N00217.002976
HUNTERS POINT
SSIC NO. 5090.3

Screening-Level Ecological Risk Assessment
Naval Station, Treasure Island
Hunters Point Annex
Parcel A

U.S. Environmental Protection Agency-Region IX
Hazardous Waste Management Division
Technical Support Section
75 Hawthorne Street (H-9-3)
San Francisco, CA 941052

April 1994

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901

APR 21 1994

Dave Song
Remedial Project Manager
Mail Code: T4A1D5
Western Division
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, CA 94066-2402

Subject: Screening-Level Ecological Risk Assessment of Hunters Point Annex, Parcel A

Dear Mr. Song:

Thank you for your comments on our Draft Screening-Level Ecological Risk Assessment for the Hunters Point Annex (HPA), Parcel A. Though the comments were directly related to the cover letter accompanying the draft ERA and not the document itself, several sentences have been revised in the final ERA to reflect the nature of your comments.

As such, enclosed please find the U.S. Environmental Protection Agency's (EPA) Screening-Level Ecological Risk Assessment (ERA) for HPA, Parcel A. The ERA concludes that because of limited habitat and generally reduced contaminant levels in Parcel A, there is de minimis risk to terrestrial ecological receptors in Parcel A.

You should be aware that this ERA does not address the minimal petroleum and Semivolatile Organic Contaminant levels which the Navy has recently detected in groundwater at Parcel A. Should confirmation sampling determine that only petroleum impacts the Parcel A groundwater, then appropriate follow-up actions should be undertaken as per guidance from the State of California. On the other hand, should confirmation sampling determine that the contaminant contributions to groundwater in Parcel A are greater than originally estimated, then we recommend that you assess the ecological risk associated with the additional findings, as well as perform any other work which may be required as regards risk to human health.

The Navy's Risk Manager should be fully aware of the inherent uncertainties contained in the ERA. First, the ERA is a screening-level assessment only, meant to confirm or refute the Navy's initial findings. It does not represent a full ERA such as the Navy will perform, for example, in areas of more abundant and sensitive aquatic receptors at HPA. Second, the Navy's Site Inspection of Parcel A upon which much of the ERA is based,

Printed on Recycled Paper

contains several gaps in the data set for Parcel A. Much of the ERA uncertainty evolves from these data gaps.

For your consideration, we offer the following recommendations:

1. The Navy's forthcoming basewide ERA should include the assessment of ecological risk associated with the discharge of stormwater from Parcel A and all other Parcels to San Francisco Bay. Further, it should include an assessment of the ecological risk to raptors which rest near PA-43 in Parcel A and forage throughout HPA and any other receptors whose range extends into and beyond Parcel A.

2. Should future investigations of Reach 10 of the sanitary sewer system indicate that release of hazardous substances to or from the sewer line has occurred, an assessment of the ecological risk associated with such release should be conducted.

3. The Risk Manager should carefully assess the assumptions and uncertainties associated with the ERA before making a final decision regarding the Parcel A property.

If you should have any questions regarding the ERA, please contact me at (415) 744-2409.

Sincerely,

Alydda Mangelsdorf
Remedial Project Manager

cc: R. Ramos, WESTDIV
M. McClleland, WESTDIV
B. Smith, RWQCB
C. Shabahari, DTSC
M. Martin, DFG
J. Haas, USFW
D. Klimas, NOAA
A. Brownell, SFPHD
J. Cooper, SF
B Rhett, SFRD

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA), Region IX, Technical Support Services (TSS) conducted a screening-level qualitative Ecological Risk Assessment (ERA) at the Naval Station, Treasure Island, Hunters Point Annex (HPA), Parcel A. HPA Parcel A is the first of several parcels slated for transfer to the City and County of San Francisco. An ERA is required to ensure that the cleanup actions taken by the Navy in Parcel A fully comply with requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as they relate to environmental protection.

PRC Environmental Management, Inc. (PRC) and Harding Lawson Associates (HLA), contractor and subcontractor to the Navy, respectively, have conducted a Site Inspection (SI) of Parcel A for hazardous substance releases. In the Draft Final Parcel A Site Inspection Report dated October 15, 1993 (SI Report), PRC and HLA concluded that of the several sites on Parcel A from which releases of contaminants were confirmed (see Section 2.0, Site History, below), contaminant residuals left after excavation were "not expected to result in substantial chemical exposures, and no significant hazards [were] anticipated." EPA has conducted a supplemental screening-level ERA to confirm the initial finding by PRC and HLA.

