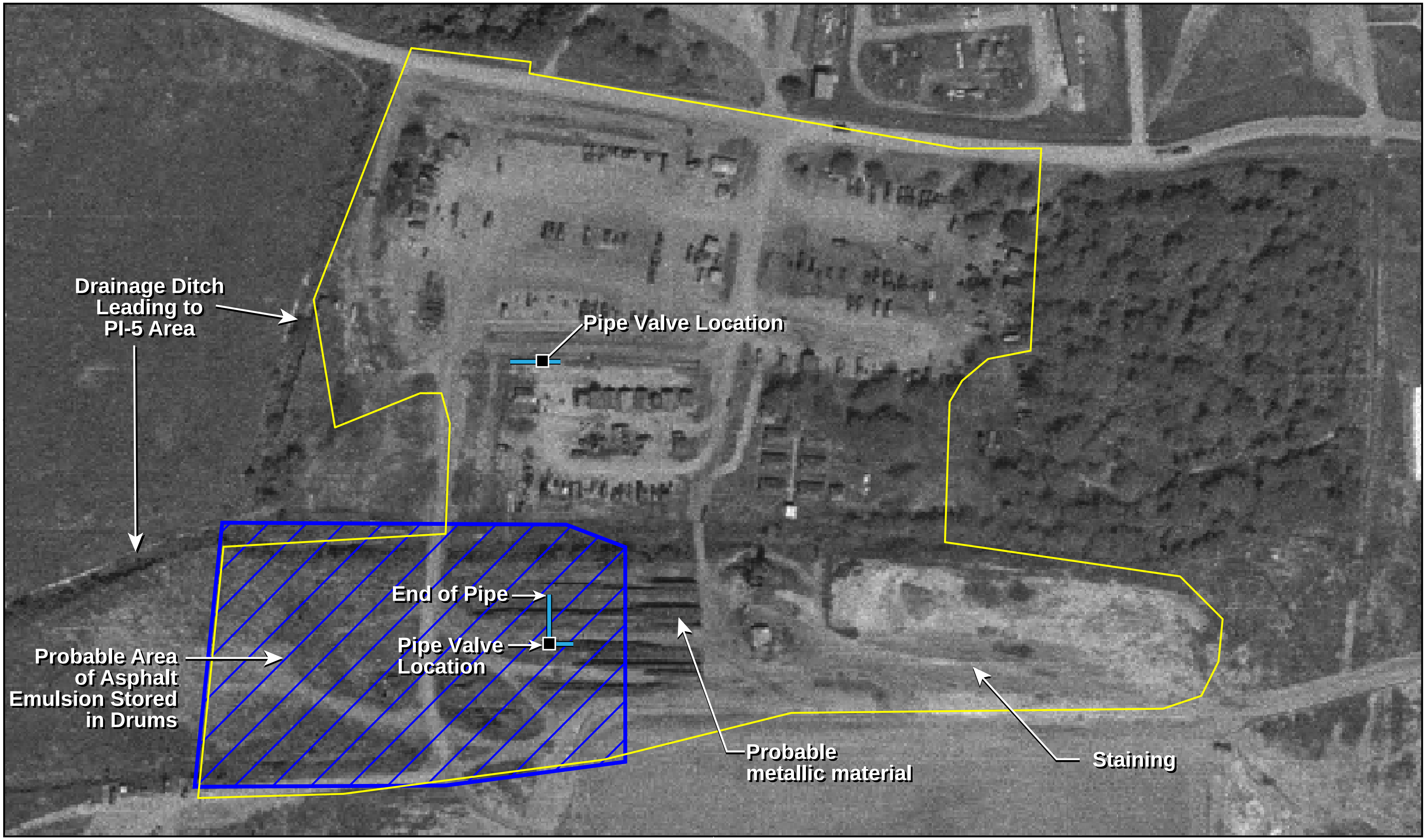
ERI Notes:
- Open storage of vehicles
- Equipment and multi-colored materials (some probably metallic)
- Heavy staining noted south of probable maintenance buildings

N W E S

0 100 200 400 Feet

FIGURE 10-2
PI-8 Sample Locations
1962 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend
- PI-8
- Area Reconoitered with Metal Detecting Equipment
- Pipe
- Valve Box

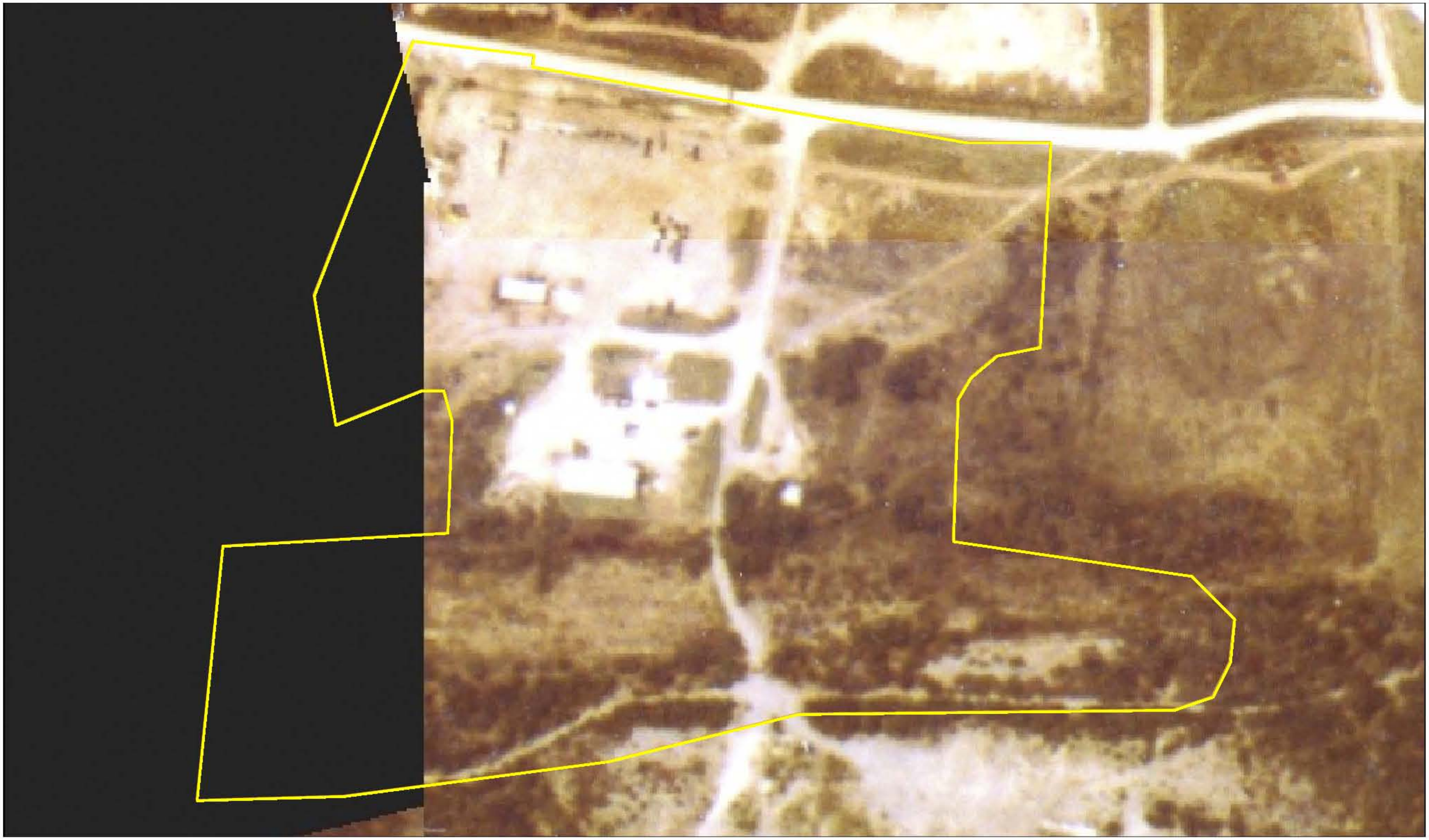
0 100 200 400 Feet

N E S W

ERI Notes:
• Vehicle and equipment storage remains

FIGURE 10-3
PI-8 1964 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

PI-8

ERI Notes:

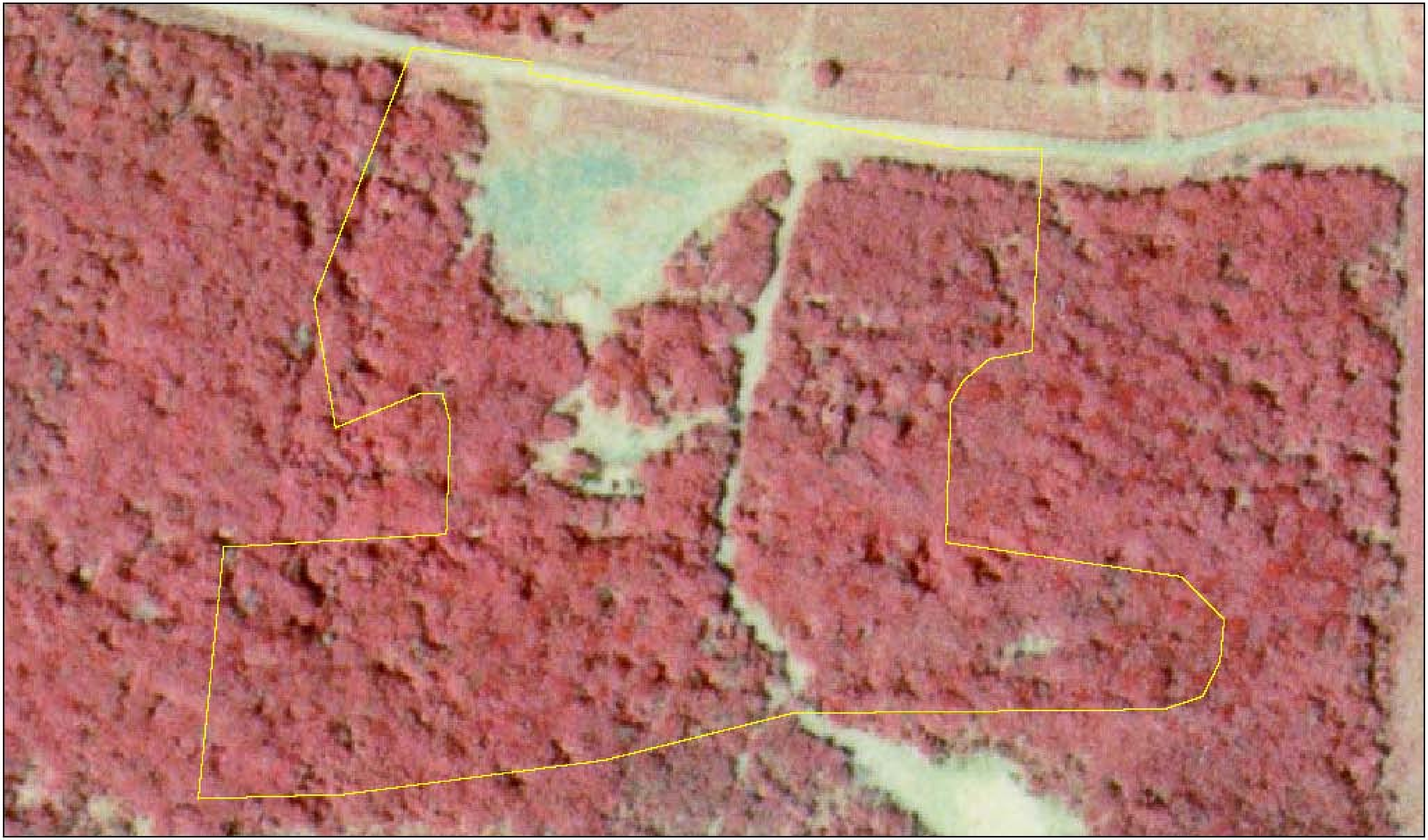
- Probable staining is noted on the north side of a probable maintenance building.
- The southern portion of the site appears inactive.

N W E S

0 100 200 400 Feet

FIGURE 10-4
PI-8 1970 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

PI-8

ERI Notes:
• Inactive

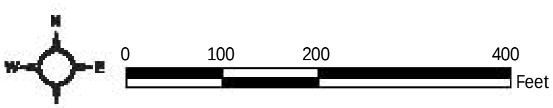


FIGURE 10-5
PI-8 1985 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Legend

PI-8

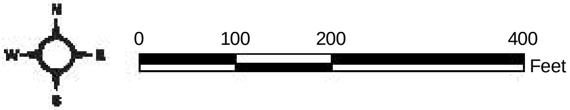
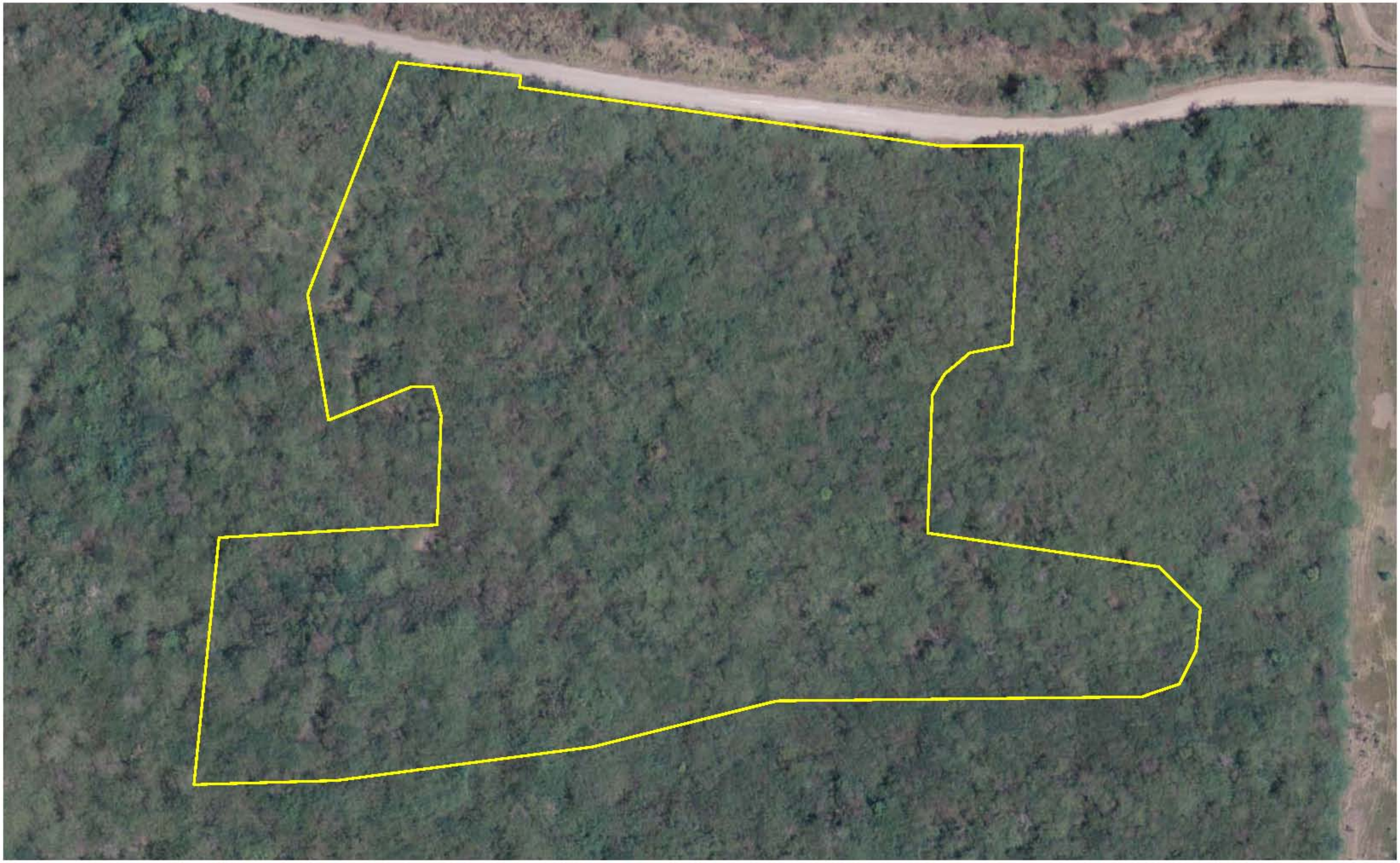


FIGURE 10-6
PI-8 2005 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

PI-8

0 100 200 400 Feet

FIGURE 10-7
PI-8 2007 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

ES051310153702TPA F10-7_PI-8 2005 Aerial.ai mstuart

CH2MHILL

(A) Northern Valve box with piping

(B) Southern Valve box

(C) Northern Valve with Manufacturer name

(D) Northern Valve with part numbers

FIGURE 10-8
PI-8 Site Photographs of Valves
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 11

PI 10—Former Wastewater Leach Field

This section presents a summary of the pertinent historical information and rationale for the no action determination for PI 10. A more detailed discussion of the PI 10 evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

11.1 Conceptual Site Model

11.1.1 Site Description and Potential Sources of Release

Records indicate that PI 10 was a possible leach field for a wastewater treatment plant, used as sludge-drying lagoons. The site was inactive by 1964, and completely re-vegetated by 1994. PI 10 is shown in a series of aerial photographs taken in 1962, 1964, and 2007 (**Figures 11-1 through 11-3)**, including identification of features observed in aerial photographs and sample locations.

ERI conducted an analysis of the historical aerial photographs from 1959 and 1964 (ERI, 2000). The general observation made by ERI was that PI 10 comprised a series of four impoundments with liquid. This is assumed to be a misprint because six impoundments are visible in the 1962 aerial photograph. Additionally, ERI identified a series of six lagoons containing brown to black liquid and liquid outside the lagoons in the north in the 1962 aerial photograph (**Figure 11-1**). ERI did not specifically label any of the features on the aerial photographs. Therefore, the locations of features labeled on them are best professional judgment based on the descriptions provided in the ERI report. It is also important to note that features identified by ERI on the aerial photographs (e.g., liquid) are not necessarily accurate because ERI did not perform a site visit to substantiate those features, and their photographic analysis was done many years after the aerial photographs were taken. Further, site visits performed by the ERP Technical Subcommittee to various sites whose aerial photographs were reviewed by ERI did not confirm and, in some cases, refuted observations made by ERI (e.g., see the discussion of PI 20 in Section 7 of CH2M HILL [2009]).

The EBS (2002) site visit found two rectangular openings in the forest partially surrounded by the remains of low earthen berms. Dark colored soils were observed in portions of the enclosed areas. Trash was observed in the area. Based on these observations three surface soil samples (PI10-1 through PI10-3) were collected within the rectangular areas and in the vicinity of trash (**Figure 11-1**). However, due to the nature of the impoundments (i.e., bermed areas where releases could have been in the subsurface, not just to the surface), surface soil samples alone were not deemed sufficient to make CERCLA-related release determinations.

Based on the above information, the potential source of a CERCLA-related release at PI 10 is the former sludge managed in the lagoons.

11.1.2 Investigation History

EBS Soil Sampling

Based on observations made during the EBS, three surface soil samples (PI10-1 through PI10-3) were collected within the rectangular areas and in the vicinity of trash. The samples were analyzed for VOCs, SVOCs, pesticides, herbicides, PCBs, and inorganics.

SI Soil Sampling

To help determine if there was a CERCLA-related release at PI 10, three soil borings were installed during the SI at the locations selected by the ERP Technical Subcommittee during the January 2009 site visit and illustrated on **Figure 11-1**. Per the SAP (CH2M HILL 2009b), the standard subsurface soil sample collection protocol was not followed where the bottom of the lagoon material was visually distinguishable from the native material. At the remaining locations, the subsurface soil samples were collected in accordance with the standard protocol. Specifically, samples were collected as follows:

Sample SS/SB01 was collected just outside the bermed area, in the area noted by ERI to be where liquid was observed outside the lagoons in the 1962 aerial photograph. The location of SS/SB01 was concurred upon and staked during the Vieques ERP Technical Subcommittee site visit (January 2009). The surface soil sample was collected from 0 to 1 ft bgs. There were no PID readings were observed above 1.1 ppm, which is not indicative of contamination. Also, no sludge material was identified in the soil boring. Therefore, the subsurface soil sample was collected at the default depth (4 to 6 ft bgs) in accordance with the SAP.

Two co-located surface soil and subsurface soil samples (SS/SB02 and SS/SB03) were collected from the approximate locations of the EBS samples within the former impoundment, as shown in **Figure 11-1**. Surface soil samples SS02 and SS03 were collected from 0 to 1 ft bgs.

At SO02, the lagoon material was identified as clayey silt in the first 3 ft bgs. Therefore, the subsurface soil sample (SB02) was collected from 1 to 3 ft bgs. There were no PID readings above 0.1 ppm.

In the vicinity of EBS sample PI10-3, numerous borehole attempts were made to identify lagoon material. However, any lagoon material present was not visually distinguishable from native material. Additionally, there were no PID readings above 0.0 ppm observed. Therefore, the subsurface soil sample (SB03) was collected at the default depth (4 to 6 ft bgs) in accordance with the SAP.

All samples collected during the SI were analyzed for TCL VOCs and SVOCs, and TAL inorganics. **Tables 11-1 and 11-2** summarize the constituents detected in PI 10 surface soil and subsurface soil samples, respectively, collected during the SI (2009) and EBS (2002). The tables also identify screening criteria exceedances.

11.1.3 Physical Setting

The site is flat except for a number of low earthen berms, with a maximum elevation of approximately 16 ft amsl. The area surrounding PI10 slopes very gently to the south and southwest. Sludge material was identified at the site and consisted of brown clayey silt. The native soil and the soil beneath the lagoon material consist mostly of sandy clayey silt, lean clays, clayey sands, and sandy clays. The subsurface geology comprises alluvial deposits such as sand, silt, clay, gravel flood plain, terrace deposits, and piedmont fan deposits. The groundwater in the area likely exists within the fractured bedrock and flows in a southerly direction toward the coast. No surface water bodies are present at the site and the closest surface water body topographically downgradient of the site is Bahia Corcho along the coast, approximately 0.5 mile to the south.

11.2 PI 10 Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 11-1 and 11-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was formerly a possible leach field for a wastewater treatment plant. Although surface soil samples were collected during the EBS, due to the nature of the impoundments (i.e., they are bermed areas where releases could be in the subsurface, not just to the surface), collection of surface soil samples was not sufficient to conclude no CERCLA-related release occurred or that a CERCLA-related release at this site has not resulted in contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Additional sample collection took place during the 2009 SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

EBS (2002)

Although EBS data were not subject to third-party validation, the data still underwent some validation processes. The results of laboratory QA/QC samples were compared to limits specified by the analytical methodology and/or laboratory SOPs. At a minimum, these QA/QC samples included blanks, calibrations, and MS/MSDs. No QA/QC exceedances were noted. These historical data are available for used as reported.

SI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the SI (2009) and EBS (2002), the following inorganics above the background UTLs and non-inorganics were detected by sampling event and by medium:

EBS (2002) Surface Soil

- VOCs: none detected
- SVOCs: none detected
- Pesticides/PCBs: none detected
- Herbicides: none detected
- Inorganics above background UTLs: thallium

SI (2009) Surface Soil

- VOCs: none detected
- SVOCs: acenaphthylene, benzo(a)anthracene, carbazole
- Inorganics above background UTLs: beryllium, calcium, cobalt, copper, lead, and sodium

SI (2009) Subsurface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene
- Inorganics above background UTLs: aluminum, arsenic, beryllium, calcium, copper, iron, potassium, sodium, and zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

Based on the potential source areas at PI 10 (i.e., former wastewater leach field), it is assumed that the detected constituent groups (i.e., SVOCs, inorganics) are potentially attributable to CERCLA-related releases from the former leachfield. Therefore, constituents detected at PI 10 (other than thallium) are further considered in the decision analysis process.

The thallium concentrations reported for samples collected during the EBS utilized a method that, although standard at the time, tended to provide falsely elevated results (see Section 1 of the Final SI/ESI Report (CH2M HILL, 2010)). The thallium data collected at PI 10 support this assertion. **Table 11-1** shows that no thallium was detected in the three SI surface soil samples collected adjacent to the EBS surface soil samples. Thallium concentrations of approximately 1 mg/kg were detected in all EBS samples. Based on this, the thallium results from the EBS are not considered further in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

SI (2009) Surface Soil

- SVOCs: no exceedances
- Cobalt: one detection (sample SS02) at a concentration (23 mg/kg) above the adjusted RSL (2.3 mg/kg), the ecological screening value (13 mg/kg), the SSL at a DAF of 1 (0.49 mg/kg), and background UTL (16 mg/kg)
- Copper: three detections (samples SS01, SS02 and SS03) at concentrations (57, 74 and 63 mg/kg, respectively) above the ecological screening value (70 mg/kg, SS02 only), the SSL at a DAF of 1 (46 mg/kg), and background UTL (53 mg/kg)

SI (2009) Subsurface Soil

- Benzo(a)anthracene: one detection (sample SB03) at a concentration (11 µg/kg) above the SSL at a DAF of 1 (10 µg/kg)
- Aluminum: two detections (sample SB01 and SB03) at concentrations (42,200 and 40,800 mg/kg, respectively) above the adjusted RSL (7,700 mg/kg) and background UTL (35,000 mg/kg)
- Arsenic: one detection (sample SB03) at a concentration (1.8 mg/kg) above the RSL (0.39 mg/kg), the SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Copper: three detections (samples SB01, SB02, and SB03) at concentrations (65, 60, and 61 mg/kg, respectively) above the SSL at a DAF of 1 (46 mg/kg) and background UTL (53 mg/kg)
- Iron: one detection (sample SB01) at a concentration (38,200 mg/kg) above the adjusted RSL (5,500 mg/kg),the SSL at a DAF of 1 (640 mg/kg), and background UTL (38,100 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at PI 10. The site is approximately 0.5 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (**see Table 11-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Four constituents (aluminum, arsenic, cobalt, and iron) were detected in surface or subsurface soil samples above background UTLs and human health screening levels (see **Table 11-3**).

- Aluminum was detected in two of three subsurface soil samples above background and its adjusted RSL (7,700 mg/kg), at a maximum concentration of 42,200 mg/kg. Based on the maximum detected concentration, the HI is 0.5, which is within the EPA acceptable level and aluminum would not be identified as a risk driver.
- Arsenic was detected in one of three subsurface soil samples above background and its RSL (0.39 mg/kg), at a concentration of 1.8 mg/kg. Based on the maximum detected concentration, the ELCR is 5×10^{-6} and the HI is 0.1, which are within EPA acceptable levels, and arsenic would not be identified as a risk driver.
- Cobalt was detected in one of six surface soil samples above background and its adjusted RSL (2.3 mg/kg), at a concentration of 23 mg/kg. Based on the maximum detected concentration, the ELCR is 6×10^{-8} and the HI is 1.0, which are within EPA acceptable levels, and cobalt would not be identified as a risk driver.
- Iron was detected in one of three subsurface soil samples above background and its adjusted RSL (5,500 mg/kg), at a concentration of 38,200 mg/kg. Based on the maximum detected concentration, the HI is 0.7, which is within the EPA acceptable level and iron would not be identified as a risk driver.

Three additional constituents (chromium, manganese, and vanadium) were detected in soil above human health screening levels but below background UTLs. Based on the historical source of potential releases identified at the site (see Section 11.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on the maximum detected concentrations of aluminum, arsenic, cobalt, iron, and the three additional constituents, the cumulative maximum target organ-specific HI is 1.4 and the ELCR is 5×10^{-6} (**see Table 11-3**) Although the cumulative target organ-specific HIs exceeds EPA's target level, it is due to manganese in soil, which is within background concentrations. Therefore, cumulative effects from multiple site-related chemicals in soil are not a concern relative to background.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 1×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Two inorganics (cobalt and copper) exceeded ecological screening values and background UTLs in at least one surface soil sample collected at the site (**Table 11-1**). Neither of these constituents poses an unacceptable risk to ecological receptors based upon the following:

- The site is overgrown with vegetation, with no signs of stressed vegetation.
- Cobalt exceeded the background UTL in one of six samples at a maximum ratio of 1.77 (**Table 11-4**). All other cobalt concentrations were below the background UTL, indicating that exposures are generally attributable to background. In addition, the mean HQ for the comparison to screening values (0.94) was less than 1.
- Copper exceeded the ecological screening value in just one of six samples at a maximum HQ of 1.06 (**Table 11-4**). However, the mean HQ (0.70) was less than 1.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

   – depth of contamination with respect to estimated groundwater depth
   – mobility of contaminant
   – number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Two inorganics (cobalt and copper) were detected in surface soil at concentrations above SSLs at a DAF of 1 and background UTLs. However, cobalt was not detected in subsurface soil above the background UTL. One SVOC (benzo[a]anthracene), arsenic, copper, and iron were detected in subsurface soil at concentrations above the SSL at a DAF of 1 and background UTLs. However, as observed at various sites on east Vieques, the SSLs at a DAF of 1 are not accurate predictors of leaching to groundwater (see PI 4 and SWMU 10). Further, the PI 10 area is small (about 100 ft x 100 ft), so a higher DAF is warranted. The benzo(a)anthracene concentration does not exceed the SSL at a DAF of just over 1. No arsenic concentrations exceed the SSL at a DAF of approximately 6. No copper concentration exceeds the SSL at a DAF of 2. Additionally, the only iron concentration (i.e., 38,200 mg/kg) to exceed an SSL at a DAF of 1 and background UTL (38,100 mg/kg) is likely attributable to background (i.e., differs by only 100 mg/kg).

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the former impoundments and areas of “liquid” observed in historical aerial photographs. Based on this information, soil samples were collected at each of these areas. Therefore, the spatial distribution of the samples collected during the SI and resulting data indicate the potential source area has been sufficiently characterized.

11.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PI 10 or, if there has been a CERCLA-related release, it has not resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Therefore, no action is warranted for PI 10.

Table 11-1
Surface Soil Detection and Exceedance Results
PI-10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (Qa)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VNTR-PI10-1	VNTR-PI10-2		VNTR-PI10-3	VEP10-SO01	VEP10-SO02	VEP10-SO03
Sample ID					VNTR-PI10-1	VNTR-PI10-2	VNTR-PI10-2D	VNTR-PI10-3	VEP10-SS01-01-0309	VEP10-SS02-01-0309	VEP10-SS03-01-0309
Sample Date					12/12/02	12/12/02	12/12/02	12/12/02	03/11/09	03/11/09	03/13/09
Chemical Name											
Volatile Organic Compounds (UG/KG)											
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)											
Acenaphthylene	--	340,000	--	22,000	333 U	333 U	333 U	333 U	22 UJ	24 UJ	7.0 J
Benzo(a)anthracene	--	150	--	10	333 U	333 U	333 U	333 U	22 UJ	24 UJ	9.4 J
Carbazole	--	24,000	--	--	NA	NA	NA	NA	22 UJ	24 UJ	3.1 J
PAH HMW (Total)	--	--	18,000	--	0 U	0 U	0 U	0 U	0 U	0 U	9.4
PAH LMW (Total)	--	--	29,000	--	0 U	0 U	0 U	0 U	0 U	0 U	7.0
Pesticide/Polychlorinated Biphenyls (UG/KG)											
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA
Herbicides (UG/KG)											
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA
Total Metals (MG/KG)											
Aluminum	35,000	7,700	--	55,000	NA	NA	NA	NA	29,100	31,600	32,200
Antimony	5.8	3.1	78	0.27	5.1 U	4.9 U	4.6 U	5.1 U	0.11 U	0.098 U	0.13 J
Arsenic	1.6	0.39	18	0.29	0.85 U	0.82 U	0.77 U	0.85 U	1.1	1.0	1.0 J
Barium	212	1,500	330	82	47	34	39	51	135	196	80
Beryllium	0.27	16	40	3.2	0.42 U	0.41 U	0.39 U	0.42 U	**0.30**	**0.44**	0.27
Cadmium	2.2	7.0	32	0.38	0.42 U	0.41 U	0.39 U	0.42 U	0.11 U	0.098 U	0.050 J
Calcium	11,900	--	--	--	NA	NA	NA	NA	**24,300**	5,940	4,700
Chromium	72	0.29	64	0.00083	13	10.1	13	14	19	22	20 J
Cobalt	16	2.3	13	0.49	8.2	5.9	7.1	9.0	16	**23**	10
Copper	53	310	70	46	32	25	28	40	**57**	**74**	**63 J**
Iron	38,100	5,500	--	640	NA	NA	NA	NA	28,800	30,900	27,900
Lead	5.4	400	120	27	3.0	3.2	4.4	3.0	**5.6**	3.4	2.1 J
Magnesium	22,200	--	--	--	NA	NA	NA	NA	6,190	6,490	5,880
Manganese	1,630	180	220	57	NA	NA	NA	NA	801	1,580	495 J
Mercury	0.057	0.78	0.10	0.57	0.083 U	0.071 U	0.080 U	0.065 U	0.037 U	0.039 U	0.020 J
Nickel	22	160	38	48	7.1	3.5	4.0	6.6	9.6	15	9.0 J
Potassium	5,270	--	--	--	NA	NA	NA	NA	2,070	2,540	2,510 J
Selenium	0.51	39	0.52	0.26	0.85 U	0.82 U	0.77 U	0.85 U	0.49 J	0.43 J	0.51 U
Sodium	1,590	--	--	--	NA	NA	NA	NA	892	**2,250**	402 J
Thallium	0.13	--	1.0	0.14	**0.94**	**0.90**	**1.0**	**1.2**	0.11 U	0.098 U	0.10 U
Vanadium	144	39	130	180	69	53	64	80	109	103	86 J
Zinc	32	2,400	120	680	15	15	18	19	27	32	31

Notes

Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 11-2
Subsurface Soil Detection and Exceedance Results
PI-10
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (Qa)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	VEP10-SO01	VEP10-SO02	VEP10-SO03
Sample ID				VEP10-SB01-46-0309	VEP10-SB02-13-0309	VEP10-SB03-46-0309
Sample Date				03/11/09	03/13/09	03/13/09
Chemical Name						
Volatile Organic Compounds (UG/KG)						
No Detections	--	--	--	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)						
Benzo(a)anthracene	--	150	10	25 UJ	25 U	**11 J**
Total Metals (MG/KG)						
Aluminum	35,000	7,700	55,000	**42,200**	30,500	**40,800**
Arsenic	1.6	0.39	0.29	1.4	1.0 J	**1.8 J**
Barium	212	1,500	82	107	54	99
Beryllium	0.27	16	3.2	**0.42**	**0.30**	**0.35**
Cadmium	2.2	7.0	0.38	0.097 U	0.060 J	0.10 J
Calcium	11,900	--	--	**21,700**	**12,400**	**36,400**
Chromium	72	0.29	0.00083	28	21 J	25 J
Cobalt	16	2.3	0.49	13	7.3	14
Copper	53	310	46	**65**	**60 J**	**61 J**
Iron	38,100	5,500	640	**38,200**	29,100	35,000
Lead	3.3	400	27	2.5	2.1 J	3.1 J
Magnesium	22,200	--	--	8,930	6,910	8,820
Manganese	1,630	180	57	696	232 J	821 J
Nickel	22	160	48	11	7.1 J	11 J
Potassium	2,000	--	--	**3,120**	**2,920 J**	**3,480 J**
Selenium	0.51	39	0.26	0.22 J	0.54 U	0.60 U
Sodium	2,250	--	--	**5,460**	**5,070 J**	**5,750 J**
Vanadium	144	39	180	119	82 J	119 J
Zinc	32	2,400	680	**44**	**36**	**39**

Notes:

Exceeds Background UTL

Exceeds Background UTL and Adjusted RSL for Residential Soil

Exceeds Background UTL and SSL (DAF=1)

Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

ND - Not detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 11-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PI-10
Media: Surface Soil, Subsurface Soil
Historical Function: Former Wastewater Leach Field

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value Qa (1)	Max Exceeds Background Qa	December RSL Adjusted (2)	Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PI-10	7429-90-5	Aluminum	2.9E+04	3.22E+04	mg/kg	VEP10-SO03	3 / 3	3 / 3	4.35E+00 - 4.72E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	7440-38-2	Arsenic	1.0E+00 J	1.10E+00	mg/kg	VEP10-SO01	3 / 6	3 / 6	1.50E-01 - 1.60E-01	1.6E+00	No	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	1.0E+01	2.19E+01	mg/kg	VEP10-SO02	6 / 6	6 / 6	9.00E-02 - 1.00E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	5.9E+00	2.30E+01	mg/kg	VEP10-SO02	6 / 6	6 / 6	1.00E-02 - 1.00E-02	1.6E+01	Yes	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	1.0	6.3E-08
	7439-89-6	Iron	2.8E+04	3.09E+04	mg/kg	VEP10-SO02	3 / 3	3 / 3	1.18E+00 - 1.28E+00	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--		gastrointestinal effects	--	--
	7439-96-5	Manganese	5.0E+02 J	1.58E+03	mg/kg	VEP10-SO02	3 / 3	3 / 3	3.90E-01 - 4.20E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	Max	CNS	0.9	--
	7440-62-2	Vanadium	5.3E+01 J	1.09E+02	mg/kg	VEP10-SO01	6 / 6	6 / 6	6.00E-02 - 7.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
PI-10	7429-90-5	Aluminum	3.1E+04	4.2E+04	mg/kg	VEP10-SO01	3 / 3	3 / 3	4.28E+00 - 5.28E+00	3.5E+04	Yes	7.7E+03 nc	No	--	7.7E+04	--	--	Max	CNS	0.5	--
Subsurface Soil	7440-38-2	Arsenic	1.0E+00 J	1.8E+00 J	mg/kg	VEP10-SO03	3 / 3	3 / 3	1.50E-01 - 1.80E-01	1.6E+00	Yes	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.08	4.6E-06
	7440-47-3	Chromium	2.1E+01 J	2.8E+01	mg/kg	VEP10-SO01	3 / 3	3 / 3	9.00E-02 - 1.10E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	7.3E+00	1.4E+01	mg/kg	VEP10-SO03	3 / 3	3 / 3	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	2.9E+04	3.8E+04	mg/kg	VEP10-SO01	3 / 3	3 / 3	1.16E+00 - 1.43E+00	3.8E+04	Yes	5.5E+03 nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.7	--
	7439-96-5	Manganese	2.3E+02 J	8.2E+02 J	mg/kg	VEP10-SO03	3 / 3	3 / 3	3.80E-01 - 4.70E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	8.2E+01 J	1.2E+02 J	mg/kg	VEP10-SO01, VEP10-SO03	3 / 3	3 / 3	6.00E-02 - 8.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.3	--

Note:
(1) East Vieques Soil Type Qa.
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

Site Cumulative Risk	Max HI *	ELCR
Soil	1.4	5E-06
Groundwater	--	--
Total Risk	1.4	5E-06

* - Max HI is the highest HI associated with any target organ or critical effect.

TABLE 11-4
Ecological Risk Assessment Screening Statistics for PI 10 Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Cobalt	-- - --	6 / 6	7.1	23.000	12.28	6.11	17.31	13.00	2 / 6	1.77	16.0	2 / 6	0.77	1.44	1.33	0.94
Copper	-- - --	6 / 6	28.4	74.2	49.1	18.30	64.2	70.0	1 / 6	1.06	53.0	3 / 6	0.93	1.40	0.92	0.70

Legend
- PI-10
- EBS Surface Soil Sample Locations
- SI/ESI Surface and Subsurface Soil Sample Locations

N W E S

0 100 200 400 Feet

FIGURE 11-1
PI-10 Sample Locations
1962 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

Legend

PI-10

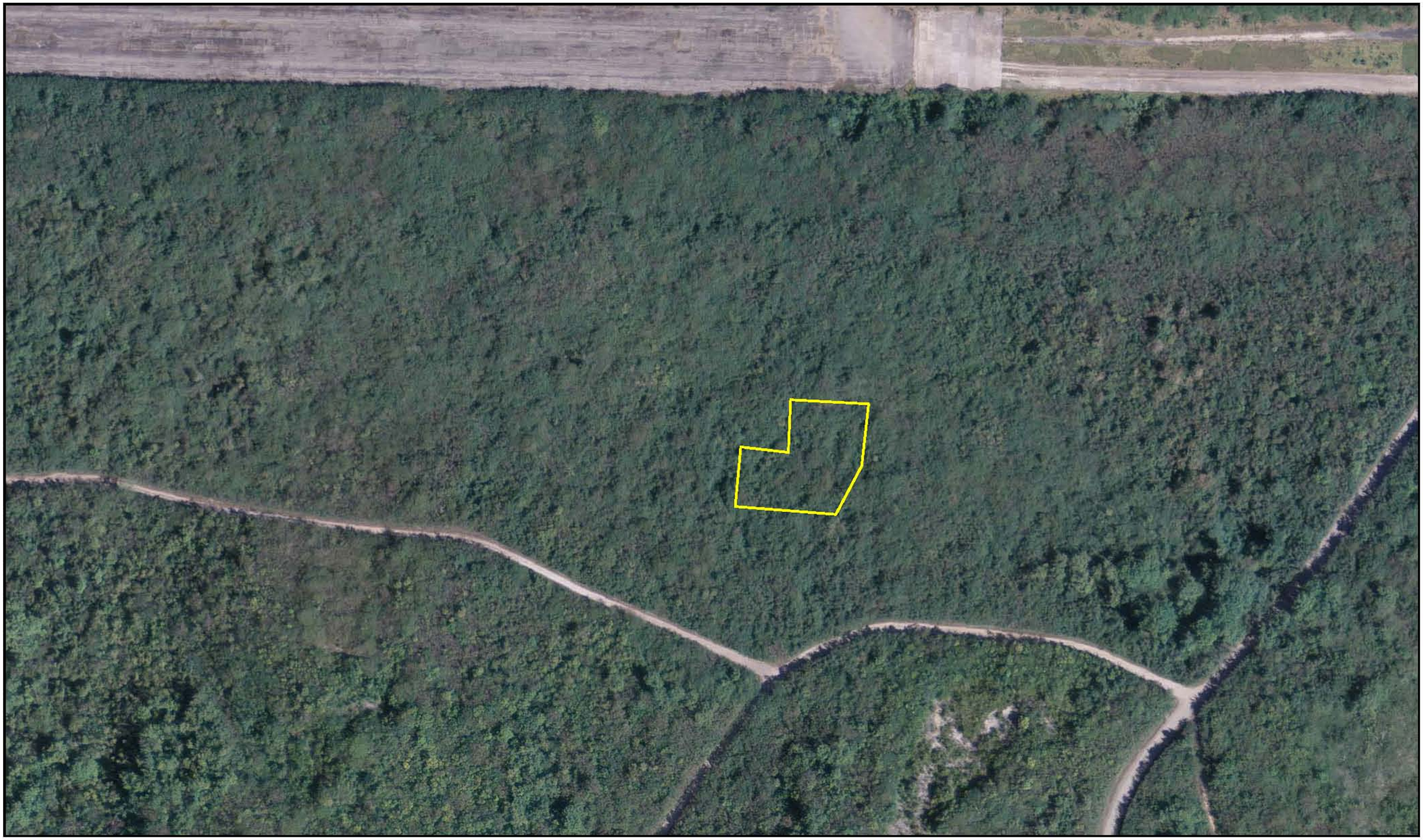
N
W E
S

ERI Notes:
- Lagoons inactive - revegetating
- Site not completely re-vegetated by 1985
- Site completely re-vegetated by 1994

0 100 200 400
Feet

FIGURE 11-2
PI-10 1964 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL



Legend

PI-10

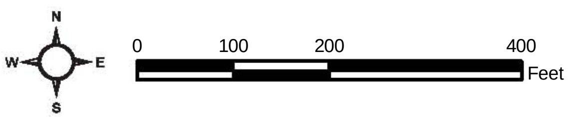


FIGURE 11-3
PI-10 2007 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

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SECTION 12

PAOC I—Former Power Plant and Mechanics Shop

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC I. A more detailed discussion of the PAOC I evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

12.1 Conceptual Site Model

12.1.1 Site Description and Potential Sources of Release

Records indicate that PAOC I comprises Building 401, a former power plant and mechanics shop at Camp Garcia (**Figures 12-1 through 12-3**). Site visits conducted during the RFI (2001), EBS (2002), and SI (2007 and 2009) found no evidence of hazardous material, hazardous waste, petroleum, or munitions storage or disposal.

During the 2007 SI scoping session the building was found to contain no interior structures. As shown in **Figure 12-3**, two doors, one each on the south and west sides of building, were identified. Additionally, there were three pipe penetrations through the buildings walls, two on the south side of the building and one on the east side of building. Past use of these pipes is unknown.

Based on the above information, the potential sources of a CERCLA-related release are the historic boiler- and mechanics-related activities that took place within Building 401. Conceptually, releases from these activities would have taken place via discharge through pipe penetrations and/or building egress points. Although there are no records of past releases at PAOC I and there was no evidence of past releases observed during the site visits, the potential presence of CERCLA-related hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Therefore, an SI was warranted to determine if a CERCLA-related release occurred at the site and, if so, whether it warrants further investigation or action. The constituents likely associated with potential releases from Building 401 are VOCs, SVOCs, PCBs, and inorganics

12.1.2 Investigation History

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), five co-located surface soil and subsurface soil samples (SS/SB-01 through SS/SB-05 as shown on **Figure 12-3**) were collected during the SI at PAOC I at the following locations concurred upon during the ERP Technical Subcommittee site visit in October 2007.