The ERA is composed of three elements: (1) a review of the site history, (2) a habitat assessment, and (3) a risk characterization. The site's history was obtained from the SI Report. The site's habitat and species diversity was assessed through a site reconnaissance survey. The site's ecological risk was assessed through a comparison of site contaminant residual soil values of concern with No Observable Adverse Effect Level (NOAEL) toxicity literature values for resident or surrogate species.

The documents reviewed as part of the ERA include the following:

1. Draft Final Parcel A Site Inspection Report, PRC and HLA (1993)
2. Site Survey, PRC (1993)
3. Site Survey, HLA (1993)
4. USFWS Reports (1970 to 1993)
5. Hazardous Substance Data Base (1993)

This ERA is limited by the data which was collected as part of the SI effort. It does not include an assessment of those areas for which there is no environmental data available. A Phase II ERA may be required for those areas for which there is no environmental data if future information or data collection confirms releases of hazardous substances which are currently

undocumented.

2.0 SITE HISTORY

HPA Parcel A is a mixed urban industrial Naval complex that is located within the City and County of San Francisco, adjacent to and upland from San Francisco Bay. The area occupies approximately 90 acres (SI Report, 1993) in which there are abandoned single family residences, military dormitories and warehouse facilities. The surrounding areas are comprised, for the most part, of paved walkways, streets, and parking areas. Adjacent to the HPA facility is a high-density, single-family residential community.

PRC and HLA identified four utility areas, five building sites, and 1 underground storage tank (UST) requiring investigation. PRC and HLA subsequently investigated the release or threat of release of hazardous substances from: PA-45 (Steam Lines), PA-50 (Storm Drains), PA-50 (Sanitary Sewers), PA-51 (Transformer Locations), PA-41 (Building 818-Chlorination Plant), PA-41 (Building 816-Naval Radiological Defense Laboratory (NRDL) High Voltage Accelerator/Laboratory), PA-19 (Building 901-Officers Club), PA-43 (Building 906-Gardening Tool House), and UST S-812 (Building 813). The history of these sites and findings of the investigations are outlined in the SI Report. A summary is given below.

2.1 PA-45 (Steam Lines)

The steam lines identified as PA-45 were built approximately 40 years ago to supply steam heat to HPA buildings. Steam lines associated with other HPA Parcels were rumored to have been used to transfer waste oil, as well as steam heat. The Parcel A steam lines were investigated for similar activity.

The SI included a review of historical information and visual inspections, but no environmental data were collected. Two locations were inspected (PA45ST100 and PA45ST101) and no visible contamination or oil staining was observed. PRC and HLA concluded that there were no releases to the environment. PA-45, therefore, was not included as part of the ERA.

2.2 PA-50 (Storm Drains)

The storm drains were built beginning in 1940 as a combined system with the sanitary sewers. Separation of the drainage systems was initiated but never completed. Interconnections between the two systems in some areas still remain today.

The SI reports that stormwater runoff from Parcel A is collected in four separate stormwater systems, identified by PRC and HLA as Drainage Areas A, B, D, and G. Drainage Area A

includes runoff from PA-41 (Buildings 818 and 816) and Buildings 808 and 815. Drainage Area B includes runoff from PA-43 (Building 906) and former residential housing areas. Drainage Area D includes runoff from PA-19 (Building 901) and Building 101. Drainage Area G includes runoff from Building 813.

The SI included the visual inspection of 24 manholes and catch basins. It did not, however, involve the collection of environmental samples from any of these stations. At three observation stations (PA50SW109, PA50SW114, and PA50SW118), OVA readings indicated the presence of volatile materials (1 ppm, trace amounts, and 1.5 ppm, respectively). In all three cases, however, the manhole vault was observed to be in good condition. At PA50SW116 a "trace sheen" was observed on "stagnant water." (SI Report, 1993)

Though there were no environmental samples collected from within the storm drain system in Parcel A, sediment samples were collected within the system downgradient of Parcel A in Parcel B. Samples from PA50FC211--downgradient of PA-43 (Gardeners Tool House)--were analyzed for organochlorine pesticides, resulting in no detections. The sample was not analyzed, however, for any of the other pesticides and herbicides which were found at PA-43. PRC and HLA concluded that if the relatively persistent organochlorine pesticides were not detected in the storm drain, then other pesticides and herbicides were likely not present, either. PRC and HLA recommended the removal of storm drain sediments and monitoring of the drainage system in future. No further investigation was recommended.

Because of the apparent absence of exposure pathways from the storm drains to receptors in Parcel A, PA-50 (Storm Drain) was not included as part of the Parcel A ERA. Should future investigation of the storm drain system indicate that releases of hazardous substances either to or from the storm drain system have occurred, then an assessment of the ecological risk associated with such releases should also be conducted. The Navy adds that it will include a qualitative determination of whether stormwater from Hunters Point Annex is a significant vector for potential contaminants entering San Francisco Bay as part of the Phase 1A base wide ecological risk assessment.

2.3 PA-50 (Sanitary Sewer)

The sanitary sewer system was built beginning in 1940 as a combined system with the storm drains. Separation of the drainage systems was initiated but not completed. The interconnections between the two systems in some areas still remain today.

Two sewage drainage reaches serve Parcel A. They are Reach 1 and Reach 10. Reach 1 serves the former residential area,

including PA-43 (Gardening Tool House) and PA-19 (Officers Club). Reach 10 serves Buildings 110 and 101 and buildings along Crisp Avenue, including PA-41 (Buildings 816 and 818). The SI reports that the sewer lines are generally in good condition, though Reach 10 suffers several areas of sagging line. The Navy adds that the sanitary sewer in this area is actually below the water table and therefore acts as a sink rather than a source of contaminants. Further, Buildings 816 and 818 are currently unoccupied and therefore do not receive contributions to the sanitary sewer.

The investigation of Parcel A sewer lines involved the visual inspection of approximately 50 manholes and sampling of a total of 10 soil borings. Soil samples were taken near those sewer lines immediately downgradient of PA-43 (Gardening Tool House) and to a maximum depth of 80 feet. They were analyzed for chlorinated herbicides and organochlorine pesticides. No environmental samples were taken in or around Reach 10 in the vicinity of PA-41 (Buildings 816 and 818).

PRC and HLA conclude that pesticides have migrated from PA-43 towards the downgradient sewer lines but that the "generally dry soil and rock conditions encountered during drilling indicate...[that] leakage [from the line] is probably minor." (SI Report, 1993)

The soil samples collected as part of the SI are evaluated in this ERA. Analysis of samples PA50B001 through PA50B005 and PA50B007--samples representing site residuals--detected the organic compounds listed below. According to the data presented in the SI Report, the samples were not analyzed for inorganic compounds as part of the SI.

TABLE 1

Compound	Minimum ug/kg	Maximum ug/kg	Average ug/kg
Heptachlor epoxide	ND	1.9	1.9
4,4'-DDT	ND	39	22.65
Endrin aldehyde	ND	3.8	3.8
2,4-DB	ND	160	93.89
2,4,5-T	ND	35	25
2,4,5-TP (Silvex)	ND	16	14
Dichloroprop	ND	92	72.8
MCPA	ND	23000	14058.33
MCPP	ND	11000	7275

All of these compounds, except MCPA and MCPP, were detected at levels below a maximum of 0.2 part per million (ppm) and below an average of 0.1 ppm. Therefore, they present a minimal ecological risk. MCPA, at a maximum of 23 ppm, and MCPP, at a maximum of 11 ppm, are of greater concern. According to the SI Report, "the method used for the analyses, electron capture detection (ECD), is not sensitive to MCPP and MCPA, which results in a high reporting limit." (SI Report, 1993) In addition, as subsurface samples, the potential for exposure is limited unless the contaminants migrate through the groundwater pathway to surface seeps downgradient. Sampling of the seeps downgradient of PA-43 would be needed before the nature of this de minimis risk can be assessed for this pathway. MCPA and MCPP are considered in Section 4.0, Risk Characterization.

2.4 PA-51 (Transformer Locations)

According to the SI Report, a previous transformer investigation at HPA led to the discovery and removal of 199 transformers. A follow-up investigation was initiated as part of the SI in Parcel A to ensure that all transformers had been identified. As a result of the SI, nine additional transformers were identified in Parcel A. Visual inspections identified staining on the concrete pads of five transformer stations, but no soil staining. No environmental samples were collected. Further, "the attempt to correlate the 48 transformers whose original locations were unknown to locations in Parcel A was not successful." (SI Report, 1993) Since there was no information to suggest that the 48 unidentified transformers were in Parcel A rather than elsewhere on the base, PRC and HLA concluded that no further action was necessary.