One co-located surface soil and subsurface soil sample was collected adjacent to each of the two doors, one on the south side of the building (SO05) and one of the west side of the building (SO02). Additionally, one co-located surface soil and subsurface soil sample was collected adjacent to each of the three pipe penetrations, two on south side of building (SO01 toward the west end; SO03 toward the center) and one on the east side of the building (SO04).

No reliable PID readings were collected as the instrument readings were unstable likely due to the humidity. The absence of reliable PID readings at the site does not affect the data evaluation for the site because no VOCs were detected in any of the 10 samples collected. In addition, no odors were detected and no evidence of staining was observed in soil cores; therefore, all soil samples were collected at default depths in accordance with the work plan. All samples were analyzed for TCL VOCs, SVOCs, and PCBs; and TAL inorganics.

Tables 12-1 and 12-2 summarize the constituents detected in PAOC I surface soil and subsurface soil samples, respectively, collected during the SI. The tables also identify screening criteria exceedances.

12.1.3 Physical Setting

The site is relatively flat, at an elevation of approximately 55 ft amsl; the land surrounding the site slopes gently to the south and is relatively open and not routinely maintained. The soil consists mostly of silts and silty sands. The bedrock is composed of igneous rocks, primarily granodiorite and quartz diorite. Groundwater occurs within the fractured bedrock and flows in a southerly direction toward the coast. There are no surface water bodies at or immediately adjacent to the site.

12.2 PAOC I Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 12-1 and 12-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information indicates PAOC I, Building 401, was a former power plant and mechanics shop. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visit, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2009 SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Surface Soil

- VOCs: none detected
- SVOCs: benzaldehyde, benzo(a)anthracene , bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, pyrene
- Pesticides/PCBs: none detected
- Inorganics above background UTLs: aluminum, arsenic, calcium, copper, cyanide, iron, lead, magnesium, mercury, zinc

Subsurface Soil

- VOCs: none detected
- SVOCs: fluoranthene, pyrene
- Pesticides/PCBs: none detected
- Inorganics above background UTLs: none detected

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records or visual evidence of past releases at PAOC I. However, based on the potential source areas at PAOC I (former power plant and mechanics shop), it is assumed that the detected constituent groups (i.e., SVOCs and inorganics) are potentially attributable to CERCLA-related releases because they are potentially associated with power plant and mechanical activities. Therefore, all detected constituents are further considered in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Surface Soil

- SVOCs: no exceedances
- Aluminum: one detection (sample SS03) at a concentration (40,000 mg/kg) above the adjusted RSL (7,700 mg/kg) and background UTL (35,000 mg/kg)
- Arsenic: one detection (sample SS04) at a concentration (2.0 mg/kg) above the RSL (0.39 mg/kg), the SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Copper: one detection (sample SS03) at a concentration (84 mg/kg) above the ecological screening value (70 mg/kg), the SSL at a DAF of 1 (46 mg/kg), and background UTL (66 mg/kg)

- Iron: one detection (sample SS03) at a concentration (40,400 mg/kg) above the adjusted RSL (5,500 mg/kg), the SSL at a DAF of 1 (640 mg/kg), and background UTL (38,100 mg/kg)
- Zinc: one detection (sample SS03) at a concentration (320 mg/kg) above the ecological screening value (120 mg/kg) and background UTL (32 mg/kg)

Subsurface Soil

- SVOCs: no exceedances

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at PAOC I. The site is approximately 0.04 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 12-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Three constituents (aluminum, arsenic, and iron) were detected in surface soil samples above the human health screening levels and background.

- Aluminum was detected in one of five surface soil samples above both the background UTL and the adjusted RSL (7,700 mg/kg), at a concentration of 40,000 mg/kg. Based on the maximum detected concentration, the HI is 0.5 (see **Table 12-3**), which is within the EPA acceptable level, and aluminum would not be identified as a risk driver.
- Iron was detected in one of five surface soil samples above both the background UTL and the adjusted RSL (5,500 mg/kg), at a concentration of 40,400 mg/kg. Based on the maximum detected concentration, the HI is 0.7 (see **Table 12-3**), which is within the EPA acceptable level, and iron would not be identified as a risk driver.
- Arsenic was detected in one of five surface soil samples above its background UTL and its RSL (0.39 mg/kg), at a concentration of 2.0 mg/kg. Based on the maximum detected

concentration, the HI is 0.09 and the ELCR is 5 x 10^{-6} (see **Table 12-3**), which are within EPA acceptable levels, and arsenic would not be identified as a risk driver.

Five additional constituents (antimony, chromium, cobalt, manganese, and vanadium) were detected in soil above human health screening levels but below background UTLs. Based on the historical source of potential releases identified at the site (see Section 12.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), Cr^{3+} is the expected form of chromium at the site, especially considering its detected concentrations are within background levels (see **Table 12-3**). Based on maximum detected concentrations of aluminum, iron, arsenic, and the five additional constituents, the cumulative ELCR is 5 x 10^{-6} and the maximum target organ-specific HI is 1.0 Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 1 x 10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Two inorganics (copper and zinc) exceeded ecological screening values and background UTLs in one surface soil sample collected at the site (**Table 12-1**). Neither of these constituents likely poses an unacceptable risk to ecological receptors based upon the following:

- The area evaluated is immediately adjacent to a building is very small in size and is periodically cleared. Thus, the potential exposures to ecological receptors are minimal.
- Copper exceeded the ecological screening value in one of five samples at a maximum HQ of 1.20 (**Table 12-4**). However, the HQ was less than 1 in the field duplicate of this sample. In addition, the mean HQ (0.72) was less than 1.
- Zinc exceeded the ecological screening value in one of five samples at a maximum HQ of 2.67 (**Table 12-4**). However, the HQ was less than 1 in the field duplicate of this sample. In addition, the mean HQ (0.79) was less than 1.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Three inorganics (arsenic, iron, and copper) were detected in surface soil at concentrations above the SSLs at a DAF of 1 and background UTLs. However, none of these constituents was detected in subsurface soil at concentrations above the SSL at a DAF of 1 and background UTL. Further, PAOC I is small (less than approximately 50 ft x 25 ft) and soil/groundwater data evaluations presented for other sites suggest SSLs at a DAF of 1 are not representative predictors of leaching to groundwater (e.g., see PI 4 and SWMU 10). Further, as shown in Table 24-1 of the Final SI/ESI Report (CH2M HILL 2010), neither arsenic nor iron was detected in groundwater downgradient of PAOC I (i.e., regional groundwater well VECG-MW01, as shown in Figure 12-1 of this report and Figure 24-1 of the Final SI/ESI Report (CH2M HILL 2010)), and copper was detected two orders of magnitude or more below the adjusted tapwater RSL and MCL.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely locations of CERCLA-related releases are doors and pipe penetrations in Building 401. Based on this information, soil samples were collected at each of these areas. Therefore, the spatial distribution of the samples collected during the SI and resulting data indicate the potential source area has been sufficiently characterized.

12.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PAOC I that has resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Therefore, no action is warranted for PAOC I.

Table 12-1
Surface Soil Detection and Exceedance Results
PAOC I
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VEPI-SO01	VEPI-SO02	VEPI-SO03		VEPI-SO04	VEPI-SO05
Sample ID					VEPI-SS01-01-0209	VEPI-SS02-01-0209	VEPI-SS03-01-0209	VEPI-SS03P-01-0209	VEPI-SS04-01-0209	VEPI-SS05-01-0209
Sample Date					02/24/09	02/24/09	02/24/09	02/24/09	02/24/09	02/24/09
Chemical Name										
Volatile Organic Compounds (UG/KG)										
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)										
Benzaldehyde	--	780,000	--	810	410 UJ	400 UJ	410 J	380 UJ	390 UJ	420 UJ
Benzo(a)anthracene	--	150	--	10	2.5 J	3.5 J	28 UJ	21 UJ	22 UJ	24 UJ
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	110 UJ	68 J	120 J	100 UJ	49 J	120 UJ
Chrysene	--	15,000	--	1,100	3.4 J	4.7 J	28 UJ	21 UJ	22 UJ	24 UJ
Fluoranthene	--	230,000	--	160,000	3.4 J	6.0 J	28 UJ	21 UJ	3.0 J	24 UJ
PAH HMW (Total)	--	--	18,000	--	79	81	126 U	95 U	93	108 U
PAH LMW (Total)	--	--	29,000	--	95	94	126 U	95 U	91	108 U
Pyrene	--	170,000	--	120,000	3.7 J	6.3 J	28 UJ	21 UJ	5.1 J	24 UJ
			--							
Pesticide/Polychlorinated Biphenyls (UG/KG)										
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND
Total Metals (MG/KG)										
Aluminum	35,000	7,700	--	55,000	28,600	26,300	**40,000 J**	13,900 J	12,600	15,000
Antimony	5.8	3.1	78	0.27	0.25 J	0.13 J	0.11 UJ	0.34 J	4.7 J	1.2 J
Arsenic	1.6	0.39	18	0.29	0.47 J	0.74	0.68	1.2	**2.0**	0.64
Barium	147	1,500	330	82	97	62	90	74	75	74
Beryllium	0.27	16	40	3.2	0.18	0.17	0.26	0.13	0.10	0.16
Cadmium	2.2	7.0	32	0.38	0.040 J	0.10	0.070 J	0.34	0.20	0.050 J
Calcium	8,840	--	--	--	4,870	7,270	**10,500 J**	**21,600 J**	**110,000**	5,700
Chromium	72	0.29	64	0.00083	24	19	28 J	19 J	17	23
Cobalt	16	2.3	13	0.49	14	9.6	15	11	6.8	12
Copper	66	310	70	46	53	49	**84 J**	43 J	30	37
Cyanide	0.33	160	15.8	2.0	0.73 U	0.73 U	0.92 U	0.66 U	0.66 U	**0.44 J**
Iron	38,100	5,500	--	640	29,400	28,600	**40,400 J**	23,400 J	19,500	28,800
Lead	5.4	400	120	27	2.1	4.2	3.6 J	**21 J**	**11**	1.8
Magnesium	3,710	--	--	--	2,870	3,090	**5,020 J**	3,480 J	**15,500**	2,030
Manganese	1,630	180	220	57	679	493	664	701	360	861
Mercury	0.057	0.78	0.10	0.57	0.010 J	**0.070**	0.045 U	0.030	0.030 J	0.010 J
Nickel	22	160	38	48	8.9	7.8	11	8.5	5.9	6.8
Potassium	5,270	--	--	--	1,460 J	1,470 J	1,780 J	730 J	919 J	1,100 J
Selenium	0.51	39	0.52	0.26	0.52 U	0.52 U	0.57 U	0.20 J	0.49	0.54 U
Silver	0.22	39	560	1.6	0.10 U	0.020 J	0.11 U	0.080 J	0.040 J	0.11 U
Sodium	1,590	--	--	--	142	169	242 J	166 J	243	143
Vanadium	144	39	130	180	106	93	133 J	84 J	80	118
Zinc	32	2,400	120	680	30	**41**	**67 J**	**320 J**	**65**	16

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 12-2
Subsurface Soil Detection and Exceedance Results
PAOC I
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	VEPI-SO01	VEPI-SO02	VEPI-SO03	VEPI-SO04	VEPI-SO05
Sample ID				VEPI-SB01-46-0209	VEPI-SB02-46-0209	VEPI-SB03-46-0209	VEPI-SB04-46-0209	VEPI-SB05-46-0209
Sample Date				02/24/09	02/24/09	02/24/09	02/24/09	02/24/09
Chemical Name								
Volatile Organic Compounds (UG/KG)								
No Detections	--	--	--	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)								
Fluoranthene	--	230,000	160,000	21 UJ	21 UJ	21 UJ	1.9 J	24 UJ
Pyrene	--	170,000	120,000	21 UJ	21 UJ	21 UJ	3.2 J	24 UJ
Pesticide/Polychlorinated Biphenyls (UG/KG)								
No Detections	--	--	--	ND	ND	ND	ND	ND
Total Metals (MG/KG)								
Aluminum	35,000	7,700	55,000	10,600	13,400	8,580	15,600	9,700
Antimony	5.8	3.1	0.27	0.086 UJ	0.081 UJ	0.087 UJ	0.060 J	0.020 J
Arsenic	1.6	0.39	0.29	0.44	0.65	0.44 J	0.50	0.38 J
Barium	147	1,500	82	42	52	40	55	45
Beryllium	0.27	16	3.2	0.10	0.12	0.090	0.13	0.11
Cadmium	2.2	7.0	0.38	0.030 J	0.050 J	0.030 J	0.040 J	0.030 J
Calcium	8,840	--	--	3,380	4,990	3,620	5,850	3,220
Chromium	72	0.29	0.00083	21	21	21	23	20
Cobalt	16	2.3	0.49	10	9.7	6.8	10	7.9
Copper	66	310	46	39	40	29	60	35
Cyanide	0.89	160	2.0	0.66 U	0.66 U	0.26 J	0.66 U	0.73 U
Iron	38,100	5,500	640	24,000	25,100	23,600	28,900	23,100
Lead	3.3	400	27	0.96	2.3	0.97	1.9	0.91
Magnesium	3,710	--	--	2,310	2,940	1,820	3,550	2,240
Manganese	1,630	180	57	362	452	330	376	379
Nickel	22	160	48	6.0	7.0	5.2	7.2	5.5
Potassium	2,000	--	--	536 J	712 J	514 J	718 J	535 J
Sodium	2,250	--	--	241	378	156	355	211
Vanadium	144	39	180	104	106	103	118	97
Zinc	32	2,400	680	14	29	14	20	15

Notes:
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 12-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PAOC-I
Media: Surface Soil, Subsurface Soil
Historical Function: Former Power Plant and Mechanics Shop

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)	Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC-I	7429-90-5	Aluminum	1.3E+04	4.00E+04 J	mg/kg	VEPI-SO03	5 / 5	5 / 5	1.62E+00 - 2.54E+00	3.5E+04	Yes	7.7E+03 nc	No	--	7.7E+04	--	--	Max	CNS	0.5	--
Surface Soil	7440-36-0	Antimony	1.3E-01 J	4.70E+00 J	mg/kg	VEPI-SO04	5 / 5	1 / 5	1.00E-02 - 2.00E-02	5.8E+00	No	3.1E+00 nc	No	--	3.1E+01	--	--	Max	Longevity, blood	0.2	--
	7440-38-2	Arsenic	4.7E-01 J	2.00E+00	mg/kg	VEPI-SO04	5 / 5	5 / 5	1.10E-01 - 1.70E-01	1.6E+00	Yes	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.09	5.1E-06
	7440-47-3	Chromium	1.7E+01	2.78E+01 J	mg/kg	VEPI-SO03	5 / 5	5 / 5	7.00E-02 - 1.10E-01	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	6.8E+00	1.45E+01	mg/kg	VEPI-SO03	5 / 5	5 / 5	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.6	3.9E-08
	7439-89-6	Iron	2.0E+04	4.04E+04 J	mg/kg	VEPI-SO03	5 / 5	5 / 5	4.40E-01 - 6.90E-01	3.8E+04	Yes	5.5E+03 nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.7	--
	7439-96-5	Manganese	3.6E+02	8.61E+02	mg/kg	VEPI-SO05	5 / 5	5 / 5	2.90E-01 - 4.50E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	Max	CNS	0.5	--
	7440-62-2	Vanadium	8.0E+01	1.33E+02 J	mg/kg	VEPI-SO03	5 / 5	5 / 5	5.00E-02 - 7.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.3	--
PAOC-I	7429-90-5	Aluminum	8.6E+03	1.6E+04	mg/kg	VEPI-SO04	5 / 5	5 / 5	1.79E+00 - 2.11E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	--	CNS	--	--
Subsurface Soil	7440-38-2	Arsenic	3.8E-01 J	6.5E-01	mg/kg	VEPI-SO02	5 / 5	4 / 5	1.20E-01 - 1.40E-01	1.6E+00	No	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	2.0E+01	2.3E+01	mg/kg	VEPI-SO04	5 / 5	5 / 5	4.00E-02 - 9.00E-02	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	6.8E+00	1.0E+01	mg/kg	VEPI-SO01	5 / 5	5 / 5	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	2.3E+04	2.9E+04	mg/kg	VEPI-SO04	5 / 5	5 / 5	4.90E-01 - 5.70E-01	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	3.3E+02	4.5E+02	mg/kg	VEPI-SO02	5 / 5	5 / 5	1.90E-01 - 3.60E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	9.7E+01	1.2E+02	mg/kg	VEPI-SO04	5 / 5	5 / 5	3.00E-02 - 6.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.998	5E-06
Groundwater	--	--
Total Risk	0.998	5E-06

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

* - Max HI is the highest HI associated with any target organ or critical effect.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 12-4
Ecological Risk Assessment Screening Statistics for PAOC I Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Copper	-- - --	5 / 5	30.2	84.0	50.5	20.8	70.3	70.0	1 / 5	1.20	66.0	1 / 5	0.77	1.27	1.00	0.72
Zinc	-- - --	5 / 5	15.60	320.0	94.3	127.5	215.8	120	1 / 5	2.67	32.0	3 - 5	2.95	10.00	1.80	0.79

Legend

Camp Garcia Area

SI/ESI Surface and Subsurface Sampling Locations

SI/ESI Monitoring Wells

FIGURE 12-1
PAOC I Sample Locations
1983 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Legend

Camp Garcia Area

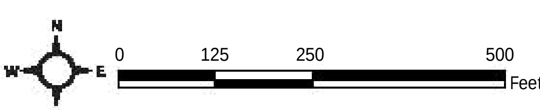

FIGURE 12-2
PAOC I 1994 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

ES051310153702TPA F12-2 PAOC I 1994 Photo.ai mstuart

Note: VEPI-SS/SB04 not shown and is located on the east side of the building.

Photo Date: September 24, 2008

Photo Date 2007

LEGEND

▲ SI/ESI Surface Soil and Subsurface Soil Sample Location

FIGURE 12-3
PAOC I Photograph of Building 401
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 13

PAOC J—Former Vehicle Maintenance Area

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC J. A more detailed discussion of the PAOC J evaluation is presented in the Final PA/SI Report (CH2M HILL, 2008).

13.1 Conceptual Site Model

13.1.1 Site Description and Potential Sources of Release

An interview conducted in June 2000 with an employee from NASD (CH2M HILL, 2001) indicated that a former vehicle maintenance area at Camp García existed immediately north of the main road at the location shown on **Figures 1-2 and 13-1**. A review of the historical aerial photos indicates that all structures were demolished prior to 1980. The interviewee was not aware of any hazardous material or hazardous waste releases at the site. During the EBS VSI conducted in October 2002, there was no evidence of hazardous material, hazardous waste, petroleum, or munitions storage or disposal (NAVFACENGCOM, 2003). However, due to the past use of this site, implementation of a PA/SI was performed.

13.1.2 Investigation History

As presented in the PA/SI Work Plan (CH2M HILL, 2006), six soil boring locations and one monitoring well location were selected for the PA/SI (**Figure 13-1**). At each of the six soil borings, one surface soil sample and one subsurface soil sample were collected. The locations of the borings were chosen to spatially cover the former vehicle maintenance area, and were placed on or adjacent to former structures identified on historical aerial photographs. No FID readings significantly above background were observed in the soil borings; therefore, subsurface samples were collected at default depths (or refusal, whichever was encountered first) in accordance with the work plan. All surface soil and subsurface soil samples were analyzed for TCL VOCs, SVOCs, pesticides, and PCBs; and TAL inorganics.

The monitoring well borehole installed at PAOC J was dry. Therefore, the borehole was grouted up on February 17, 2006. To confirm that from the sites within the eastern half of Camp Garcia (including PAOC J) there have not been releases that have adversely affected groundwater quality, two monitoring wells were installed just south of the eastern half of Camp Garcia during the SI/ESI. Of these wells, MW02 was installed to represent groundwater conditions downgradient of several sites, including PAOC J (**Figure 13-2**). Groundwater samples were collected from this well and analyzed for TCL VOCs, SVOCs, pesticides, PCBs, and TAL total and dissolved inorganics.

Tables 13-1 and 13-2 summarize the constituents detected in PAOC J surface soil samples and subsurface soil samples, respectively, collected during the PA/SI. The tables also identify screening criteria exceedances. **Table 13-3 s**ummarizes the constituents detected in regional groundwater monitoring well MW02 collected during the SI/ESI.

13.1.3 Physical Setting

The site slopes very gently to the southwest, with the highest elevation at approximately 72 ft amsl. The land around the site is cleared periodically as part of routine maintenance activities. Soil consists of silty or clayey sand and weathered rock overlying bedrock. The bedrock consists of igneous rock, primarily granodiorite and quartz diorite. Groundwater in this area exists within fractures in the bedrock and flows in a southerly direction toward the coast (**Figure 13-2**). There are no surface water bodies at or immediately adjacent to the site. The closest surface water body topographically downgradient of the site is Bahia Corcho and Bahia Tapon along the coast, less than 1 mile to the south and southeast, respectively.

13.2 PAOC J Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 13-1, 13-2, and 13-3**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former vehicle maintenance area. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visits, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2006 PA/SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

PA/SI (2006)

Appendix N, Section N.16 of the Final PA/SI Report (CH2M HILL 2008) discusses the evaluation of the PAOC J data quality. As detailed in Section N.16, the PAOC J data are acceptable for use in evaluating aspects of environmental conditions at PAOC J, which is done in Steps 3 and 7 below.

ESI (2009)

As detailed in Appendix M of the Final SI/ESI Report (CH2M HILL 2010), 99 percent of the SI/ESI data from MW02 are usable for the intended purpose. Therefore, the regional groundwater data are acceptable for use in evaluating whether regional groundwater has been impacted by a CERCLA-related release from sites within Camp Garcia, including PAOC J.

Step 3: Were any inorganics above the background upper tolerance level (UTL) detected or were any non-inorganics detected?

For the samples collected during the PA/SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Surface Soil

- VOCs: no detections

- SVOCs: no detections
- PCBs: no detections
- Pesticides: 4, 4'-DDD, 4, 4'-DDE, 4, 4'-DDT
- Inorganics above background UTLs: calcium, lead, magnesium, selenium, zinc

Subsurface Soil

- VOCs: no detections
- SVOCS: no detections
- PCBs : no detections
- Pesticides: 4, 4'-DDE, 4, 4'-DDT, beta-BHC
- Inorganics above background UTLs: calcium, magnesium, mercury, potassium, selenium

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

As noted previously, there is no history or visual evidence of releases at PAOC J. Further, the pesticides detected at this site are the same pesticides and of similar concentrations detected at other sites across east Vieques. This information, coupled with the history of the site, suggests the pesticides are present due to normal pesticide use, not a CERCLA-related release of the Final SI/ESI Report (CH2M Hill 2010. Therefore, pesticides are not considered further in the decision analysis process. Because metals may be associated with historical vehicle maintenance, they are further considered in the decision analysis process, even though other constituents likely to be detected if there were releases associated with historical vehicle maintenance activities (e.g., SVOCs) were not present.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 3 are compared to the screening criteria described in Section 1 and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Surface Soil

- Selenium: four detections (samples SS01, SS02, SS05, SS06) at concentrations (0.54 mg/kg to 0.91 mg/kg) above the ecological screening value (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)

Subsurface Soil

- Selenium: four detections (samples SB02, SB03, SB04, SB05) at concentrations (0.55 mg/kg to 0.87 mg/kg) above the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a “hot spot” of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a “hot spot” was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at the PAOC J. The site is approximately 1.3 acres in size whereas a residential lot may be approximately 0.75 acre. However, no chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 13-4**). Therefore, no hot spots were identified and all soil data (surface and subsurface) were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Seven constituents (aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium) were detected in surface or subsurface soil above human health screening levels but below background UTLs. Based on the historical source of potential releases identified at the site and the environmental conditions on Vieques, the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on maximum detected concentrations, the cumulative ELCR is 3×10^{-6} and the maximum target organ-specific HI is 0.6 (see Table **13-4**), which are within EPA acceptable levels. Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil. Most importantly, as mentioned previously, the concentrations of these seven constituents detected in PAOC J soil are consistent with background.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. This health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 2×10^{-5}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

One inorganic (selenium) exceeded the ecological screening value in four surface soil samples collected from the site (see Table 13-5). Selenium does not pose an unacceptable risk to ecological receptors on a site-wide basis based upon the following:

- The site is small (about 1.3 acres) and provides limited ecological habitat, especially considering the area is maintained by periodic mowing. Thus, the potential exposures to ecological receptors are minimal.
- Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the east Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at PAOC J (maximum of 0.91 mg/kg) may be within the range of background, especially considering that other data collected for the site do not suggest a CERCLA-related release has occurred. Further, the ecological screening value for selenium is based upon effects to plants, an endpoint that is not appropriate for the site given the periodically mowed grass habitats present. All selenium concentrations are less than ecological screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates). Thus, selenium has a low potential for unacceptable risks, especially given the very low potential for exposure of soil organisms based upon the limited habitat present.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Selenium concentrations in several soil samples exceed the SSL at a DAF of 1 and background. Only two of the four soil sampling locations where selenium was detected in the surface soil above the SSL had selenium in the subsurface soil above the SSL. Two additional subsurface soil samples contained selenium at concentrations above the SSL, but their corresponding surface soil samples did not. This information, coupled with the fact that constituents such as calcium and magnesium were detected above their background UTLs and the fact that other types of contaminants were not observed at the site, suggests the selenium is likely part of innate background. This is supported by the fact that similar selenium concentrations were detected at adjacent sites PAOC K and PAOC L. In addition, a similar pattern of selenium detections in the soil were observed at PI 4, which is in the same geologic unit as PAOC J. At PI 4, selenium was detected in groundwater below screening criteria. Similarly, selenium was detected in regional groundwater well MW02, but its concentrations were more than an order of magnitude below the MCL and tap water RSL. Therefore, the SSLs at a DAF of 1 are not likely realistic predictors of leaching to groundwater at PAOC J. At a DAF of 4, none of the selenium concentrations exceeds the SSL.

All of the above information, together with the fact that no non-inorganic contaminants were detected other than pesticides, suggests no CERCLA-related release has occurred at PAOC J or that any release has not resulted in constituent levels that likely pose an unacceptable risk over that of background.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely source of CERCLA-related releases at PAOC J is the former vehicle maintenance area. Based on this information, soil samples were collected across the area, the spatial distribution and resulting data of which indicate the potential source area has been sufficiently characterized.

13.3 Conclusions and No Action Determination

The decision analysis above indicates there has not been a CERCLA-related release at PAOC J or if there has been a release, it did not result in contamination of soil at concentrations that would likely pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Although several inorganics were detected in surface and subsurface soil, most of their concentrations are below human health and ecological screening criteria and none pose a leaching concern for groundwater. Further, pesticide detections at the site are consistent with normal pesticide application associated with maintenance of the historical facilities present at the site.

Therefore, a no action is warranted for PAOC J.

Table 13-1
Surface Soil Detection and Exceedance Results
PAOC J
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	EPAJ-SO01	EPAJ-SO02	EPAJ-SO03	EPAJ-SO04	EPAJ-SO05		EPAJ-SO06
Sample ID					EPAJ-SS01-0001	EPAJ-SS02-0001	EPAJ-SS03-0001	EPAJ-SS04-0001	EPAJ-SS05-0001	EPAJ-SS05P-0001	EPAJ-SS06-0001
Sample Date					03/02/06	03/01/06	03/01/06	03/01/06	03/02/06	03/02/06	03/01/06
Chemical Name											
Volatile Organic Compounds (UG/KG)											
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)											
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND
Pesticide/Polychlorinated Biphenyls (UG/KG)											
4,4'-DDD	--	2,000	583	66	2.0 J	3.6 U	4.0	6.8 J	3.5 U	3.6 U	3.8 U
4,4'-DDE	--	1,400	114	47	**92**	**51**	**420**	**1,200**	**49**	3.0 J	1.2 J
4,4'-DDT	--	1,700	100	67	28	8.5	46	**990**	11	21	1.7 J
Total Metals (MG/KG)											
Aluminum	35,000	7,700	--	55,000	8,920 J	8,630 J	7,760 J	6,730 J	8,590 J	8,080 J	8,630 J
Antimony[1]	5.8	3.1	78	0.27	0.27 J	0.43 J	0.33 J	0.53 J	0.65 J	0.43 J	6.8 UJ
Arsenic	1.6	0.39	18	0.29	1.1 U	0.48 J	1.0 J	0.84 J	1.1 U	1.1 U	1.1 U
Barium	147	1,500	330	82	88 J	72 J	50 J	48 J	61 J	58 J	51 J
Beryllium	0.27	16	40	3.2	0.039 J	0.026 J	0.52 U	0.52 U	0.53 U	0.55 U	0.57 U
Cadmium	2.2	7.0	32	0.38	0.079 J	0.082 J	0.13 J	0.11 J	0.53 U	0.55 U	0.073 J
Calcium	8,840	--	--	--	**12,900 J**	5,410 J	**88,800 J**	**18,400 J**	**19,600 J**	**13,300 J**	**24,500 J**
Chromium	72	0.29	64	0.00083	4.2	6.0	7.1	5.0	4.4	4.3	4.9
Cobalt	16	2.3	13	0.49	8.4 J	8.1 J	7.0 J	9.1 J	6.6 J	6.4 J	6.4 J
Copper	66	310	70	46	30	32	40	55	34	33	25
Iron	38,100	5,500	--	640	13,200 J	14,900 J	11,500 J	12,600 J	12,200 J	11,600 J	12,400 J
Lead	5.4	400	120	27	**12**	**7.3**	**8.3**	**20**	**15**	**16**	1.5
Magnesium	3,710	--	--	--	2,550 J	2,150 J	**5,270 J**	**4,870 J**	2,670 J	2,670 J	3,670 J
Manganese	1,630	180	220	57	601 J	546 J	357 J	298 J	370 J	381 J	349 J
Mercury	0.057	0.78	0.10	0.57	0.11 U	0.11 U	0.10 U	0.10 U	0.11 U	0.049 J	0.11 U
Nickel	22	160	38	48	4.3 U	4.4 U	4.2	4.2 U	4.3 U	4.4 U	4.5 U
Potassium	5,270	--	--	--	1,400	1,310	1,130	1,730	1,310	1,330	1,180
Selenium	0.51	39	0.52	0.26	**0.91 J**	**0.87 J**	3.6 U	0.50 J	**0.54 J**	3.9 U	**0.56 J**
Vanadium	144	39	130	180	43 J	52 J	36 J	34 J	40 J	37 J	51 J
Zinc	32	2,400	120	680	**43**	30	32	**47**	**33**	**35**	12

Notes:

Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

ND - Not Detected
-- Not part of background data set
-- Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] Background value used is the maximum value detected from the EPA split samples from the East Vieques Background Soil Inorganics Investigation Report (CH2M HILL, October 2007)

Table 13-2
Subsurface Soil Detection and Exceedance Results
PAOC J
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	EPAJ-SO01	EPAJ-SO02	EPAJ-SO03	EPAJ-SO04	EPAJ-SO05		EPAJ-SO06
Sample ID				EPAJ-SB01-0405	EPAJ-SB02-0406	EPAJ-SB03-0406	EPAJ-SB04-0406	EPAJ-SB05-0406	EPAJ-SB05P-0406	EPAJ-SB06-0406
Sample Date				03/02/06	03/01/06	03/01/06	03/02/06	03/02/06	03/02/06	03/01/06
Chemical Name										
Volatile Organic Compounds (UG/KG)										
No Detections	--	--	--	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)										
No Detections	--	--	--	ND	ND	ND	ND	ND	ND	ND
Pesticide/Polychlorinated Biphenyls (UG/KG)										
4,4'-DDE	--	1,400	47	3.1 J	3.7 U	2.1 J	48	2.5 J	3.1 J	1.3 J
4,4'-DDT	--	1,700	67	1.7 J	3.7 U	3.5 U	27	1.3 J	1.3 J	27
beta-BHC	--	270	0.22	1.8 U	1.9 U	1.8 U	1.9 U	1.9 U	**2.2 JN**	1.8 U
Total Metals (MG/KG)										
Aluminum	35,000	7,700	55,000	7,340 J	9,340 J	8,400 J	15,400 J	10,100 J	9,560 J	8,410 J
Antimony[1]	5.8	3.1	0.27	0.34 J	0.28 J	0.31 J	0.46 J	0.22 J	6.7 UJ	6.3 UJ
Barium	147	1,500	82	107 J	90 J	51 J	55 J	54 J	95 J	50 J
Beryllium	0.27	16	3.2	0.52 U	0.10 J	0.049 J	0.13 J	0.14 J	0.12 J	0.041 J
Cadmium	2.2	7.0	0.38	0.026 J	0.047 J	0.027 J	0.042 J	0.56 U	0.56 U	0.043 J
Calcium	8,840	--	--	1,720 J	**17,800 J**	4,570 J	1,880 J	2,850 J	2,850 J	**10,500 J**
Chromium	72	0.29	0.00083	2.3	4.9	3.1	3.4	5.0	5.0	4.6
Cobalt	16	2.3	0.49	8.0 J	10 J	8.3 J	6.4 J	7.1 J	9.1 J	6.6 J
Copper	66	310	46	22	24	33	27	24	23	26
Iron	38,100	5,500	640	12,200 J	13,600 J	14,300 J	19,200 J	13,600 J	14,400 J	12,300 J
Lead	3.3	400	27	0.70 J	1.8	1.3	1.1	2.0	2.0	1.3
Magnesium	3,710	--	--	2,750 J	**3,860 J**	**3,930 J**	2,740 J	3,240 J	3,410 J	3,130 J
Manganese	1,630	180	57	222 J	710 J	260 J	163 J	522 J	729 J	372 J
Mercury	0.057	0.78	0.57	0.10 U	0.11 U	**0.058 J**	0.11 U	0.11 U	0.11 U	0.10 U
Nickel	22	160	48	1.7 J	4.4 U	4.3 U	4.4 U	4.5 U	4.5 U	4.2 U
Potassium	2,000	--	--	**2,270**	1,150	1,760	**5,790**	1,280	1,220	1,210
Selenium	0.51	39	0.26	3.7 U	**0.55 J**	**0.70 J**	**0.87 J**	**0.69 J**	**0.68 J**	3.7 U
Silver	0.22	39	1.6	0.070 J	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.0 U
Sodium	2,250	--	--	522 U	778	534 U	554 U	563 U	562 U	524 U
Vanadium	144	39	180	38 J	60 J	54 J	63 J	44 J	53 J	52 J
Zinc	32	2,400	680	15	14	19	15	14	15	12

Notes:
Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
ND - Not Detected
-- Not part of background data set
-- Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
JN - Qualitative identification questionable due to poor resolution. Analyte presumptively present at approximate quantity
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] Background value used is the maximum value detected from the EPA split samples from the East Vieques Background Soil Inorganics Investigation Report (CH2M HILL, October 2007)

Table 13-3
Camp Garcia Regional Groundwater Study Detection and Exceedance Results
PAOC J (MW02)
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Station ID	PAOC-N EPAN-MW02 Background	Adjusted RSL for Tapwater	MCL - Groundwater	VECG-MW02
Sample ID				VECG-MW02-0409
Sample Date				04/01/09
Chemical Name				
Volatile Organic Compounds (UG/L)				
Acetone	--	2,200	--	6.0
Chloroform	--	0.19	80	**0.40 J**
Semivolatile Organic Compounds (UG/L)				
Fluoranthene	--	150	--	0.21 J
Pesticide/Polychlorinated Biphenyls (UG/L)				
Dieldrin	--	0.0042	--	**0.025 J**
Total Metals (UG/L)				
Barium	200	730	2,000	22 J
Calcium	144,000	--	--	68,200
Chromium	3.6 J	0.043	100	**3.8**
Copper	25 U	150	1,300	**1.5**
Magnesium	75,600	--	--	23,300 J
Manganese	8.0 J	88	--	**18 J**
Nickel	2.4 J	73	--	**4.4**
Potassium	1,780 J	--	--	1,270
Selenium	35 U	18	50	**2.3 J**
Sodium	323,000	--	--	77,200 J
Vanadium	50 U	18	--	**12 J**
Dissolved Metals (UG/L)				
Barium, Dissolved	200 U	730	2,000	**28 J**
Calcium, Dissolved	139,000	--	--	66,200
Copper, Dissolved	25 U	150	1,300	**1.2**
Magnesium, Dissolved	73,400	--	--	28,700 J
Manganese, Dissolved	15 U	88	--	**19 J**
Nickel, Dissolved	40 U	73	--	**3.1**
Potassium, Dissolved	1,710 J	--	--	1,430
Selenium, Dissolved	35 U	18	50	**2.2 J**
Sodium, Dissolved	311,000	--	--	86,800
Vanadium, Dissolved	50 U	18	--	**14 J**
Wet Chemistry (MG/L)				
Chloride	NA	--	--	60
Total dissolved solids (TDS)	1,490	--	--	500

Notes:

Exceeds Background
Exceeds Background and Adjusted RSL for Tapwater

NA - Not Analyzed
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/L - Milligrams per liter
UG/L - Micrograms per liter

TABLE 13-4
HHRA COPC SUMMARY TABLE
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PAOC-J
Media: Surface Soil, Subsurface Soil
Historical Function: Former Vehicle Maintenance Area

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC J	7429-90-5	Aluminum	6.7E+03	J	8.9E+03	J	mg/kg	EPAJ-SO01	6 / 6	5 / 6	-	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	7440-38-2	Arsenic	4.8E-01	J	1.0E+00	J	mg/kg	EPAJ-SO03	3 / 6	3 / 6	-	1.6E+00	No	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.05	2.6E-06
	7440-47-3	Chromium	4.2E+00		7.1E+00		mg/kg	EPAJ-SO03	6 / 6	6 / 6	-	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.00006	--
	7440-48-4	Cobalt	6.4E+00	J	9.1E+00	J	mg/kg	EPAJ-SO04	6 / 6	6 / 6	-	1.6E+01	No	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	1.2E+04	J	1.5E+04	J	mg/kg	EPAJ-SO02	6 / 6	6 / 6	-	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	3.0E+02	J	6.0E+02	J	mg/kg	EPAJ-SO01	6 / 6	6 / 6	-	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	3.4E+01	J	5.2E+01	J	mg/kg	EPAJ-SO02	6 / 6	4 / 6	-	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
PAOC J	7429-90-5	Aluminum	7.3E+03	J	1.5E+04	J	mg/kg	EPAJ-SO04	6 / 6	5 / 6	-	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	Max	CNS	0.2	--
Subsurface Soil	7440-47-3	Chromium	2.3E+00		5.0E+00		mg/kg	EPAJ-SO05	6 / 6	6 / 6	-	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	6.4E+00	J	1.0E+01	J	mg/kg	EPAJ-SO02	6 / 6	6 / 6	-	1.6E+01	No	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.5	2.8E-08
	7439-89-6	Iron	1.2E+04	J	1.9E+04	J	mg/kg	EPAJ-SO04	6 / 6	6 / 6	-	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.3	--
	7439-96-5	Manganese	1.6E+02	J	7.3E+02	J	mg/kg	EPAJ-SO05	6 / 6	5 / 6	-	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	Max	CNS	0.4	--
	7440-62-2	Vanadium	3.8E+01	J	6.3E+01	J	mg/kg	EPAJ-SO04	6 / 6	5 / 6	-	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.2	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.6	3E-06
Total Risk	0.6	3E-06

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

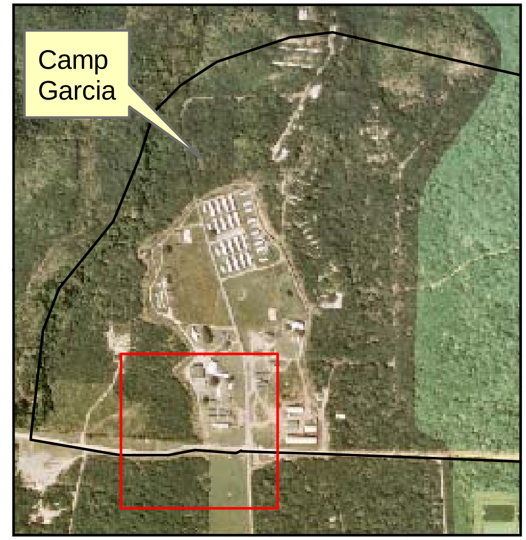
ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central nervous System

TABLE 13-5
Ecological Risk Assessment Screening Statistics for PAOC J Surface Soil
No Action/No Further Action Decision Docume
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Selenium	3.6 - 3.6	5 / 6	0.50	0.91	0.86	0.49	1.3	0.52	4 / 6	1.75	0.5	4 / 6	1.69	1.78	2.44	1.66

PHOTO DATE 1962

PHOTO DATE 1983



LEGEND

- PA/SI Surface and Subsurface Soil Sample Location
- PA/SI Surface and Subsurface Soil Sample and Abandoned Bedrock Boring Location
- Former/ Current Location of Structure
- General Area, PAOC J

N W E S

0 100 200 Feet

FIGURE 13-1

1962 Aerial Photograph of the PAOC J Area

No Action/No Further Action Decision Document

7 Consent Order Sites and 14 PI/PAOC Sites

Vieques, Puerto Rico

CH2MHILL

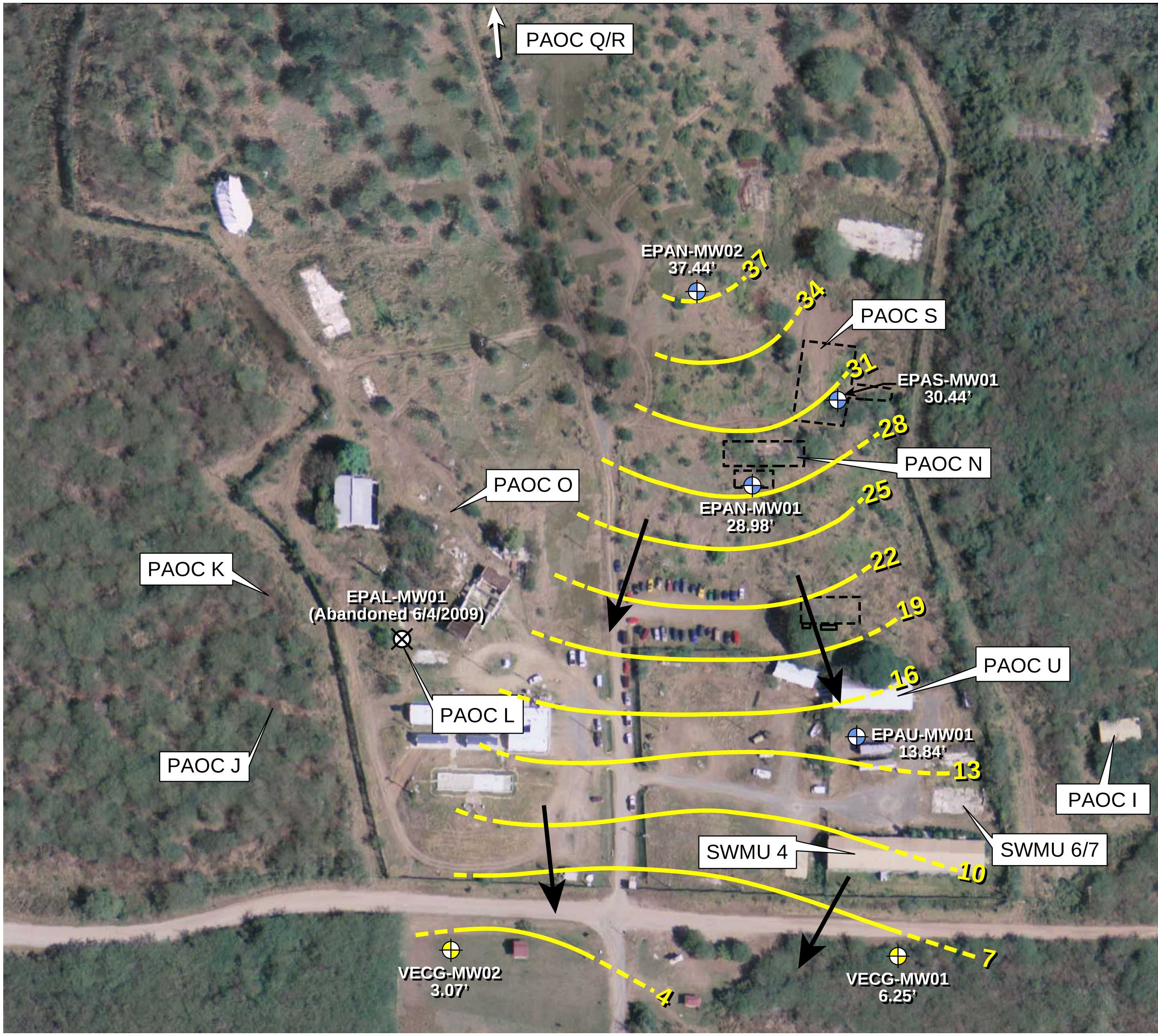
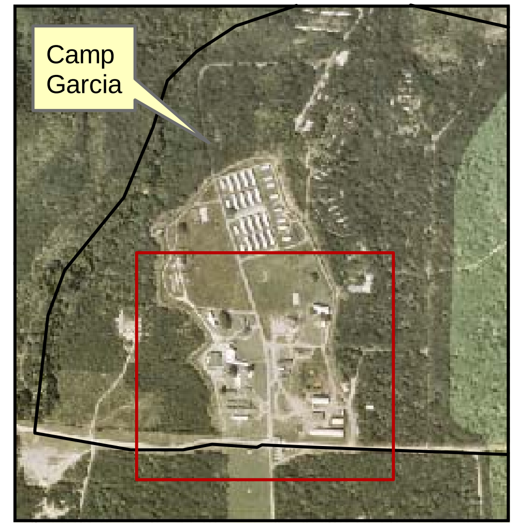


PHOTO DATE: 2007

PHOTO DATE 1983



LEGEND

- SI/ESI Monitoring Well Location
- PA/SI Monitoring Well Location
- Abandonded Well
- Groundwater Flow Direction
- Estimated Potentiometric Contour
- Dashed Where Estimated
- 37 Potentiometric Contour in Feet Above Mean Sea Level
- 37.44' Feet of Water Above Mean Sea Level (6/12/09)

North

0 150 300 Feet

FIGURE 13-2
Potentiometric Surface Map of Camp Garcia
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 14

PAOC K—Former Wash Rack

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC K. A more detailed discussion of the PAOC K evaluation is presented in the Final PA/SI Report (CH2M HILL, 2008). PAOC K was first identified in a site visit conducted in June 2000 with an employee from NSRR (CH2M HILL, 2001).