Based on these conclusions, PA-51 was not included as part of the ERA. Should future investigations indicate PCB contamination related to transformer storage or handling in Parcel A, then an assessment of the associated ecological risk should also be conducted.

2.5 PA-41 (Building 818-Chlorination Plant)

According to the SI Report, the Chlorination Plant was used for water chlorination. However, the building is currently vacant. An observed stain north of Building 818 has been investigated as part of the Building 816 investigation and is included in Section 2.6 below. "Site visits to existing Building 818 were performed in 1993 during the SI and no visible evidence of soil impacts was observed. Therefore, sampling was not recommended." (SI Report, 1993) PA-41 (Building 818) was, therefore, not included in the ERA.

2.6 PA-41 (Building 816-High Voltage Accelerator/Laboratory)

Building 816 was constructed in the 1940s and was operated by the Navy until 1976. It has been vacant since then. During the SI, three areas of concern were identified. "(1) the north side of the site, (2) a stain on the asphalt in the southwest corner of the parking lot, and (3) the former drum storage area." (SI Report, 1993) The SI reports that 11 soil samples were collected and analyzed for total petroleum hydrocarbons (TPH), Polyaromatic Hydrocarbons (PAH), Total Oil and Grease (TOG), Volatile Organic Compounds (VOC), Semivolatile Organic Compounds (SVOC), Pesticides/PCBs, and priority pollutant metals. Discussion of the three areas of concern are included in Sections 2.6.1 through 2.6.3 below.

2.6.1 North Side of the Site

According to the SI Report, six soil samples were collected in the unpaved area north of the site, indicating low levels of PAHs, unknown TPHs, TOG, and several metals. According to the SI Report, the levels were above the Navy's Interim Ambient Levels (IALs). PRC and HLA recommended no further action.

This subsite was included in the ERA. Analyses of samples PA41SS01 through PA41SS06--samples representing contaminant residuals--indicated the presence of the compounds listed below. The detection limits for many samples were higher than the detected values for others. Thus, detection limits are not included in the average calculation. Further, results from samples collected from under the asphalt (PA41SS07) are not included since the asphalt prohibits any exposure to terrestrial ecological receptors.

TABLE 2

Compound	Minimum ug/kg	Maximum ug/kg	Average ug/kg
Dibenzofuran	ND	60	**
Phenanthrene	55	120	88
Fluoranthene	ND	54	**
Pyrene	ND	44	**
Chrysene	ND	54	47*
Benzo(b)fluoranthene	ND	52	49*
Benzo(g,h,i)perylene	ND	47	42*

	Minimum mg/kg	Maximum mg/kg	Average mg/kg
Mercury	ND	0.23	0.14*
Aluminum	7360	32700	17693
Arsenic	1.2	5.5	2.9
Lead	9.1	186	121
Barium	32.4	485	216.4
Chromium	170	405	305
Cobalt	30.8	81.3	48.5
Copper	ND	69.9	49.8
Manganese	323	1590	1021
Nickel	621	1360	862
Vanadium	33.6	82.5	58.7
Zinc	95.3	334	235.1

* Nondetects were not included in the average calculation.
** Detection limits were for many samples higher than the detections for others.

The substances identified are metals and SVOCs and are evaluated below. Metals, in a soil of neutral pH, are for the most part, naturally occurring, immobile and not readily translocated to flora shoots or readily absorbed by faunal subjects. Therefore, aluminum, cadmium, cobalt, copper, vanadium, and zinc are excluded from further consideration. Because soils naturally formed from serpentinite rock commonly contain elevated levels of nickel and chromium and Parcel A is in large part comprised of such soils, nickel and chromium were excluded from further consideration. Barium and manganese occur naturally at high concentrations in plants and are therefore excluded from further consideration. Of the site metal residuals listed above, only lead, with a maximum concentration of 186 ppm, and arsenic with a maximum concentration of 5.5 ppm, have the potential to cause ecological risk. Lead and arsenic are considered in Section 4.0, Risk Characterization.

The SVOC residuals are all measured at less than 0.2 ppm. These levels do not appear to pose a significant ecological risk and therefore are excluded from further consideration.

2.6.2 Southwest Corner of Parking Lot

One sample was collected from underneath the asphalt in the southwest corner of the parking lot near Building 816. PCE was detected in the sample but was also detected in the laboratory method blank. Further, copper was detected in excess of the Navy's IALs. PRC and HLA recommended no further action.