14.1 Conceptual Site Model

14.1.1 Site Description and Potential Sources of Release

The site is located in an area north of the main road of Camp García, adjacent to PAOCs J and L, as shown on **Figure 14-1**. Interviewees identified PAOC K as being a potential source of petroleum contamination from washing vehicles on the vehicle wash rack. The structure was demolished prior to 1980. During a site visit in October 2002, no evidence of hazardous materials, hazardous waste, petroleum, or munitions storage or disposal was observed at the site (NAVFACENGCOM, 2003). While there was no observable evidence of a release, a PA/SI was performed due to past vehicle washing activities at the site.

14.1.2 Investigation History

As presented in the PA/SI Work Plan (CH2M HILL, 2006), five soil borings were installed at the locations illustrated on **Figure 14-1**. At each of the five soil borings, one surface soil sample and one subsurface soil sample were collected. Four of the soil borings were installed around the perimeter of the former wash rack where runoff would most likely have occurred. In addition, one soil boring was completed in the center of where the former wash rack was located. No FID readings significantly above background were observed in the soil borings; therefore, subsurface soil samples were collected at default depths in accordance with the work plan. The surface soil and subsurface soil samples collected from each of the six borings were analyzed for TCL VOCs, SVOCs, pesticides, and PCBs; and TAL metals.

To confirm that from the sites within the eastern half of Camp Garcia (including PAOC K) there have not been releases that have adversely affected groundwater quality, two monitoring wells were installed just south of the eastern half of Camp Garcia during the SI/ESI. Of these wells, MW02 was installed to represent groundwater conditions downgradient of several sites, including PAOC J (**Figure 14-2**). Groundwater samples were collected from this well and analyzed for TCL VOCs, SVOCs, pesticides, PCBs, and TAL total and dissolved inorganics.

Tables 14-1 and 14-2 summarize the constituents detected in PAOC K surface soil samples and subsurface soil samples, respectively, collected during the PA/SI. **Table 14-3 s**ummarizes the constituents detected in regional groundwater monitoring well MW02 collected during the SI/ESI. The tables also identify screening criteria exceedances.

14.1.3 Physical Setting

The site slopes very gently to the southwest, with the highest elevation at approximately 72 ft amsl. The land around the site is cleared periodically as part of routine maintenance activities. Soil is well graded sand, often with silt, clay, or gravel. Bedrock consists of igneous rock, primarily granodiorite and quartz diorite. Groundwater in the area occurs within fractures in the bedrock and flows in a southerly direction toward the coast (**Figure 14-2**). There are no surface water bodies at or immediately adjacent to the site. The closest surface water bodies topographically downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, less than 1 mile to the south and southeast, respectively.

14.2 PAOC-K Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 14-1, 14-2, and 14-3**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former vehicle wash rack. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visits, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2006 PA/SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

PA/SI (2006)

Appendix N, Section N.17 of the Final PA/SI Report (CH2M HILL 2008) discusses the evaluation of the PAOC K data quality. As detailed in Section N.17, the PAOC K data are acceptable for use in evaluating aspects of environmental conditions at PAOC K, which is done in Steps 3 and 7 below.

ESI (2009)

As detailed in Appendix M of the Final SI/ESI Report (CH2M HILL 2010), the SI/ESI analytical data, 99 percent of the SI/ESI data from MW02 are usable for the intended purpose. Therefore, the regional groundwater data are acceptable for use in evaluating whether regional groundwater has been impacted by a CERCLA-related release and, if so, whether there is a source of contamination with the Camp Garcia boundary that warrants further investigation.

Step 3: Were any inorganics above the background upper tolerance level (UTL) detected or were any non-inorganics detected?

For the samples collected during the PA/SI, the following inorganics above background UTLs and non-inorganics were detected by medium:

Surface Soil

- VOCs: none detected
- SVOCs: none detected
- PCBs: none detected
- Pesticides: 4,4′-DDD, 4,4′-DDE, 4,4′-DDT, gamma-chlordane
- Inorganics above background UTLs: arsenic, calcium, cobalt, copper, lead, magnesium, mercury, selenium, and zinc

Subsurface Soil

- VOCs: none detected
- SVOCs: none detected
- Pesticides: 4,4′-DDD, 4,4′-DDE, 4,4′-DDT, endrin ketone, gamma-chlordane
- PCBs: arochlor-1260
- Inorganics above background UTLs: arsenic, barium, calcium, lead, magnesium, potassium, selenium, and zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There is no history or visual evidence of releases at PAOC K. Further, the pesticides detected at this site are the same pesticides and of similar concentrations detected at other sites across east Vieques. This information, coupled with the history of the site, suggests the pesticides are present due to normal pesticide use, not a CERCLA-related release (see *Pesticides and Herbicides* under Section 1.1.1 of the Final SI/ESI Report (CH2M HILL 2010). Therefore, pesticides are not considered further in the decision analysis process. Because metals (and the single PCB detection) may be associated with historical vehicle washing, they are further considered in the decision analysis process, even though other constituents likely to be detected if there were releases associated with historical vehicle washing (e.g., SVOCs) were not present.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 3 are compared to the screening criteria described in Section 1 and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Surface Soil

- Arsenic: two detections (samples SS03 and SS05) at concentrations (2.0 and 1.7 mg/kg, respectively) above the adjusted RSL (0.39 mg/kg), SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)

- Cobalt: one detection (sample SS04) at a concentration (21mg/kg) above the adjusted RSL (2.3 mg/kg), ecological screening value (13 mg/kg), SSL at a DAF of 1 (0.49 mg/kg), and background UTL (16 mg/kg)
- Copper: one detection (sample SS04) at a concentration (113 mg/kg) above the ecological screening value (70 mg/kg), SSL at a DAF of 1 (46 mg/kg), and background UTL (66 mg/kg)
- Lead: two detections (samples SS03 and SS04,) at concentrations (27 mg/kg and 61 mg/kg, respectively) above the SSL at a DAF of 1 (27 mg/kg) and background UTL (5.4 mg/kg)
- Selenium: three detections (samples SS01, SS02, and SS04) at concentrations (0.53 mg/kg to 0.59 mg/kg) above the ecological screening value (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)

Subsurface Soil

- PCBs: no exceedances
- Arsenic: one detection (sample SB04) at a concentration (2.3 mg/kg) above the adjusted RSL (0.39 mg/kg), SSL at a DAF of 1 (0.29 mg/kg), and background UTL (1.6 mg/kg)
- Barium: one detection (sample SB01) at a concentration (469 mg/kg) above the SSL at a DAF of 1 (82 mg/kg) and background UTL (147 mg/kg)
- Selenium: four detections (samples SB01, SB03, SB04, and SB05) at concentrations (0.74 mg/kg to 1.1 mg/kg) above the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at the PAOC K. The site is approximately 0.2 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background (for inorganics) and RSLs at concentrations exceeding 100 times the screening levels (see **Table 14-4**). Therefore, no hot spots were identified and all soil data (surface and subsurface) were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Two inorganics (arsenic and cobalt) were detected in surface or subsurface soil above both human health screening levels and background levels (see **Table 14-4**).

- Arsenic was detected in four of five surface soil and one of five subsurface soil samples above background and its RSL (0.39 mg/kg), at a maximum concentration of 2.3 mg/kg. Based on the maximum detected concentration, the ELCR is 6×10^{-6} and the HQ is 0.1, which are within EPA acceptable levels and arsenic would not be identified as a risk driver.
- Cobalt was detected in five of five surface soil and subsurface soil samples above its background UTL and adjusted RSL (2.3 mg/kg), at a maximum concentration of 21 mg/kg. Based on the maximum detected concentration, the ELCR is 6×10^{-8} and the HQ is 0.9, which are within EPA acceptable levels, and cobalt would not be identified as a risk driver.

  Five additional constituents (aluminum, chromium, iron, manganese, and vanadium) were detected in surface or subsurface soil above human health screening levels but below background UTLs. Based on the historical sources of potential release identified at the site and the environmental conditions on Vieques, the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on maximum detected concentrations of arsenic, cobalt, and the five additional constituents, the cumulative ELCR is 6×10^{-6} and the maximum target organ-specific HI is 0.9 (see **Table 14-4**), which are within EPA's acceptable levels. Consequently, there is not a concern for potential cumulative effects from multiple chemicals in site soil.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. This health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 6×10^{-5}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Three inorganics (cobalt, copper, and selenium) exceed ecological screening values in at least one surface soil sample collected from the site (see **Table 14-5**). None of these constituents poses an unacceptable risk to ecological receptors on a site-wide basis based upon the following:

- The site is small (about 0.2 acre) and provides limited ecological habitat, especially considering the area is maintained by periodic mowing. Thus, the potential exposures to ecological receptors are minimal.
- Cobalt and copper each exceed their respective ecological screening values and the background UTL in one of five surface soil samples. In each case, the associated duplicate for the exceeding sample is less than the background UTL and comparable to, or less than, the ecological screening value (see Table 14-1). Additionally, the mean site concentrations of both constituents are comparable to, or less than, the ecological screening values. Thus, no unacceptable ecological risks are likely associated with exposure to these two constituents.
- Selenium exceeds the ecological screening value and background UTL in three of the five surface soil samples. The HQ based on the maximum concentration is 1.13. The screening value (0.52 mg/kg), however, is based upon potential impacts to plants. The site consists of periodically mowed grass, so plant endpoints are not likely representative of ecological exposures. None of the selenium concentrations exceeds ecological screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates). Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the east Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at PAOC K (maximum of 0.59 mg/kg) may be within the range of background. Thus, selenium has a low potential for unacceptable risks, especially given the low potential for exposure to soil organisms.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Six inorganics (arsenic, barium, cobalt, copper, lead, and selenium) were detected in PAOC K soil above the SSLs at a DAF of 1 and background UTLs. However, as shown in Step 5, only selenium in two locations was detected in both surface soil and subsurface soil above the SSL. This information, coupled with the fact that constituents such as calcium, magnesium, and potassium were also detected above their background UTLs (see Step 3) and the fact that other types of contaminants generally were not observed at the site, suggests the inorganics are likely part of innate background and that SSLs at a DAF of 1 are not realistic predictors of leaching to groundwater. Further, as shown in Table 14-3, arsenic, cobalt, and lead were not detected in downgradient regional well MW02 and the concentrations of barium, copper, and selenium in downgradient regional well MW02 are more than an order of magnitude below MCLs and tap water RSLs.

All of the information above suggests no CERCLA-related release has occurred at PAOC K or that any release has not resulted in constituent levels that potentially pose an unacceptable risk over that of background.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely source of CERCLA-related releases at PAOC K is the former wash rack. Based on this information, soil samples were collected on each side of the former wash rack, and in the center of the former location; the spatial distribution and resulting data indicate the potential source area has been sufficiently characterized.

14.3 Conclusions and No Action Determination

The decision analysis above indicates there has not been a CERCLA-related release at PAOC K that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Although several inorganics were detected in surface and subsurface soil and one PCB was detected in subsurface soil, their concentrations do not pose an unacceptable risk to human health or ecological receptors. Further, pesticide detections at the site are consistent with normal pesticide application associated with maintenance of the historical facilities present at the site.

Therefore, no action is warranted for PAOC K.

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Table 14-1
Surface Soil Detection and Exceedance Results
PAOC K
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	EPAK-SO01	EPAK-SO02	EPAK-SO03	EPAK-SO04		EPAK-SO05
Sample ID					EPAK-SS01-0001	EPAK-SS02-0001	EPAK-SS03-0001	EPAK-SS04-0001	EPAK-SS04P-0001	EPAK-SS05-0001
Sample Date					03/01/06	02/28/06	03/02/06	02/28/06	02/28/06	02/28/06
Chemical Name										
Volatile Organic Compounds (UG/KG)										
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)										
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND
Pesticide/Polychlorinated Biphenyls (UG/KG)										
4,4'-DDD	--	2,000	583	66	3.8 U	3.9 U	3.5 U	6.1 J	7.9	3.4 U
4,4'-DDE	--	1,400	114	47	25	3.3 J	**110**	**1,200**	**830**	**50**
4,4'-DDT	--	1,700	100	67	8.7	3.9 U	27	**490**	**320**	16
gamma-Chlordane	--	1,600	11	140	2.0 U	2.0 U	1.8 U	8.8 U	1.3 J	1.8 U
Total Metals (MG/KG)										
Aluminum	35,000	7,700	--	55,000	12,900	16,600	14,000	11,600	11,500	14,900
Antimony[1]	5.8	3.1	78	0.27	0.83 J	0.74 J	0.91 J	1.2 J	1.2 J	0.78 J
Arsenic	1.6	0.39	18	0.29	1.1 U	1.4	**2.0**	1.5	1.3	**1.7**
Barium	147	1,500	330	82	91	50	60	60	60	41
Cadmium	2.2	7.0	32	0.38	0.56 U	0.59 U	0.54 U	0.52 U	0.18 J	0.52 U
Calcium	8,840	--	--	--	**20,300**	**60,800**	**23,600**	**23,900**	**26,900**	**79,400**
Chromium	72	0.29	64	0.00083	6.9	19	12	15	16	19
Cobalt	16	2.3	13	0.49	11	12	14	**21**	14	11
Copper	66	310	70	46	39	36	57	50 J	**113 J**	32
Iron	38,100	5,500	--	640	18,800	24,000	22,100	21,400	21,700	21,300
Lead	5.4	400	120	27	**20**	3.7	**27**	**61**	**57**	**5.8**
Magnesium	3,710	--	--	--	2,980	**11,600**	**7,900**	**6,380**	**6,560**	**10,100**
Manganese	1,630	180	220	57	630	449	420	396	391	392
Mercury	0.057	0.78	0.10	0.57	0.11 U	0.12 R	0.048 J	**0.093 J**	**0.095 J**	0.10 R
Nickel	22	160	38	48	2.9 J	12	6.6	4.0 J	4.1 J	11
Potassium	5,270	--	--	--	1,510	1,680	1,540	1,130	1,060	1,160
Selenium	0.51	39	0.52	0.26	**0.53 J**	**0.57 J**	0.49 J	3.6 UJ	**0.59 J**	3.6 UJ
Vanadium	144	39	130	180	63	84	59	59	63	77
Zinc	32	2,400	120	680	**90**	26	**77**	**94**	**73**	32

Notes:

Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

ND - Not Detected
-- Not part of background data set
-- Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
R - Unreliable result
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] Background value used is the maximum value detected from the EPA split samples from the East Vieques Background Soil Inorganics Investigation Report (CH2M HILL, October 2007)

Table 14-2
Subsurface Soil Detection and Exceedance Results
PAOC K
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	EPAK-SO01	EPAK-SO02	EPAK-SO03	EPAK-SO04	EPAK-SO05
Sample ID				EPAK-SB01-0406	EPAK-SB02-0406	EPAK-SB03-0406	EPAK-SB04-0406	EPAK-SB05-0406
Sample Date				03/01/06	02/28/06	03/02/06	03/08/06	02/28/06
Chemical Name								
Volatile Organic Compounds (UG/KG)								
No Detections	--	--	--	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)								
No Detections	--	--	--	ND	ND	ND	ND	ND
Pesticide/Polychlorinated Biphenyls (UG/KG)								
4,4'-DDD	--	2,000	66	3.8 U	3.6 U	3.3 U	44	4.3 U
4,4'-DDE	--	1,400	47	0.89 J	3.6 U	21	**540**	4.6
4,4'-DDT	--	1,700	67	3.8 U	3.6 U	7.5	**950**	4.3 U
Aroclor-1260	--	220	24	38 U	36 U	33 U	**69**	43 U
Endrin ketone	--	1,800	81	3.8 U	3.6 U	0.82 J	3.6 U	4.3 U
gamma-Chlordane	--	1,600	140	2.0 U	1.9 U	1.7 U	0.76 J	2.2 U
Total Metals (MG/KG)								
Aluminum	35,000	7,700	55,000	14,200	18,000	11,300	16,100	17,100
Antimony[1]	5.8	3.1	0.27	0.54 J	0.59 J	0.62 J	0.80 J	0.64 J
Arsenic	1.6	0.39	0.29	1.1 U	1.1 U	1.0 U	**2.3**	1.3 U
Barium	147	1,500	82	**469**	58	77	78	55
Calcium	8,840	--	--	3,480	2,430	**13,300**	**48,600**	3,380
Chromium	72	0.29	0.00083	4.0	7.9	5.0	14	6.4
Cobalt	16	2.3	0.49	9.0	9.7	9.0	14	9.6
Copper	66	310	46	23	33	30	39	28
Cyanide	0.89	160	2.0	2.9 U	2.7 U	2.5 U	0.46 J	3.3 U
Iron	38,100	5,500	640	19,600	25,200	15,800	21,300	23,800
Lead	3.3	400	27	1.6	1.5	**10**	**21**	1.3 U
Magnesium	3,710	--	--	2,880	**4,340**	2,200	**6,460**	**4,040**
Manganese	1,630	180	57	394	489	563	483	397
Nickel	22	160	48	2.1 J	4.4 U	4.0 U	5.0	3.2 J
Potassium	2,000	--	--	816	**2,130**	1,240	1,250	1,580
Selenium	0.51	39	0.26	**0.79 J**	3.8 UJ	**0.79 J**	**0.74 J**	**1.1 J**
Sodium	2,250	--	--	574 U	549 U	504 U	735	650 U
Vanadium	144	39	180	70	74	53	52	71
Zinc	32	2,400	680	16	20	**63**	**56**	20

Notes:

Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

ND - Not Detected
-- Not part of background data set
-- Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] Background value used is the maximum value detected from the EPA split samples from the East Vieques Background Soil Inorganics Investigation Report (CH2M HILL, October 2007)

Table 14-3
Camp Garcia Regional Groundwater Study Detection and Exceedance Results
PAOC K (MW02)
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Former NASD, Vieques, Puerto Rico

Station ID	PAOC-N EPAN-MW02 Background	Adjusted RSL for Tapwater	MCL - Groundwater	VECG-MW02
Sample ID				VECG-MW02-0409
Sample Date				04/01/09
Chemical Name				
Volatile Organic Compounds (UG/L)				
Acetone	--	2,200	--	6.0
Chloroform	--	0.19	80	**0.40 J**
Semivolatile Organic Compounds (UG/L)				
Fluoranthene	--	150	--	0.21 J
Pesticide/Polychlorinated Biphenyls (UG/L)				
Dieldrin	--	0.0042	--	**0.025 J**
Total Metals (UG/L)				
Barium	200	730	2,000	22 J
Calcium	144,000	--	--	68,200
Chromium	3.6 J	0.043	100	**3.8**
Copper	25 U	150	1,300	**1.5**
Magnesium	75,600	--	--	23,300 J
Manganese	8.0 J	88	--	**18 J**
Nickel	2.4 J	73	--	**4.4**
Potassium	1,780 J	--	--	1,270
Selenium	35 U	18	50	**2.3 J**
Sodium	323,000	--	--	77,200 J
Vanadium	50 U	18	--	**12 J**
Dissolved Metals (UG/L)				
Barium, Dissolved	200 U	730	2,000	**28 J**
Calcium, Dissolved	139,000	--	--	66,200
Copper, Dissolved	25 U	150	1,300	**1.2**
Magnesium, Dissolved	73,400	--	--	28,700 J
Manganese, Dissolved	15 U	88	--	**19 J**
Nickel, Dissolved	40 U	73	--	**3.1**
Potassium, Dissolved	1,710 J	--	--	1,430
Selenium, Dissolved	35 U	18	50	**2.2 J**
Sodium, Dissolved	311,000	--	--	86,800
Vanadium, Dissolved	50 U	18	--	**14 J**
Wet Chemistry (MG/L)				
Chloride	NA	--	--	60
Total dissolved solids (TDS)	1,490	--	--	500

Notes:

Exceeds Background

Exceeds Background and Adjusted RSL for Tapwater

NA - Not Analyzed
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/L - Milligrams per liter
UG/L - Micrograms per liter

TABLE 14-4
HHRA COPC SUMMARY TABLE
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PAOC-K
Media: Surface Soil, Subsurface Soil
Historical Function: Former Wash Rack

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC K	7429-90-5	Aluminum	1.2E+04		1.7E+04		mg/kg	EPAK-SO02	5 / 5	5 / 5	-	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	7440-38-2	Arsenic	1.4E+00		2.0E+00		mg/kg	EPAK-SO03	4 / 5	4 / 5	-	1.6E+00	Yes	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	6.9E+00		1.9E+01		mg/kg	EPAK-SO05	5 / 5	5 / 5	-	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	1.1E+01		2.1E+01		mg/kg	EPAK-SO04	5 / 5	5 / 5	-	1.6E+01	Yes	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.9	5.7E-08
	7439-89-6	Iron	1.9E+04		2.4E+04		mg/kg	EPAK-SO02	5 / 5	5 / 5	-	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	3.9E+02		6.3E+02		mg/kg	EPAK-SO01	5 / 5	5 / 5	-	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	Max	CNS	0.4	--
	7440-62-2	Vanadium	5.9E+01		8.4E+01		mg/kg	EPAK-SO02	5 / 5	5 / 5	-	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.2	--
PAOC K	7429-90-5	Aluminum	1.1E+04		1.8E+04		mg/kg	EPAK-SO02	5 / 5	5 / 5	-	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	Max	CNS	0.2	--
Subsurface Soil	7440-38-2	Arsenic	2.3E+00		2.3E+00		mg/kg	EPAK-SO04	1 / 5	1 / 5	-	1.6E+00	Yes	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.1	5.9E-06
	7440-47-3	Chromium	4.0E+00		1.4E+01		mg/kg	EPAK-SO04	5 / 5	5 / 5	-	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	9.0E+00		1.4E+01		mg/kg	EPAK-SO04	5 / 5	5 / 5	-	1.6E+01	No	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	1.6E+04		2.5E+04		mg/kg	EPAK-SO02	5 / 5	5 / 5	-	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.5	--
	7439-96-5	Manganese	3.9E+02		5.6E+02		mg/kg	EPAK-SO03	5 / 5	5 / 5	-	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	5.2E+01		7.4E+01		mg/kg	EPAK-SO02	5 / 5	5 / 5	-	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.9	6E-06
Total Risk	0.9	6E-06

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

* - Max HI is the highest HI associated with any target organ or critical effect.

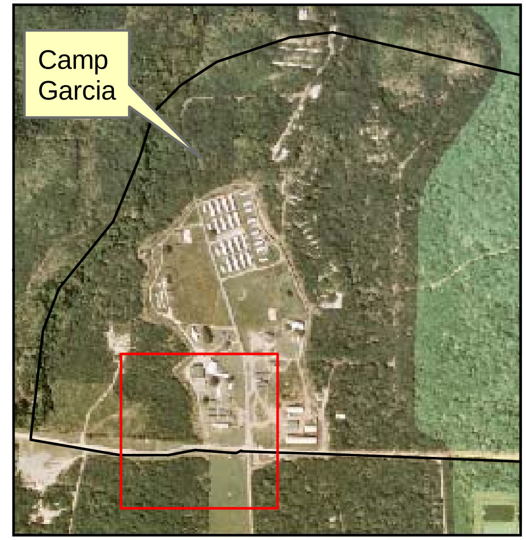
ca = Carcinogenic
nc = Noncarcinogenic
ELCR = Excess Lifetime Cancer Risk
CNS = Central nervous System

TABLE 14-5
Ecological Risk Assessment Screening Statistics for PAOC K Surface Soil
No Action/No Further Action Decision Docume
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Cobalt	-- - --	5 / 5	10.6	21	13.7	4.29	17.79	13	2 / 5	1.62	16.0	1 / 5	0.86	1.32	1.37	1.05
Copper	-- - --	5 / 5	32.4	113	55.4	33.50	87.36	70	1 / 5	1.61	66.0	1 / 5	0.84	1.71	1.25	0.79
Selenium	3.6 - 3.6	4 / 5	0.5	0.6	0.8	0.56	1.3	0.52	3 / 5	1.13	0.51	3 / 5	1.56	1.16	2.56	1.53

PHOTO DATE 1962

PHOTO DATE 1983



LEGEND

- PA/SI Surface and Subsurface Soil Sample Location
- Former/ Current Location of Structure

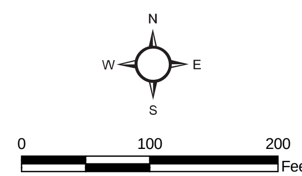


FIGURE 14-1
1962 Aerial Photograph of the PAOC K Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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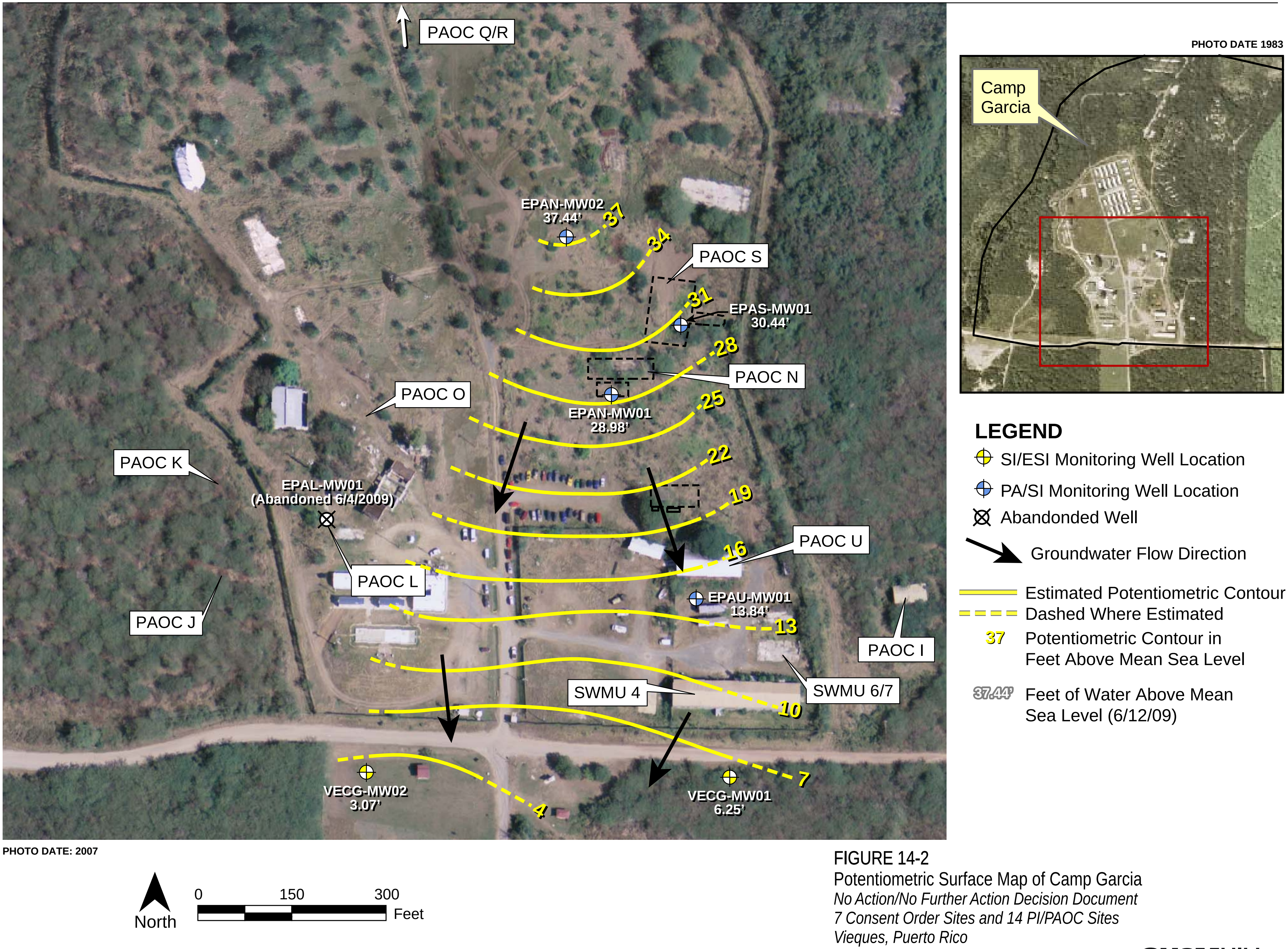

FIGURE 14-2
Potentiometric Surface Map of Camp Garcia
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

ES051310153702TPA F14-2 Pot Surface Map of Campa Garcia.ai mstuart

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SECTION 15

PAOC L—Former Paint and Transformer Storage Area

This section presents a summary of the pertinent historical information and rationale for the no further action determination for PAOC L. A more detailed discussion of the PAOC L evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

15.1 Conceptual Site Model

15.1.1 Site Description and Potential Sources of Release

PAOC L, located within Camp Garcia, was initially identified as a potential site in 2000 as part of the Description of Current Conditions site reconnaissance (CH2M HILL, 2001). Historical information suggests the site was used to store paint and transformers. While the building is no longer in use, the structure still exists. As shown in **Figure 15-1**, it is a small (approximately 11 ft by 13 ft), single room, concrete block building. Based on aerial photographs, the structure was built sometime after 1985.

No evidence of PCBs, hazardous materials, hazardous waste, petroleum, or munitions storage or disposal was evident during the 2000 reconnaissance (Description of Current Conditions recon), the 2002 reconnaissance (EBS), the 2006 sampling effort (PA/SI), or the 2009 sampling effort (ESI). While there was no observable evidence of a release during historical site visits, a PA/SI (2006) was performed due to past storage of paints and transformers.

15.1.2 Investigation History

During the PA/SI, co-located surface soil and subsurface soil samples were collected from four locations (SS/SB-01 through SS/SB-04) around the perimeter of the building (**Figure 15-2**). The southernmost boring (SB01) was finished as a monitoring well (MW01).

Pesticide data collected at multiple Vieques sites show that while the concentrations of pesticides vary within and across sites, the concentration of any particular pesticide in any particular sample is generally similar to that found at other sites, with the exception of PAOC L. While the concentrations of individual pesticides across multiple sites (other than PAOC L) vary from less than 1 micrograms per kilogram (μg/kg) to over 1,000 μg/kg, pesticide concentrations more than an order of magnitude higher than at any other site (i.e., up to 67,000 μg/kg) were detected in the PA/SI surface soil samples collected at PAOC L. It is certainly possible that the pesticide concentrations in the PA/SI surface soil samples were consistent with normal, legal application. Further, there is no historical information that suggests the building at PAOC L was used to store pesticides. However, because the structure was used to store chemicals (i.e., paints) and because the pesticide concentrations at this location were an order of magnitude higher than any other site, the Navy took the conservative approach to consider the pesticide concentrations detected in surface soil at PAOC L during the PA/SI to be associated with a potential CERCLA-related release.

The conclusion of the Final PA/SI Report was that refinement of the spatial distribution of potentially CERCLA-related pesticide releases in surface soil was warranted. The subsurface soil pesticide concentrations detected during the PA/SI were comparable to those consistent with normal, legal application; therefore, no additional subsurface soil pesticide concentration delineation was necessary. An additional round of groundwater sampling to confirm the PA/SI Report conclusion of no action for groundwater was also deemed warranted.

PA/SI Soil Sampling

As noted previously, co-located surface soil and subsurface soil samples were collected from four locations (SS/SB-01 through SS/SB-04) around the perimeter of the building (**Figure 15-2**). All soil samples were analyzed for TCL VOCs, SVOCs, pesticides, and PCBs; and TAL inorganics.

PA/SI Groundwater Sampling

The groundwater sample collected from MW01 was analyzed for TCL VOCs, SVOCs, pesticides, and PCBs; and TAL total and dissolved inorganics.

Initial ESI Soil Sampling

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), eight surface soil samples (SS05 through SS12, as shown on **Figure 15-2**) were collected further out from the building than the initial PA/SI (2006) samples. This outer ring of surface soil samples was analyzed for TCL pesticides in order to delineate the extent of the elevated levels of pesticides in surface soil. All samples were collected from 0 to 1 ft bgs.

Evaluation of the outer ring of surface soil samples showed that the concentrations of the pesticides detected during the PA/SI so much higher than the normal-use range (i.e., DDD, DDE, and DDT) were within the normal-use range in the samples collected from the outer ring. DDD went from a high of 940 µg/kg adjacent to the building to a high of 7 µg/kg further out. Similarly, DDE went from a high of 3,400 µg/kg to a high of 820 µg/kg, and DDT went from a high of 67,000 µg/kg to a high of 390 µg/kg.

Initial ESI Excavation Activities

Based on the above information, as well as the finding from the PA/SI Report that the subsurface soil pesticide concentrations at the site are within the normal-use pesticide concentration range, the Navy proposed and EPA and EQB concurred that it would be beneficial to remove the soil at PAOC L that contained the elevated pesticide concentrations (i.e., non-normal-use concentrations). The advantages of performing this work as part of the ESI were: (1) excavation equipment was already onsite doing similar work at other sites; (2) the area containing the elevated pesticide concentrations was very small; (3) soil posing a potentially unacceptable risk could be removed from the site (i.e., immediate risk reduction); and (4) determinations for the site could then be made in the ESI Report by excluding the PA/SI surface soil data that would likely show an unacceptable risk that would have to be reduced or managed in the future. It was further concurred that following this soil removal, additional soil samples from the bottom of the excavation would be collected at the approximate locations of the PA/SI samples to confirm the remaining pesticide concentrations are within the normal-use range.

Based on the above, soil was excavated to a depth of 2 ft bgs on all sides of the building out to or just beyond the outer ring of surface soil samples that contained pesticide concentrations in the normal-use range, as shown in **Figure 15-2**.

Initial Confirmatory ESI Soil Sampling

Following the initial excavation, four confirmatory soil samples were collected (SB13 through SB16, as shown in **Figure 15-2**). These samples were collected from the first 6 inches below the bottom of the excavation (i.e., 2 to 2.5 ft bgs), in accordance with the sampling logic applied to other sites where a potential contaminant source was removed (e.g., PI 7). All samples were analyzed for pesticides. Evaluation of the pesticide data for the four soil samples suggested sufficient soil had been removed from the northern and western sides of the building, but that additional soil removal was warranted around the southern and eastern sides of the building.

Additional ESI Excavation Activities

Based on the above information, an additional 2 ft of soil was excavated to a total depth of 4 ft bgs on the southern and eastern sides of the building, as shown in **Figure 15-2**. In order to conduct the excavation in a safe manner, monitoring well MW01 was abandoned prior to the additional excavation. The well had been sampled during the ESI prior to its abandonment.

Final Confirmatory ESI Soil Sampling

Following the additional excavation activities, two additional confirmatory soil samples were collected (SB17 and SB18, as shown in **Figure 15-2**) to replace samples SB14 and SB15 that were removed as part of the additional excavation. Like the previous confirmatory soil samples, these soil samples were collected from the first 6 inches below the bottom of the excavation (i.e., 4 to 4.5 ft bgs). All samples were analyzed for pesticides. Evaluation of the pesticide data for the two new confirmatory soil samples suggested sufficient soil had been removed from the southern and eastern sides of the building.

Soil with pesticides and concrete were disposed of at the Peñuelas Valley Landfill in Peñuelas, Puerto Rico. Additionally, minor scrap metal (metal pipe, etc.) identified on the site was transported to the Navy Central Processing Center (CPC) for disposal.

ESI Groundwater Sampling

A groundwater sample was collected from monitoring well MW01, to determine if a second round of groundwater data would confirm the results of the PA/SI (2006), and that no action is necessary for groundwater. The sample was analyzed for TCL VOCs, SVOCs, pesticides, PCBs, and TAL total and dissolved inorganics. **Tables 15-1 through 15-3** summarize the constituents detected in PAOC L surface soil, subsurface soil, and groundwater samples, respectively. Briefly, the data show that a VOC and several SVOCs, pesticides, and inorganics were detected in surface soil; several pesticides and inorganics were detected in subsurface soil; and several VOCs and inorganics were detected in groundwater.

Tables 15-1 through 15-3 summarize the constituents detected in PAOC L surface soil, subsurface soil, and groundwater samples, respectively, collected during the PA/SI and ESI. The tables also identify screening criteria exceedances.

15.1.3 Physical Setting

The site slopes very gently to the southwest, with the highest elevation at approximately 72 ft amsl. The land is cleared periodically as part of routine maintenance. The soils consist mostly of silty sand with some gravel. The subsurface geology consists of igneous rocks, primarily granodiorite and quartz diorite. Groundwater in the area exists within the fractured bedrock and flows in a southerly direction toward the coast. There are no surface water bodies immediately adjacent to the site. The closest surface water bodies topographically downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, approximately 1 mile to the south and southeast, respectively.

15.2 PAOC L Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 15-1 through 15-3**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former paint and transformer storage building. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visits, the concentrations of pesticides in surface soil detected during the PA/SI were conservatively considered potentially attributable to a CERCLA-related release. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

PA/SI (2006)

Appendix N, Section N.18 of the Final PA/SI Report (CH2M HILL 2008) discusses the evaluation of the PAOC L data quality. As detailed in Section N.18, the PAOC L data are acceptable for use in evaluating aspects of environmental conditions at PAOC L, including whether a CERCLA-related release has occurred and, if so, whether it warrants further investigation or action.

ESI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

As discussed in Section 15.0, soil removal activities occurred at PAOC L during the ESI. The soil removal resulted in removal of soil at some of the historical and interim confirmatory soil sample locations. Based on the soil removal activities, the soil samples that best represent current (i.e., post-excavation) site conditions are the boundary and near-boundary samples shown in **Figure 15-3**. The data from these samples are utilized in the decision analysis process. Data for soil samples SS/SB01, SS02, SS03, SS/SB04, SB14, and SB15 are not included in the decision analysis process because they do not represent post-excavation site conditions.

For the applicable samples collected during the PA/SI (2006) and the ESI (2009), the following inorganics above background UTL and non-inorganics were detected by sampling event and by medium:

PA/SI (2006) Subsurface Soil

- VOCs: none detected
- SVOCs: none detected
- Pesticides: 4,4′-DDE, 4,4′-DDT, endosulfan I
- PCBs: none detected
- Inorganics above background UTLs: calcium, lead, magnesium, potassium, selenium, and zinc

PA/SI (2006) Groundwater

- VOCs: chloroform, TCE
- SVOCs: none detected
- Pesticides: none detected
- PCBs: none detected
- Total inorganics above background (EPAN MW02): aluminum, chromium, cobalt, copper, iron, manganese, nickel, potassium, and selenium
- Dissolved inorganics above background (EPAN MW02): barium, chromium, cobalt, manganese, nickel, potassium, selenium, and vanadium

ESI (2009) Surface Soil

- Pesticides: 4,4'-DDD, 4,4′-DDE, 4,4′-DDT, alpha-chlordane, dieldrin, endosulfan I, endosulfan sulfate, endrin aldehyde, gamma-chlordane, methoxychlor

ESI (2009) Subsurface Soil

- Pesticides: 4,4'-DDD, 4,4′-DDE, 4,4′-DDT, dieldrin

ESI (2009) Groundwater

- VOCs: acetone, benzene, carbon disulfide, vinyl chloride
- SVOCs: none detected
- Pesticides: none detected
- PCBs: none detected
- Total inorganics above background (EPAN MW02): aluminum, antimony, arsenic, chromium, cobalt, iron, lead, manganese, nickel, potassium, selenium, vanadium, and zinc
- Dissolved inorganics above background (EPAN MW02): antimony, arsenic, barium, iron, manganese, nickel, potassium, selenium, vanadium, and zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

Constituent groups VOCs, SVOCs, and inorganics may be associated with paints historically stored at the site. Therefore, they are considered further in the decision analysis process as potentially being associated with a CERCLA-related release. As noted previously, soil removal was conducted during the ESI to eliminate pesticide concentrations potentially indicative of a CERCLA-related release. Pre- and post-excavation soil samples were collected to ensure the residual pesticide concentrations are consistent with the concentrations indicative of normal pesticide use (i.e., comparable to pesticide concentrations detected at other sites across east Vieques). Soil removal continued until the boundary sample concentrations (surface and subsurface soil) were found to be indicative of normal pesticide use and not a CERCLA-related release (see Appendix O and *Pesticides and Herbicides* under Section 1.1.1 of the Final SI/ESI Report (CH2M HILL, 2010)). Therefore, although the SI/ESI SAP stated that the PAOC L pesticide data would be evaluated in Step 5 of the decision analysis, this approach was based on the assumption that no soil removal was going to take place during the ESI. However, upon collection and analysis of the ESI pesticide data, the ERP Technical Subcommittee concurred upon a revised approach for PAOC L whereby the soil containing the elevated pesticide concentrations observed during the PA/SI would be excavated and confirmatory samples collected. Therefore, it is appropriate to compare the residual pesticide concentrations to the range of pesticide concentrations attributable to normal pesticide application rather than necessarily via Step 5. The samples representative of post-excavation concentrations are:

- Surface Soil – SS05, SS06, SS07, SS08, SS09, SS10, SS11, SS12, as shown in **Figure 15-3**
- Subsurface Soil – SB02, SB03, SB13, SB16, SB17, SB18, as shown in **Figure 15-3**

Because the pesticide concentrations (**Table 15-1**) in the applicable post-excavation soil samples (i.e., representative of post-excavation conditions) are comparable to the normal-use range of pesticide concentrations (Table O-1 of the Final SI/ESI Report (CH2M HILL, 2010)), they are not considered further in the decision analysis process. For example, 4,4′-DDD, 4,4′-DDE, and 4,4′-DDT were detected in PAOC L post-excavation surface soil samples at concentrations between 2.2 μg/kg and 6.6 μg/kg (4,4′-DDD), 58 μg/kg and 820 μg/kg (4,4′-DDE), and 24 μg/kg and 390 μg/kg (4,4′-DDT) which are similar to the concentrations detected at other sites across east Vieques (i.e., 0.16 μg/kg to 26 μg/kg for 4,4′-DDD; 0.08 μg/kg to 1,200 μg/kg for 4,4′-DDE; and 0.30 μg/kg to 990 μg/kg for 4,4′-DDT). This is consistent with the approach taken for other east Vieques sites with comparable pesticide concentrations. Evaluation of the historical (PA/SI) pesticide data, as well as data for historical samples eliminated by the soil removal, is presented in Section 18 of the Final PA/SI Report (CH2M HILL, 2008).

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the CERCLA-related constituent data identified in Step 4 for the applicable post-excavation soil samples are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

PA/SI (2006) Subsurface Soil

- Lead: one detection (sample SB02) at a concentration (79 mg/kg) above the SSL at a DAF of 1 (27 mg/kg) and background UTL (3.3 mg/kg)

PA/SI (2006) Groundwater

- Chloroform: detected at a concentration (0.49 μg/L) above the tap water RSL (0.19 μg/L)
- Chromium (total and dissolved): detected at concentrations (4.3 μg/L total and 0.66 μg/L dissolved) above the adjusted tap water RSL (0.043 μg/L) and background (3.6 μg/L total and non-detect dissolved)
- Selenium (total and dissolved): detected at concentrations (22 μg/L total and 23 μg/L dissolved) above the adjusted tap water RSL (18 μg/L) and background (non-detect)

ESI (2009) Groundwater

- Vinyl chloride: detected at a concentration (0.065 μg/L) above the tap water RSL (0.016 μg/L)
- Arsenic (total and dissolved): detected at concentrations (5.0 μg/L total and 5.8 μg/L dissolved) above the tap water RSL (0.045 μg/L) and background (non-detect)
- Chromium (total): detected at a concentration (11 μg/L) above the tap water RSL (0.043 μg/L) and background (3.6 μg/L)
- Manganese (total): detected at a concentration (124 μg/L) above the adjusted tap water RSL (88 μg/L) and background (8 μg/L)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

Soil

As a conservative approach, risk estimates were prepared for a future residential scenario at PAOC L. The site is approximately 0.2 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 15-4**). In fact, no constituents were detected in surface or subsurface soil above both human health screening levels and background levels. Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Seven constituents (aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium) were detected in surface or subsurface soil above human health screening levels but below background UTLs. Based on the historical source of potential releases identified at the site (see Section 15.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on maximum detected concentrations of the seven constituents, the cumulative ELCR is 2×10^{-6} and the maximum target organ-specific HI is 0.6 (see **Table 15-4**). Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil.