This subsite was not included in the ERA, despite copper levels, because the asphalt prohibits exposure to ecological receptors.

2.6.3 Former Drum Storage Area

The former drum storage area was investigated by excavation. A total of 58 cubic yards of material was excavated from the site, though confirmatory soil samples indicate that contaminant residuals remain. PRC and HLA conclude that "the resulting risk levels of the confirmatory soil samples (PA41SS10 and PA41SS11) approach that of background and are considered the minimum risk that is acceptable...at this site. Therefore, no further investigation of the former drum storage area is recommended." (SI Report, 1993)

Data from the former drum storage area is evaluated below. Analyses of samples PA41SS10 and PA41SS11--samples representing site residuals--were only conducted for organic constituents. Further, the detection limits for PA41SS10 were higher than the levels detected in PA41SS11. Thus, only PA41SS11 results are listed.

TABLE 3

Compound	Concentration (ug/kg)
Naphthalene	38
2-Methylnaphthalene	57
Acenaphthylene	25
Phenanthrene	67
Anthracene	13
Fluoranthene	68
Pyrene	120
Benzo(a)anthracene	58
Chrysene	100
Benzo(b)fluoranthene	110
Benzo(k)fluoranthene	94
Benzo(a)pyrene	100

The SVOC residuals are all measured at less than 0.2 ppm. These levels do not appear to pose a significant ecological risk and therefore are excluded from further consideration.

2.7 PA-41 (Building 816-High Voltage Accelerator/Laboratory)

The High Voltage Accelerator/Laboratory previously contained an electron and ion accelerator and housed a tritium target preparation and electronic component cleaning room. "Oral historical accounts indicate that the building was contaminated with tritium and was subsequently decontaminated." (SI Report, 1993) The SI endeavored to determine if the soil, concrete and asphalt outside of Building 816 was also contaminated with tritium.

According to the SI Report, a total of 52 soil, concrete and asphaltic concrete samples were collected and analyzed for tritium from around the doors and exits to Building 816. Detections ranged from 0.13 to 0.44 pico Curies per gram (pCi/g), less than the 0.5 pCi/g identified by PRC and HLA as the minimum detectable activity (MDA) level.

This subsite was not included in the ERA because of the negligible levels detected.

2.8 PA-19 (Building 901-Officer's Club)

PA-19 (Building 901-Officer's Club) is currently vacant and is situated on a knoll overlooking the southern and eastern portions of HPA. "The building and surrounding parking area occupy slightly less than 1 acre." (SI Report, 1993).

Two parking medians occupying less than 0.25 acres in front of the Officers Club were investigated during the SI because of a suspicion that sandblast grit and oily materials were disposed of there. The SI reports that fill material overlying a liner in the parking medians was removed and transferred to Parcel E. Then, eleven soil samples were taken to determine if contaminants remained either in the medians or under the parking lot asphalt. The SI reports that as a result of the sampling, PRC and HLA excavated an additional 6 to 12 inches of material from the medians for a total excavation of 315 cubic yards.

PRC and HLA concluded that "the risk levels of the confirmatory soil samples approach that of background and are considered de minimis at this site. Therefore, no further investigation of PA-19 is recommended." (SI Report, 1993)

PA-19 is included in the ERA. Analysis of samples 14219006, 14219008, 14219010, and 14219012--taken from 12-18 inches below the original ground surface (bgs)--indicate the presence of the contaminants listed below. Detection limits were for many samples higher than the contaminant levels found in other samples. For that reason, detection limits are not used to calculate the average. Samples collected from under the asphalt are also not included since the asphalt prohibits exposure to terrestrial ecological receptors.

TABLE 4

Compound	Minimum ug/kg	Maximum ug/kg	Average ug/kg
4,4'-DDD	ND	82	0.484
4,4'-DDE	ND	1.5	1.07
4,4'-DDT	ND	0.28	0.28
Aroclor-1254	ND	12	12
Aroclor-1260	ND	610	610
Beta-BHC	ND	0.056	0.056
Dieldrin	ND	3.6	1.87
Endosulfan I	ND	0.097	0.097
Endrin	ND	9.1	3.19
Endrin Aldehyde	ND	10.0	10.0
Endrin Ketone	ND	0.51	0.27
Gamma-Chlordane	ND	0.43	0.43
Methoxychlor	ND	0.78	0.78
Aluminum	3600	31000	19000
Antimony	ND	12.2	9.65
Arsenic	ND	9.1	5.8
Barium	7.4	89.8	62.4
Beryllium	ND	0.40	0.38
Cadmium	ND	2.0	1.47
Chromium	293	768	450
Cobalt	33.9	84.3	51.9
Copper	67.4	149	107.4
Lead	ND	8.3	6.3
Manganese	746	1370	1001
Mercury	ND	0.12	0.12
Molybdenum	1.4	1.9	1.7
Nickel	517	1400	875
Vanadium	21.4	76.8	55.1
Zinc	83	228	143.9