Groundwater

For a chemical identified as a COPC in both "total" and "dissolved" groundwater, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Two organics (chloroform and vinyl chloride) and four inorganic constituents were detected in groundwater at concentrations above the human health screening levels and background levels (for inorganics) (see **Table 15-4**). However, none was detected above its MCL.

- Chloroform was detected above its RSL (0.19 μg/L) in one of two samples at a concentration of 0.49 μg/L. Based on the maximum detected concentration, the HI is

0.004 and the ELCR is 3 x 10^{-6}, which are within EPA acceptable levels. Therefore, chloroform would not be identified as a risk driver.

- Vinyl chloride was detected above its RSL (0.016 µg/L) in one of two samples at a concentration of 0.065 µg/L. Based on the maximum detected concentration, the HI is 0.0009 and the ELCR is 4 x 10^{-6}, which are within EPA's acceptable levels. Therefore, vinyl chloride would not be identified as a risk driver. In addition, detected concentration is nearly two orders of magnitude less than the MCL (2 µg/L).
- Arsenic was detected above its RSL (0.045 µg/L) in one of two samples (based on total results) and one of two samples (based on dissolved results). The maximum detected concentrations of arsenic (total and dissolved) were 5 µg/L and 5.8 µg/L, respectively. Based on the maximum detected ("total") concentration, the HI is 0.5 and the ELCR is 1 x 10^{-4}. However, arsenic concentrations are below the MCL (10 µg/L). Further, no arsenic concentrations above background were detected in soil. Therefore, the arsenic concentrations detected in groundwater are attributable to background.
- Chromium was detected above its RSL (0.043 µg/L based on Cr^{6+}) in all samples (total and dissolved), at a maximum concentration of 11 µg/L; detected concentrations are less than the MCL (100 µg/L). Based on the maximum "total" concentration and the expected form of chromium (Cr^{3+}) at the site, the HI is 0.0002, which is within the EPA acceptable level, and chromium would not be identified as a risk driver. Additionally, all chromium detections in soil are below the background UTL, which indicates that the presence of chromium in groundwater is attributable to background.
- Manganese was detected above its adjusted RSL (88 µg/L) in one of two samples (based on total results); dissolved results were below the adjusted RSL. Based on the maximum detected concentration (124 µg /L), the HI is 0.1, which is within the EPA acceptable level. Therefore, manganese would not be identified as a risk driver. Further, no manganese concentrations above background were detected in soil. Therefore, the manganese concentration detected in groundwater is attributable to background.
- Selenium was detected above its adjusted RSL (18 µg/L) in one of two samples (based on total results) and one of two samples (based on dissolved results). The maximum detected concentrations were of 22 µg/L (based on total results) and 23 µg/L (based on dissolved results). Based on the maximum detected "total" concentration, the HI is 0.1, which is within the EPA acceptable level. Therefore, selenium would not be identified as a risk driver. In addition, selenium concentrations are below the MCL (50 µg/L).

Based on the above EPCs for chloroform, vinyl chloride, arsenic, chromium, manganese, and selenium, the cumulative groundwater ELCR is 1 x 10^{-4} and the maximum target organ-specific HI is 0.5 (see **Table 15-4**). Because the cumulative ELCR and target organ-specific HIs do not exceed EPA acceptable levels, effects from multiple chemicals in groundwater are not a concern. Although the arsenic ELCR is 1 x 10^{-4}, the maximum detected concentration is below its MCL. Further, arsenic, the primary contributor to the ELCR, is attributable to background.

Cumulative Soil and Groundwater

Potential cumulative risks from both residential soil and groundwater exposures were evaluated. As indicated on **Table 15-4**, the cumulative ELCR is 1×10^{-4} (driven by arsenic in groundwater) and the maximum target organ-specific HI is 0.8. Because the cumulative ELCR and target organ-specific HIs do not exceed EPA acceptable levels, effects from multiple chemicals in soil and groundwater are not a concern. As noted previously, the arsenic in groundwater is attributable to background.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 3×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Two inorganics (lead and selenium) were detected at concentrations above the SSLs at a DAF of 1 and background UTLs. However, total lead was detected in groundwater below its action level and no dissolved lead was detected in groundwater. Further, selenium was detected in groundwater below its MCL. This information suggests the SSLs at a DAF of 1 are not representative of inorganics leaching through soil to groundwater at the site. At a DAF of 3, the lead and selenium concentrations do not exceed the SSLs.

It is also important to note that only a single well was installed and used to represent background inorganics concentrations in groundwater for PAOC L. In actuality, background is represented by a range of concentrations because environmental media are not homogeneous. Therefore, the data from the background well for PAOC L (EPAN MW02) represent a single point within that range of background concentrations for each inorganic constituent. Most importantly, the second (ESI) round of data is comparable to the first (SI) round, and no concentrations exceeded MCLs in either round.

It should be noted that once the area is backfilled with soil, the locations of the post-excavation soil samples would be at depths of between 2 and 4 feet bgs, which would be below depths considered to have the potential for ecological exposures (0 to 1 ft).

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely source of CERCLA-related releases is the former paint storage and potential spills of pesticides at the site. Based on this information, soil removal activities were conducted and surface and subsurface soil samples were collected to confirm residual pesticide concentrations are comparable to those considered to be due to normal pesticide use. In addition, two rounds of groundwater data have been collected at the site and the resulting data show good comparability between the two events. Therefore, the temporal and spatial distribution of the samples collected during the SI and ESI and resulting data indicate the potential source area has been removed and the residual concentrations sufficiently characterized.

15.3 Conclusions and No Action Determination

The decision analysis process described above indicates that the area of surface and subsurface soil containing pesticide concentrations potentially attributable to a CERCLA-related release has been removed and that the residual soil concentrations are consistent with the concentrations attributable to normal pesticide use. Therefore, no further action is warranted for PAOC L; the soil from the road expansion activities will be used to backfill the excavation at PAOC L (see Section 21 of the Final SI/ESI Report [CH2M HILL, 2010]).

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Table 15-1
Surface Soil Detection and Exceedance Results
PAOC L
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	EPAL-SO01		EPAL-SO02	EPAL-SO03	EPAL-SO04	EPAL-SO05	EPAL-SO06	EPAL-SO07	EPAL-SO08	EPAL-SO09
Sample ID					EPAL-SS01-0002	EPAL-SS01P-0002	EPAL-SS02-0001	EPAL-SS03-0002	EPAL-SS04-0001	VEPL-SS05-01-0209	VEPL-SS06-01-0209	VEPL-SS07-01-0209	VEPL-SS08-01-0209	VEPL-SS09-01-0209
Sample Date					02/27/06	02/27/06	03/08/06	02/27/06	03/08/06	02/09/09	02/09/09	02/09/09	02/09/09	02/09/09
Chemical Name														
Volatile Organic Compounds (UG/KG)														
Acetone	--	6,100,000	--	4,500	10 U	10 U	4.0 J	10 U	12 U	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)														
Acetophenone	--	780,000	--	1,100	120 J	360 U	340 U	370 U	350 UJ	NA	NA	NA	NA	NA
Benzo(a)anthracene	--	150	--	10	**76 J**	360 U	340 U	370 U	350 UJ	NA	NA	NA	NA	NA
Benzo(a)pyrene	--	15	--	240	**73 J**	360 U	340 U	370 U	350 UJ	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	--	1,500	--	350	74 J	360 U	340 U	370 U	350 UJ	NA	NA	NA	NA	NA
Chrysene	--	15,000	--	1,100	78 J	360 U	340 U	370 U	350 UJ	NA	NA	NA	NA	NA
Fluoranthene	--	230,000	--	160,000	120 J	74 J	340 U	110 J	350 UJ	NA	NA	NA	NA	NA
Pyrene	--	170,000	--	120,000	120 J	360 U	340 U	110 J	350 UJ	NA	NA	NA	NA	NA
PAH HMW (Total)	--	--	18,000	--										
PAH LMW (Total)	--	--	29,000	--										
Pesticide/Polychlorinated Biphenyls (UG/KG)														
4,4'-DDD	--	2,000	583	66	6.0 NJ	24	17 U	3.7 NJ	**940 J**	3.8 U	4.2 R	6.5	3.4 U	2.2 J
4,4'-DDE	--	1,400	114	47	**930**	**1,400**	**3,400**	**670 J**	**2,300**	**72**	**66**	**170**	**58**	**430**
4,4'-DDT	--	1,700	100	67	**910**	**2,800**	**530**	**300 J**	**67,000**	24	54	40	35	**230**
alpha-Chlordane	--	1,600	11	140	1.8 UJ	1.8 U	8.7 U	1.9 UJ	180 U	3.2 U	3.0 U	3.1 U	2.9 U	1.7 J
Dieldrin	--	30	10.5	0.170	3.5 U	3.6 U	17 U	**0.79 J**	350 U	3.8 U	3.5 U	**3.8**	3.4 U	**2.0 J**
Endosulfan I	--	37,000	6.32	3,000	1.8 UJ	1.8 U	8.7 U	1.9 UJ	180 U	2.6 U	2.4 U	2.4 U	2.3 U	2.4 U
Endosulfan sulfate	--	37,000	6.32	3,000	3.5 UJ	3.6 U	17 U	3.7 UJ	350 U	3.8 U	3.5 U	3.7 U	3.4 U	3.7 U
Endrin	--	1,800	1.95	81	0.78 J	3.6 U	17 U	3.7 UJ	350 U	3.8 U	3.5 U	3.7 U	3.4 U	3.7 U
Endrin aldehyde	--	1,800	1.95	81	3.5 UJ	3.6 U	17 U	3.7 UJ	350 U	3.8 U	3.5 U	3.7 U	3.4 U	3.7 U
gamma-Chlordane	--	1,600	11	140	1.8 U	1.8 U	8.7 U	1.9 UJ	180 U	2.9 U	2.7 U	2.8 U	2.6 U	2.8 U
Methoxychlor	--	31,000	500	2,200	18 UJ	18 U	87 U	19 UJ	1,800 U	20 U	18 U	19 U	18 U	19 U
Total Metals (MG/KG)														
Aluminum	35,000	7,700	--	55,000	8,630	9,080	10,800	8,740	8,990	NA	NA	NA	NA	NA
Antimony	5.8	3.1	78	0.27	0.70 J	0.69 J	0.76 J	0.58 J	0.81 J	NA	NA	NA	NA	NA
Arsenic	1.6	0.39	18	0.29	0.50 J	0.43 J	1.0 U	1.1 U	0.46 J	NA	NA	NA	NA	NA
Barium	147	1,500	330	82	71	86	58	96	71	NA	NA	NA	NA	NA
Calcium	8,840	--	--	--	**34,100 J**	**52,200 J**	**16,600**	**16,300**	**38,700**	NA	NA	NA	NA	NA
Chromium	72	0.29	64	0.00083	4.7	5.5	15	5.7	6.1	NA	NA	NA	NA	NA
Cobalt	16	2.3	13	0.49	6.6	7.1	10	12	7.1	NA	NA	NA	NA	NA
Copper	66	310	70	46	**67**	**70**	52	50	63	NA	NA	NA	NA	NA
Cyanide	0.33	160	15.8	2.0	2.7 U	0.21 J	2.5 U	2.8 U	2.6 U	NA	NA	NA	NA	NA
Iron	38,100	5,500	--	640	13,300	14,700	18,500	14,400	14,500	NA	NA	NA	NA	NA
Lead	5.4	400	120	27	**36**	**38**	**11**	**12**	**15**	NA	NA	NA	NA	NA
Magnesium	3,710	--	--	--	**4,250**	**4,760**	**6,710**	**4,550**	**5,620**	NA	NA	NA	NA	NA
Manganese	1,630	180	220	57	368	418	464	699	423	NA	NA	NA	NA	NA
Nickel	22	160	38	48	4.3 U	4.4 U	5.9	5.6	4.2 U	NA	NA	NA	NA	NA
Potassium	5,270	--	--	--	1,030 J	1,200 J	1,230 J	698 J	941 J	NA	NA	NA	NA	NA
Selenium	0.51	39	0.52	0.26	**0.54 J**	**0.74 J**	**0.77 J**	**0.81 J**	**0.79 J**	NA	NA	NA	NA	NA
Vanadium	144	39	130	180	34	42	48	38	37	NA	NA	NA	NA	NA
Zinc	32	2,400	120	680	**258**	**215**	**90**	**48**	**54**	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UG/KG - Micrograms per kilogram

Table 15-1
Surface Soil Detection and Exceedance Results
PAOC L
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	EPAL-SO10	EPAL-SO11		EPAL-SO12
Sample ID					VEPL-SS10-01-0209	VEPL-SS11-01-0209	VEPL-SS11P-01-0209	VEPL-SS12-01-0209
Sample Date					02/09/09	02/09/09	02/09/09	02/09/09
Chemical Name								
Volatile Organic Compounds (UG/KG)								
Acetone	--	6,100,000	--	4,500	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)								
Acetophenone	--	780,000	--	1,100	NA	NA	NA	NA
Benzo(a)anthracene	--	150	--	10	NA	NA	NA	NA
Benzo(a)pyrene	--	15	--	240	NA	NA	NA	NA
Benzo(k)fluoranthene	--	1,500	--	350	NA	NA	NA	NA
Chrysene	--	15,000	--	1,100	NA	NA	NA	NA
Fluoranthene	--	230,000	--	160,000	NA	NA	NA	NA
Pyrene	--	170,000	--	120,000	NA	NA	NA	NA
PAH HMW (Total)	--	--	18,000	--				
PAH LMW (Total)	--	--	29,000	--				
Pesticide/Polychlorinated Biphenyls (UG/KG)								
4,4'-DDD	--	2,000	583	66	6.6 J	3.5 U	3.5 U	3.7 U
4,4'-DDE	--	1,400	114	47	**820**	**230**	**190**	**440**
4,4'-DDT	--	1,700	100	67	**170**	34 J	29	**390 J**
alpha-Chlordane	--	1,600	11	140	2.9 U	3.0 U	3.0 U	4.3 J
Dieldrin	--	30	10.5	0.170	3.4 U	3.5 U	3.5 U	**19**
Endosulfan I	--	37,000	6.32	3,000	2.3 U	2.4 U	2.3 U	**8.6**
Endosulfan sulfate	--	37,000	6.32	3,000	3.4 U	3.5 U	3.5 U	**11**
Endrin	--	1,800	1.95	81	3.4 U	3.5 U	3.5 U	3.7 U
Endrin aldehyde	--	1,800	1.95	81	3.4 U	3.5 U	3.5 U	**44 J**
gamma-Chlordane	--	1,600	11	140	2.6 U	4.6 J	2.8 J	**160 J**
Methoxychlor	--	31,000	500	2,200	18 U	18 U	18 U	82
Total Metals (MG/KG)								
Aluminum	35,000	7,700	--	55,000	NA	NA	NA	NA
Antimony	5.8	3.1	78	0.27	NA	NA	NA	NA
Arsenic	1.6	0.39	18	0.29	NA	NA	NA	NA
Barium	147	1,500	330	82	NA	NA	NA	NA
Calcium	8,840	--	--	--	NA	NA	NA	NA
Chromium	72	0.29	64	0.00083	NA	NA	NA	NA
Cobalt	16	2.3	13	0.49	NA	NA	NA	NA
Copper	66	310	70	46	NA	NA	NA	NA
Cyanide	0.33	160	15.8	2.0	NA	NA	NA	NA
Iron	38,100	5,500	--	640	NA	NA	NA	NA
Lead	5.4	400	120	27	NA	NA	NA	NA
Magnesium	3,710	--	--	--	NA	NA	NA	NA
Manganese	1,630	180	220	57	NA	NA	NA	NA
Nickel	22	160	38	48	NA	NA	NA	NA
Potassium	5,270	--	--	--	NA	NA	NA	NA
Selenium	0.51	39	0.52	0.26	NA	NA	NA	NA
Vanadium	144	39	130	180	NA	NA	NA	NA
Zinc	32	2,400	120	680	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UG/KG - Micrograms per kilogram

Table 15-2
Subsurface Soil Detection and Exceedance Results
PAOC L
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	EPAL-SO01	EPAL-SO02	EPAL-SO03	EPAL-SO04	EPAL-SO13	EPAL-SO14		EPAL-SO15	EPAL-SO16	EPAL-SO17	VEPL-SO18
Sample ID				EPAL-SB01-0204	EPAL-SB02-0406	EPAL-SB03-0406	EPAL-SB04-0204	VEPL-SB13-22H-0509	VEPL-SB14-22H-0509	VEPL-SB14P-22H-0509	VEPL-SB15-22H-0509	VEPL-SB16-22H-0509	VEPL-SB17-44H-0509	VEPL-SB18-44H-0509
Sample Date				02/27/06	03/08/06	03/08/06	03/08/06	05/01/09	05/01/09	05/01/09	05/01/09	05/01/09	05/07/09	05/18/09
Chemical Name														
Volatile Organic Compounds (UG/KG)														
No Detections	--	--	--	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/KG)														
No Detections	--	--	--	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/KG)														
4,4'-DDD	--	2,000	66	3.8 UJ	3.6 U	3.6 U	3.7 U	1.9 J	1.2 J	12 J	**160 J**	7.3 J	7.3	1.6 J
4,4'-DDE	--	1,400	47	2.3 J	**330**	**250**	**100**	**170**	43	44	**1,100**	**170**	**500**	14
4,4'-DDT	--	1,700	67	1.2 J	**180**	25	12	**74**	52 J	**780 J**	**8,200**	**310**	**410**	6.5
Dieldrin	--	30	0.170	3.8 UJ	3.6 U	3.6 U	3.7 U	**1.2 J**	**0.79 J**	17 U	**120 J**	**6.9 J**	**6.3**	3.8 U
Endosulfan I	--	37,000	3,000	1.9 UJ	1.9	1.8 U	1.9 U	2.3 U	2.2 U	11 U	220 U	12 U	2.4 U	2.5 U
Total Metals (MG/KG)														
Aluminum	35,000	7,700	55,000	19,400	10,100	9,380	10,300	NA	NA	NA	NA	NA	NA	NA
Antimony	5.8	3.1	0.27	0.71 J	0.74 J	0.40 J	0.62 J	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.6	0.39	0.29	1.1 U	0.79 J	0.53 J	0.79 J	NA	NA	NA	NA	NA	NA	NA
Barium	147	1,500	82	60	106	70	97	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.27	16	3.2	0.15 J	0.55 U	0.54 U	0.031 J	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.2	7.0	0.38	0.57 U	0.55 U	0.54 U	0.17 J	NA	NA	NA	NA	NA	NA	NA
Calcium	8,840	--	--	3,640	**76,900**	**51,600**	**86,000**	NA	NA	NA	NA	NA	NA	NA
Chromium	72	0.29	0.00083	5.2	10	8.8	4.7	NA	NA	NA	NA	NA	NA	NA
Cobalt	16	2.3	0.49	7.3	6.4	6.4	6.7	NA	NA	NA	NA	NA	NA	NA
Copper	66	310	46	37	41	45	50	NA	NA	NA	NA	NA	NA	NA
Iron	38,100	5,500	640	21,200	14,500	13,100	13,900	NA	NA	NA	NA	NA	NA	NA
Lead	3.3	400	27	1.3	**79**	**17**	**52**	NA	NA	NA	NA	NA	NA	NA
Magnesium	3,710	--	--	2,880	**4,690**	**4,600**	**5,660**	NA	NA	NA	NA	NA	NA	NA
Manganese	1,630	180	57	367	339	351	391	NA	NA	NA	NA	NA	NA	NA
Nickel	22	160	48	2.6 J	5.5	5.8	4.5 U	NA	NA	NA	NA	NA	NA	NA
Potassium	2,000	--	--	**2,620 J**	**2,150 J**	1,960 J	1,950 J	NA	NA	NA	NA	NA	NA	NA
Selenium	0.51	39	0.26	**0.68 J**	0.43 J	3.8 U	**0.58 J**	NA	NA	NA	NA	NA	NA	NA
Sodium	2,250	--	--	567 U	801	541 U	706	NA	NA	NA	NA	NA	NA	NA
Vanadium	144	39	180	67	39	36	36	NA	NA	NA	NA	NA	NA	NA
Zinc	32	2,400	680	22	**91**	**63**	**289**	NA	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 15-3
Groundwater Detection and Exceedance Results
PAOC L
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	PAOC-N	Adjusted RSL for Tapwater	MCL - Groundwater	EPAL-MW01	
Sample ID	EPAN-MW02			EPAL-GW01-06B	VEPL-GW01-0409
Sample Date	Background			04/06/06	04/28/09
Chemical Name					
Volatile Organic Compounds (UG/L)					
Acetone	--	2,200	--	6.1 U	6.0 J
Benzene	--	0.41	5.0	0.50 U	0.19 J
Carbon disulfide	--	100	--	0.50 U	0.70 J
Chloroform	--	0.19	80	**0.49 J**	1.0 U
Trichloroethene	--	2	5.0	0.11 J	1.0 U
Vinyl chloride	--	0.016	2.0	0.50 U	**0.065 J**
Semivolatile Organic Compounds (UG/L)					
No Detections	--	--	--	ND	ND
Pesticide/Polychlorinated Biphenyls (UG/L)					
No Detections	--	--	--	ND	ND
Total Metals (UG/L)					
Aluminum	263	3,700	--	**911**	**3,330 J**
Antimony	60 U	1.5	6.0	60 U	**1.2**
Arsenic	10 U	0.045	10	10 U	**5.0**
Barium	200	730	2,000	200 U	79
Calcium	144,000	--	--	94,700	87,200
Chromium	3.6 J	0.043	100	**4.3 J**	**11**
Cobalt	50 U	1.1	--	**0.77 J**	**0.99 J**
Copper	25 U	150	1,300	**4.6 J**	22 R
Iron	198	2,600	--	**631**	**2,390**
Lead	10 U	15	15	10 U	**7.6 J**
Magnesium	75,600	--	--	40,600	35,900
Manganese	8 J	88	--	**66**	**124**
Nickel	2.4 J	73	--	**2.7 J**	**8.0**
Potassium	1,780 J	--	--	**32,500 J**	**23,100**
Selenium	35 U	18	50	**22 J**	**9.1 J**
Sodium	323,000	--	--	281,000	275,000
Vanadium	50 U	18	--	50 U	**18**
Zinc	60 U	1,100	--	60 U	**20**
Dissolved Metals (UG/L)					
Antimony, Dissolved	60 U	1.5	6.0	60 U	**1.2**
Arsenic, Dissolved	10 U	0.045	10	10 U	**5.8**
Barium, Dissolved	200 U	730	2,000	**74 J**	**64**
Calcium, Dissolved	139,000	--	--	89,000	83,300
Chromium, Dissolved	10 U	0.043	100	**0.66 J**	3.0 U
Cobalt, Dissolved	50 U	1.1	--	**0.43 J**	1.0 U
Iron, Dissolved	100 U	2,600	--	100 U	**187**
Magnesium, Dissolved	73,400	--	--	39,100	35,800
Manganese, Dissolved	15 U	88	--	**50**	**72**
Nickel, Dissolved	40 U	73	--	**1.4 J**	**9.3**
Potassium, Dissolved	1,710 J	--	--	**32,800 J**	**22,900**
Selenium, Dissolved	35 U	18	50	**23 J**	**12 J**
Sodium, Dissolved	311,000	--	--	266,000	276,000
Vanadium, Dissolved	50 U	18	--	**7.0 J**	**14**
Zinc, Dissolved	60 U	1,100	--	60 U	**17**
Wet Chemistry (MG/L)					
Chloride	NA	--	--	NA	96
Total dissolved solids (TDS)	1,490	--	--	1,160	720

Notes:
Exceeds Background
Exceeds Background and Adjusted RSL for Tapwater
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
MG/L - Milligrams per liter
UG/L - Micrograms per liter

Table 15-4
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

BPAOC-L
BSurface Soil, Subsurface Soil, Groundwater
BFormer Paint and Transformer Storage Area

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	PAOC-N MW2		December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screeing Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC-L	7429-90-5	Aluminum	8.7E+03		1.08E+04		mg/kg	EPAL-SO02	4 / 4	4 / 4	--	3.5E+04	No	--	--	7.7E+03	nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	7440-38-2	Arsenic	4.6E-01	J	5.00E-01	J	mg/kg	EPAL-SO01	2 / 4	2 / 4	--	1.6E+00	No	--	--	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	5.5E+00		1.53E+01		mg/kg	EPAL-SO02	4 / 4	4 / 4	--	7.2E+01	No	--	--	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0001	--
	7440-48-4	Cobalt	7.1E+00		1.16E+01		mg/kg	EPAL-SO03	4 / 4	4 / 4	--	1.6E+01	No	--	--	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.5	3.2E-08
	7439-89-6	Iron	1.4E+04		1.85E+04		mg/kg	EPAL-SO02	4 / 4	4 / 4	--	3.8E+04	No	--	--	5.5E+03	nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	4.2E+02		6.99E+02		mg/kg	EPAL-SO03	4 / 4	4 / 4	--	1.6E+03	No	--	--	1.8E+02	nc	No	--	1.8E+03	--	--	Max	CNS	0.4	--
	7440-62-2	Vanadium	3.7E+01		4.84E+01		mg/kg	EPAL-SO02	4 / 4	2 / 4	--	1.4E+02	No	--	--	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
														--	--											
PAOC-L	7429-90-5	Aluminum	9.4E+03		1.9E+04		mg/kg	EPAL-SO01	4 / 4	4 / 4	-	3.5E+04	No	--	--	7.7E+03	nc	No	--	7.7E+04	--	--	Max	CNS	0.3	--
Subsurface Soil	7440-38-2	Arsenic	5.3E-01	J	7.9E-01	J	mg/kg	EPAL-SO02, EPAL-SO04	3 / 4	3 / 4	-	1.6E+00	No	--	--	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.04	2.0E-06
	7440-47-3	Chromium	4.7E+00		1.0E+01		mg/kg	EPAL-SO02	4 / 4	4 / 4	-	7.2E+01	No	--	--	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	6.4E+00		7.3E+00		mg/kg	EPAL-SO01	4 / 4	4 / 4	-	1.6E+01	No	--	--	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	1.3E+04		2.1E+04		mg/kg	EPAL-SO01	4 / 4	4 / 4	-	3.8E+04	No	--	--	5.5E+03	nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.4	--
	7439-96-5	Manganese	3.4E+02		3.9E+02		mg/kg	EPAL-SO04	4 / 4	4 / 4	-	1.6E+03	No	--	--	1.8E+02	nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	3.6E+01		6.7E+01		mg/kg	EPAL-SO01	4 / 4	2 / 4	-	1.4E+02	No	--	--	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.2	--
														--	--											
PAOC-L Groundwater	7440-38-2_D	Arsenic, Dissolved	5.8E+00		5.8E+00		ug/L	EPAL-MW01	1 / 2	1 / 2	1.50E+00 - 1.50E+00	--	--	1.0E+01	U	4.5E-02	ca	Yes	4.5E-02	1.1E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3_D	Chromium, Dissolved	6.6E-01	J	6.6E-01	J	ug/L	EPAL-MW01	1 / 2	1 / 2	3.00E-01 - 3.00E-01	--	--	1.0E+01	U	4.3E-02	ca	No	--	5.5E+04	--	--	--	No Observed Effects	--	--
	7782-49-2_D	Selenium, Dissolved	1.2E+01	J	2.3E+01	J	ug/L	EPAL-MW01	2 / 2	1 / 2	8.00E-01 - 8.00E-01	--	--	3.5E+01	U	1.8E+01	nc	No	--	1.8E+02	--	--	--	Clinical selenosis	--	--
	7440-38-2	Arsenic	5.0E+00		5.0E+00		ug/L	EPAL-MW01	1 / 2	1 / 2	1.50E+00 - 1.50E+00	--	--	1.0E+01	U	4.5E-02	ca	Yes	4.5E-02	1.1E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.5	1.1E-04
	7440-47-3	Chromium	4.3E+00	J	1.1E+01		ug/L	EPAL-MW01	2 / 2	2 / 2	3.00E-01 - 3.00E-01	--	--	3.6E+00	J	4.3E-02	ca	Yes	--	5.5E+04	--	--	Max	No Observed Effects	0.0002	--
	7439-96-5	Manganese	6.6E+01		1.2E+02		ug/L	EPAL-MW01	2 / 2	1 / 2	1.50E-01 - 1.50E-01	--	--	8.0E+00	J	8.8E+01	nc	No	--	8.8E+02	--	--	Max	CNS	0.1	--
	7782-49-2	Selenium	9.1E+00	J	2.2E+01	J	ug/L	EPAL-MW01	2 / 2	1 / 2	8.00E-01 - 8.00E-01	--	--	3.5E+01	U	1.8E+01	nc	No	--	1.8E+02	--	--	Max	Clinical selenosis	0.1	--
	67-66-3	Chloroform	4.9E-01	J	4.9E-01	J	ug/L	EPAL-MW01	1 / 2	1 / 2	2.00E-01 - 2.00E-01	--	--	--	--	1.9E-01	ca	No	1.9E-01	1.3E+02	--	--	Max	Liver cell polymorphism	0.004	2.6E-06
	75-01-4	Vinyl chloride	6.5E-02	J	6.5E-02	J	ug/L	EPAL-MW01	1 / 2	1 / 2	9.30E-03 - 9.30E-03	--	--	--	--	1.6E-02	ca	No	1.6E-02	7.2E+01	--	--	Max	Liver cell polymorphism	0.0009	4.1E-06

Site Cumulative Risk	Max HI *	ELCR
Soil	0.6	2E-06
Groundwater	0.5	1E-04
Total Risk	0.8	1E-04

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

* - Max HI is the highest HI associated with any target organ or critical effect.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

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Photo Date: December 30, 2004

(A) Building for investigation at PAOC L

Photo Date: December 30, 2004

(B) Open doorway of building at PAOC L

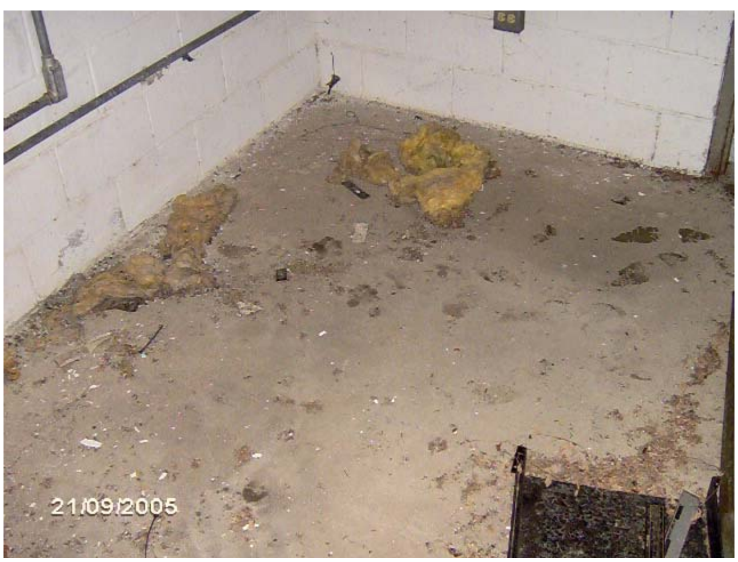

Photo Date: September 21, 2005

(C) Floor of building at PAOC L

Photo Date: September 21, 2005

(D) Floor of building at PAOC L

FIGURE 15-1
PAOC L Photographs
Former Paint and Transformer Storage Area
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

PHOTO DATE 2005

PHOTO DATE 1983

LEGEND

- PA/SI Surface Soil and Subsurface Soil Sample
- SI/ESI Surface Soil Sample
- SI/ESI Subsurface Soil Sample
- PA/SI Surface and Subsurface Soil Sample Location and Monitoring Well
- 2' Below Grade Excavation
- 4' Below Grade Excavation

Notes:

EPAL-MW01 abandoned on 6/4/2009 during SI/ESI event.

The white buildings shown southeast of the PAOC L storage shed are no longer present.

N
W E
S

0 30 60
Feet

FIGURE 15-2
Soil Sample and Monitoring Well Locations at PAOC L
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

LEGEND

- PA/SI Subsurface Soil Sample
- SI/ESI Surface Soil Sample
- SI/ESI Subsurface Soil Sample
- 2' Below Grade Excavation
- 4' Below Grade Excavation

Notes:

EPAL-MW01 abandoned on 6/4/2009 during SI/ESI event.

The white building shown southeast of the PAOC L storage shed is no longer present.

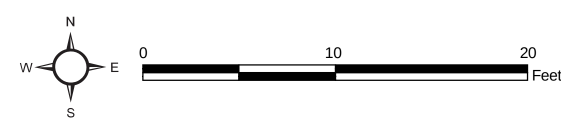

FIGURE 15-3
Soil Samples Representing Post-Excavation Conditions
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

SECTION 16

PAOC M—Former Fuel Facility

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC M. A more detailed discussion of the PAOC M evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

16.1 Conceptual Site Model

16.1.1 Site Description and Potential Sources of Release

Historical information indicates the site (former Building 4503) was a former dispatch office, sleeping quarters, and fuel facility. The facility was constructed in 1986 and demolished in 1991. The relatively limited historical information that exists about PAOC M comes from the following site visits during the EBS and SI scoping as well as personnel interviews and historical records review during the EBS. Aerial photographs reviewed include those shown in **Figures 16-1 through 16-3**, from 1983, 2005 and 2007. Additionally, **Figure 16-4,** is an historic schematic map showing the potential location of the former PAOC M building.

The EBS conducted in 2002, found no evidence of hazardous material, hazardous waste, petroleum, or munitions storage or disposal. Additionally, the SI Scoping Session site visit (2007) found the structure is no longer present. The area was observed to be periodically used as a parking area and the area just south of the former building has been reworked for restroom construction.

The potential source of a CERCLA-related release is the historic fuel facility, if it housed fuel-related materials; therefore, this site was included in the SI/ESI.

16.1.2 Investigation History

As presented in the SI/ESI SAP (CH2M HILL, 2009b), soil borings (from ground surface to refusal at 20 to 24 ft bgs) were advanced at four locations (**Figure 16-1**) around the footprint of the former small white building shown in the 1983 aerial photograph, which is believed to be former Building 4503. At each soil boring location, the soil cores were screened visually, by smell, and with a PID for the presence of potential contamination. There were no PID readings above 0 ppm, no visual indication of contamination, and no suspicious odors. Therefore, in accordance with the SI/ESI SAP (CH2M HILL, 2009b) no release is suspected and, therefore, no soil sampling was warranted.

16.1.3 Physical Setting

The site is flat, at approximately 57 ft amsl and sloping about 1 to 2 ft every 100 ft to the south. The land is cleared as it is used as a restroom and periodic parking area. The soil consists mostly of silty sand with some sands and silts. The subsurface geology consists of igneous rocks, primarily granodiorite and quartz diorite. Groundwater in this area exists within the fractured bedrock and flows in a southerly direction toward the coast. No surface water bodies are present at the site. The closest surface water bodies downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, approximately 1 mile to the south and southeast, respectively.

16.2 Conclusions and No Action Determination

Four continuous soil borings were advanced around former Building 4503 to evaluate the site for potential historical releases. There was no sign of potential contamination, which indicates there has not been a CERCLA-related release at the site. Therefore, based on the above information, a no action is warranted for PAOCM.

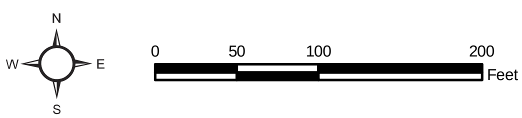

FIGURE 16-1
PAOC M 1983 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

FIGURE 16-2
PAOC M 2005 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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FIGURE 16-3
PAOC M 2007 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

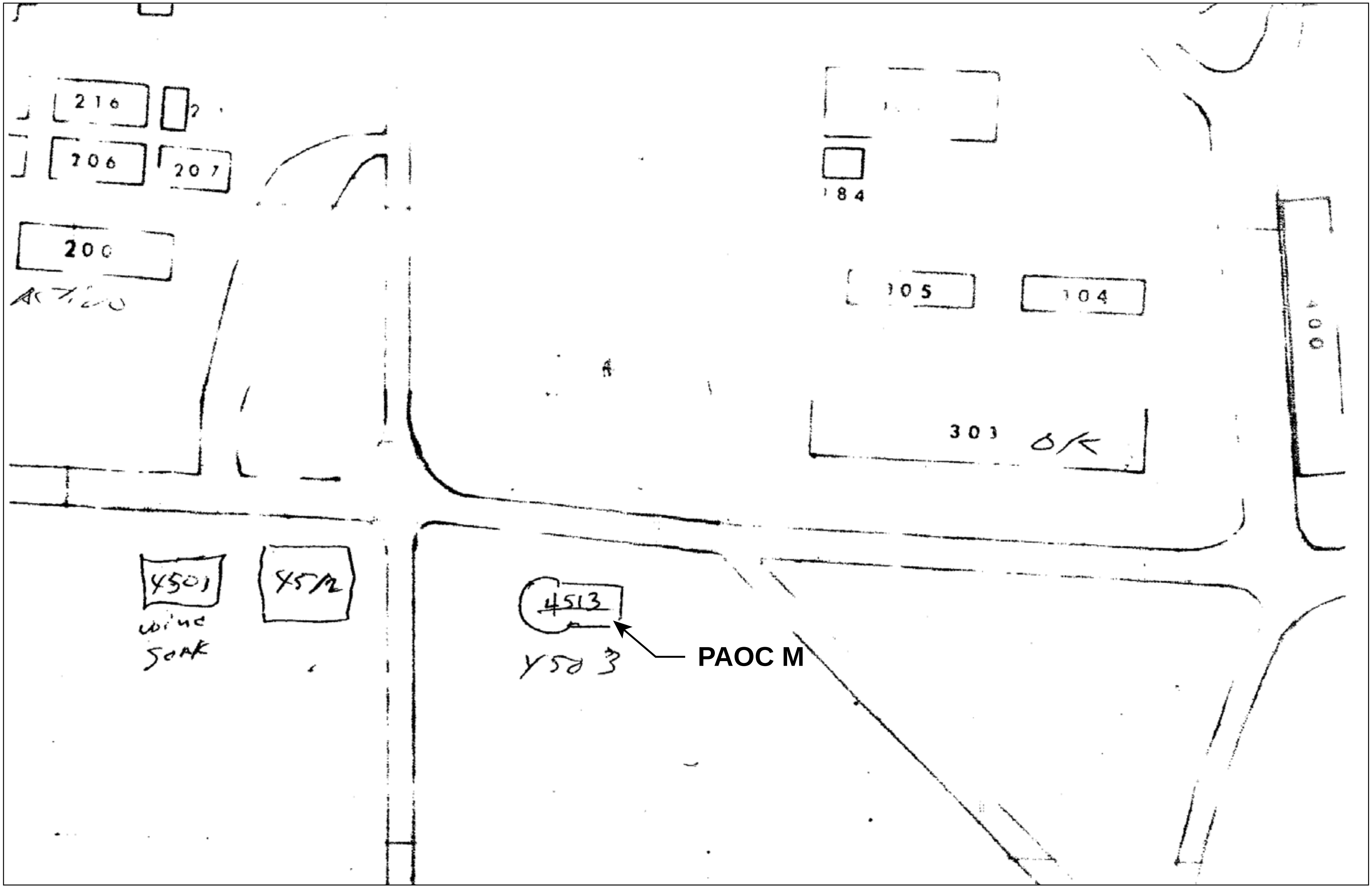

FIGURE 16-4
PAOC M Schematic Map Showing Potential Location of Building
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 17

PAOC N—Former Fuel Farm and Filling Station

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC N. A more detailed discussion of the PAOC N evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

17.1 Conceptual Site Model

17.1.1 Site Description and Potential Sources of Release

Records indicate that PAOC N was a fuel farm and filling station formerly located at the Camp Garcia Compound at the location shown on **Figure 17-1**. An historic site map shows that three ASTs numbered 4504, 4505, and 4506 existed in the area. As can be seen in **Figure 17-2**, another historic map shows the un-numbered tanks listed as fuel tanks. The fuel farm and filling station was built in 1985 and demolished in November 1992 (CH2M HILL, 2003b).

The site later became the Camp Garcia Refueling Station. A two-compartment, secondarily contained tank (Convault) was installed in 2000 (right-most tank shown on the photograph in **Figure 17-3**). One compartment contained diesel fuel (2,000 gallons) and one compartment contained gasoline (1,000 gallons), both of which were used for vehicle refueling. The tank is constructed of vaulted steel and is still present. The other two tanks shown in that figure have since been removed.

Interview records indicate that no known releases occurred at this facility. No evidence of hazardous material, hazardous waste, petroleum, or munitions storage or disposal was observed during the VSI conducted for the EBS in October 2002 (NAVFACENGCOM, 2003). However, due to the presence of the former fuel tanks, and because they had not been investigated for possible leaks, the site was included in the 2006 PA/SI (CH2M HILL, 2008).

Although the 2006 PA/SI suggested there had not been a release that warranted further evaluation and there is no historical information that suggested fuel for the generators at the power plant portion of PAOC S was supplied via direct piping from PAOC N (former fuel farm and filling station), it was recognized that a source of diesel (i.e., the Convault) was located with approximately 100 feet of the former power plant. Based on this, a geophysical survey was deemed warranted between the former fuel tank locations at PAOC N and the former PAOC S power plant building to ascertain whether an underground fuel pipeline exists between the former tanks and the former power plant. Therefore, this site was included in the 2009 ESI.

17.1.2 Investigation History

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), because no underground pipeline was identified during the geophysical survey, no soil sampling was necessary. During the PA/SI, four soil borings and a monitoring well were installed at PAOC N at the locations shown on **Figure 17-1**. At each soil boring location, one surface soil sample and one subsurface soil sample were collected. Three soil borings were installed adjacent to the locations of the former and current ASTs, and one soil boring was installed at the location of the former fuel building. Slightly elevated PID readings relative to background were encountered at soil boring SB03 in the 1-to-3-foot interval; therefore, the subsurface soil sample at this location was collected from this interval. No PID or FID readings significantly above background were observed in the remaining soil borings (see Soil Boring Logs, Appendix D of the Final PA/SI Report [CH2M HILL, 2008]); therefore, subsurface soil samples were collected at default depths in accordance with the work plan (see Table 2-1 of the Final PA/SI Report [CH2M HILL, 2008] for subsurface soil sample depths). The soil boring at the location of the former fuel building was completed as a monitoring well. The surface and subsurface soil samples were analyzed for TCL VOCs and SVOCs, TAL metals, and petroleum hydrocarbons (TPH-DRO, TPH-GRO, and TPH-ORO). Groundwater samples were analyzed for the same parameters. In addition, one monitoring well (EPAN-MW02) was installed upgradient of the site, as shown on **Figure 17-1**. This well also serves as the upgradient well for the power plant portion of PAOC S. The groundwater sample collected from the background well was analyzed for TAL metals.

Tables 17-1, 17-2, and 17-3 summarize the constituents detected in PAOC N surface soil samples, subsurface soil samples, and groundwater samples, respectively, collected during the PA/SI. The tables also identify screening criteria exceedances.

It is important to note that evaluation of these data, as presented in the PA/SI Report (CH2M HILL, 2008), determined that there has not been a CERCLA-related release at PAOC N that resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. However, because the site has not yet been closed out (due to the need to conduct a geophysical evaluation during the ESI), the PA/SI data have been re-evaluated in this SI/ESI Report to account for the new EPA RSLs/SSLs that superseded the EPA Region IX PRGs/SSLs and to account for ecological screening values that have been updated. It is also important to note that this re-evaluation resulted in no changes to constituents exceeding screening levels or the conclusions reached.

17.1.3 Physical Setting

The site is flat, at approximately 77 ft amsl and slopes approximately 1 to 2 ft every 100 ft to the south. The land is cleared periodically but not regularly maintained. The soil consists mostly of silt and silt with sand. The bedrock was encountered between 22 ft and 36 ft bgs and consists of igneous rocks, primarily granodiorite and quartz diorite. Groundwater occurs within the fractured bedrock and is presumed to flow in a southerly direction toward the coast. No surface water bodies are present at the site and the closest surface water bodies topographically downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, approximately 1 mile to the south and southeast, respectively.

17.2 PAOC N Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 17-1 through 17-3**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former fuel farm and filling station. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visit, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2006 PA/SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Appendix N, Section N.19 of the Final PA/SI 12 Consent Order Sites and 8 PI/PAOC Sites (CH2M HILL, 2008) discusses the evaluation of the PAOC N data quality. As detailed in Section N.19, the PAOC N data are acceptable for use in evaluating whether a release of hazardous waste or hazardous constituents warranting further investigation or action occurred at PAOC N.

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the PA/SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Surface Soil

- VOCs: none detected
- SVOCs: acetophenone, di-n-octylphthalate, bis(2-ethylhexyl)phthalate
- Inorganics above background UTLs: calcium, lead, magnesium, selenium, and zinc
- TPH: TPH-DRO

Subsurface Soil

- VOCs: none detected
- SVOCs: acetophenone, bis(2-ethylhexyl)phthalate
- Inorganics above background UTLs: selenium
- TPH: TPH-DRO

Groundwater

- VOCs: none detected
- SVOCs: none detected
- Total inorganics above background (EPAN MW02): manganese and nickel
- Dissolved inorganics above background (EPAN MW02): chromium and manganese
- TPH: none detected

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records or visual evidence of past releases at PAOC N. However, based on the potential source areas at PAOC N (i.e., former fuel tanks and filling station), it is assumed that the detected constituent groups (i.e., SVOCs, inorganics, TPH) are potentially attributable to CERCLA-related releases from the former tanks because they are all potentially associated with petroleum hydrocarbons. Therefore, constituents detected as part of the PA/SI are further considered in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Surface Soil

- SVOCs: no exceedances
- TPH-DRO: no exceedances
- Selenium: one detection (sample SS03) at a concentration (0.69 mg/kg) above the ecological screening value (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg), and background UTL (0.51 mg/kg)
- Zinc: one detection (sample SS03) at a concentration (183 mg/kg) above the ecological screening value (120 mg/kg) and background UTL (32 mg/kg)

Subsurface Soil

- SVOCs: no exceedances
- TPH-DRO: no exceedances
- Selenium: one detection (sample SB04) at a concentration (0.64 mg/kg) above the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)

Groundwater

- Chromium (dissolved): detected at a concentration (0.70 μg/L) above the tap water RSL (0.043 μg/L)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

Soil

As a conservative approach, risk estimates were prepared for a future residential scenario at PAOC N. The site is approximately 0.5 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 17-4**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

No chemicals were detected in surface or subsurface soil above both human health screening levels and background UTLs (for inorganics).

Seven constituents (aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium) were detected in surface or subsurface soil above human health screening levels but below background UTLs. Based on the historical source of potential releases identified at the site (see Section 17.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on maximum detected concentrations, the cumulative ELCR (of the chemicals below background in soil) is 2×10^{-6} and the maximum target organ-specific HI is 0.5 (see **Table 17-4**). Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil.

Groundwater

For a chemical identified as a COPC in both "total" and "dissolved" groundwater, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Chromium was detected above its RSL (0.043 μg/L based on Cr^{6+}) but below background in the one groundwater sample collected from the site, at a maximum concentration of 3.1 μg/L; detected concentrations are less than the MCL (100 μg/L). Based on the maximum "total" concentration and the expected form of chromium (Cr^{3+}) at the site (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the HI is 0.00006 which is within the EPA acceptable level, and chromium would not be identified as a risk driver. Additionally, all chromium detections in soil are below the background UTL, which indicates that the presence of chromium in groundwater is attributable to background.

Cumulative Soil and Groundwater

Potential cumulative risks from both residential soil and groundwater exposures were evaluated. As indicated on **Table 17-4**, the cumulative ELCR is 2×10^{-6} and the maximum target organ-specific HI is 0.5. Because the cumulative ELCR and target organ-specific HIs do not exceed EPA acceptable levels, effects from multiple chemicals in soil and groundwater are not a concern.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 1×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Two inorganics (selenium and zinc) exceeded ecological screening values and background UTLs in at one surface soil sample collected at the site (**Table 17-1**). None of these constituents likely poses an unacceptable risk to ecological receptors based upon the following:

Selenium was detected in one surface soil sample above the background UTL and the ecological soil screening value (applies to surface soil only). The maximum HQ (based upon the ecological surface soil screening value) for selenium in surface soil is 1.33 (**Table 17-5**). Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the east Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at PAOC N (maximum of 0.69 mg/kg) may be within the range of background. Further, all selenium concentrations are less than ecological screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates). Thus, selenium has a low potential for unacceptable risks, especially given the very low exposure potential for ecological receptors.

Zinc exceeds the ecological screening value and background UTL in one of four surface soil samples (**Table 17-5**). The sample is bounded to the east, west, and south by the other three soil samples. However, the maximum HQ is just 1.53 and the mean HQ is less than 1. Thus, potential unacceptable risks associated with zinc at this site are not likely, especially considering the small size of the site and even smaller area where zinc was found above the screening value. The site is also within the developed portion of Camp Garcia and is periodically mowed or cleared of vegetation during maintenance.

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Selenium was detected in one surface and subsurface soil sample above the background UTL and SSL at a DAF of 1. However, selenium was not detected in groundwater at the site, which suggests the SSL at a DAF of 1 is not representative of selenium leaching through soil to groundwater. At a DAF of 3, no selenium concentrations exceed the SSL.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the former fuel tanks and the filling station. Based on this information, soil samples were collected at each of these areas, and a groundwater sample was collected in the downgradient part of the site. In addition, a geophysical survey conducted at the site showed no evidence of a buried pipeline between the former fuel tanks and the former power plant (PAOC S). Therefore, the spatial distribution of the samples collected during the PA/SI and resulting data indicate the potential source area has been sufficiently characterized.

17.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PAOC N that has resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Additionally, the geophysical survey conducted as part of the ESI found no evidence of a buried pipeline, which indicates that fuel for the generators at the power plant portion of PAOC S was not supplied via direct piping from PAOC N. Therefore, no action is warranted for PAOC N.

Table 17-1
Surface Soil Detection and Exceedance Results
PAOC N
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	PREQB Corrective Action Level	EPAN-SO01	EPAN-SO02	EPAN-SO03	EPAN-SO04	
Sample ID						EPAN-SS01-0001	EPAN-SS02-0001	EPAN-SS03-0001	EPAN-SS04-0001	EPAN-SS04P-0001
Sample Date						02/01/06	02/01/06	02/01/06	02/01/06	02/01/06
Chemical Name										
Volatile Organic Compounds (UG/KG)										
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND
Semi-volatile Organic Compounds (UG/KG)										
Acetophenone	--	780,000	--	1,100	--	350 U	350 U	350 U	260 J	350 U
Di-n-octylphthalate	--	35,000	30,000	1,100	--	350 U	120 J	350 U	360 U	350 U
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	--	170 J	350 U	350 U	79 J	350 U
Total Metals (MG/KG)										
Aluminum	35,000	7,700	--	55,000	--	11,000	8,790	7,640	8,110	8,190
Antimony	5.8	3.1	78	0.27	--	0.72 J	0.69 J	0.59 J	0.97 J	0.65 J
Arsenic	1.6	0.39	18	0.29	--	0.67 J	0.50 J	0.56 J	1.1 U	0.43 J
Barium	147	1,500	330	82	--	52	89	75	58	62
Calcium	8,840	--	--	--	--	**20,700**	**41,200**	**26,200**	**46,600 J**	**30,300 J**
Chromium	72	0.29	64	0.00083	--	17	6.6	5.8	9.5 J	6.5 J
Cobalt	16	2.3	13	0.49	--	12	9.7	7.9	8.6	8.5
Copper	66	310	70	46	--	47	49	49	39	38
Iron	38,100	5,500	--	640	--	19,000	15,800	14,900	16,500	14,100
Lead	5.4	400	120	27	--	**8.8**	5.2	**5.8**	4.6	3.9
Magnesium	3,710	--	--	--	--	**7,130**	**5,270**	**4,730**	**5,240**	**4,720**
Manganese	1,630	180	220	57	--	480 J	557 J	470 J	426 J	418 J
Nickel	22	160	38	48	--	9.5	4.3	4.2 U	4.3	4.3 U
Potassium	5,270	--	--	--	--	904 J	536 U	558 J	589 J	497 J
Selenium	0.51	39	0.52	0.26	--	3.7 UJ	0.40 J	**0.69 J**	3.8 UJ	3.8 UJ
Vanadium	144	39	130	180	--	58	45	42	51	41
Zinc	32	2,400	120	680	--	**42**	29	**183**	24	25
Total Petroleum Hydrocarbons (MG/KG)										
TPH-diesel range	--	--	--	--	100	8.4 J	8.9 J	13	11	8.9 J

Notes:

Exceeds Background UTL
Exceeds Background UTL and ECO (E)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram

Table 17-2
Subsurface Soil Detection and Exceedance Results
PAOC N
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	PREQB Corrective Action Level	EPAN-SO01	EPAN-SO02	EPAN-SO03	EPAN-SO04
Sample ID					EPAN-SB01-0406	EPAN-SB02-0406	EPAN-SB03-0103	EPAN-SB04-0406
Sample Date					02/01/06	02/01/06	02/01/06	02/01/06
Chemical Name								
Volatile Organic Compounds (UG/KG)								
No Detections	--	--	--	--	ND	ND	ND	ND
Semi-volatile Organic Compounds (UG/KG)								
Acetophenone	--	780,000	1,100	--	340 U	360 U	350 U	100 J
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	--	160 J	84 J	350 U	350 U
Total Metals (MG/KG)								
Aluminum	35,000	7,700	55,000	--	7,340	7,490	8,700	6,250
Antimony	5.8	3.1	0.27	--	0.56 J	0.49 J	0.58 J	0.52 J
Arsenic	1.6	0.39	0.29	--	1.0 U	1.1 U	1.1 U	0.73 J
Barium	147	1,500	82	--	48	47	54	40
Calcium	8,840	--	--	--	3,210	2,110	5,560	2,380
Chromium	72	0.29	0.00083	--	9.4	8.6	9.9	9.2
Cobalt	16	2.3	0.49	--	8.6	7.3	7.5	6.4
Copper	66	310	46	--	52	50	51	55
Iron	38,100	5,500	640	--	21,000	17,900	18,500	20,000
Lead	3.3	400	27	--	0.72 J	0.54 J	2.0	1.1 U
Magnesium	3,710	--	--	--	2,960	2,410	2,680	2,300
Manganese	1,630	180	57	--	323 J	316 J	408 J	231 J
Nickel	22	160	48	--	3.8 J	3.6 J	4.3 U	4.3 U
Potassium	2,000	--	--	--	522 U	578 J	550 J	533 U
Selenium	0.51	39	0.26	--	0.41 J	3.8 UJ	3.8 U	**0.64 J**
Sodium	2,250	--	--	--	154 J	200 J	540 U	533 U
Vanadium	144	39	180	--	76	63	63	71
Zinc	32	2,400	680	--	17	14	19	13
Total Petroleum Hydrocarbons (MG/KG)								
TPH-diesel range	--	--	--	100	10 U	11 U	11 U	8.2 J

Notes:

Exceeds Background UTL and SSL (DAF=1)

NA - Not analyzed

ND - None Detected

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated

J - Analyte present; reported value may or may not be accurate or precise

U - Analyte not detected

UJ - Analyte not detected; quantitation limit may be inaccurate or imprecise

MG/KG - Milligrams per Kilogram

UG/KG - Micrograms per Kilogram

Table 17-3
Groundwater Detection and Exceedance Results
PAOC N
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	PAOC-N EPAN-MW02 Background		Adjusted RSL for Tapwater	MCL - Groundwater	EPAN-MW01
Sample ID					EPAN-GW01-06B
Sample Date					04/04/06
Chemical Name					
Volatile Organic Compounds (UG/L)					
No Detections	--		--	--	ND
Semi-volatile Organic Compounds (UG/L)					
No Detections	--		--	--	ND
Total Metals (UG/L)					
Barium	200		730	2,000	104 J
Calcium	144,000		--	--	78,900
Chromium	3.6	J	0.043	100	3.1 J
Iron	198		2,600	--	122
Magnesium	75,600		--	--	51,100
Manganese	8	J	88	--	**13.1 J**
Nickel	2.4	J	73	--	**4.0 J**
Potassium	1,780	J	--	--	1,730 J
Sodium	323,000		--	--	216,000
Dissolved Metals (UG/L)					
Calcium	139,000		--	--	74,200
Chromium	--		0.043	100	**0.70 J**
Magnesium	73,400		--	--	48,200
Manganese	--		88	--	0.82 J
Potassium	1,710	J	--	--	1,630
Sodium	311,000		--	--	204,000
Wet Chemistry (MG/L)					
Total dissolved solids (TDS)	--		--	--	948
Total Petroleum Hydrocarbons (MG/L)					
No Detections	--		--	--	ND

Notes:

Exceeds Background UTL

Exceeds Background and Adjusted RSL for Tapwater

NA - Not analyzed

ND - None Detected

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated

J - Analyte present; reported value may or may not be accurate or precise

MG/L - Milligrams per Liter

UG/L - Micrograms per Liter

Table 17-4
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PAOC-N
Media: Surface Soil, Subsurface Soil, Groundwater
Historical Function: Former Fuel Farm and Filling Station

Exposure Point	CAS Number	Chemical	Minimum Concentration	Qualifier	Maximum Concentration	Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	PAOC-N MW2		December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC-N	7429-90-5	Aluminum	7.6E+03		1.10E+04		mg/kg	EPAN-SO01	4 / 4	3 / 4	--	3.5E+04	No	--	--	7.7E+03	nc	No	--	7.7E+04	--	--	Max	CNS	0.1	--
Surface Soil	7440-38-2	Arsenic	4.3E-01	J	6.70E-01	J	mg/kg	EPAN-SO01	4 / 4	4 / 4	--	1.6E+00	No	--	--	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	5.8E+00		1.74E+01		mg/kg	EPAN-SO01	4 / 4	4 / 4	--	7.2E+01	No	--	--	2.9E-01	ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.0001	--
	7440-48-4	Cobalt	7.9E+00		1.18E+01		mg/kg	EPAN-SO01	4 / 4	4 / 4	--	1.6E+01	No	--	--	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.5	3.2E-08
	7439-89-6	Iron	1.5E+04		1.90E+04		mg/kg	EPAN-SO01	4 / 4	4 / 4	--	3.8E+04	No	--	--	5.5E+03	nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	4.3E+02	J	5.57E+02	J	mg/kg	EPAN-SO02	4 / 4	4 / 4	--	1.6E+03	No	--	--	1.8E+02	nc	No	--	1.8E+03	--	--	Max	CNS	0.3	--
	7440-62-2	Vanadium	4.2E+01		5.78E+01		mg/kg	EPAN-SO01	4 / 4	4 / 4	--	1.4E+02	No	--	--	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
PAOC-N	7429-90-5	Aluminum	6.3E+03		8.7E+03		mg/kg	EPAN-SO03	4 / 4	1 / 4	-	3.5E+04	No	--	--	7.7E+03	nc	No	--	7.7E+04	--	--	--	CNS	--	--
Subsurface Soil	7440-38-2	Arsenic	7.3E-01	J	7.3E-01	J	mg/kg	EPAN-SO04	1 / 4	1 / 4	-	1.6E+00	No	--	--	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.03	1.9E-06
	7440-47-3	Chromium	8.6E+00		9.9E+00		mg/kg	EPAN-SO03	4 / 4	4 / 4	-	7.2E+01	No	--	--	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	6.4E+00		8.6E+00		mg/kg	EPAN-SO01	4 / 4	4 / 4	-	1.6E+01	No	--	--	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	1.8E+04		2.1E+04		mg/kg	EPAN-SO01	4 / 4	4 / 4	-	3.8E+04	No	--	--	5.5E+03	nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.4	--
	7439-96-5	Manganese	2.3E+02	J	4.1E+02	J	mg/kg	EPAN-SO03	4 / 4	4 / 4	-	1.6E+03	No	--	--	1.8E+02	nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	6.3E+01		7.6E+01		mg/kg	EPAN-SO01	4 / 4	4 / 4	-	1.4E+02	No	--	--	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.2	--
PAOC-N	7440-47-3_D	Chromium, Dissolved	7.0E-01	J	7.0E-01	J	ug/L	EPAN-MW01	1 / 1	1 / 1	-	--	--	1.0E+01	U	4.3E-02	ca	No	--	5.5E+04	--	--	--	No Observed Effects	--	--
Groundwater	7440-47-3	Chromium	3.1E+00	J	3.1E+00	J	ug/L	EPAN-MW01	1 / 1	1 / 1	-	--	--	3.6E+00		4.3E-02	ca	No	--	5.5E+04	--	--	Max	No Observed Effects	0.00006	--

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

Site Cumulative Risk	Max HI *	ELCR
Soil	0.5	2E-06
Groundwater	0.0001	--
Total Risk	0.5	2E-06

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

* - Max HI is the highest HI associated with any target organ or critical effect.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk

TABLE 17-5
Ecological Risk Assessment Screening Statistics for PAOC N Surface Soil - Plants and Invertebrate
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Selenium	3.7 - 3.8	2 / 4	0.40	0.69	1.21	0.78	2.12	0.52	1 / 4	1.33	0.51	1 / 4	2.37	1.35	4.09	2.33
Zinc	-- - --	4 / 4	24.6	183	69.6	76.0	159	120	1 / 4	1.53	32.0	2 / 4	2.18	5.72	1.32	0.58

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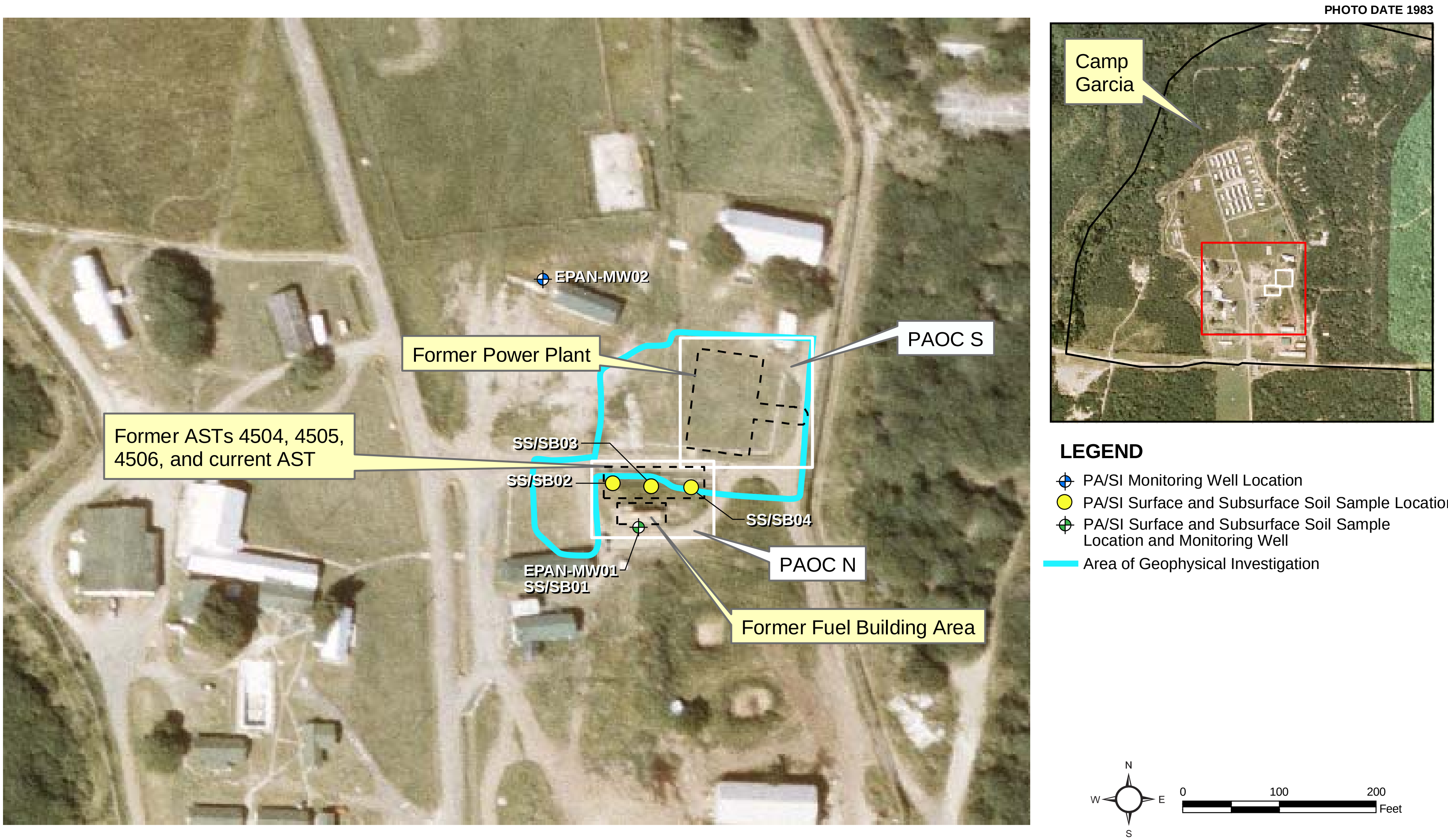

FIGURE 17-1
PAOCs N and S Geophysical Investigation,
1983 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

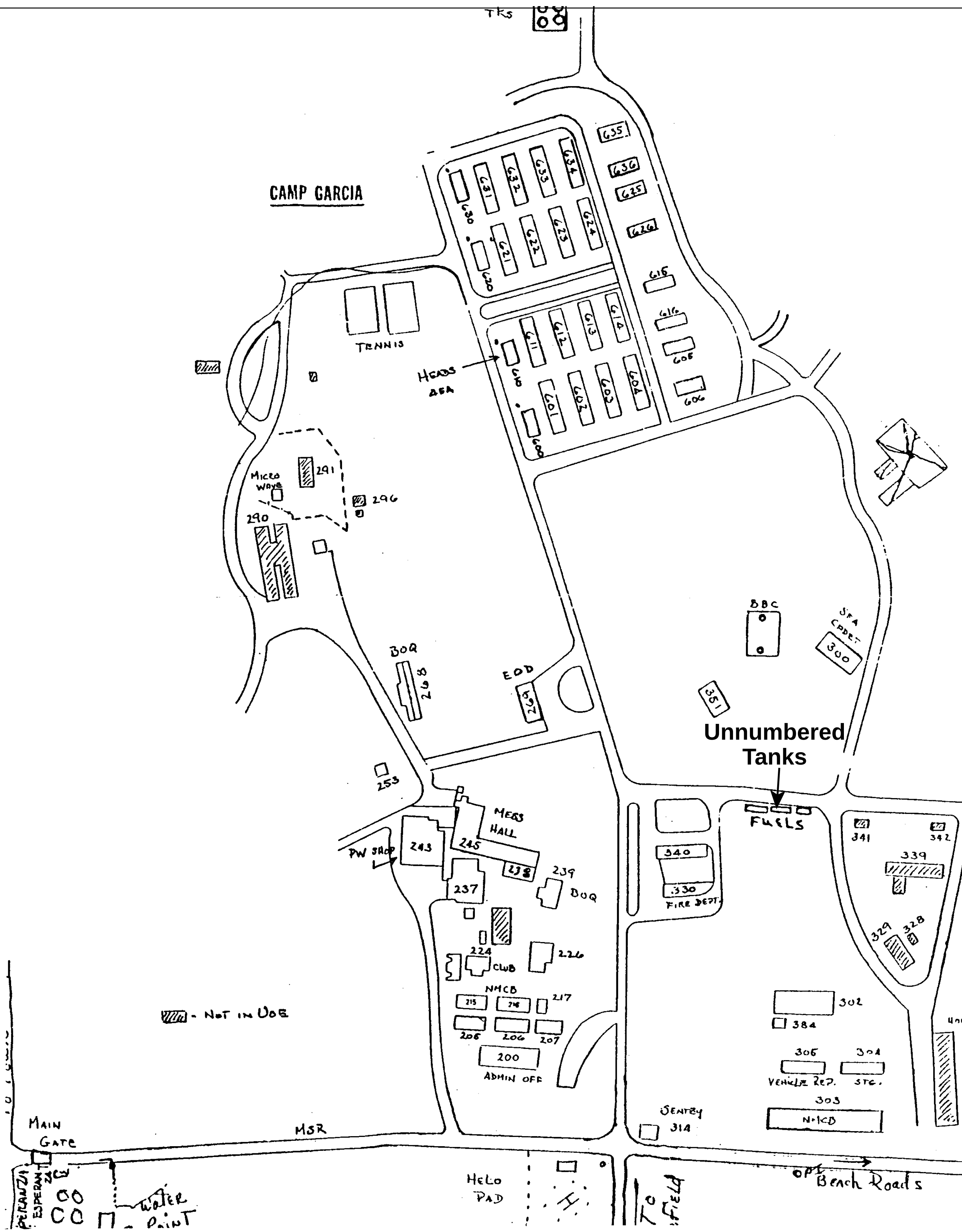

FIGURE 17-2
PAOC N Former Fuel Farm and Filling Station
Historical Site Map, Unknown Date
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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FIGURE 17-3
Camp Garcia Refueling Station
Site Photograph Taken August 2000
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 18

PAOC O— Former Boiler Room in Heat Plant Building 238

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC O. A more detailed discussion of the PAOC O evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

18.1 Conceptual Site Model

18.1.1 Site Description and Potential Sources of Release

PAOC O, constructed in 1953 and demolished in 1989, was a boiler room in former heat plant Building 238 at Camp Garcia (**Figure 18-1**). The relatively limited historical information that exists about PAOC O was gained from site visits during the EBS and SI scoping session, as well as personnel interviews and historical records review during the EBS. The EBS site visit (2002) found no evidence of hazardous material, hazardous waste, petroleum, or munitions storage or disposal. However, due to the presence of the former boiler and boiler-related activities, the site was included in the 2009 SI for evaluation of a potential CERCLA-related release.

18.1.2 Investigation History

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), to determine if there has been a release of hazardous constituents at PAOC O, two co-located surface soil and subsurface soil samples were collected within the former footprint of Building 238 at the locations selected during the ERP Technical Subcommittee site visit in January 2009. The locations of these soil borings (SS/SB-1 and SS/SB-2) are shown on **Figure 18-1**.

At each soil boring location, one surface soil sample and one subsurface soil sample were collected. No PID readings above 0.0 ppm were observed in the soil borings; therefore, subsurface soil samples were collected at default depths in accordance with the SAP. The surface and subsurface soil samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics.

Tables 18-1 and 18-2 summarize the constituents detected in PAOC O surface soil samples and subsurface soil samples, respectively, collected during the SI. The tables also identify screening criteria and background exceedances.

18.1.3 Physical Setting

The site is relatively flat, at an elevation of approximately 71 ft amsl; the area around the site slopes to the south and southeast. The land around the site is open but not regularly maintained. The soil is mostly silty sand. The subsurface geology consists of igneous rocks, primarily granodiorite and quartz dioritie. Groundwater in this area exists within the fractured bedrock and flows in a southerly direction toward the coast. There are no surface water bodies at or immediately adjacent to the site. The closest surface water bodies topographically downgradient of the site are Bahia Corcho and Bahia Tapon along the coast, approximately 1 mile to the south and southeast, respectively.

18.2 PAOC O Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 18-1 and 18-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former boiler room in Heat Plant Building 238. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visits, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2009 SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Surface Soil

- VOCs: acetone and methyl acetate
- SVOCs: acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene
- Inorganics above background UTLs: calcium, lead, magnesium, mercury, and zinc

Subsurface Soil

- VOCs: none detected
- SVOCs: benzo(a)anthracene, fluoranthene
- Inorganics above background UTLs: magnesium and potassium

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records or visual evidence of past releases at PAOC O. However, based on the potential source area at PAOC O (i.e., former boiler room in a heating plant), it is assumed that the detected constituent groups (i.e., VOCs, SVOCs, inorganics) are potentially attributable to CERCLA-related releases from the former boiler room because they are all potentially associated with boiler activities. Therefore, all detected constituents are further considered in the decision analysis process.

Step 5: For potentially complete exposure pathways, are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

Surface Soil

- VOCs: no exceedances
- Benzo(a)anthracene: two detections (samples SS01 and SS02) at a concentration (12 and 44 µg/kg, respectively) above the SSL at a DAF of 1 (10 µg/kg)
- Benzo(a)pyrene: one detection (sample SS02) at a concentration (48 µg/kg) above the RSL for residential soil (15 µg/kg)
- Benzo(b)fluoranthene: one detection (sample SS02) at a concentration (40 µg/kg) above the SSL at a DAF of 1 (35 µg/kg)
- Dibenz(a,h)anthracene: one detection (sample SS02) at a concentration (22 µg/kg) above the RSL for residential soil (15 µg/kg) and the SSL at a DAF of 1 (11 µg/kg)
- Lead: one detection (sample SS02) at a concentration (33 mg/kg) above the SSL at a DAF of 1 (27 mg/kg) and background UTL (5.4 mg/kg)
- Zinc: one detection (sample SS01) at a concentration (126 mg/kg) above the ecological screening value (120 mg/kg) and background UTL (32 mg/kg)

Subsurface Soil

- SVOCs: no exceedances
- Inorganics above background UTLs: no exceedances

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a “hot spot” of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at PAOC O. The site is approximately 0.01 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 18-3**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Two constituents were detected in surface soil samples above the human health screening levels: benzo(a)pyrene (B[a]P) and dibenz(a,h)anthracene (D[a,h]A).

- B(a)P was detected in one of two surface soil samples above its RSL (15 µg/kg), at a concentration of 48 µg/kg. Based on the maximum detected concentration, the ELCR is 3 x 10^{-6}, which is within the EPA acceptable range, and B(a)P would not be identified as a risk driver.
- D(a,h)A was detected in one of two surface soil samples above its RSL (15 µg/kg), at a concentration of 22 µg/kg. Based on the maximum detected concentration, the ELCR is 2 x 10^{-6}, which is within EPA's acceptable range, and D(a,h)A would not be identified as a risk driver.

Seven additional constituents (aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium) were detected in soil above human health screening levels but below background UTLs. Based on the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on the maximum detected concentrations of B(a)P, D(a,h)A, and the seven additional constituents, the cumulative ELCR is 8 x 10^{-6} and the maximum target organ-specific HI is 0.5. Because the cumulative ELCR and HI are within EPA acceptable levels, effects from multiple chemicals in soil are not a concern.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 3 x

10^{-5}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

One inorganic (zinc) exceeded the ecological screening value and background UTL in one surface soil sample collected at the site (**Table 18-1**). Zinc does not likely pose an unacceptable risk to ecological receptors based upon the following:

- The area evaluated is located in a periodically cleared area in the vicinity of buildings, is very small in size, and provides very limited habitat. Thus, the potential exposures to ecological receptors are minimal.
- Zinc exceeds the ecological screening value in one of the two samples but the maximum HQ is 1.05; the mean HQ is less than 1 (**Table 18-4**).

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Three SVOCs (benzo(a)anthracene [B(a)A], benzo(b)fluoranthene [B(b)F], and D[a,h]A) and one inorganic (lead) were detected in surface soil at concentrations above SSLs at a DAF of 1 (and background for lead). However, neither B(b)F nor D(a,h)A was detected in the subsurface soil and the concentrations of B(a)A and lead detected in the subsurface soil are below their respective SSLs at a DAF of 1. PAOC O is small (less than approximately 50 ft x 50 ft) and soil/groundwater data evaluations presented for other sites suggest SSLs at a DAF of 1 are not representative predictors of leaching to groundwater (e.g., see PI-4 and SWMU 10). Further, as shown in Table 24-1 of the Final SI/ESI Report (CH2M HILL, 2010), B(a)A, B(b)F, D(a,h)A, and lead were not detected in groundwater downgradient of PAOC O (i.e., well VECG-MW02, as shown in **Figure 18-1** of this report, and Figure 24-1 of the Final SI/ESI Report (CH2M HILL, 2010)).

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely source of CERCLA-related releases is the former boiler in former heat plant Building 238. Based on this information, soil samples were collected within the footprint of the former building, the spatial distribution and resulting data of which indicate the potential source area has been sufficiently characterized.

18.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PAOC O that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Therefore, no action is warranted for PAOC O.

Table 18-1
Surface Soil Detection and Exceedance Results
PAOC O
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VEPO-SO01	VEPO-SO02	
Sample ID					VEPO-SS01-01-0209	VEPO-SS02-01-0209	VEPO-SS02P-01-0209
Sample Date					02/20/09	02/20/09	02/20/09
Chemical Name							
Volatile Organic Compounds (UG/KG)							
Acetone	--	6,100,000	--	4,500	250	42 U	42 U
Methyl acetate	--	7,800,000	--	7,500	8.0 J	18 U	18 U
Semivolatile Organic Compounds (UG/KG)							
Acenaphthylene	--	340,000	--	22,000	1.8 J	2.5 J	3.6 J
Anthracene	--	1,700,000	--	360,000	27 U	26 U	3.9 J
Benzo(a)anthracene	--	150	--	10	**12 J**	**27 J**	**44 J**
Benzo(a)pyrene	--	15	--	240	9.4 J	**30 J**	**48 J**
Benzo(b)fluoranthene	--	150	--	35	15 J	28 J	**40 J**
Benzo(g,h,i)perylene	--	170,000	--	120,000	10 J	19 J	29 J
Benzo(k)fluoranthene	--	1,500	--	350	10 J	30 J	46 J
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	130 UJ	42 J	130 UJ
Chrysene	--	15,000	--	1,100	8.7 J	28 J	46 J
Dibenz(a,h)anthracene	--	15	--	11	27 U	**17 J**	**22 J**
Fluoranthene	--	230,000	--	160,000	11 J	29 J	55 J
Indeno(1,2,3-cd)pyrene	--	150	--	120	22 J	36	48
PAH HMW (Total)	--	--	18,000	--	94	235	359
PAH LMW (Total)	--	--	29,000	--	13	35	78
Phenanthrene	--	1,700,000	--	360,000	27 UJ	3.9 J	15 J
Pyrene	--	170,000	--	120,000	6.9 J	20 J	36 J

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 18-1
Surface Soil Detection and Exceedance Results
PAOC O
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VEPO-SO01	VEPO-SO02	
Sample ID					VEPO-SS01-01-0209	VEPO-SS02-01-0209	VEPO-SS02P-01-0209
Sample Date					02/20/09	02/20/09	02/20/09
Chemical Name							
Total Metals (MG/KG)							
Aluminum	35,000	7,700	--	55,000	18,100	17,300	14,400
Antimony	5.8	3.1	78	0.27	0.44 J	0.60 J	0.66 J
Arsenic	1.6	0.39	18	0.29	1.2	1.4	1.3
Barium	147	1,500	330	82	85	88	102
Beryllium	0.27	16	40	3.2	0.15	0.15	0.13
Cadmium	2.2	7.0	32	0.38	0.13	0.12 U	0.11
Calcium	8,840	--	--	--	**50,700**	**52,200**	**57,800**
Chromium	72	0.29	64	0.00083	6.7	8.5	8.1
Cobalt	16	2.3	13	0.49	7.4	9.0	6.4
Copper	66	310	70	46	40 J	51 J	48 J
Iron	38,100	5,500	--	640	21,400	20,900	19,800
Lead	5.4	400	120	27	**11**	**25**	**33**
Magnesium	3,710	--	--	--	**4,340**	**5,020**	**4,730**
Manganese	1,630	180	220	57	454	418	405
Mercury	0.057	0.78	0.10	0.57	0.04 U	**0.07**	**0.06**
Nickel	22	160	38	48	4.3	4.4	3.9
Potassium	5,270	--	--	--	2,240 J	2,280 J	2,020 J
Selenium	0.51	39	0.52	0.26	0.15 J	0.29 J	0.25 J
Sodium	1,590	--	--	--	328 J	438 J	473 J
Vanadium	144	39	130	180	67	63	58
Zinc	32	2,400	120	680	**126**	**81**	**76**

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil and SSL (DAF=1)

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 18-2
Subsurface Soil Detection and Exceedance Results
PAOC O
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	VEPO-SO01	VEPO-SO02
Sample ID				VEPO-SB01-46-0209	VEPO-SB02-46-0209
Sample Date				02/20/09	02/20/09
Chemical Name					
Volatile Organic Compounds (UG/KG)					
No Detections	--	--	--	ND	ND
Semivolatile Organic Compounds (UG/KG)					
Benzo(a)anthracene	--	150	10	5.9 J	5.5 J
Fluoranthene	--	230,000	160,000	2.6 J	2.8 J
Total Metals (MG/KG)					
Aluminum	35,000	7,700	55,000	17,500	14,300
Antimony	5.8	3.1	0.27	0.13 UJ	0.030 J
Arsenic	1.6	0.39	0.29	0.64 U	0.17 J
Barium	147	1,500	82	60	70
Beryllium	0.27	16	3.2	0.16	0.12
Calcium	8,840	--	--	5,510	6,560
Chromium	72	0.29	0.00083	4.4	6.8
Cobalt	16	2.3	0.49	7.0	7.6
Copper	66	310	46	33 J	33 J
Iron	38,100	5,500	640	21,800	23,200
Lead	3.3	400	27	1.1	1.1
Magnesium	3,710	--	--	3,260	**3,840**
Manganese	1,630	180	57	258	368
Nickel	22	160	48	2.5	2.7
Potassium	2,000	--	--	**2,610 J**	**2,540 J**
Sodium	2,250	--	--	347 J	423 J
Vanadium	144	39	180	67	72
Zinc	32	2,400	680	24	29

Notes:

Exceeds Background UTL

ND - None Detected

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated

J - Analyte present, value may or may not be accurate or precise

U - Not detected or not detected significantly greater than that in an associated blank.

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 18-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PAOC-O
Media: Surface Soil, Subsurface Soil
Historical Function: Former Boiler Room in Heat Plant Building 238

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)	Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC-O	7429-90-5	Aluminum	1.7E+04	1.81E+04	mg/kg	VEPO-SO01	2 / 2	2 / 2	2.66E+00 - 2.69E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	Max	CNS	0.2	--
Surface Soil	7440-38-2	Arsenic	1.2E+00	1.40E+00	mg/kg	VEPO-SO02	2 / 2	2 / 2	1.80E-01 - 1.80E-01	1.6E+00	No	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.06	3.6E-06
	7440-47-3	Chromium	6.7E+00	8.50E+00	mg/kg	VEPO-SO02	2 / 2	2 / 2	6.00E-02 - 6.00E-02	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.00007	--
	7440-48-4	Cobalt	7.4E+00	9.00E+00	mg/kg	VEPO-SO02	2 / 2	2 / 2	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.4	2.4E-08
	7439-89-6	Iron	2.1E+04	2.14E+04	mg/kg	VEPO-SO01	2 / 2	2 / 2	7.20E-01 - 7.30E-01	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	4.2E+02	4.54E+02	mg/kg	VEPO-SO01	2 / 2	2 / 2	2.40E-01 - 3.20E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	Max	CNS	0.3	--
	7440-62-2	Vanadium	6.3E+01	6.74E+01	mg/kg	VEPO-SO01	2 / 2	2 / 2	4.00E-02 - 4.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
	50-32-8	Benzo(a)pyrene	9.4E-03 J	4.80E-02 J	mg/kg	VEPO-SO02	2 / 2	1 / 2	4.40E-03 - 4.40E-03	--	--	1.5E-02 ca	No	1.5E-02	--	--	--	Max	--	--	3.2E-06
	53-70-3	Dibenz(a,h)anthracene	2.2E-02 J	2.20E-02 J	mg/kg	VEPO-SO02	1 / 2	1 / 2	2.40E-03 - 2.40E-03	--	--	1.5E-02 ca	No	1.5E-02	--	--	--	Max	--	--	1.5E-06
PAOC-O	7429-90-5	Aluminum	1.4E+04	1.8E+04	mg/kg	VEPO-SO01	2 / 2	2 / 2	2.27E+00 - 2.83E+00	3.5E+04	No	7.7E+03 nc	No	--	7.7E+04	--	--	--	CNS	--	--
Subsurface Soil	7440-47-3	Chromium	4.4E+00	6.8E+00	mg/kg	VEPO-SO02	2 / 2	2 / 2	5.00E-02 - 6.00E-02	7.2E+01	No	2.9E-01 ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	7.0E+00	7.6E+00	mg/kg	VEPO-SO02	2 / 2	2 / 2	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	2.2E+04	2.3E+04	mg/kg	VEPO-SO02	2 / 2	2 / 2	6.20E-01 - 7.70E-01	3.8E+04	No	5.5E+03 nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.4	--
	7439-96-5	Manganese	2.6E+02	3.7E+02	mg/kg	VEPO-SO02	2 / 2	2 / 2	2.00E-01 - 2.50E-01	1.6E+03	No	1.8E+02 nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	6.7E+01	7.2E+01	mg/kg	VEPO-SO02	2 / 2	2 / 2	3.00E-02 - 4.00E-02	1.4E+02	No	3.9E+01 nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.2	--

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

Site Cumulative Risk	Max HI *	ELCR
Soil	0.5	8E-06
Groundwater	--	--
Total Risk	0.5	8E-06

* - Max HI is the highest HI associated with any target organ or critical effect.

TABLE 18-4
Ecological Risk Assessment Screening Statistics for PAOC O Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Zinc	-- - --	2 / 2	81.0	126.0	103.5	31.8	245.6	120	1 / 2	1.05	32.0	2 - 2	3.23	3.94	2.05	0.86

Legend

Camp Garcia Area

SI/ESI Surface and Subsurface Sampling Locations

SI/ESI Monitoring Wells

FIGURE 18-1
PAOC O Sample Locations,
1983 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 19

PAOC P— Former Water Treatment Pumphouse

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC P. A more detailed discussion of the PAOC P evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

19.1 Conceptual Site Model

19.1.1 Site Description and Potential Sources of Release

Records indicate that PAOC P (**Figures 19-1 and 19-2**) was a former water treatment pumphouse (Building 500) on the western boundary of Camp Garcia at the former VNTR. Building 500 was constructed in 1953 and demolished in 1989. The relatively limited historical information that exists about PAOC P was gained from site visits during the EBS and SI scoping, as well as personnel interviews and historical records review during the EBS.

The EBS site visit (2002) found no evidence of hazardous material, hazardous waste, petroleum, or munitions storage or disposal. However, a mobile generator (**Figure 19-3[B])** was found at PAOC P during the SI scoping session site visit (2007). At that time, it was concurred upon by the regulatory agencies and Navy that no sampling at the former pumphouse was warranted, but that removal of the generator and sampling beneath it were warranted.

During the Vieques ERP Technical Subcommittee site visit to concur on the sampling location (January 2009), following vegetation clearance and prior to commencement of SI sampling activities, a trailer-mounted water tank was observed onsite (**Figure 19-3[A]**).

Based on the above information, the former water treatment facility pumphouse is not a likely source of a CERCLA-related release. However, the mobile generator observed during the 2007 site visit was considered a potential source of a CERCLA-related release. Therefore an SI was warranted to determine if a CERCLA-related release occurred from the mobile generator and, if so, whether it warrants further investigation or action. It is important to note that a significant release from the generator's oil reservoir is unlikely because it was intact and holding oil at the time of removal (see **Figure 19-3[C]**). The reservoir was drained of its oil (approximately 4 gallons) prior to removal. Further, any potential for future releases at the site was eliminated by removing the generator and other debris that were observed at the site (see **Figure 19-3[D through I]**). The scrap metal debris was transported to the Navy Central Processing Center (CPC) for disposal.

19.1.2 Investigation History

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), one co-located surface soil and subsurface soil sample (SS/SB-01) was collected beneath the mobile generator. The location of this soil boring is illustrated as VEPP-SS/SB01 on **Figure 19-2**. No PID readings above 0.0 ppm were observed in the soil boring; therefore, the subsurface soil sample was collected at the default depth in accordance with the SAP. The samples were analyzed for BTEX, MTBE, PAHs, lead, TPH-GRO, and TPH-DRO to determine if a release had occurred from the mobile generator.

Tables 19-1 and 19-2 summarize the constituents detected in the PAOC P surface soil sample and subsurface soil sample, respectively, collected during the SI. The tables also identify screening criteria and background exceedances.

19.1.3 Physical Setting

The site slopes to the east toward an ephemeral stream with the highest elevation at approximately 50 ft amsl. The land at the site is not maintained. Soil consists of silt, sand, and silty sand which graded into lean clay with depth. The bedrock is composed of igneous rock, primarily granodiorite and quartz diorite. Groundwater in this area likely exists within the fractured bedrock and flows in a southerly direction toward the coast. There was no surface water present on the site. The site slopes east into an ephemeral stream which drains approximately 5,000 ft south to Bahia Corcho, the closest surface water body topographically downgradient of PAOC P.

19.2 PAOC P Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 19-1 and 19-2**).

Step 1: Is the site potentially CERCLA-eligible?

As shown by the CSM, the former mobile generator is the most likely source of a release at PAOC P. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visits, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the presence of the mobile generator. Sample collection took place during the 2009 SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Surface Soil

- BTEX/MTBE: none detected
- PAHs: anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene
- Lead
- TPH: TPH-DRO

Subsurface Soil

- BTEX/MTBE: none detected
- PAHs: bis(2-ethylhexyl)phthalate
- TPH: TPH-DRO

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records or visual evidence of past releases at PAOC P. However, based on the potential source area at PAOC P (i.e., mobile generator), it is assumed that the detected constituent groups (i.e., PAHs, lead, TPH-DRO) are potentially attributable to CERCLA-related releases from the mobile generator because they are all potentially associated with petroleum hydrocarbons. Therefore, all detected constituents are further considered in the decision analysis process.

Step 5: For potentially complete exposure pathways, are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for lead) are listed below by medium.

Surface Soil

- Benzo(a)anthracene: detected at a concentration (11 μg/kg) above the SSL at a DAF of 1 (10 μg/kg)
- Lead: no exceedance
- TPH: no exceedance

Subsurface Soil

- PAHs: no exceedance
- TPH: no exceedance

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

- depth of contamination with respect to estimated groundwater depth
- mobility of contaminant
- number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

One constituent (benzo[a]anthracene) was detected at a concentration above the SSL at a DAF of 1. However, the exceedance was slight (i.e., detected at 11 μg/kg vs SSL at a DAF of 1 of 10 μg/kg); the concentration does not exceed the SSL at a DAF of 1.1. Further, the benzo(a)anthracene concentration in the duplicate sample (i.e., 9.7 μg/kg) is less than the SSL at a DAF of 1.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely source of CERCLA-related releases is the former mobile generator. Based on this information, the generator (together with other debris observed at the site) was removed (to eliminate potential future sources of contamination) and a co-located surface and subsurface soil sample was collected beneath the former generator. Based on this information, the spatial distribution of the samples collected during the SI and the resulting data indicate the potential source area has been sufficiently characterized.

19.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PAOC P that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. In addition, any potential future source of release has been removed from the site. Therefore, no further action is warranted for PAOC P.

Table 19-1
Surface Soil Detection and Exceedance Results
PAOC P
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	PREQB Corrective Action Level	VEPP-SO01	
Sample ID						VEPP-SS01-01-0309	VEPP-SS01P-01-0309
Sample Date						03/11/09	03/11/09
Chemical Name							
Volatile Organic Compounds (UG/KG)							
No Detections	--	--	--	--	--	ND	ND
Semivolatile Organic Compounds (UG/KG)							
Anthracene	--	1,700,000	--	360,000	--	2.2 J	2.1 J
Benzo(a)anthracene	--	150	--	10	--	**11 J**	9.7 J
Benzo(b)fluoranthene	--	150	--	35	--	11 J	11 J
Benzo(g,h,i)perylene	--	170,000	--	120,000	--	3.4 J	4.8 J
Benzo(k)fluoranthene	--	1,500	--	350	--	13 J	13 J
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	--	41 J	43 J
Carbazole	--	24,000	--	--	--	21 UJ	3.1 J
Chrysene	--	15,000	--	1,100	--	8.3 J	6.5 J
Fluoranthene	--	230,000	--	160,000	--	6.9 J	7.6 J
Indeno(1,2,3-cd)pyrene	--	150	--	120	--	6.7 J	8.7 J
PAH HMW (Total)	--	--	18,000	--	--	57	57
PAH LMW (Total)	--	--	29,000	--	--	9.0	10
Pyrene	--	170,000	--	120,000	--	3.9 J	3.7 J
Total Metals (MG/KG)							
Lead	5.4	400	120	27	50	4.2 J	**6.7 J**
Total Petroleum Hydrocarbons (MG/KG)							
TPH-diesel range	--	--	--	--	100	15 J	24 J

Notes:

Exceeds Background UTL

Exceeds Background UTL and SSL (DAF=1)

ND - None Detected

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated

J - Analyte present, value may or may not be accurate or precise

UJ - Analyte not detected, quantitation limit may be inaccurate

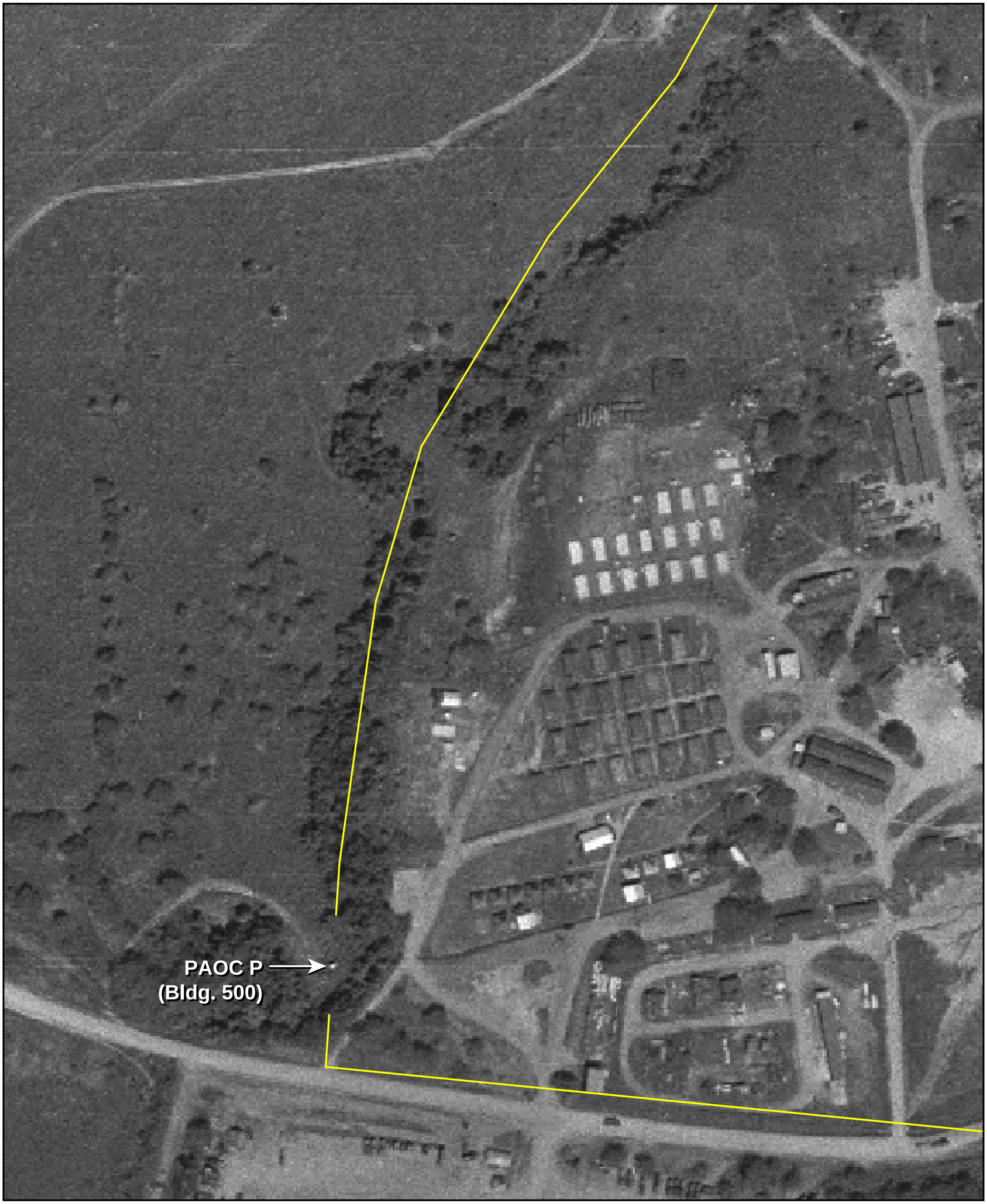
MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 19-2
Subsurface Soil Detection and Exceedance Results
PAOC P
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID Sample ID Sample Date	Background UTL (KTd)	Adjusted RSL for Residential Soil	SSL (DAF=1)	PREQB Corrective Action Level	VEPP-SO01 VEPP-SB01-46-0309 03/11/09
Chemical Name					
Volatile Organic Compounds (UG/KG)					
No Detections	--	--	--	--	ND
Semivolatile Organic Compounds (UG/KG)					
bis(2-Ethylhexyl)phthalate	--	35,000	1,400	--	120 J
Total Metals (MG/KG)					
Lead	3.3	400	27	50	1.1
Total Petroleum Hydrocarbons (MG/KG)					
TPH-diesel range	--	--	--	100	17

Notes:
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram



Legend

Camp Garcia Boundary

0 100 200 400 Feet

North

FIGURE 19-1
PAOC P 1964 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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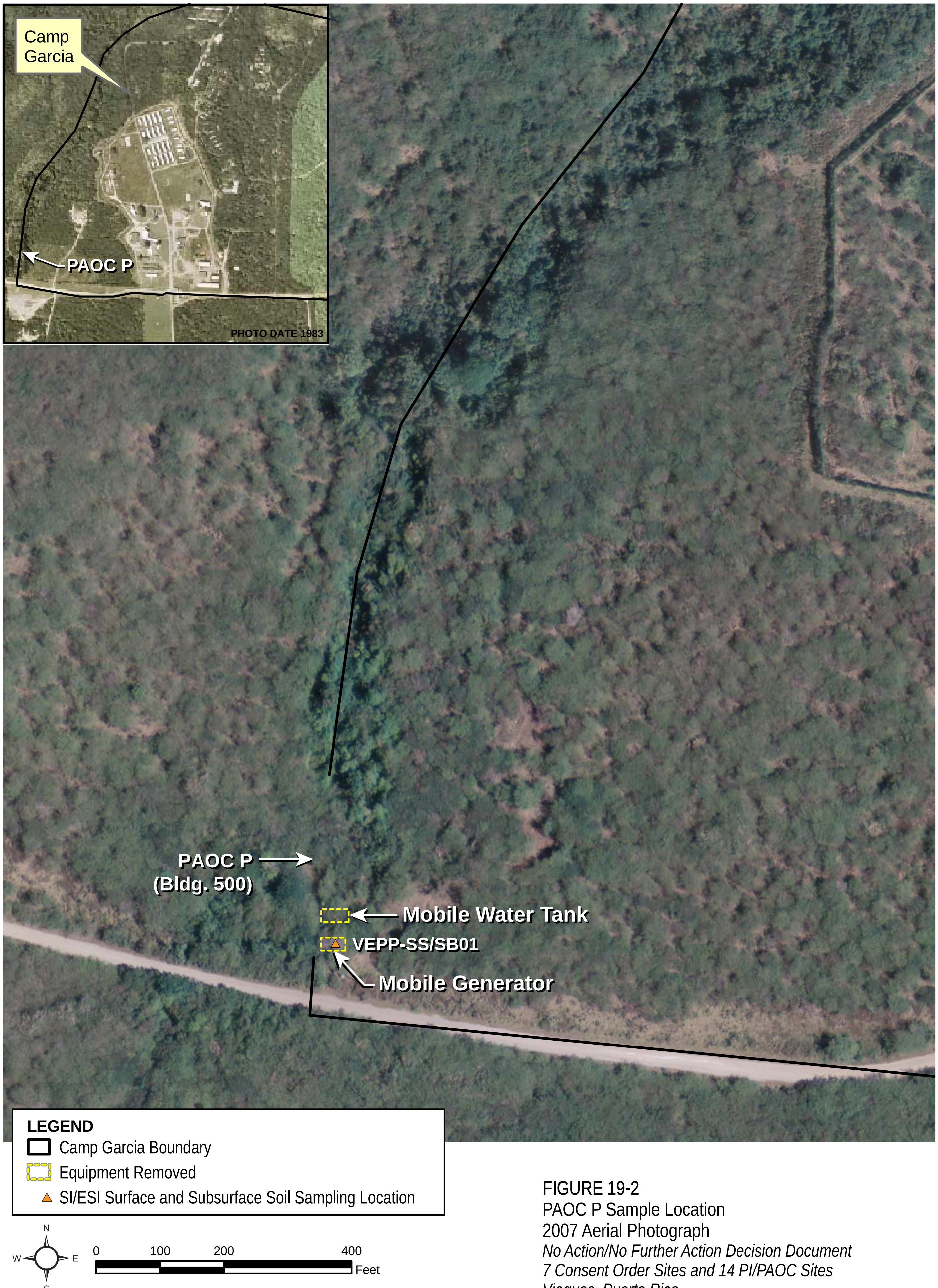

FIGURE 19-2
PAOC P Sample Location
2007 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

(A) PAOC P as seen during the Vieques ERP Technical Subcommittee Site Visit and Meeting (January 2009)

(B) Generator Before Disassembling

(C) Generator Being Drained

(D) Generator After Demolition

(E) Tank and Trailer Prior to Dismantling

(F) Tank Demolition

(G) Tank Trailer Dismantling

(H) Tank and Trailer Metal Debris Pile (Includes Truck from PAOC X)

(I) Area Cleared of Debris

FIGURE 19-3
PAOC P Site Photographs
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 20

PAOC S—Former POL Pipeline and Power Plant

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC S. A more detailed discussion of the PAOC S evaluation is presented Final SI/ESI Report (CH2M HILL, 2010).

20.1 Conceptual Site Model

20.1.1 Site Description and Potential Sources of Release

PAOC S includes the location of a former petroleum, oil, and lubricant (POL) pipeline that ran above ground (other than where it crossed under Red Beach Road) from the aboveground fuel tanks at SWMU 2 to an area south of the Camp Garcia Compound (**Figure 1-2**) where there was a valve used to fill fuel trucks (Garcia, 2004). The pipeline and probable valve locations are shown on **Figure 20-1**. The former fuel tanks at SWMU 2 stored diesel fuel, gasoline, aviation gas, and JP-5 fuel. Therefore, it is probable that these fuels were transported in the former pipeline at PAOC S. Records show that the pipeline was removed in 1984 (NAVFACENGCOM, 2003). A power plant, also identified on an historical aerial photograph (**Figure 20-2**), was added to PAOC S for the purposes of investigation, but has no known direct relationship with the former pipeline. Although there are no known records regarding the fuel type used by the generator(s) at the PAOC S power plant, it is likely they used diesel fuel. According to former Camp Garcia personnel, there are no records of USTs at Camp Garcia and that all fuel tanks were ASTs, in which case any fuel storage at the PAOC S power plant would likely have been in an AST, specifically a day tank. However, a design diagram for a UST at the power house facility (shown in **Figure 20-3**) was found. The diagram does not indicate whether the design was ever implemented. Further, no other information was found in reference to whether the UST was installed or, if installed, whether it was removed.

Personnel interviewed during the EBS indicated that no known releases occurred along the pipeline or at the former power plant. Further, no evidence of hazardous material, hazardous waste, petroleum, or munitions storage or disposal was observed during a site visit (NAVFACENGCOM, 2003). However, because the POL pipeline extended from the SWMU 2 fuel farm to an area south of the Camp Garcia Compound, and because it had not been investigated for possible leaks, sampling along the former pipeline area was included in the PA/SI. Additionally, sampling at the former power plant building was included in the PA/SI due to its unknown potential as a source of release.

20.1.2 Investigation History

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), because no underground pipeline or UST was identified at the former power plant portion of PAOC S during the geophysical survey, no additional soil sampling was necessary. During the PA/SI, 14 soil borings were installed at the locations along the former pipeline, as shown in **Figure 20-1**. At each soil boring location, one surface soil sample and one subsurface soil sample were collected. Eleven of the soil borings (SO09 through SO19) were installed at approximately 500-ft intervals along the POL pipeline. Three additional soil borings (SO06 through SO08) were installed in the vicinity of the probable valve location. The surface and subsurface soil samples were analyzed for TCL VOCs and SVOCs.

In addition to the above, two surface soil samples (SO20 and SO21) were collected in a potential depositional area downgradient of the pipeline, but upgradient of a salt flat, in observed land crab habitat and analyzed for TCL VOCs and SVOCs. The locations of these two samples were selected in the field by USFWS and NOAA personnel at the beginning of the PA/SI fieldwork.

Five soil borings (SO01 through SO05) were installed around the perimeter and in the center of the former power plant building, as shown in **Figure 20-2**. No PID or FID readings significantly above background were observed in the soil borings (see Soil Boring Logs, Appendix D of the Final PA/SI 12 Consent Order Sites and 8 PI/PAOC Sites (CH2M HILL, 2008)); therefore, subsurface soil samples were collected at default depths (or refusal, whichever was encountered first) in accordance with the work plan (see Table 2-1 of the Final PA/SI 12 Consent Order Sites and 8 PI/PAOC Sites (CH2M HILL, 2008) for subsurface soil sample depths). The building center boring was completed as a monitoring well. The surface and subsurface soil samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs; and TAL metals. The groundwater sample was analyzed for TCL VOCs, SVOCs, pesticides and PCBs; TAL inorganics; and TDS.

Tables 20-1, 20-2, and 20-3 summarize the constituents detected in PAOC S surface soil samples, subsurface soil samples, and groundwater samples, respectively, collected during the PA/SI. The tables also identify screening criteria exceedances. Note that the groundwater data from the upgradient well at PAOC N (EPAN-MW02), which is also upgradient of the former power plant part of PAOC S, was used for initial background comparison for the groundwater data collected at PAOC S.

It is important to note that evaluation of these data, as presented in the PA/SI Report (CH2M HILL, 2008), determined that there has not been a CERCLA-related release at PAOC S that resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. However, because the site has not yet been closed out (due to the need to conduct a geophysical evaluation during the ESI), the PA/SI data have been re-evaluated in this SI/ESI Report to account for the new EPA RSLs/SSLs that superseded the EPA Region IX PRGs/SSLs and to account for ecological screening values that have been updated. It is also important to note that this re-evaluation resulted in no changes to the conclusions reached.

20.1.3 Physical Setting

Former POL Pipeline

The PAOC S pipeline originated at SWMU 2 on a peninsula between Bahia Tapon and Bahia de la Chavia. The pipeline ran past the northern edge of Bahia Tapon, north of a black mangrove wetland/salt flat at an elevation of approximately 5 ft amsl, and up to the eastern edge of the former Camp Garcia runway, at an elevation of approximately 26 ft amsl. The peninsula contains moderately sloped hills, whereas the area north of the wetlands and the area by the edge of the runway forms a very gentle slope to the south-southeast. The current vegetation is thorn scrub, likely because the land was cleared when the pipeline was installed. The southeastern end of the pipeline overlies bedrock consisting of sandstones, siltstones, conglomerates, lava, tuff and tuffaceous breccias, and some limestone. Groundwater in this area exists within the alluvial deposits and fractured bedrock and is presumed to flow in a southerly direction to the coast. There are no ephemeral streams at or adjacent to the site.

Former Power Plant

The former power plant area is relatively flat, at approximately 65 ft amsl, and sloping 1 ft to 2 ft every 100 ft to the south. The land around the power plant portion of the site is cleared but not regularly maintained. Soil consists of some combination of sand, silt, and/or clay. Bedrock was encountered between 30 and 36 ft bgs and consists of igneous rocks, primarily granodiorite and quartz diorite. Groundwater occurs within the fractured bedrock and is presumed to flow in a southerly direction toward the coast. No surface water bodies are present at the site and the closest surface water bodies topographically downgradient of the site is Bahia Corcho and Bahia Tapon along the coast, approximately 1 mile to the south and southeast, respectively.

20.2 PAOC S Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 20-1 through 20-3**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a former POL pipeline and power plant. Although there are no records of past releases at the site and there was no evidence of past releases observed during the site visit, the potential presence of CERCLA hazardous substances could not be confidently ruled out without sample collection due to the nature of the historical activities at the site. Sample collection took place during the 2006 PA/SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

Appendix N, Section N.20 of the Final PA/SI Report (CH2M HILL, 2008) discusses the evaluation of the PAOC S data quality. As detailed in Section N.20, the PAOC S data are acceptable for use in evaluating whether a release of hazardous waste or hazardous constituents warranting further action occurred at PAOC S.

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the PA/SI, the following inorganics above the background UTLs and non-inorganics were detected by medium:

Former Power Plant

Surface Soil

- VOCs: none detected
- SVOCs: bis(2-ethylhexyl)phthalate
- Pesticides: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT
- PCBs: none detected
- Inorganics above background UTLs: calcium, lead, magnesium, mercury, selenium, and zinc

Subsurface Soil

- VOCs: none detected
- SVOCs: bis(2-ethylhexyl)phthalate
- Pesticides: 4,4'-DDE, 4,4'-DDT, methoxychlor
- PCBs: none detected
- Inorganics above background UTLs: copper, magnesium and selenium

Groundwater

- VOCs: none detected
- SVOCs: none detected
- Pesticides: none detected
- PCBs: none detected
- Total inorganics above background (EPAN MW02): aluminum, barium, cobalt, iron, manganese, selenium
- Dissolved inorganics above background (EPAN MW02): aluminum, barium, manganese, nickel

Former POL Pipeline

Surface Soil

- VOCs: none detected
- SVOCs: di-n-butylphthalate, di-n-octylphthalate

Subsurface Soil

- VOCs: none detected
- SVOCs: bis(2-ethylhexyl)phthalate

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records or visual evidence of past releases at PAOC S. However, based on the potential source areas at PAOC S (i.e., former POL pipeline and power plant), it is assumed that the constituent groups detected in site media, except for pesticides, are potentially attributable to CERCLA-related releases. The pesticides detected at this site (**Table 20-1**) are the same pesticides and of similar concentrations detected at other sites across Vieques (Tables O-1 of the Final SI/ESI Report (CH2M HILL, 2010)). For example, 4,4′-DDD, 4,4′-DDE, and 4,4′-DDT were detected in PAOC S surface soil samples at concentrations between 1.8 µg/kg and 7.9 µg/kg (4,4′-DDD), 17 µg/kg and 650 µg/kg (4,4′-DDE), and 5.4 µg/kg and 270 µg/kg (4,4′-DDT), which are similar to the concentrations detected at other sites across east Vieques (i.e., 0.16 µg/kg to 26 µg/kg for 4,4′-DDD; 0.08 µg/kg to 1,200 µg/kg for 4,4′-DDE; and 0.30 µg/kg to 990 µg/kg for 4,4′-DDT). This information, coupled with the history of the site, suggests the pesticides are present due to normal pesticide use, not a CERCLA-related release (see Appendix O and Pesticides and Herbicides under Section 1.1.1 of the Final SI/ESI Report (CH2M HILL, 2010)). Therefore, pesticides are not considered further in the decision analysis process. All other detected constituents are further considered in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

<u>Former Power Plant</u>

Surface Soil

- SVOCs: no exceedances
- Lead: two detections (samples SS01 and SS04) at concentrations (12 and 12.3 mg/kg, respectively) above the ecological soil screening value for birds and mammals (11 mg/kg) and background UTL (5.4 mg/kg)
- Mercury: one detection (sample SS01) at a concentration (1.2 mg/kg) above the adjusted RSL (0.78 mg/kg), the SSL at a DAF of 1 (0.57 mg/kg), the ecological soil screening value for plants and invertebrates (0.1 mg/kg), and background UTL (0.057 mg/kg).
- Selenium: four detections (samples SS01, SS02, SS03, and SS04) at concentrations (0.62 mg/kg to 0.74 mg/kg) above the ecological soil screening value for plants and invertebrates (0.52 mg/kg), the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg). Selenium was also detected above background and the ecological screening value for birds and mammals (0.63 mg/kg) in three samples (SS01, SS03, and SS03)
- Zinc: one detection (sample SS01) at a concentration (54 mg/kg) above the ecological soil screening value for birds and mammals (46 mg/kg) and background UTL (32 mg/kg)

Subsurface Soil

- SVOCs: no exceedances
- Copper: one detection (sample SB01) at a concentration (83.3 mg/kg) above the SSL at a DAF of 1 (46 mg/kg) and background UTL (66 mg/kg)
- Selenium: two detections (samples SB01 and SB03) at concentrations (0.68 mg/kg and 0.69 mg/kg, respectively) above the SSL at a DAF of 1 (0.26 mg/kg) and background UTL (0.51 mg/kg)

Groundwater

- Total and dissolved inorganics: no exceedances

Former POL Pipeline

Surface Soil

- SVOCs: no exceedances

Subsurface Soil

- SVOCs: no exceedances

As shown above, there are exceedances of the most conservative screening values for the former power plant portion of PAOC S. Therefore, the decision analysis process for those data continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Former Power Plant

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL Soil.

As a conservative approach, risk estimates were prepared for a future residential scenario at PAOC S. The site is approximately 0.2 acre in size whereas a residential lot may be approximately 0.75 acre. No chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 20-4**). Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Mercury was the only chemical detected in soil above both its human health screening level and background UTL (Table 20-4). Mercury was detected in surface soil above background and its adjusted RSL (0.78 mg/kg), at a maximum concentration of 1.2 mg/kg. Based on the maximum detected concentration, the HQ is 0.2, which is within the EPA acceptable level and mercury would not be identified as a risk driver.

Seven additional constituents (aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium) were detected in surface or subsurface soil above human health screening levels but below background UTLs. Based on the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on maximum detected concentrations of mercury and the seven additional constituents, the cumulative ELCR is 2×10^{-6} and the maximum target organ-specific HI is 0.7 (see **Table 20-4**). Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil.

Groundwater

For a chemical identified as a COPC in both "total" and "dissolved" groundwater, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Chromium was detected above its RSL (0.043 μg/L based on Cr^{6+}) but below background in the groundwater sample collected from the site, at a maximum concentration of 1.5 μg/L; detected concentrations are less than the MCL (100 μg/L). Based on the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Based on the maximum "total" concentration and the expected form of chromium (Cr^{3+}) at the site, the HI is 0.00003 (see **Table 20-4**), which is within the EPA acceptable level, and chromium would not be identified as a risk driver. Additionally, all chromium detections in soil are below the background UTL, which indicates that the presence of chromium in groundwater is attributable to background.

Cumulative Soil and Groundwater

Potential cumulative risks from both residential soil and groundwater exposures were evaluated. As indicated on **Table 20-4,** the cumulative ELCR is 2×10^{-6} and the maximum target organ-specific HI is 0.7. Because the cumulative ELCR and target organ-specific HIs do not exceed EPA acceptable levels, cumulative effects from multiple chemicals in soil and groundwater are not a concern.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 7×10^{-5}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Four inorganics (lead, mercury, selenium, and zinc) exceeded ecological screening values and background UTLs in at least one surface soil sample collected at the site (**Table 20-1**). Based on site size and habitat characteristics, exposure of bioaccumulative chemicals to upper trophic level receptors (birds and mammals) was considered in addition to direct exposure of all detected chemicals to soil organisms (plants and invertebrates). Accordingly, the results of screening value exceedances for each of these receptor groups are evaluated.

Mercury and selenium exceeded soil screening values for soil organisms (plants and invertebrates). None of these constituents poses an unacceptable risk to plants and invertebrates based upon the following:

- Mercury was not detected in four of the five surface soil samples, which were collected around the sample with the elevated mercury concentration (1.2 mg/kg in SS01). Thus, the exceedance for mercury is restricted to a relatively small area centered near SS01 and, since mercury was not detected in the subsurface sample SB01, is limited to the surface strata.

- Selenium exceeded the ecological screening value for soil organisms (0.52 mg/kg) in 4 of 5 samples at a maximum HQ of 1.42 (**Table 20-5**). Although the background UTL for selenium in this soil type is 0.51 mg/kg, selenium concentrations up to 1.3 mg/kg were detected during the east Vieques background soil inorganics investigation in nearby soil types (CH2M HILL, 2007b). This suggests that the selenium concentrations detected at PAOC S (maximum of 0.74 mg/kg) may be within the range of background. Further, all selenium concentrations are less than ecological screening values based upon other receptors (e.g., 4.10 mg/kg for soil invertebrates). Thus, selenium has a low potential for unacceptable risks to soil invertebrates and plants, especially given the very low potential for exposure.

Lead, mercury, selenium and zinc exceeded the screening values (Eco SSLs) protective of upper trophic level organisms. None of these constituents poses an unacceptable risk to birds and mammals based upon the following:

- Lead exceeded background and the Eco SSL for birds (11 mg/kg) in 2 of 5 samples. Food web HQs (and calculations) based upon maximum (screening) and mean (baseline) lead exposure doses for each target receptor are listed in **Tables 20-6 through 20-9**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the pearly-eyed thrasher, but the mean exposure dose HQ was less than one. Based on these results, lead does not pose an unacceptable risk to upper trophic level receptors based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

- Mercury exceeded background in 1 of 5 samples. Food web HQs and calculations for each target receptor are listed in **Tables 20-6 through 20-9**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Based on these results, mercury does not pose an unacceptable risk to upper trophic level receptors based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).
- Selenium exceeded background and the Eco SSL for mammals (0.63 mg/kg) in 3 of 5 samples. Food web HQs and calculations for each target receptor are listed in **Tables 20-6 through 20-9**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, but the mean exposure dose HQ was less than one. Based on these results, selenium does not pose an unacceptable risk to upper trophic level receptors based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).
- Zinc exceeded background and the Eco SSL for birds (46 mg/kg) in 1 of 5 samples. Food web HQs and calculations for each target receptor are listed in **Tables 20-6 through 20-9**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Indian mongoose and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Based on these results, zinc does not pose an unacceptable risk to upper trophic level receptors based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

– depth of contamination with respect to estimated groundwater depth

– mobility of contaminant

– number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Mercury and selenium exceed the SSLs at a DAF of 1 and background UTLs in surface soil samples (one for mercury and four for selenium) and copper and selenium exceed the SSLs at a DAF of 1 and background UTLs in subsurface soil samples (one for copper and two for selenium). Neither copper nor mercury was detected in groundwater, and mercury was not detected in any subsurface soil samples. Total selenium was detected in groundwater, but its concentration is an order of magnitude or more below the tap water RSL and MCL. Dissolved selenium was not detected in groundwater. This information indicates that the SSLs at a DAF of 1 for the inorganic constituents detected at PAOC S are not representative predictors of leaching to groundwater. At a DAF of 3 none of these inorganics concentrations exceeds the SSL.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely sources of CERCLA-related releases are the former pipeline and power plant. Based on this information, multiple soil samples and a groundwater sample were collected within these areas. In addition, a geophysical survey conducted at the former power plant portion of PAOC S showed no evidence of a buried pipeline between the former fuel tanks and the former power plant or a UST within the footprint of the former power plant. Therefore, the area of geophysical survey and the spatial distribution of the samples collected during the PA/SI and resulting data indicate the potential source area has been sufficiently characterized.

20.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PAOC S that has resulted in contamination of soil or groundwater at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. The soil data collected along the pipeline portion of PAOC S suggest a fuel release did not occur; therefore, analysis of other constituents, such as inorganics, is not warranted. Further, pesticide detections at the site are consistent with normal pesticide application associated with maintenance of the historical facilities present at the site. Additionally, the geophysical survey conducted as part of the ESI found no evidence of a buried pipeline or UST at the power plant portion of PAOC S. Therefore, no action is warranted for PAOC S.

Table 20-1
Surface Soil Detection and Exceedance Results
PAOC S
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Vieques (East) Background Zone KTd SS	Vieques (East) Background Zone Qa SS	Vieques (East) Background Zone Kv SS	Adjusted RSL for Residential Soil	ECO (E)	SSL (DAF=1)	EPAS-SO01[1]		EPAS-SO02[1]	EPAS-SO03[1]	EPAS-SO04[1]	EPAS-SO05[1]	EPAS-SO06[2]	EPAS-SO07[2]	EPAS-SO08[2]	EPAS-SO09[2]
Sample ID							EPAS-SS01-0001	EPAS-SS01P-0001	EPAS-SS02-0001	EPAS-SS03-0001	EPAS-SS04-0001	EPAS-SS05-0001	EPAS-SS06-0002	EPAS-SS07-0002	EPAS-SS08-0002	EPAS-SS09-0002
Sample Date							02/02/06	02/02/06	02/02/06	02/02/06	02/02/06	02/02/06	02/16/06	02/16/06	02/16/06	02/15/06
Chemical Name																
Volatile Organic Compounds (UG/KG)	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
No Detections																
Semi-volatile Organic Compounds (UG/KG)																
Di-n-butylphthalate	--	--	--	610,000	40,000	9,200	380 U	360 U	370 U	340 U	380 U	360 U	360 U	360 U	360 U	350 U
Di-n-octylphthalate	--	--	--	35,000	30,000	1,100	380 U	360 U	370 U	340 U	380 U	360 UJ	360 U	360 U	360 U	74 J
bis(2-Ethylhexyl)phthalate	--	--	--	35,000	30,000	1,400	380 U	90 J	370 U	340 U	380 U	360 U	360 U	360 U	360 U	350 U
Pesticide/Polychlorinated Biphenyls (UG/KG)																
4,4'-DDD	--	--	--	2,000	21	66	7.9	4.6	1.8 J	3.4 U	3.8 U	6.9	NA	NA	NA	NA
4,4'-DDE	--	--	--	1,400	21	47	**550**	**650**	**270**	**330**	17	**580**	NA	NA	NA	NA
4,4'-DDT	--	--	--	1,700	21	67	**110**	**100**	**70**	15	5.4	**270**	NA	NA	NA	NA
Total Metals (MG/KG)																
Aluminum	35,000	35,000	35,000	7,700	--	55,000	10,400	9,530	10,600	7,310	10,200	9,790	NA	NA	NA	NA
Antimony	5.8	5.8	5.8	3.1	0.27	0.27	0.63 J	0.67 J	0.5 J	0.49 J	0.25 J	0.53 J	NA	NA	NA	NA
Arsenic	1.6	1.6	1.6	0.39	18	0.29	1.1 U	1.1 U	0.78 J	1.0 U	0.55 J	0.55 J	NA	NA	NA	NA
Barium	147	212	212	1,500	330	82	57	54	66	53	53	78	NA	NA	NA	NA
Cadmium	2.2	2.2	2.2	7	0.36	0.38	0.13 J	0.036 J	0.12 J	0.52 U	0.015 J	0.029 J	NA	NA	NA	NA
Calcium	8,840	11,900	8,840	--	--	--	**19,800 J**	7,840	**22,000**	**16,500**	**25,700**	**23,800**	NA	NA	NA	NA
Chromium	72	72	72	0.29	26	0.00083	9.6	9.1	9.3	6.2	9.6	8.2	NA	NA	NA	NA
Cobalt	16	16	26	2.3	13	0.49	11	11	13	8.6	9.4	11	NA	NA	NA	NA
Copper	66	53	94	310	28	46	51	46	41	45	34	44	NA	NA	NA	NA
Iron	38,100	38,100	43,200	5,500	--	640	17,500	17,000	19,600	13,700	17,100	16,600	NA	NA	NA	NA
Lead	5.4	5.4	5.4	400	11	27	**12 J**	**7.5 J**	**6.9 J**	3.6 J	**12.3 J**	**6.0 J**	NA	NA	NA	NA
Magnesium	3,710	22,200	22,200	--	--	--	**5,040**	**4,190**	**5,550**	**5,560**	**3,870**	**4,540**	NA	NA	NA	NA
Manganese	1,630	1,630	1,630	180	220	57	568	551	638	432	485	489	NA	NA	NA	NA
Mercury	0.057	0.057	0.057	0.78	0.10	0.57	**1.2**	**1.2**	0.11 U	0.10 U	0.12 U	0.11 U	NA	NA	NA	NA
Nickel	22	22	41	160	38	48	4.6	4.8	4.5 U	4.2 U	4.6 U	4.4 U	NA	NA	NA	NA
Potassium	5,270	5,270	5,270	--	--	--	1,160 J	857 J	852 J	519 U	918 J	953 J	NA	NA	NA	NA
Selenium	0.51	0.51	0.51	39	0.52	0.26	**0.68 J**	0.41 J	**0.62 J**	**0.69 J**	**0.74 J**	0.41 J	NA	NA	NA	NA
Vanadium	144	144	144	39	7.8	180	52	52	63	39	59	53	NA	NA	NA	NA
Zinc	32	32	32	2,400	46	680	**54**	**38**	29	24	21	30	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and ECO (E)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] - Samples associated with this station were compared against Vieques (East) Background Zone KTd SS, Vieques Eco SO, and Vieques HHRA SO.
[2] - Samples associated with this station were compared against Vieques (East) Background Zone Qa SS, Vieques Eco SO, and Vieques HHRA SO.
[3] - Samples associated with this station were compared against Vieques (East) Background Zone Kv SS, Vieques Eco SO, and Vieques HHRA SO.

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PAOC S
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Vieques, Puerto Rico

Station ID	Vieques (East) Background Zone KTd SS	Vieques (East) Background Zone Qa SS	Vieques (East) Background Zone Kv SS	Adjusted RSL for Residential Soil	ECO (E)	SSL (DAF=1)	EPAS-SO10[2]	EPAS-SO11[2]	EPAS-SO12[2]		EPAS-SO13[2]	EPAS-SO14[2]	EPAS-SO15[3]	EPAS-SO16[3]	EPAS-SO17[3]	EPAS-SO18[3]
Sample ID							EPAS-SS10-0002	EPAS-SS11-0002	EPAS-SS12-0002	EPAS-SS12P-0002	EPAS-SS13-0002	EPAS-SS14-0002	EPAS-SS15-0002	EPAS-SS16-0002	EPAS-SS17-0002	EPAS-SS18-0002
Sample Date							02/08/06	02/08/06	02/08/06	02/08/06	02/07/06	02/07/06	02/09/06	02/09/06	02/09/06	02/14/06
Chemical Name																
Volatile Organic Compounds (UG/KG)	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
No Detections																
Semi-volatile Organic Compounds (UG/KG)																
Di-n-butylphthalate	--	--	--	610,000	40,000	9,200	350 U	360 U	360 U	420 U	360 U	350 U	360 U	390 U	360 U	350 U
Di-n-octylphthalate	--	--	--	35,000	30,000	1,100	350 U	360 U	360 U	420 U	360 U	830	360 U	390 U	360 U	350 U
bis(2-Ethylhexyl)phthalate	--	--	--	35,000	30,000	1,400	350 U	360 U	360 U	420 U	360 U	350 U	360 U	390 U	360 U	350 U
Pesticide/Polychlorinated Biphenyls (UG/KG)																
4,4'-DDD	--	--	--	2,000	21	66	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	--	--	--	1,400	21	47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	--	--	--	1,700	21	67	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (MG/KG)																
Aluminum	35,000	35,000	35,000	7,700	--	55,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	5.8	5.8	5.8	3.1	0.27	0.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.6	1.6	1.6	0.39	18	0.29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	147	212	212	1,500	330	82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.2	2.2	2.2	7	0.36	0.38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	8,840	11,900	8,840	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	72	72	72	0.29	26	0.00083	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	16	16	26	2.3	13	0.49	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	66	53	94	310	28	46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	38,100	38,100	43,200	5,500	--	640	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	5.4	5.4	5.4	400	11	27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	3,710	22,200	22,200	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1,630	1,630	1,630	180	220	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.057	0.057	0.057	0.78	0.10	0.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	22	22	41	160	38	48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	5,270	5,270	5,270	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.51	0.51	0.51	39	0.52	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	144	144	144	39	7.8	180	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	32	32	32	2,400	46	680	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and ECO (E)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] - Samples associated with this station were compared against Vieques (East) Background Zone KTd SS, Vieques Eco SO, and Vieques HHRA SO.
[2] - Samples associated with this station were compared against Vieques (East) Background Zone Qa SS, Vieques Eco SO, and Vieques HHRA SO.
[3] - Samples associated with this station were compared against Vieques (East) Background Zone Kv SS, Vieques Eco SO, and Vieques HHRA SO.

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PAOC S
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7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Vieques (East) Background Zone KTd SS	Vieques (East) Background Zone Qa SS	Vieques (East) Background Zone Kv SS	Adjusted RSL for Residential Soil	ECO (E)	SSL (DAF=1)	EPAS-SO19[3]	EPAS-SO20[2]	EPAS-SO21[2]	
Sample ID							EPAS-SS19-0002	EPAS-SS20-0002	EPAS-SS21-0002	EPAS-SS21P-0002
Sample Date							02/15/06	02/06/06	02/06/06	02/06/06
Chemical Name										
Volatile Organic Compounds (UG/KG)	--	--	--	--	--	--	ND	ND	ND	ND
No Detections										
Semi-volatile Organic Compounds (UG/KG)										
Di-n-butylphthalate	--	--	--	610,000	40,000	9,200	370	470 U	450 U	410 U
Di-n-octylphthalate	--	--	--	35,000	30,000	1,100	350 U	470 U	450 U	410 U
bis(2-Ethylhexyl)phthalate	--	--	--	35,000	30,000	1,400	350 U	470 U	450 U	410 U
Pesticide/Polychlorinated Biphenyls (UG/KG)										
4,4'-DDD	--	--	--	2,000	21	66	NA	NA	NA	NA
4,4'-DDE	--	--	--	1,400	21	47	NA	NA	NA	NA
4,4'-DDT	--	--	--	1,700	21	67	NA	NA	NA	NA
Total Metals (MG/KG)										
Aluminum	35,000	35,000	35,000	7,700	--	55,000	NA	NA	NA	NA
Antimony	5.8	5.8	5.8	3.1	0.27	0.27	NA	NA	NA	NA
Arsenic	1.6	1.6	1.6	0.39	18	0.29	NA	NA	NA	NA
Barium	147	212	212	1,500	330	82	NA	NA	NA	NA
Cadmium	2.2	2.2	2.2	7	0.36	0.38	NA	NA	NA	NA
Calcium	8,840	11,900	8,840	--	--	--	NA	NA	NA	NA
Chromium	72	72	72	0.29	26	0.00083	NA	NA	NA	NA
Cobalt	16	16	26	2.3	13	0.49	NA	NA	NA	NA
Copper	66	53	94	310	28	46	NA	NA	NA	NA
Iron	38,100	38,100	43,200	5,500	--	640	NA	NA	NA	NA
Lead	5.4	5.4	5.4	400	11	27	NA	NA	NA	NA
Magnesium	3,710	22,200	22,200	--	--	--	NA	NA	NA	NA
Manganese	1,630	1,630	1,630	180	220	57	NA	NA	NA	NA
Mercury	0.057	0.057	0.057	0.78	0.10	0.57	NA	NA	NA	NA
Nickel	22	22	41	160	38	48	NA	NA	NA	NA
Potassium	5,270	5,270	5,270	--	--	--	NA	NA	NA	NA
Selenium	0.51	0.51	0.51	39	0.52	0.26	NA	NA	NA	NA
Vanadium	144	144	144	39	7.8	180	NA	NA	NA	NA
Zinc	32	32	32	2,400	46	680	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and ECO (E)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)
Exceeds Background UTL, Adjusted RSL for Residential Soil, ECO (E) and SSL (DAF=1)

NA - Not analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] - Samples associated with this station were compared against Vieques (East) Background Zone KTd SS, Vieques Eco SO, and Vieques HHRA SO.
[2] - Samples associated with this station were compared against Vieques (East) Background Zone Qa SS, Vieques Eco SO, and Vieques HHRA SO.
[3] - Samples associated with this station were compared against Vieques (East) Background Zone Kv SS, Vieques Eco SO, and Vieques HHRA SO.

Table 20-2
Subsurface Soil Detection and Exceedance Results
PAOC S
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Vieques (East) Background Zone KTd SB	Vieques (East) Background Zone Qa SB	Vieques (East) Background Zone Kv SB	Adjusted RSL for Residential Soil	Risk-Based SSL DAF=1	EPAS-SO01[1]	EPAS-SO02[1]	EPAS-SO03[1]		EPAS-SO04[1]	EPAS-SO05[1]	EPAS-SO06[2]	EPAS-SO07[2]	EPAS-SO08[2]
Sample ID						EPAS-SB01-0406	EPAS-SB02-0406	EPAS-SB03-0406	EPAS-SB03P-0406	EPAS-SB04-0406	EPAS-SB05-0406	EPAS-SB06-0406	EPAS-SB07-0406	EPAS-SB08-0406
Sample Date						02/02/06	02/02/06	02/02/06	02/02/06	02/02/06	02/02/06	02/16/06	02/16/06	02/16/06
Chemical Name														
Volatile Organic Compounds (UG/KG)														
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semi-volatile Organic Compounds (UG/KG)														
bis(2-Ethylhexyl)phthalate	--	--	--	35,000	1,400	130 J	350 U	380 U	380 U	380 U	360 U	81 J	380 U	350 U
Pesticide/Polychlorinated Biphenyls (UG/KG)														
4,4'-DDE	--	--	--	1,400	47	35	29	3.8 U	3.8 U	3.8 U	2.8 J	NA	NA	NA
4,4'-DDT	--	--	--	1,700	67	6.7	13	3.8 U	3.8 U	3.8 U	1.8 J	NA	NA	NA
Methoxychlor	--	--	--	31,000	2,200	20 U	18 U	20 U	20 U	19 U	11 J	NA	NA	NA
Total Metals (MG/KG)														
Aluminum	35,000	35,000	35,000	7,700	55,000	12,500	6,860	10,100	9,450	8,450	7,620	NA	NA	NA
Antimony	5.8	5.8	5.8	3.1	0.27	0.56 J	0.31 J	0.46 J	0.22 J	0.26 J	0.22 J	NA	NA	NA
Barium	147	212	212	1,500	82	83	44	79	73	71	47	NA	NA	NA
Calcium	8,840	11,900	8,840	--	--	4,120	2,500	3,060	2,660	2,630	2,240	NA	NA	NA
Chromium	72	72	72	0.29	0.00083	9.1	5.1	8.4	9.6	6.3	6.0	NA	NA	NA
Cobalt	16	16	26	2.3	0.49	12	6	8.7	10	7.6	6.7	NA	NA	NA
Copper	66	53	94	310	46	**83**	47	41	37	29	49	NA	NA	NA
Iron	38,100	38,100	43,200	5,500	640	20,300	12,300	19,000	20,600	14,400	13,100	NA	NA	NA
Lead	3.3	3.3	3.3	400	27	1.4 J	0.88 J	1.1 J	1.2 J	1.0 J	0.72 J	NA	NA	NA
Magnesium	3,710	22,200	22,200	--	--	**5,200**	2,800	3,610	2,920	2,660	2,660	NA	NA	NA
Manganese	1,630	1,630	1,630	180	57	563	297	468	386	424	342	NA	NA	NA
Nickel	22	22	41	160	48	6.4	4.3 U	4.7 U	5.2	4.5 U	4.4 U	NA	NA	NA
Potassium	2,000	2,000	2,000	--	--	623 J	538 U	734 J	777 J	567 U	570 J	NA	NA	NA
Selenium	0.51	0.51	0.51	39	0.26	**0.68 J**	3.8 U	**0.64 J**	**0.69 J**	0.45 J	3.9 U	NA	NA	NA
Vanadium	144	144	144	39	180	63	39	66	79	53	44	NA	NA	NA
Zinc	32	32	32	2,400	680	29	15	18	17	14	14	NA	NA	NA

Notes:

Exceeds Background UTL

Exceeds Background UTL and SSL (DAF=1)

NA - Not analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
1 - Samples associated with this station were compared against Vieques (East) Background Zone KTd SB, Vieques Eco SO, and Vieques HHRA SO.
2 - Samples associated with this station were compared against Vieques (East) Background Zone Qa SB, Vieques Eco SO, and Vieques HHRA SO.
3 - Samples associated with this station were compared against Vieques (East) Background Zone Kv SB, Vieques Eco SO, and Vieques HHRA SO.

Table 20-2
Subsurface Soil Detection and Exceedance Results
PAOC S
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Vieques (East) Background Zone KTd SB	Vieques (East) Background Zone Qa SB	Vieques (East) Background Zone Kv SB	Adjusted RSL for Residential Soil	Risk-Based SSL DAF=1	EPAS-SO09[2]	EPAS-SO10[2]		EPAS-SO11[2]	EPAS-SO12[2]	EPAS-SO13[2]	EPAS-SO14[2]	EPAS-SO15[3]	EPAS-SO16[3]
Sample ID						EPAS-SB09-0406	EPAS-SB10-0406	EPAS-SB10P-0406	EPAS-SB11-0406	EPAS-SB12-0406	EPAS-SB13-0406	EPAS-SB14-0406	EPAS-SB15-0204.5	EPAS-SB16-0406
Sample Date						02/15/06	02/08/06	02/08/06	02/08/06	02/08/06	02/07/06	02/07/06	02/09/06	02/09/06
Chemical Name														
Volatile Organic Compounds (UG/KG)														
No Detections	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semi-volatile Organic Compounds (UG/KG)														
bis(2-Ethylhexyl)phthalate	--	--	--	35,000	1,400	380 U	360 U	360 U	380 U	390 U	390 U	370 U	370 U	450 U
Pesticide/Polychlorinated Biphenyls (UG/KG)														
4,4'-DDE	--	--	--	1,400	47	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	--	--	--	1,700	67	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	--	--	--	31,000	2,200	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (MG/KG)														
Aluminum	35,000	35,000	35,000	7,700	55,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	5.8	5.8	5.8	3.1	0.27	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	147	212	212	1,500	82	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	8,840	11,900	8,840	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	72	72	72	0.29	0.00083	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	16	16	26	2.3	0.49	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	66	53	94	310	46	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	38,100	38,100	43,200	5,500	640	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	3.3	3.3	3.3	400	27	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	3,710	22,200	22,200	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1,630	1,630	1,630	180	57	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	22	22	41	160	48	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	2,000	2,000	2,000	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.51	0.51	0.51	39	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	144	144	144	39	180	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	32	32	32	2,400	680	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Exceeds Background UTL

Exceeds Background UTL and SSL (DAF=1)

NA - Not analyzed

ND - None Detected

-- Not part of background data set (where applicable) OR Regulatory standard not promulgated

J - Analyte present; reported value may or may not be accurate or precise

U - Analyte not detected

MG/KG - Milligrams per Kilogram

UG/KG - Micrograms per Kilogram

[1] - Samples associated with this station were compared against Vieques (East) Background Zone KTd SB, Vieques Eco SO, and Vieques HHRA SO.

[2] - Samples associated with this station were compared against Vieques (East) Background Zone Qa SB, Vieques Eco SO, and Vieques HHRA SO.

[3] - Samples associated with this station were compared against Vieques (East) Background Zone Kv SB, Vieques Eco SO, and Vieques HHRA SO.

Table 20-2
Subsurface Soil Detection and Exceedance Results
PAOC S
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Vieques (East) Background Zone KTd SB	Vieques (East) Background Zone Qa SB	Vieques (East) Background Zone Kv SB	Adjusted RSL for Residential Soil	Risk-Based SSL DAF=1	EPAS-SO17[3]	EPAS-SO18[3]	EPAS-SO19[3]
Sample ID						EPAS-SB17-0203.75	EPAS-SB18-0406	EPAS-SB19-0204
Sample Date						02/09/06	02/14/06	02/15/06
Chemical Name								
Volatile Organic Compounds (UG/KG)								
No Detections	--	--	--	--	--	ND	ND	ND
Semi-volatile Organic Compounds (UG/KG)								
bis(2-Ethylhexyl)phthalate	--	--	--	35,000	1,400	380 U	110 J	360 U
Pesticide/Polychlorinated Biphenyls (UG/KG)								
4,4'-DDE	--	--	--	1,400	47	NA	NA	NA
4,4'-DDT	--	--	--	1,700	67	NA	NA	NA
Methoxychlor	--	--	--	31,000	2,200	NA	NA	NA
Total Metals (MG/KG)								
Aluminum	35,000	35,000	35,000	7,700	55,000	NA	NA	NA
Antimony	5.8	5.8	5.8	3.1	0.27	NA	NA	NA
Barium	147	212	212	1,500	82	NA	NA	NA
Calcium	8,840	11,900	8,840	--	--	NA	NA	NA
Chromium	72	72	72	0.29	0.00083	NA	NA	NA
Cobalt	16	16	26	2.3	0.49	NA	NA	NA
Copper	66	53	94	310	46	NA	NA	NA
Iron	38,100	38,100	43,200	5,500	640	NA	NA	NA
Lead	3.3	3.3	3.3	400	27	NA	NA	NA
Magnesium	3,710	22,200	22,200	--	--	NA	NA	NA
Manganese	1,630	1,630	1,630	180	57	NA	NA	NA
Nickel	22	22	41	160	48	NA	NA	NA
Potassium	2,000	2,000	2,000	--	--	NA	NA	NA
Selenium	0.51	0.51	0.51	39	0.26	NA	NA	NA
Vanadium	144	144	144	39	180	NA	NA	NA
Zinc	32	32	32	2,400	680	NA	NA	NA

Notes:

Exceeds Background UTL

Exceeds Background UTL and SSL (DAF=1)

NA - Not analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/KG - Milligrams per Kilogram
UG/KG - Micrograms per Kilogram
[1] - Samples associated with this station were compared against Vieques (East) Background Zone KTd SB, Vieques Eco SO, and Vieques HHRA SO.
[2] - Samples associated with this station were compared against Vieques (East) Background Zone Qa SB, Vieques Eco SO, and Vieques HHRA SO.
[3] - Samples associated with this station were compared against Vieques (East) Background Zone Kv SB, Vieques Eco SO, and Vieques HHRA SO.

Table 20-3
Groundwater Detection and Exceedance Results
PAOC S
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	PAOC-N EPAN-MW02 Background	Adjusted RSL for Tapwater	MCL - Groundwater	EPAS-MW01	
Sample ID				EPAS-GW01-06B	EPAS-GW01P-06B
Sample Date				04/03/06	04/03/06
Chemical Name					
Volatile Organic Compounds (UG/L)					
No Detections	--	--	--	ND	ND
Semi-volatile Organic Compounds (UG/L)					
No Detections	--	--	--	ND	ND
Pesticide/Polychlorinated Biphenyls (UG/L)					
No Detections	--	--	--	ND	ND
Total Metals (UG/L)					
Aluminum	263	3,700	--	242	**298**
Barium	200	730	2,000	**244**	**246**
Calcium	144,000	--	--	137,000	138,000
Chromium	3.6 J	0.043	100	1.3 J	1.5 J
Cobalt	--	1.1	--	0.47 J	0.45 J
Iron	198	2,600	--	**207**	**267**
Magnesium	75,600	--	--	60,100	60,400
Manganese	8.0 J	88	--	**11 J**	**13 J**
Nickel	2.4 J	73	--	1.4 J	1.3 J
Potassium	1780 J	--	--	1,360 J	1,360 J
Selenium	--	18	50	2.8 J	2.0 J
Sodium	323,000	--	--	274,000	275,000
Dissolved Metals (UG/L)					
Aluminum	--	3,700	--	200 U	34 J
Barium	--	730	2,000	239	233
Calcium	139,000	--	--	135,000	132,000
Magnesium	73,400	--	--	59,200	58,000
Manganese	--	88	--	0.74 J	1.0 J
Nickel	--	73	--	0.81 J	0.76 J
Potassium	1710 J	--	--	1,320 J	1,280 J
Sodium	311,000	--	--	269,000	261,000
Wet Chemistry (MG/L)					
Total dissolved solids (TDS)	--	--	--	1,330	1,320

Notes:
Exceeds Background UTL
NA - Not analyzed
ND - None Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present; reported value may or may not be accurate or precise
U - Analyte not detected
MG/L - Milligrams per Liter
UG/L - Micrograms per Liter

Table 20-4
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PAOC-S
Media: Surface Soil, Subsurface Soil, Groundwater
Historical Function: Former POL Pipeline and Power Plant

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value Qa (1)	Background Value KTd (2)	Background Value KV (3)
PAOC-S	7429-90-5	Aluminum	7.3E+03	1.06E+04	mg/kg	EPAS-SO02	5 / 5	4 / 5	--	3.5E+04	3.5E+04	3.5E+04
Surface Soil	7440-38-2	Arsenic	5.5E-01 J	7.80E-01 J	mg/kg	EPAS-SO02	3 / 5	3 / 5	--	1.6E+00	1.6E+00	1.6E+00
	7440-47-3	Chromium	6.2E+00	9.60E+00	mg/kg	EPAS-SO01, EPAS-SO04	5 / 5	5 / 5	--	7.2E+01	7.2E+01	7.2E+01
	7440-48-4	Cobalt	8.6E+00	1.26E+01	mg/kg	EPAS-SO02	5 / 5	5 / 5	--	1.6E+01	1.6E+01	2.6E+01
	7439-89-6	Iron	1.4E+04	1.96E+04	mg/kg	EPAS-SO02	5 / 5	5 / 5	--	3.8E+04	3.8E+04	4.3E+04
	7439-96-5	Manganese	4.3E+02	6.38E+02	mg/kg	EPAS-SO02	5 / 5	5 / 5	--	1.6E+03	1.6E+03	1.6E+03
	7439-97-6	Mercury	1.2E+00	1.20E+00	mg/kg	EPAS-SO01	1 / 5	1 / 5	--	5.7E-02	5.7E-02	5.7E-02
	7440-62-2	Vanadium	3.9E+01	6.33E+01	mg/kg	EPAS-SO02	5 / 5	4 / 5	--	1.4E+02	1.4E+02	1.4E+02
PAOC-S	7429-90-5	Aluminum	6.9E+03	1.3E+04	mg/kg	EPAS-SO01	5 / 5	3 / 5	-	3.5E+04	3.5E+04	3.5E+04
Subsurface Soil	7440-47-3	Chromium	5.1E+00	9.6E+00	mg/kg	EPAS-SO03	5 / 5	5 / 5	-	7.2E+01	7.2E+01	7.2E+01
	7440-48-4	Cobalt	6.0E+00	1.2E+01	mg/kg	EPAS-SO01	5 / 5	5 / 5	-	1.6E+01	1.6E+01	2.6E+01
	7439-89-6	Iron	1.2E+04	2.1E+04	mg/kg	EPAS-SO03	5 / 5	5 / 5	-	3.8E+04	3.8E+04	4.3E+04
	7439-96-5	Manganese	3.0E+02	5.6E+02	mg/kg	EPAS-SO01	5 / 5	5 / 5	-	1.6E+03	1.6E+03	1.6E+03
	7440-62-2	Vanadium	3.9E+01	7.9E+01	mg/kg	EPAS-SO03	5 / 5	5 / 5	-	1.4E+02	1.4E+02	1.4E+02
PAOC-S Groundwater	7440-47-3	Chromium	1.5E+00 J	1.5E+00 J	ug/L	EPAS-MW01	1 / 1	1 / 1	-	--	--	--

Exposure Point	Chemical	Max Exceeds Background Qa	Max Exceeds Background KTd	Max Exceeds Background KV	PAOC-N MW2	December RSL Adjusted (4)	Max Exceeds 100x SL	Cancer Screening Toxicity Value (5)	Non-cancer Screening Toxicity Value (5)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC-S	Aluminum	No	No	No	-- --	7.7E+03 nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	Arsenic	No	No	No	-- --	3.9E-01 ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.04	2.0E-06
	Chromium	No	No	No	-- --	2.9E-01 ca	No	--	1.2E+05	--	--	Max	No Observed Effects	0.00008	--
	Cobalt	No	No	No	-- --	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.5	3.4E-08
	Iron	No	No	No	-- --	5.5E+03 nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	Manganese	No	No	No	-- --	1.8E+02 nc	No	--	1.8E+03	--	--	Max	CNS	0.4	--
	Mercury	Yes	Yes	Yes	-- --	7.8E-01 nc	No	--	7.8E+00	--	--	Max	CNS	0.2	--
	Vanadium	No	No	No	-- --	3.9E+01 nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
PAOC-S	Aluminum	No	No	No	-- --	7.7E+03 nc	No	--	7.7E+04	--	--	Max	CNS	0.2	--
Subsurface Soil	Chromium	No	No	No	-- --	2.9E-01 ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	Cobalt	No	No	No	-- --	2.3E+00 nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	Iron	No	No	No	-- --	5.5E+03 nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.4	--
	Manganese	No	No	No	-- --	1.8E+02 nc	No	--	1.8E+03	--	--	--	CNS	--	--
	Vanadium	No	No	No	-- --	3.9E+01 nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.2	--
PAOC-S Groundwater	Chromium	--	--	--	3.6E+00 J	4.3E-02 ca	No	--	5.5E+04	--	--	Max	No Observed Effects	0.00003	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.7	2E-06
Groundwater	0.00003	--
Total Risk	0.7	2E-06

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type Qa.
(2) East Vieques Soil Type KTd
(3) East Vieques Soil Type KV.
(4) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(5) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 20-5
Ecological Risk Assessment Screening Statistics for PAOC S Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Lead	-- - --	5 / 5	3.60	12.3	8.16	3.84	11.8	120	0 / 5	0.10	--	-- - --		--	--	--
Mercury	0.10 - 0.12	1 / 5	1.20	1.20	0.28	0.51	0.77	0.10	1 / 5	12.0	0.057	1 / 5	5.0	21.1	7.72	2.84
Selenium	-- - --	5 / 5	0.41	0.74	0.63	0.13	0.75	0.52	4 / 5	1.42	0.51	4 / 5	1.2	1.45	1.44	1.21
Zinc	-- - --	5 / 5	21.0	54.3	31.6	13.2	44.2	120	0 / 5	0.45	--	-- - --	--	--	--	--

TABLE 20-6
Summary of Norway Rat Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Lead	12.3	1.522	18.72	0.468	5.76	0	1.39	4.70	6.47	8.90	0.30	0.22	0.16
Mercury	1.20	20.63	24.75	5.000	6.00	0	1.40	0.032	0.072	0.16	43.71	19.55	8.74
Selenium	0.74	1.340	0.99	3.012	2.23	0	0.52	0.20	0.26	0.33	2.61	2.03	1.58
Zinc	54.3	12.89	699.66	1.820	98.83	0	23.20	75.4	169	377	0.31	0.14	0.06

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0398 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.980 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.020 = Proportion of diet composed of soil
WIR = 0.0516 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.168 = Body weight (kg wet weight)

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Mercury	0.28	1.186	0.34	Regresson	0.19	0	0.03	0.032	0.072	0.16	0.81	0.36	0.16
Selenium	0.63	Regression	0.66	Regresson	0.30	0	0.05	0.20	0.26	0.33	0.24	0.19	0.15

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0207 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.020 = Proportion of diet composed of soil
WIR = 0.0242 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.209 = Body weight (kg wet weight)

TABLE 20-7
Summary of Indian Mongoose Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Lead	12.3	1.522	18.72	0.468	5.76	0.286	3.52	0	2.73	4.70	6.47	8.90	0.58	0.42	0.31
Mercury	1.20	20.63	24.75	5.000	6.00	0.130	0.16	0	3.55	0.15	0.19	0.25	23.68	18.34	14.21
Selenium	0.74	1.340	0.99	3.012	2.23	1.263	0.93	0	0.15	0.20	0.26	0.33	0.73	0.57	0.44
Zinc	54.3	12.89	699.66	1.820	98.83	2.782	151.07	0	100.49	75.4	169	377	1.33	0.60	0.27

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0460 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.972 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0933 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.312 = Body weight (kg wet weight)

TABLE 20-7
Summary of Indian Mongoose Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Mercury	0.28	1.186	0.34	Regresson	0.19	0.130	0.04	0	0.01	0.15	0.19	0.25	0.08	0.06	0.05
Zinc	31.6	Regression	265.56	Regresson	32.85	Regresson	112.86	0	10.15	75.4	169	377	0.13	0.06	0.03

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0285 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.564 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.111 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.297 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0557 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.528 = Body weight (kg wet weight)

TABLE 20-8
Summary of Pearly-eyed Thrasher Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Lead	12.3	1.522	18.72	0.468	5.76	0	4.01	3.85	8.61	19.3	1.04	0.47	0.21
Mercury	1.20	20.63	24.75	5.000	6.00	0	5.15	0.49	0.77	1.20	10.52	6.72	4.29
Selenium	0.74	1.340	0.99	3.012	2.23	0	0.21	0.44	0.81	1.50	0.48	0.26	0.14
Zinc	54.3	12.89	699.66	1.820	98.83	0	145.87	66.1	148	331	2.21	0.99	0.44

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0174	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.954	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.046	= Proportion of diet composed of soil
WIR =	0.0157	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.080	= Body weight (kg wet weight)

TABLE 20-8
Summary of Pearly-eyed Thrasher Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Lead	8.16	Regression	4.38	Regresson	0.86	0	0.46	3.85	8.61	19.3	0.12	0.05	0.02
Mercury	0.28	1.186	0.34	Regresson	0.19	0	0.04	0.49	0.77	1.20	0.07	0.05	0.03
Zinc	31.6	Regression	265.56	Regresson	32.85	0	24.68	66.1	148	331	0.37	0.17	0.07

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0123 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.754 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.200 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.046 = Proportion of diet composed of soil
WIR = 0.0129 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.104 = Body weight (kg wet weight)

TABLE 20-9
Summary of Red-tailed Hawk Exposure Doses - Screening
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
for 7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Lead	12.3	1.522	18.72	0.468	5.76	0.286	3.52	0	0.15	3.85	8.61	19.3	0.04	0.02	0.01
Mercury	1.20	20.63	24.75	5.000	6.00	0.130	0.16	0	0.01	0.49	0.77	1.20	0.01	0.01	0.01
Selenium	0.74	1.340	0.99	3.012	2.23	1.263	0.93	0	0.04	0.44	0.81	1.50	0.09	0.05	0.03
Zinc	54.3	12.89	699.66	1.820	98.83	2.782	151.07	0	6.24	66.1	148	331	0.09	0.04	0.02

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0395 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.000 = Proportion of diet composed of soil
WIR = 0.0680 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.957 = Body weight (kg wet weight)

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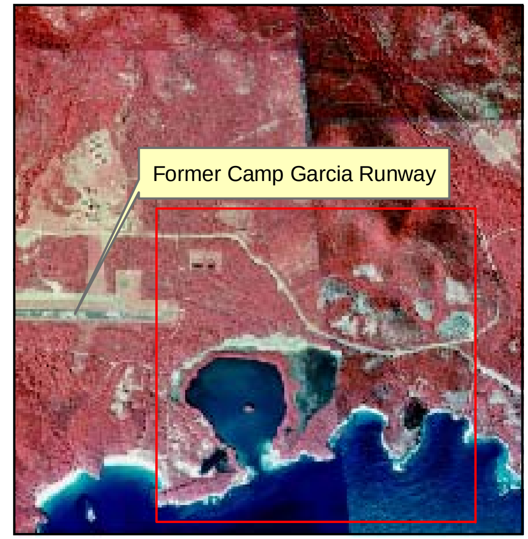
PHOTO DATE 1985

PHOTO DATE 1985



LEGEND

- PA/SI Surface and Subsurface Soil Sample Location
- POL Pipeline
- SWMU 2

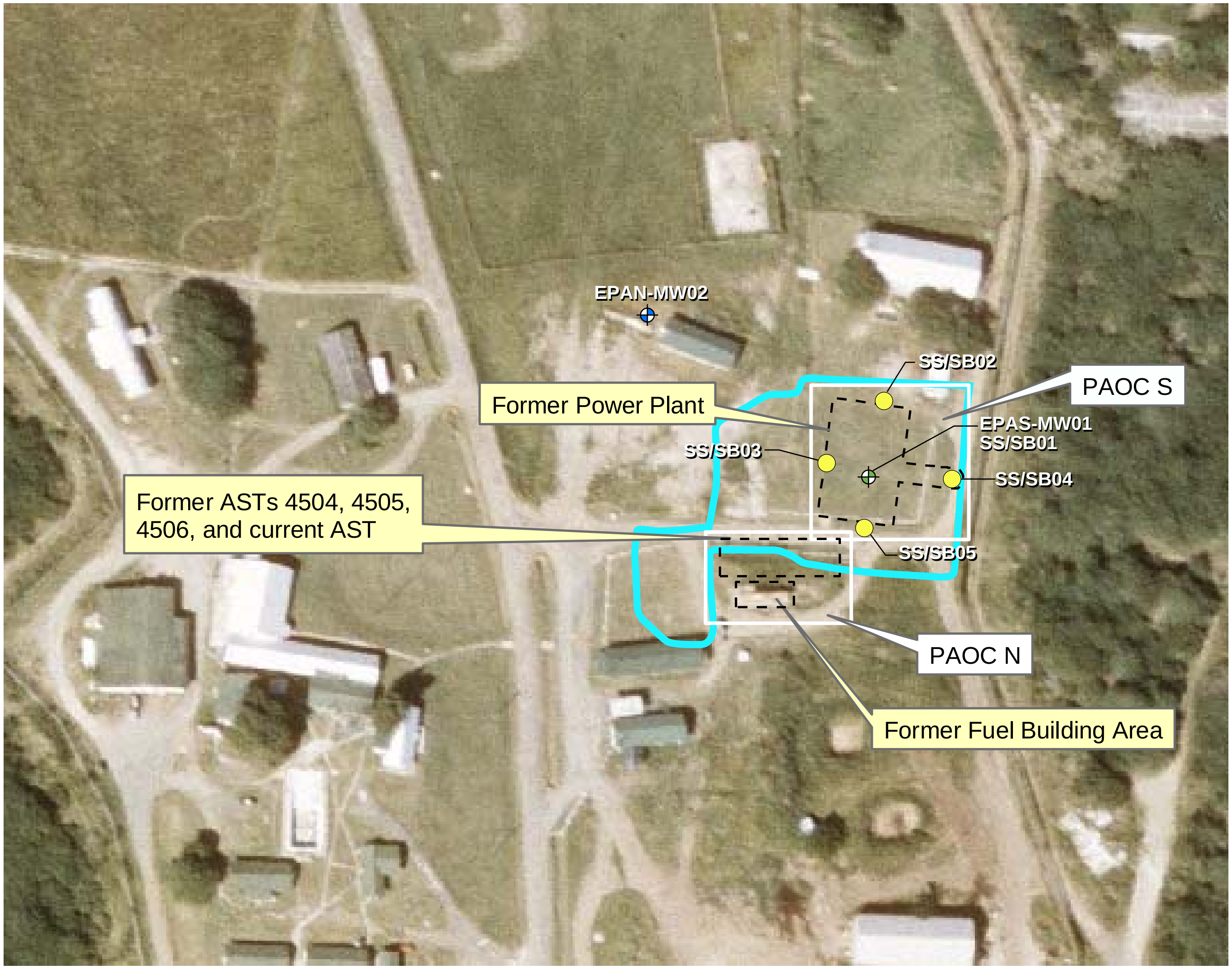
N
W E
S

0 800 1,600
Feet

FIGURE 20-1
PAOC S Pipeline Sample Locations
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

CH2MHILL

PHOTO DATE 1983



LEGEND

- PA/SI Surface and Subsurface Soil Sample Location
- PA/SI Surface and Subsurface Soil Sample Location and Monitoring Well
- Area of Geophysical Investigation

N W E S

0 100 200 Feet

FIGURE 20-2
PAOC N and S Geophysical Investigation, 1983 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

ES051310153702TPA F20-2_PAOCs N-S Geophysical Investigation.ai mstuart

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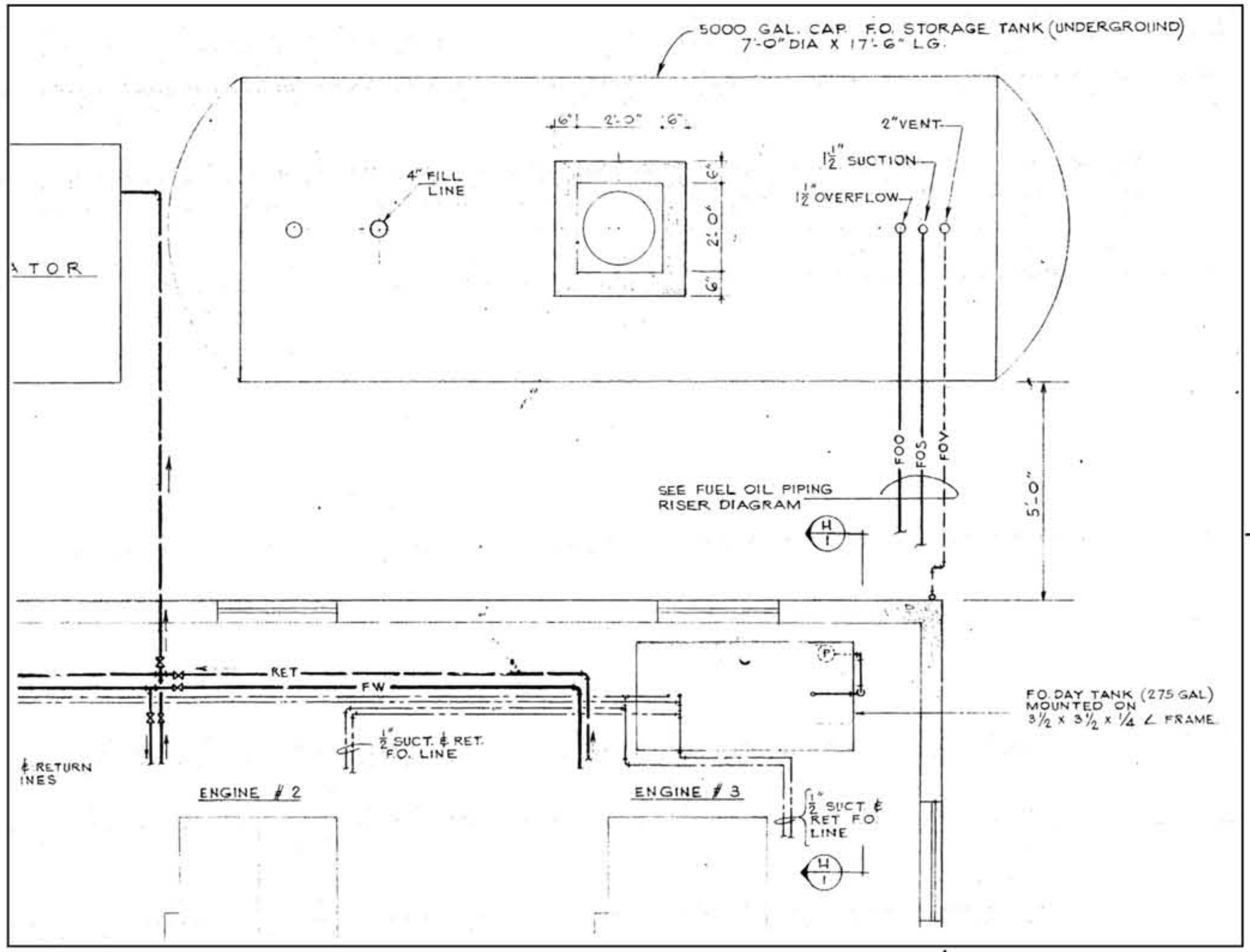

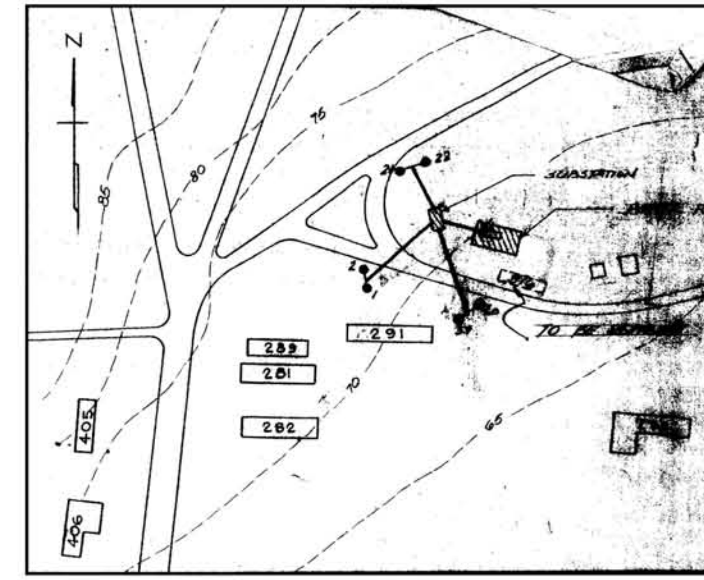

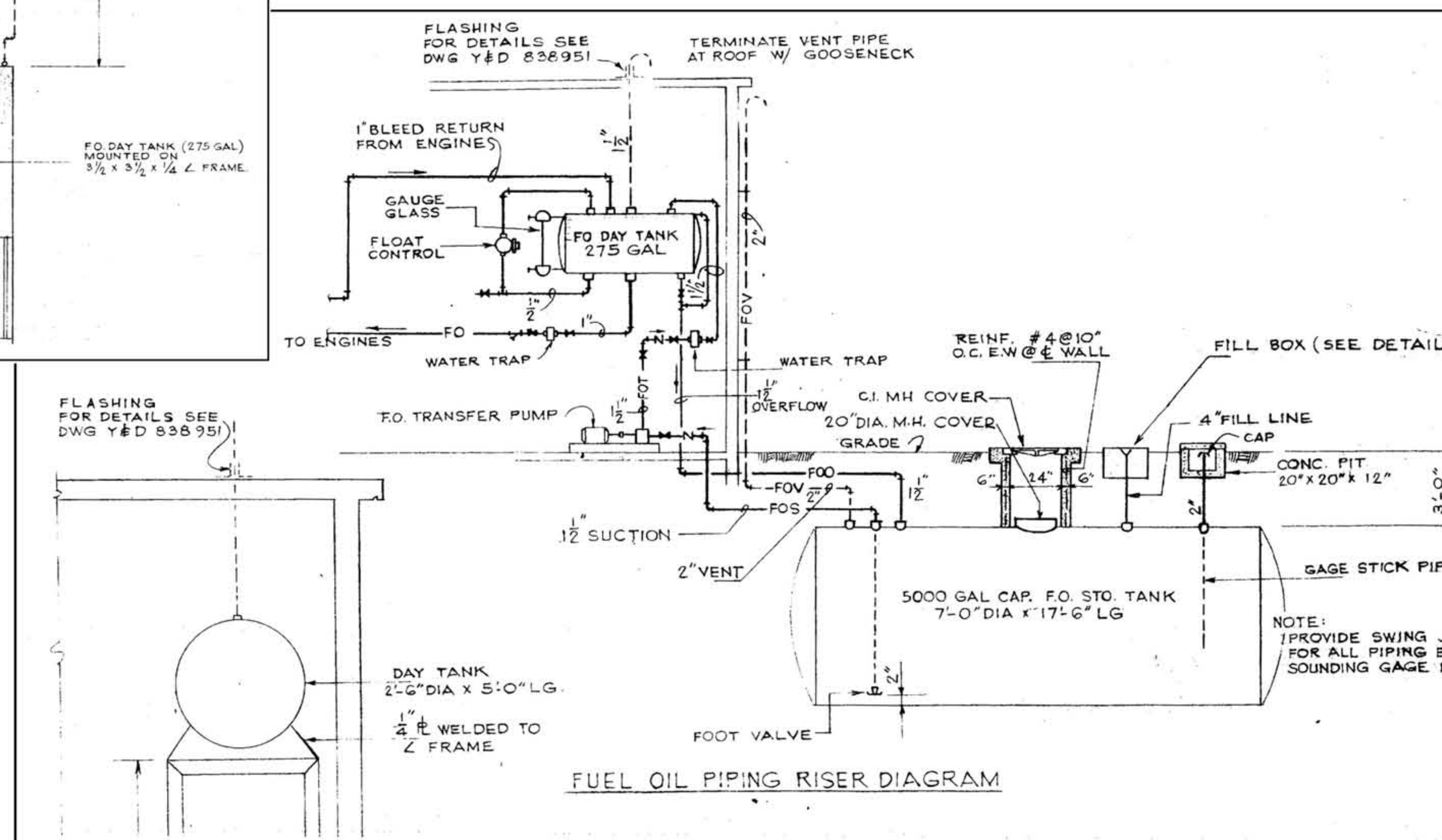

FIGURE 20-3
PAOC S UST Diagram
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

SECTION 21

PAOC X—Debris Area in Ephemeral Stream

This section presents a summary of the pertinent historical information and rationale for the no action determination for PAOC X. A more detailed discussion of the PAOC X evaluation is presented in the Final SI/ESI Report (CH2M HILL, 2010).

21.1 Conceptual Site Model

21.1.1 Site Description and Potential Sources of Release

PAOC X is located along the western boundary of Camp Garcia. Historical information suggests the site is an ephemeral stream containing some construction-related debris and an automobile. The location of the site is shown in **Figures 21-1 through 21-3**.

During the EBS (2002) site visit, an automobile body, tires, scrap metal, and construction debris were observed in the ephemeral stream north of the main road west of Camp Garcia. Based on these observations, four surface soil samples (VNTR-X-1 through VNTR-X-4) were collected in the vicinity of the debris (**Figure 21-1**). Although surface soil samples collected during the EBS suggest no CERCLA-related release in this area had resulted in contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater, there was uncertainty in this conclusion because only surface soil samples were collected and no samples were collected directly beneath the debris. It was therefore determined that incidental debris removal would be necessary in order to collect sufficient samples to complete the release assessment. This would also remove the debris as a potential future source of contamination.

In January 2009, the ERP Technical Subcommittee walked the ephemeral stream and identified the debris labeled in **Figure 21-1** (other than the abandoned truck, which was not within the ephemeral stream, but adjacent to its western bank). A partially buried car and two deteriorated, empty drums were also observed in the ephemeral stream. The ERP Technical Subcommittee also walked along the eastern bank where debris mounds were observed.

The potential sources of a CERCLA-related release at PAOC X were the automobile buried in the ephemeral stream and the mounds of debris adjacent to the east bank of the ephemeral stream.

21.1.2 Investigation History

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), debris at PAOC X was excavated, separated and stockpiled by type for disposal. Specifically, debris at the top of the east bank of the ephemeral stream and the two deteriorated drums and buried car in the ephemeral stream were removed. A truck located on the west embankment of the ephemeral stream was also removed and dismantled using a combination of backhoe and cutting torch. **Figures 21-4 and 21-5** depict examples of the debris removal activities and debris at PAOC X.

Before terminating activities for the SI (2009), the site was cleared of debris, (Figure 21-5[F]). The scrap metal, which included the truck, car, drums, cable spools, metal pallets, and engine, etc., were transported to the Navy Central Processing Center (CPC) for disposal. The concrete slabs and construction debris were disposed of at the El Coqui Landfill in Vieques, Puerto Rico EBS Soil Sampling

Based on observations made during the EBS, four surface soil samples were collected in the vicinity of debris (**Figure 21-1**). The samples were analyzed for VOCs, SVOCs, pesticides, herbicides, PCBs, inorganics, TPH-DRO, and TPH-GRO.

SI Soil Sampling

In accordance with the Final SI/ESI SAP (CH2M HILL, 2009b), during the SI soil samples were collected as follows:

To determine if a release had occurred from the automobile located within the ephemeral stream (**Figure 21-5[D]**), one confirmatory soil sample (SS05) was collected in the 6-inch interval immediately beneath the automobile. Additionally one co-located surface/subsurface soil sample (SS/SB-06) was collected in the depositional area of the ephemeral stream just downstream of the buried automobile (**Figure 21-1**). Because the depositional area is not land crab habitat, the surface soil sample was collected from 0 to 1 foot bgs. Refusal was reached at 3 ft bgs; therefore, the subsurface soil sample (SB06) was collected from 1 to 3 ft bgs.

Several soil samples were collected where debris had been pushed into mounds at the top of the ephemeral stream bank. After the mounds, an example of which is shown in **Figure 21-4[A]**, were pulled down to identify and remove debris, soil samples SS07 through SS11 were collected from the 6-inch interval directly below observed debris, including one (SS08) beneath a deteriorated drum uncovered during the excavation (**Figure 21-5[E]**). Additionally, one confirmatory sample (SB12, as shown in **Figure 21-1**) was collected within a pit (**Figure 21-4[C]**) excavated to remove cable spools (**Figure 21-4[B]**) that were uncovered when the associated mound was pulled down.

No PID readings above 0.0 ppm or visible evidence of contamination were observed; therefore, no additional subsurface soil samples were collected. In accordance with the SAP, all soil samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics.

SI Geophysical Investigation

As part of the initial debris removal activities, the site was graded to a more natural setting (**Figure 21-4[D]**). A magnetic and electromagnetic geophysical survey was conducted along the top of the bank at PAOC X to determine if there was any additional buried metallic debris (**Figure 21-4[E]**). The results of the geophysical survey showed two small anomalies within the survey area. The report concluded that these were anomalies were characteristic of small, isolated debris, not large burial areas.

SI Test Pitting Activities and Additional Sampling

Following the identification of the two anomalies described above, additional excavation and trenching activities took place. Test Pit PAOC-X-E1 contained a variety of metal debris including an engine and fly wheel, water hose, concrete, metal paint can, mop bucket, and rebar, which were subsequently removed. Within this test pit, two soil samples were collected (SB13 and SB14, as shown in **Figure 21-1**) from the 6-inch interval below the debris. Test Pit PAOC-X-E2 contained concrete debris and metal screen, which were subsequently removed. Within this test pit, one soil sample (SB15, as shown in **Figure 21-1**) was collected in the 6-inch interval below the debris.

No PID readings above 0.0 ppm or visible evidence of contamination were observed in the test pits. In accordance with the SAP, all soil samples were analyzed for TCL VOCs and SVOCs, and TAL inorganics.

Tables 21-1 and 21-2 summarize the constituents detected in PAOC X surface soil and subsurface soil samples, respectively, collected during the SI (2009) and EBS (2002). The tables also identify screening criteria exceedances.

21.1.3 Physical Setting

The site slopes to the southwest by means of an ephemeral stream which serves as drainage for the site. The site has a maximum elevation of approximately 75 ft amsl. The land around the site is not maintained. The soil consists mostly of sand and silty sand. The subsurface geology is composed of igneous rocks, primarily granodiorite and quartz diorite. Groundwater exists within fractured bedrock and flows in a southerly direction toward the coast. The site primarily comprises an ephemeral stream and its banks, no surface water was present at the site at the time of the investigation. The ephemeral stream discharges into Bahia Corcho, approximately 1 mile to the south of the site.

21.2 PAOC X Release Assessment Decision Analysis

This subsection discusses the sample results in the context of the Data Evaluation Decision Tree (**Figure 1-3**) with reference to the detection tables (**Tables 21-1 and 21-2**).

Step 1: Is the site potentially CERCLA-eligible?

Historical information suggests the site was a debris area in and adjacent to an ephemeral stream. Even though surface soil samples were collected during the EBS, the spatial distribution was not sufficient to conclude no CERCLA-related release occurred or that a CERCLA-related release at this site has not resulted in contamination at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. Additional sample collection took place during the 2009 SI. Therefore, the decision analysis proceeds to Step 2.

Step 2: Does the data quality evaluation indicate the dataset as a whole is available and useful for the intended purpose?

EBS (2002)

Although EBS data were not subject to third-party validation, the data still underwent some validation processes. The results of laboratory QA/QC samples were compared to limits specified by the analytical methodology and/or laboratory SOPs. At a minimum, these QA/QC samples included blanks, calibrations, and MS/MSDs. No QA/QC exceedances were noted. These historical data are available for used as reported.

SI (2009)

Based on the data quality evaluation of the SI/ESI analytical data, 99 percent of the data are usable for the intended purpose. The site-specific data set achieved the 95 percent project completeness goal (as defined in the UFP-SAP) for each site. Further details of the data quality evaluation are provided in Appendix M of the Final SI/ESI Report (CH2M HILL, 2010).

Step 3: Were any inorganics above the background UTL detected or were any non-inorganics detected?

For the samples collected during the EBS (2002) and the SI (2009), the following inorganics above the background UTLs and non-inorganics were detected by sampling event and by medium:

EBS (2002) Surface Soil

- VOCs: none detected
- SVOCs: none detected
- Pesticides: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT
- Inorganics above background UTLs: lead, thallium, zinc

SI (2009) Surface Soil

- VOCs: none detected
- SVOCs: acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, carbazole, chrysene, dibenz(a,h)anthracene, di-n-butylphthalate, fluoranthene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, pyrene
- Inorganics above background UTLs: calcium, copper, lead, magnesium, zinc

SI (2009) Subsurface Soil

- VOCs: none detected

- SVOCs: acenaphthylene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, di-n-butylphthalate, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene
- Inorganics above background UTLs: calcium, copper, lead, magnesium, vanadium, and zinc

Step 4: Are there any inorganic constituents above background or non-inorganic constituents that are potentially attributable to historic CERCLA-related releases at the site?

There are no records of past releases at PAOC X. However, based on the potential source areas at PAOC X (i.e., debris areas in and around the ephemeral stream), it is assumed that SVOCs and inorganics are potentially attributable to CERCLA-related releases from the debris and are, therefore, further considered in the decision analysis process.

The presence of the pesticides is likely due to normal pesticide use, not a CERCLA-related release, especially because the detected concentrations (**Table 21-1**) are similar to those found at multiple sites across Vieques (Table O-1 of the Final SI/ESI Report (CH2M HILL, 2010)). For example, 4,4′-DDD, 4,4′-DDE, and 4,4′-DDT were detected in PAOC X surface soil samples at concentrations between 5.5 μg/kg and 14 μg/kg (4,4′-DDD), 8.3 μg/kg and 310 μg/kg (4,4′-DDE), and 8.0 μg/kg and 76 μg/kg (4,4′-DDT), which are similar to the concentrations detected at other sites across east Vieques (i.e., 0.16 μg/kg to 26 μg/kg for 4,4′-DDD; 0.08 μg/kg to 1,200 μg/kg for 4,4′-DDE; and 0.30 μg/kg to 990 μg/kg for 4,4′-DDT).

In addition, the thallium concentrations reported for samples collected during the EBS utilized a method that, although standard at the time, tended to provide falsely elevated results (see Section 1 of the Final SI/ESI Report (CH2M HILL, 2010)). The thallium data collected at PAOC X support this assertion. **Table 21-1** shows that no thallium was detected in the seven surface soil samples collected during the SI, compared to thallium results of 0.73 mg/kg and 1.4 mg/kg from the EBS. Based on this, the thallium results from the EBS are not considered further in the decision analysis process.

Step 5: Are there any exceedances (over that of background) of the most conservative screening values?

In this step of the decision analysis, the data for the CERCLA-related constituents identified in Step 4 are compared to the screening criteria described in Section 1 of the Final SI/ESI Report (CH2M HILL, 2010) and shown on the detection tables. Those constituents that exceed one or more criteria (and background for inorganics) are listed below by medium.

EBS (2002) Surface Soil

- Inorganics above background: no exceedances

SI (2009) Surface Soil

- Benzo(a)anthracene: three detections (samples SS08, SS09 and SS10) at concentrations (11, 17, and 73 μg/kg, respectively) above the SSL at a DAF of 1 (10 μg/kg)
- Benzo(a)pyrene: one detection (sample SS10) at a concentration (59 μg/kg) above the RSL (15 μg/kg)

- Pentachlorophenol: two detections (samples SS09 and SS10) at concentrations (19 and 49 µg/kg, respectively) above the SSL at a DAF of 1 (10 µg/kg)
- Copper: one detection (sample SS06) at a concentration (78 mg/kg) above the ecological soil screening criteria for birds and mammals (28 mg/kg), the SSL at a DAF of 1 (46 mg/kg), and background UTL (66 mg/kg). Copper also exceeded background and the ecological soil screening value for soil organisms (70 mg/kg) in one sample (SS06).
- Lead: four detections (samples SS08 through SS11) at concentrations (12 to 64 mg/kg) above the ecological soil screening value for birds and mammals (11 mg/kg) and the SSL at a DAF of 1 (27 mg/kg, SS11 only) and background UTL (5.4 mg/kg)
- Zinc: three detections (samples SS05, SS09, and SS10) at concentrations (50 to 67 mg/kg) above the ecological soil screening value for birds and mammals (46 mg/kg) and background UTL (5.4 mg/kg).

SI (2009) Subsurface Soil

- SVOCs: no exceedances
- Copper: one detection (sample SB15) at a concentration (68 mg/kg) above the SSL at a DAF of 1 (46 mg/kg) and background UTL (66 mg/kg)
- Vanadium: two detections (samples SB13 and SB15) at concentrations (158 and 146 mg/kg, respectively) above the adjusted RSL (39 mg/kg) and background UTL (144 mg/kg)

As shown above, there are exceedances of the most conservative screening values. Therefore, the decision analysis process continues to Step 6.

Step 6: Can more realistic evaluations of the data be performed, and if so, do they suggest contaminant levels warrant no further investigation or action?

Human Health Evaluation

The human health evaluation step was performed using a conservative assumption of future residential land use. The potential for the presence of a "hot spot" of higher concentrations at the site (in comparison to other areas) was evaluated for the residential scenario. The presence of hot spots was evaluated so that the potential for diluting out higher concentrations in the EPC calculations could be assessed. For this evaluation, a "hot spot" was defined as a sample with a detected concentration exceeding 100 times the RSL.

As a conservative approach, risk estimates were prepared for a future residential scenario at PAOC X. The site is approximately 2.7 acres in size whereas a residential lot may be approximately 0.75 acre. With the exception of chromium, no chemicals in soil were detected above background and RSLs at concentrations exceeding 100 times the screening levels (see **Table 21-3**). Based on the historical source of potential releases identified at the site (see Section 21.0) and the environmental conditions on Vieques (see Appendix R of the Final SI/ESI Report (CH2M HILL, 2010)), the form of chromium expected to be present at the site is Cr^{3+}, especially considering its detected concentrations are within background levels. Therefore, although at least one chromium concentration exceeded 100 times the RSL for Cr^{6+}, the form of chromium expected to be present at the site is Cr^{3+} and nevertheless attributable to background. Therefore, no hot spots were identified and all soil data were merged in the residential evaluation.

For a chemical identified as a COPC in both surface soil and subsurface soil, the higher EPC (maximum detected concentration or 95% UCL on the mean concentration, depending on the size of the dataset) of the two datasets was used to calculate the HQ and ELCR. This conservative approach was used to provide upper-end risk estimates for the site.

Two constituents were detected in surface or subsurface soil above both human health screening levels and the background UTL (for inorganics).

- Benzo(a)pyrene (B[a]P) was detected in 1 of 11 surface soil samples above its RSL (15 µg/kg), at a concentration of 59 µg/kg. Based on the maximum detected concentration, the ELCR is 4×10^{-6} (**Table 21-3**), which is within the EPA acceptable range, and B(a)P would not be identified as a risk driver.

- Vanadium was detected in 2 of 5 subsurface soil samples above its background UTL and its adjusted RSL (39 mg/kg), at a maximum concentration of 158 mg/kg. Based on the maximum detected concentration, the HI is 0.4 (**Table 21-3**), which is within the EPA acceptable level, and vanadium would not be identified as a risk driver.

Six additional constituents (aluminum, arsenic, chromium, cobalt, iron, and manganese) were detected in surface or subsurface soil above human health screening levels but below background UTLs. As indicated above, the form of chromium expected to be present at the site is Cr^{3+}. Based on maximum detected concentrations of B(a)P, vanadium, and the six additional constituents, the cumulative ELCR is 7×10^{-6} and the maximum target organ-specific HI is 0.7 (see **Table 21-3**), which are within EPA acceptable levels. Consequently, there is not a concern for potential cumulative effects from multiple constituents in site soil.

The quantitative evaluation of chromium is based on the assumption that it is present predominantly as Cr^{3+}. Although chromium was not speciated in any media to confirm that it would most likely be present as Cr^{3+}, a discussion of why Cr^{3+} is the most likely form can be found in Appendix R of the SI/ESI Report (CH2MHILL, 2010). Since site-specific speciation data are not available and since this site is a candidate for No Action, an additional comparison of the chromium data was performed. This evaluation estimated cancer risks under the health-protective assumption that the maximum detected concentration of chromium is present as Cr^{6+}. This also assumes that any person would be exposed to the maximum detected concentration (rather than the more reasonable upper-bound of the average) for the entire exposure scenario. As shown in Table R-1 of Appendix R of the SI/ESI Report (CH2MHILL, 2010), this health-protective, conservative comparison indicates that exposure to chromium, when evaluated as Cr^{6+}, results in a risk estimate of 1×10^{-4}, which does not exceed the upper-bound of EPA's acceptable risk range and no adverse health effects would be expected. Since the actual form of chromium present at the site is likely to be a mixture of both forms, but primarily Cr^{3+}, the actual site risks of even those sites at the upper-bound risk range would not result in adverse health effects since actual site risk is expected to be less than the calculated risk estimates.

Ecological Evaluation

Three inorganics (copper, lead, and zinc) exceeded ecological screening values and background UTLs in at least one surface soil sample collected at the site (**Table 21-1**). Based on site size and habitat characteristics, exposure of bioaccumulative chemicals to upper trophic level receptors (birds and mammals) was considered in addition to direct exposure of all detected chemicals to soil organisms (plants and invertebrates). Accordingly, the results of screening value exceedances for each of these receptor groups are evaluated.

Copper exceeded the soil screening value for soil organisms (plants and invertebrates). Copper does not pose an unacceptable risk to plants and invertebrates based upon the following:

- The site is heavily vegetated, with no apparent impacts to the terrestrial plant community.
- Copper exceeded the ecological screening value for soil organisms (70 mg/kg) in 1 of 11 samples at a maximum HQ of 1.12 (**Table 21-4**). However, the mean HQ (0.60) was below 1. Thus, copper does not pose an unacceptable risk to ecological receptors at the site.

Copper, lead, and zinc exceeded soil screening values (Eco SSLs) protective of upper trophic level organisms. None of these constituents poses an unacceptable risk to birds and mammals based upon the following:

- Copper exceeded background and the Eco SSL for birds (28 mg/kg) in 1 of 11 samples. Food web HQs (and calculations) based upon maximum (screening) and mean (baseline) copper exposure doses for each target receptor are listed in **Tables 21-5 through 21-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Therefore, copper does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).
- Lead exceeded background and the Eco SSL for birds (11 mg/kg) in 4 of 11 samples. Food web HQs and calculations for each target receptor are listed in **Tables 21-5 through 21-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Norway rat, Indian mongoose, and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Therefore, lead does not pose an unacceptable risk to upper trophic level receptors, based upon the decision rule in the draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).
- Zinc exceeded background and the Eco SSL for birds (46 mg/kg) in 3 of 11 samples. Food web HQs and calculations for each target receptor are listed in **Tables 21-5 through 21-8**. Based upon a comparison to NOAELs, the maximum exposure dose HQs exceeded one for the Indian mongoose and pearly-eyed thrasher. However, the mean exposure dose HQs were less than one for all receptors. Therefore, zinc does not pose an unacceptable risk to upper trophic level receptors based upon the decision rule in the

draft final ERA protocol (acceptable risk if the mean exposure HQ based on the MATC is less than one for all receptors).

Additional Comparisons

When evaluating the potential for contaminant migration from soils to groundwater, the use of EPA generic SSLs applying a DAF of 1 were used as the most conservative approach. However, as a general rule, DAF values from 1 to 20* can be applied dependent upon site-specific data (e.g., size of site, depth to groundwater, etc.). In addition, in the absence of groundwater data, other information such as that listed below was used, as applicable, to evaluate the potential for groundwater impacts from soil contamination:

– depth of contamination with respect to estimated groundwater depth

– mobility of contaminant

– number of exceedances

*SSLs for DAF values of 1 and 20 are provided in Table 1 of Appendix A of the EPA Generic SSL guidance. Estimated SSLs for DAF values in between 1 and 20 were used in this evaluation.

Two organics (benzo(a)anthracene and pentachlorophenol) and three inorganics (copper, lead, and vanadium) were detected in soil at concentrations above the SSL at a DAF of 1 (and background for the inorganics). However, as demonstrated at multiple east Vieques sites (e.g., PI 4 and SWMU 10), the SSLs at a DAF of 1 are not representative of leaching to groundwater. No concentrations of any of these constituents exceed their respective SSLs at DAFs between 2 and 7.

Step 7: Does the historic information and/or spatial distribution of data indicate the potential source area was sufficiently sampled?

The historical information (aerial photographs, interviews, site inspections) indicates the most likely source of CERCLA-related releases was the debris in the ephemeral stream and in mounds adjacent to the east bank of the stream. Based on this information, soil samples were collected directly below debris following its removal. Therefore, the spatial distribution of the samples collected during the SI and resulting data indicate the potential source area has been sufficiently characterized.

21.3 Conclusions and No Action Determination

The decision analysis process described above indicates there has not been a CERCLA-Related release at PAOC X that has resulted in contamination of soil at concentrations that would pose a potentially unacceptable risk to human or ecological receptors or leaching concern for groundwater. In addition, the debris has been removed, which eliminated a potential future source of contamination at the site. Therefore, no further action is warranted for PAOC X.

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Table 21-1
Surface Soil Detection and Exceedance Results
PAOC X
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	Background UTL (KTd)	Adjusted RSL for Residential Soil	Eco (E)	SSL (DAF=1)	VNTR-X-1	VNTR-X-2	VNTR-X-3	VNTR-X-4	VEPX-SO05	VEPX-SO06	VEPX-SO07	VEPX-SO08
Sample ID					VNTR-X-1	VNTR-X-2	VNTR-X-3	VNTR-X-4	VEPX-SS05-0H-0309	VEPX-SS06-01-0309	VEPX-SS07-0H-0309	VEPX-SS08-0H-0309
Sample Date					12/12/02	12/12/02	12/12/02	12/12/02	03/13/09	03/05/09	03/04/09	03/04/09
Chemical Name												
Volatile Organic Compounds (UG/KG)												
No Detections	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)												
Acenaphthylene	--	340,000	--	22,000	333 U	333 U	333 U	333 U	21 U	28 U	21 U	22 U
Anthracene	--	1,700,000	--	360,000	333 U	333 U	333 U	333 U	21 U	28 U	21 U	22 U
Benzo(a)anthracene	--	150	--	10	333 U	333 U	333 U	333 U	7.9 J	2.9 J	21 U	**11 J**
Benzo(a)pyrene	--	15	--	240	333 U	333 U	333 U	333 U	21 U	4.9 J	21 U	13 J
Benzo(b)fluoranthene	--	150	--	35	333 U	333 U	333 U	333 U	21 UJ	8.6 J	21 U	21 J
Benzo(g,h,i)perylene	--	170,000	--	120,000	333 U	333 U	333 U	333 U	21 U	9.5 J	21 UJ	7.5 J
Benzo(k)fluoranthene	--	1,500	--	350	333 U	333 U	333 U	333 U	21 UJ	5.5 J	21 U	11 J
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	333 U	333 U	333 U	333 U	100 U	140 U	70 J	180 J
Butylbenzylphthalate	--	260,000	30,000	510	333 U	333 U	333 U	333 U	350 U	460 U	350 U	140 J
Carbazole	--	24,000	--	--	NA	NA	NA	NA	21 U	28 U	21 U	22 U
Chrysene	--	15,000	--	1,100	333 U	333 U	333 U	333 U	21 U	5.1 J	21 U	16 J
Dibenz(a,h)anthracene	--	15	--	11	333 U	333 U	333 U	333 U	21 U	28 U	21 U	22 UJ
Di-n-butylphthalate	--	610,000	40,000	9,200	99	333 U	333 U	333 U	100 UJ	140 U	110 U	110 U
Fluoranthene	--	230,000	--	160,000	333 U	333 U	333 U	333 U	21 U	28 U	21 U	13 J
Indeno(1,2,3-cd)pyrene	--	150	--	120	333 U	333 U	333 U	333 U	21 U	13 J	21 U	17 J
PAH HMW (Total)	--	--	1,100	--	0.0 U	0.0 U	0.0 U	0.0 U	8.0	54	0.0 U	118
PAH LMW (Total)	--	--	29,000	--	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	16
Pentachlorophenol	--	3,000	2,100	10	833 U	833 U	833 U	833 U	100 UJ	140 UJ	110 UJ	110 UJ
Phenanthrene	--	1,700,000	--	360,000	333 U	333 U	333 U	333 U	21 UJ	28 U	21 U	2.5 J
Pyrene	--	170,000	--	120,000	333 U	333 U	333 U	333 U	21 UJ	4.0 J	21 U	21 J
Pesticide/Polychlorinated Biphenyls (UG/KG)												
4,4'-DDD	--	2,000	21	66	14	3.3 U	33 U	5.5	NA	NA	NA	NA
4,4'-DDE	--	1,400	21	47	19	8.3	**310**	**45**	NA	NA	NA	NA
4,4'-DDT	--	1,700	21	67	**38**	3.3 U	**76**	8.0	NA	NA	NA	NA
Herbicides (UG/KG)												
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA	NA
Total Metals (MG/KG)												
Aluminum	35,000	7,700	--	55,000	NA	NA	NA	NA	7,670	17,800	13,500	15,400
Antimony	5.8	3.1	0.27	0.27	4.8 U	5.0 U	6.0 U	4.4 U	0.078 UJ	0.21 J	0.20 J	1.0 J
Arsenic	1.6	0.39	18	0.29	0.79 U	0.83 U	1.0 U	0.73 U	0.55 J	1.0	0.66	1.1
Barium	147	1,500	330	82	22	24	59	28	27	68	55	56
Beryllium	0.27	16	21	3.2	0.40 U	0.42 U	0.50 U	0.36 U	0.10	0.21	0.18	0.18
Cadmium	2.2	7.0	0.36	0.38	0.40 U	0.42 U	0.50 U	0.36 U	0.58	0.14	0.090	0.13
Calcium	8,840	--	--	--	NA	NA	NA	NA	4,660	**9,490**	4,740	**20,000**
Chromium	72	0.29	26	0.00083	5.1	7.4	15	9.4	20 J	19	25	14
Cobalt	16	2.3	13	0.49	4.0 U	4.7	8.5	6.0	6.9	11	10	8.6
Copper	66	310	28	46	18	21	46	31	30 J	**78**	34	48
Iron	38,100	5,500	--	640	NA	NA	NA	NA	25,900	31,500	29,700	25,200
Lead	5.4	400	11	27	1.2	1.2	**7.7**	1.6	2.0 J	3.8	2.5	**12**
Magnesium	3,710	--	--	--	NA	NA	NA	NA	2,160	**4,330**	2,520	**4,200**
Manganese	1,630	180	220	57	NA	NA	NA	NA	211 J	570	610	471
Mercury	0.057	0.78	0.10	0.57	0.077 U	0.042 U	0.063 U	0.051 U	0.029 R	0.030 J	0.020 J	0.030
Nickel	22	160	38	48	3.2 U	3.3 U	8.7	11	7.8 J	7.5	7.0	5.7
Potassium	5,270	--	--	--	NA	NA	NA	NA	849 J	1,820	1,530	1,830
Selenium	0.51	39	0.52	0.26	0.79 U	0.83 U	1.0 U	0.73 U	0.39 U	0.49 J	0.21 J	0.31 J
Silver	0.22	39	4.2	1.6	0.79 U	0.83 U	1.0 U	0.73 U	0.010 J	0.10 U	0.089 U	0.088 U
Sodium	1,590	--	--	--	NA	NA	NA	NA	207 J	316	123	282
Thallium	0.13	--	1.0	0.14	0.79 U	0.83 U	**1.4**	**0.73**	0.078 U	0.1 U	0.089 U	0.088 U
Vanadium	144	39	7.8	180	31	44	74	52	100 J	107	114	84
Zinc	32	2,400	46	680	9.9	11	**39**	16	**50**	**38**	21	**44**
Total Petroleum Hydrocarbons (MG/KG)												
No Detections	--	--	--	--	ND	ND	ND	ND	NA	NA	NA	NA

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 21-1
Surface Soil Detection and Exceedance Results
PAOC X
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**Eco (E)**	**SSL (DAF=1)**	VEPX-SO09		VEPX-SO10	VEPX-SO11
Sample ID					VEPX-SS09-0H-0309	VEPX-SS09P-0H-0309	VEPX-SS10-0H-0309	VEPX-SS11-0H-0309
Sample Date					03/09/09	03/09/09	03/09/09	03/09/09
Chemical Name								
Volatile Organic Compounds (UG/KG)								
No Detections	--	--	--	--	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)								
Acenaphthylene	--	340,000	--	22,000	23 UJ	22 UJ	13 J	21 UJ
Anthracene	--	1,700,000	--	360,000	23 UJ	22 UJ	6.8 J	21 UJ
Benzo(a)anthracene	--	150	--	10	**17 J**	**16 J**	**73 J**	7.0 J
Benzo(a)pyrene	--	15	--	240	23 UJ	13 J	**59 J**	21 UJ
Benzo(b)fluoranthene	--	150	--	35	14 J	15 J	**45 J**	21 UJ
Benzo(g,h,i)perylene	--	170,000	--	120,000	12 J	8.5 J	34 J	21 UJ
Benzo(k)fluoranthene	--	1,500	--	350	18 J	17 J	40 J	21 UJ
bis(2-Ethylhexyl)phthalate	--	35,000	30,000	1,400	120 UJ	110 UJ	45 J	110 UJ
Butylbenzylphthalate	--	260,000	30,000	510	390 U	370 U	350 U	350 U
Carbazole	--	24,000	--	--	23 UJ	22 UJ	3.4 J	21 UJ
Chrysene	--	15,000	--	1,100	14 J	16 J	61 J	2.7 J
Dibenz(a,h)anthracene	--	15	--	11	23 UJ	22 UJ	11 J	21 UJ
Di-n-butylphthalate	--	610,000	40,000	9,200	24 J	110 UJ	110 UJ	110 UJ
Fluoranthene	--	230,000	--	160,000	19 J	26 J	96 J	4.2 J
Indeno(1,2,3-cd)pyrene	--	150	--	120	20 J	20 J	72 J	21 UJ
PAH HMW (Total)	--	--	1,100	--	109	120	478	12
PAH LMW (Total)	--	--	29,000	--	19	28	130	4.0
Pentachlorophenol	--	3,000	2,100	10	**19 J**	**17 J**	**49 J**	110 R
Phenanthrene	--	1,700,000	--	360,000	23 UJ	2.1 J	14 J	21 UJ
Pyrene	--	170,000	--	120,000	14 J	14 J	83 J	2.3 J
Pesticide/Polychlorinated Biphenyls (UG/KG)								
4,4'-DDD	--	2,000	21	66	NA	NA	NA	NA
4,4'-DDE	--	1,400	21	47	NA	NA	NA	NA
4,4'-DDT	--	1,700	21	67	NA	NA	NA	NA
Herbicides (UG/KG)								
No Detections	--	--	--	--	NA	NA	NA	NA
Total Metals (MG/KG)								
Aluminum	35,000	7,700	--	55,000	17,400	16,200	17,500	12,300
Antimony	5.8	3.1	0.27	0.27	1.0	1.0	1.4	0.78
Arsenic	1.6	0.39	18	0.29	0.89	0.98	1.3	0.54
Barium	147	1,500	330	82	64	59	66	55
Beryllium	0.27	16	21	3.2	0.18	0.18	0.18	0.14
Cadmium	2.2	7.0	0.36	0.38	0.13	0.14	0.14	0.22
Calcium	8,840	--	--	--	**20,400**	**19,200**	**31,200**	6,220
Chromium	72	0.29	26	0.00083	16	14	14	22
Cobalt	16	2.3	13	0.49	9.7	9.1	9.5	11
Copper	66	310	28	46	57	51	60	40
Iron	38,100	5,500	--	640	27,000	25,300	27,800	27,400
Lead	5.4	400	11	27	**13**	**12**	**24**	**64**
Magnesium	3,710	--	--	--	**4,870**	**4,880**	**5,830**	2,620
Manganese	1,630	180	220	57	539	502	504	508
Mercury	0.057	0.78	0.10	0.57	0.040	0.040 J	0.050	0.020 J
Nickel	22	160	38	48	5.7	6.0	5.5	6.0
Potassium	5,270	--	--	--	2,060	2,050	2,240	1,870
Selenium	0.51	39	0.52	0.26	0.33 J	0.33 J	0.35 J	0.24 J
Silver	0.22	39	4.2	1.6	0.089 U	0.092 U	0.097 U	0.072 U
Sodium	1,590	--	--	--	300	277	390	192
Thallium	0.13	--	1.0	0.14	0.089 U	0.092 U	0.097 U	0.072 U
Vanadium	144	39	7.8	180	93	80	92	106
Zinc	32	2,400	46	680	**61**	**55**	**67**	25
Total Petroleum Hydrocarbons (MG/KG)								
No Detections	--	--	--	--	NA	NA	NA	NA

Notes:
Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soil
Exceeds Background UTL and ECO (E)
Exceeds Background UTL and SSL (DAF=1)
Exceeds Background UTL, ECO (E) and SSL (DAF=1)

NA - Not Analyzed
ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 21-2
Subsurface Soil Detection and Exceedance Results
PAOC X
No Action / No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Station ID	**Background UTL (KTd)**	**Adjusted RSL for Residential Soil**	**SSL (DAF=1)**	VEPX-SO06		VEPX-SO12	VEPX-SO13	VEPX-SO14		VEPX-SO15
Sample ID				VEPX-SB06-13-0309	VEPX-SB06P-13-0309	VEPX-SB12-00H-0309	VEPX-SB13-8H9-0409	VEPX-SB14-10H11-0409	VEPX-SB14P-10H11-0409	VEPX-SB15-55H-0409
Sample Date				03/05/09	03/05/09	03/09/09	04/22/09	04/23/09	04/23/09	04/28/09
Chemical Name										
Volatile Organic Compounds (UG/KG)										
No Detections	--	--	--	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (UG/KG)										
Acenaphthylene	--	340,000	22,000	26 U	25 U	6.4 J	24 UJ	21 UJ	21 UJ	24 UJ
Benzo(a)anthracene	--	150	10	26 U	4.1 J	8.6 J	6.2 J	5.5 J	4.8 J	5.6 J
Benzo(b)fluoranthene	--	150	35	26 UJ	5.2 J	21 UJ	24 UJ	21 UJ	21 UJ	24 UJ
Benzo(g,h,i)perylene	--	170,000	120,000	26 U	25 U	59 J	24 UJ	21 UJ	21 UJ	24 UJ
Benzo(k)fluoranthene	--	1,500	350	26 U	4.3 J	21 UJ	24 UJ	21 UJ	21 UJ	24 UJ
Chrysene	--	15,000	1,100	26 U	5.2 J	7.7 J	24 UJ	21 UJ	21 UJ	24 UJ
Di-n-butylphthalate	--	610,000	9,200	130 U	120 U	23 J	120 UJ	100 UJ	100 UJ	120 UJ
Fluoranthene	--	230,000	160,000	26 U	6.6 J	21 UJ	24 UJ	21 UJ	21 UJ	24 UJ
Indeno(1,2,3-cd)pyrene	--	150	120	26 UJ	25 UJ	34 J	24 UJ	21 UJ	21 UJ	24 UJ
Pyrene	--	170,000	120,000	26 U	9.0 J	21 UJ	24 UJ	21 UJ	21 UJ	24 UJ
Total Metals (MG/KG)										
Aluminum	35,000	7,700	55,000	10,500	12,800	16,300	8,400	14,000	10,800	21,500
Antimony	5.8	3.1	0.27	0.11 UJ	0.11 J	0.28	0.090 U	0.086 U	0.083 U	0.087 UJ
Arsenic	1.6	0.39	0.29	0.67	0.80	0.71	0.49	0.52	0.47	0.51
Barium	147	1,500	82	38	46	65	38	66 J	45 J	78
Beryllium	0.27	16	3.2	0.14	0.15	0.18	0.10	0.12	0.10	0.21
Cadmium	2.2	7.0	0.38	0.11 U	0.10 U	0.10	0.090 U	0.086 U	0.083 U	0.080 J
Calcium	8,840	--	--	7,680	8,670	**8,860**	4,060	4,860 J	3,200 J	5,120
Chromium	72	0.29	0.00083	15	19	22	25	20	19	29
Cobalt	16	2.3	0.49	7.9	8.9	12	8.5	12	9.8	16
Copper	66	310	46	48	53	47	40	50	48	**68 J**
Iron	38,100	5,500	640	26,400	29,400	29,700	35,300	28,100	26,500	36,800
Lead	3.3	400	27	2.2	2.6	**8.7**	0.99	2.3 J	1.0 J	1.6
Magnesium	3,710	--	--	2,930	3,620	3,260	2,010 J	2,990 J	2,740 J	**4,280**
Manganese	1,630	180	57	304	378	610	320	539 J	365 J	721
Mercury	0.057	0.78	0.57	0.040 U	0.010 J	0.032 U	0.038 U	0.032 U	0.032 U	0.038 U
Nickel	22	160	48	5.0	6.1	9.6	6.0	7.0	6.1	11
Potassium	2,000	--	--	1,050	1,280	1,540	756 J	969 J	813 J	1,820 J
Selenium	0.51	39	0.26	0.18 J	0.25 J	0.26 J	0.45 U	0.43 U	0.41 U	0.44 U
Silver	0.22	39	1.6	0.11 U	0.1 U	0.076 U	0.09 U	0.086 U	0.083 U	0.087 U
Sodium	2,250	--	--	312	327	225	222	258	199	367
Thallium	0.13	--	0.14	0.11 U	0.1 U	0.076 U	0.09 U	0.086 U	0.083 U	0.087 U
Vanadium	144	39	180	96	103	111	**158**	116	108	**146**
Zinc	32	2,400	680	23	28	**35**	19	22	19	**33**

Notes:

Exceeds Background UTL
Exceeds Background UTL and Adjusted RSL for Residential Soi
Exceeds Background UTL and SSL (DAF=1)

ND - Not Detected
-- Not part of background data set (where applicable) OR Regulatory standard not promulgated
J - Analyte present, value may or may not be accurate or precise
U - Not detected or not detected significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

Table 21-3
HHRA COPC Summary Table
Former NASD, Vieques Island, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Site: PAOC-X
Media: Surface Soil, Subsurface Soil
Historical Function: Debris Area in Ephemeral Stream

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Frequency of Criteria Exceedance	Range of Detection Limits	Background Value KTd (1)	Max Exceeds Background KTd	December RSL Adjusted (2)		Max Exceeds 100x SL	Cancer Screening Toxicity Value (3)	Non-cancer Screening Toxicity Value (3)	95% UCL (N/T/G)	Statistic	Basis	Target Organ	Hazard Quotient	ELCR
PAOC-X	7429-90-5	Aluminum	7.7E+03		1.78E+04		mg/kg	VEPX-SO06	7 / 7	6 / 7	3.19E+00 - 4.67E+00	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	--	CNS	--	--
Surface Soil	7440-38-2	Arsenic	5.4E-01		1.30E+00		mg/kg	VEPX-SO10	7 / 11	7 / 11	1.10E-01 - 1.60E-01	1.6E+00	No	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	Max	Hyperpigmentation, keratosis and possible vascular complications	0.06	3.3E-06
	7440-47-3	Chromium	5.1E+00		2.45E+01		mg/kg	VEPX-SO07	11 / 11	11 / 11	7.00E-02 - 1.00E-01	7.2E+01	No	2.9E-01	ca	No	--	1.2E+05	--	--	--	No Observed Effects	--	--
	7440-48-4	Cobalt	4.7E+00		1.11E+01		mg/kg	VEPX-SO11	10 / 11	10 / 11	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	--	decreased iodine uptake	--	--
	7439-89-6	Iron	2.5E+04		3.15E+04		mg/kg	VEPX-SO06	7 / 7	7 / 7	8.70E-01 - 1.27E+00	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	--	gastrointestinal effects	--	--
	7439-96-5	Manganese	2.1E+02	J	6.10E+02		mg/kg	VEPX-SO07	7 / 7	7 / 7	2.80E-01 - 4.10E-01	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	--	CNS	--	--
	7440-62-2	Vanadium	3.1E+01		1.14E+02		mg/kg	VEPX-SO07	11 / 11	10 / 11	5.00E-02 - 7.00E-02	1.4E+02	No	3.9E+01	nc	No	--	3.9E+02	--	--	--	decreased hair cystine	--	--
	50-32-8	Benzo(a)pyrene	4.9E-03	J	5.90E-02	J	mg/kg	VEPX-SO10	4 / 11	1 / 11	3.50E-03 - 4.60E-03	--	--	1.5E-02	ca	No	1.5E-02	--	--	--	Max	--	--	3.9E-06
PAOC-X	7429-90-5	Aluminum	8.4E+03		2.2E+04		mg/kg	VEPX-SO15	5 / 5	5 / 5	4.79E+00 - 5.15E+00	3.5E+04	No	7.7E+03	nc	No	--	7.7E+04	--	--	Max	CNS	0.279	--
Subsurface Soil	7440-38-2	Arsenic	4.9E-01		8.0E-01		mg/kg	VEPX-SO06	5 / 5	5 / 5	1.30E-01 - 1.60E-01	1.6E+00	No	3.9E-01	ca	No	3.9E-01	2.2E+01	--	--	--	Hyperpigmentation, keratosis and possible vascular complications	--	--
	7440-47-3	Chromium	1.9E+01		2.9E+01		mg/kg	VEPX-SO15	5 / 5	5 / 5	1.00E-01 - 1.80E-01	7.2E+01	No	2.9E-01	ca	Yes	--	1.2E+05	--	--	Max	No Observed Effects	0.0002	--
	7440-48-4	Cobalt	8.5E+00		1.6E+01		mg/kg	VEPX-SO15	5 / 5	5 / 5	1.00E-02 - 1.00E-02	1.6E+01	No	2.3E+00	nc	No	3.7E+02	2.3E+01	--	--	Max	decreased iodine uptake	0.7	4.2E-08
	7439-89-6	Iron	2.8E+04		3.7E+04		mg/kg	VEPX-SO15	5 / 5	5 / 5	1.30E+00 - 2.33E+00	3.8E+04	No	5.5E+03	nc	No	--	5.5E+04	--	--	Max	gastrointestinal effects	0.7	--
	7439-96-5	Manganese	3.2E+02		7.2E+02		mg/kg	VEPX-SO15	5 / 5	5 / 5	1.40E-01 - 4.30E-01	1.6E+03	No	1.8E+02	nc	No	--	1.8E+03	--	--	Max	CNS	0.4	--
	7440-62-2	Vanadium	1.0E+02		1.6E+02		mg/kg	VEPX-SO13	5 / 5	5 / 5	7.00E-02 - 7.00E-02	1.4E+02	Yes	3.9E+01	nc	No	--	3.9E+02	--	--	Max	decreased hair cystine	0.4	--

Site Cumulative Risk	Max HI *	ELCR
Soil	0.7	7E-06
Groundwater	--	--
Total Risk	0.7	7E-06

* - Max HI is the highest HI associated with any target organ or critical effect.

Note:
(1) East Vieques Soil Type KTd
(2) Regional Screening Levels for Residential Soil (December 2009). Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
(3) Regional Screening Levels for Residential Soil (December 2009).

The SL for 'Chromium (VI)' was used as the adjusted SL for Chromium. The expected form of chromium is Chromium (III). Therefore, the SL for 'Chromium (III)' was used as the Cancer and Noncancer Toxicity screening value.
The SL for 'Vanadium and Compounds' was used as the adjusted SL for Vanadium.

ca = Carcinogenic
nc = Noncarcinogenic
J = compound was detected below the reporting limit in the sample
ELCR = Excess Lifetime Cancer Risk
CNS = Central Nervous System

TABLE 21-4
Ecological Risk Assessment Screening Statistics for PAOC X Surface Soil - Plants and Invertebrates
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Background UTL	Frequency of UTL Exceedance	Mean Ratio	Maximum Ratio	95% UCL Hazard Quotient	Mean Hazard Quotient
Inorganics (MG/KG)																
Copper	-- - --	11 / 11	17.6	78.3	42.0	18.1	51.9	70.0	1 / 11	1.12	66.0	1 / 11	0.64	1.19	0.74	0.60
Lead	-- - --	11 / 11	1.20	64.2	12.1	18.6	22.3	120	0 / 11	0.54	--	-- - --	--	--	--	--
Zinc	-- - --	11 / 11	9.90	66.7	34.6	19.6	45.3	120	0 / 11	0.56	--	-- - --	--	--	--	--

TABLE 21-5
Summary of Norway Rat Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	78.3	1.531	119.88	0.625	48.94	0	11.73	5.60	7.23	9.34	2.10	1.62	1.26
Lead	64.2	1.522	97.71	0.468	30.05	0	7.28	4.70	6.47	8.90	1.55	1.13	0.82
Zinc	66.7	12.89	859.43	1.820	121.39	0	28.50	75.4	169	377	0.38	0.17	0.08

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0398	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.980	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.020	= Proportion of diet composed of soil
WIR =	0.0516	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.168	= Body weight (kg wet weight)

TABLE 21-5
Summary of Norway Rat Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	42.0	Regression	14.32	Regresson	8.51	0	1.19	5.60	7.23	9.34	0.21	0.17	0.13
Lead	12.1	Regression	6.02	Regresson	1.07	0	0.37	4.70	6.47	8.90	0.08	0.06	0.04

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0207 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.490 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.020 = Proportion of diet composed of soil
WIR = 0.0242 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.209 = Body weight (kg wet weight)

TABLE 21-6
Summary of Indian Mongoose Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Copper	78.3	1.531	119.88	0.625	48.94	0.554	43.38	0	17.50	11.7	13.3	15.1	1.50	1.32	1.16
Lead	64.2	1.522	97.71	0.468	30.05	0.286	18.36	0	14.27	4.70	6.47	8.90	3.04	2.21	1.60
Zinc	66.7	12.89	859.43	1.820	121.39	2.782	185.57	0	123.43	75.4	169	377	1.64	0.73	0.33

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0460 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.972 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0933 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.312 = Body weight (kg wet weight)

TABLE 21-6
Summary of Indian Mongoose Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Copper	42.0	Regression	14.32	Regresson	8.51	Regresson	11.72	0	0.74	11.7	13.3	15.1	0.06	0.06	0.05
Lead	12.1	Regression	6.02	Regresson	1.07	Regresson	3.25	0	0.26	4.70	6.47	8.90	0.06	0.04	0.03
Zinc	34.6	Regression	273.57	Regresson	34.54	Regresson	113.62	0	10.42	75.4	169	377	0.14	0.06	0.03

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0285 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.564 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.111 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.297 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.0557 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.528 = Body weight (kg wet weight)

TABLE 21-7
Summary of Pearly-eyed Thrasher Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	78.3	1.531	119.88	0.625	48.94	0	25.68	4.05	7.00	12.1	6.34	3.67	2.12
Lead	64.2	1.522	97.71	0.468	30.05	0	20.94	3.85	8.61	19.3	5.44	2.43	1.09
Zinc	66.7	12.89	859.43	1.820	121.39	0	179.18	66.1	148	331	2.71	1.21	0.54

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0174	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.954	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.000	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.046	= Proportion of diet composed of soil
WIR =	0.0157	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.080	= Body weight (kg wet weight)

TABLE 21-7
Summary of Pearly-eyed Thrasher Exposure Doses - Screening and Baseline
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Baseline Exposure (Mean)

Chemical	Mean Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Mean Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals													
Copper	42.0	Regression	14.32	Regresson	8.51	0	1.71	4.05	7.00	12.1	0.42	0.24	0.14
Lead	12.1	Regression	6.02	Regresson	1.07	0	0.63	3.85	8.61	19.3	0.16	0.07	0.03
Zinc	34.6	Regression	273.57	Regresson	34.54	0	25.45	66.1	148	331	0.39	0.17	0.08

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0123 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.754 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.200 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.046 = Proportion of diet composed of soil
WIR = 0.0129 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.104 = Body weight (kg wet weight)

TABLE 21-8
Summary of Red-tailed Hawk Exposure Doses - Screening
Former NASD, Vieques, Puerto Rico
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Screening Exposure (Maximum)

Chemical	Maximum Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Maximum Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	MATC TRV (mg/kg/d)	LOAEL TRV (mg/kg/d)	NOAEL HQ	MATC HQ	LOAEL HQ
Metals															
Copper	78.3	1.531	119.88	0.625	48.94	0.554	43.38	0	1.79	4.05	7.00	12.1	0.44	0.26	0.15
Lead	64.2	1.522	97.71	0.468	30.05	0.286	18.36	0	0.76	3.85	8.61	19.3	0.20	0.09	0.04
Zinc	66.7	12.89	859.43	1.820	121.39	2.782	185.57	0	7.66	66.1	148	331	0.12	0.05	0.02

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0395 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (terrestrial plants)
FCxi = Chemical-specific = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of food item (small mammals)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.000 = Proportion of diet composed of soil
WIR = 0.0680 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.957 = Body weight (kg wet weight)

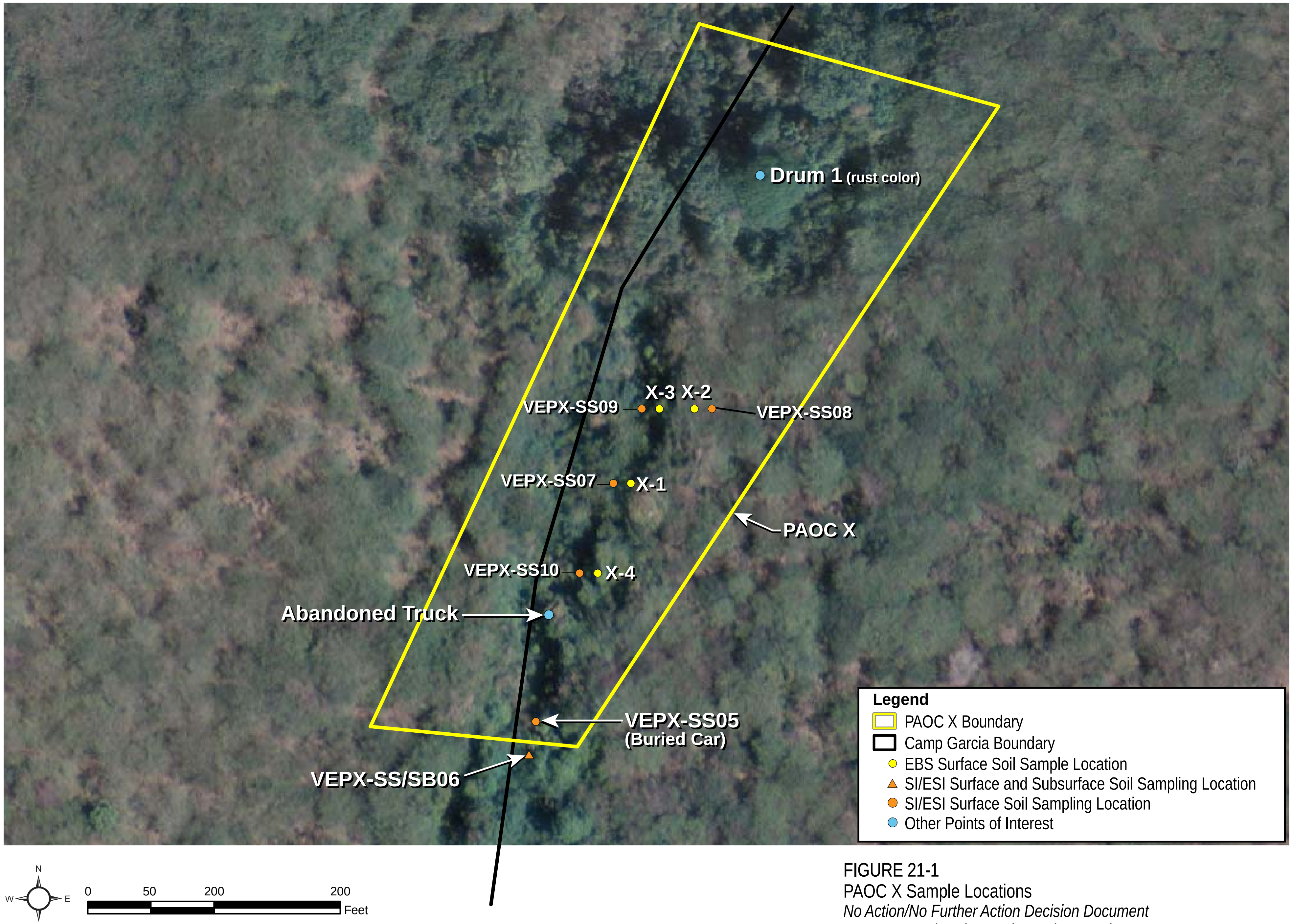

FIGURE 21-1
PAOC X Sample Locations
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

Legend

PAOC X and Camp Garcia Boundaries

North

0 100 200 400 Feet

FIGURE 21-2
PAOC X 1936-37 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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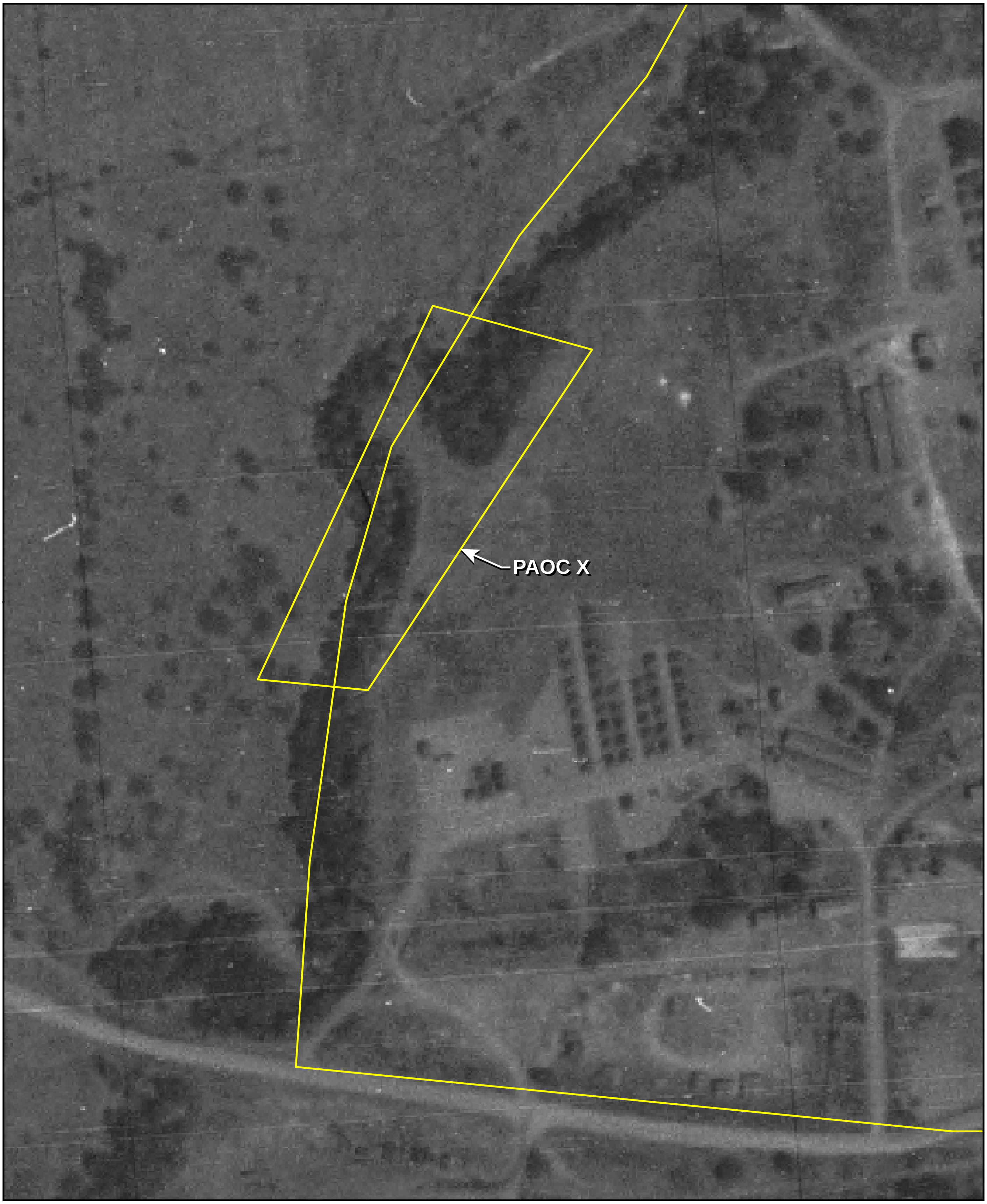

Legend

PAOC X and Camp Garcia Boundaries

North

0 100 200 400 Feet

FIGURE 21-3
PAOC X 1959 Aerial Photograph
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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(A) Excavating soil piles along bank of ephemeral stream

(B) Staged debris pile with concrete and metal

(C) Excavation of observed debris (cable spools)

(D) Cleared area prior to Geophysical Survey

(E) Geophysical Survey

(F) Excavation of Geophysical Anomalies

FIGURE 21-4
PAOC X Site Photographs
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

(A) Truck in place looking East

(B) Truck extraction

(C) Dismantling the truck

(D) Excavation of car in ephemeral stream

(E) Sample VEPX-SS08 was collected in the 6-inch interval beneath this excavated drum

(F) Metal debris removal

FIGURE 21-5
PAOC X Site Photographs
No Action/No Further Action Decision Document
7 Consent Order Sites and 14 PI/PAOC Sites
Vieques, Puerto Rico

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SECTION 22

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