The substances identified above are pesticides and metals. Metals, in a soil of neutral pH, are for the most part naturally occurring, immobile, not readily translocated to flora shoots or readily absorbed by faunal subjects. Therefore, aluminum, cadmium, cobalt, copper, vanadium, and zinc are excluded from further consideration. Because soils naturally formed from serpentinite rock commonly contain elevated levels of nickel and chromium and Parcel A is in large part comprised of such soils, nickel and chromium were excluded from further consideration. Barium and manganese naturally occur at high concentrations in plants and are therefore excluded from further consideration. Of the list of residual concentrations, only arsenic with a maximum concentration of 9.1 ppm has the potential to cause ecological risk. Arsenic is considered in Section 4.0, Risk Characterization. Lead is considered due to the levels found at PA-41.

With the exception of Aroclor 1260, the Pesticide residuals are all measured at less than 0.2 ppm. These levels do not appear to pose a significant ecological risk and therefore are excluded from further consideration. Aroclor 1260, with a maximum concentration of 0.61 ppm does have the potential for ecological risk and is therefore considered in Section 4.0, Risk Characterization.

2.9 PA-43 (Building 906-Gardening Tool House)

The Gardening Tool House is located on the ridge of Parcel A near Coleman Street. As part of the SI, the Tool House and surrounding soil was removed in an investigation by excavation. "Although limited historical information is available, it is likely that the Gardening Tool House was used for the storage and repair of gardening and landscape equipment. Signs in the dirt-floored room indicated that pesticides and fertilizers were stored and mixed in the building...An exterior sump and drain of terra cotta were located in the front porch of the building." (SI Report, 1993).

A total of 33 soil samples were collected from PA-43 and analyzed for VOCs, SVOCs, Pesticides/PCBs, Herbicides, Total recoverable Petroleum Hydrocarbons (TRPH), and metals. Soil was excavated anywhere from 6 to 36 inches throughout most of the site with 12 to 60 inches of soil removed from the drain pipe trench. According to the SI Report, a total of 555 cubic yards of soil were excavated from the site.

As reported in the SI, PRC and HLA concluded that "no further confirmation sampling was required after...excavation because the analytical data indicated that contamination did not extend below the final grade...[A]fter the contaminated soil was removed, the risk levels of the confirmatory soil samples approach that of background and are considered de minimis at this site." (SI Report, 1993)

PA-43 is included in the ERA. Table F-26 from the SI Report presents a statistical summary of chemical analyses for remaining soil samples at PA-43. It is included as an attachment to this report.

The substances identified are Semivolatile Organic Compounds (SVOC), Pesticides, Herbicides, and metals. Elevated levels of SVOCs were identified in the soil residuals at PA-43. Except for the following, the SVOCs were detected at levels less than 0.2 ppm and therefore do not appear to represent a significant ecological risk. Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, fluoranthene, indeno(1,2,3-CD)pyrene, naphthalene, phenanthrene, and pyrene, however, were all detected at levels above 0.2 ppm. They were only detected at high levels,

however, in one sample (#14243100), taken from a depth of 30-36 inches. Though left in place, the residuals at this location will be backfilled with 30-36 inches of clean material. Thus, while there may be incidental exposure to burrowing receptors, at 36 inches, regular contact is not expected. For this reason, the SVOCs are excluded from further consideration.

Elevated levels of Pesticides were also identified in the soil residuals at PA-43. For example, 4,4'-DDD and 4,4'-DDT were detected at levels above 0.6 ppm. They were only detected at such elevated levels in sample #14243022, however, at a depth of 6-12 inches. 4,4'-DDD, with a maximum concentration of 2.1 ppm at 6 inches has the potential to cause ecological risk and is considered in Section 4.0, Risk Characterization.

Elevated levels of Herbicides were also identified in the soil residuals at PA-43. For example, 2,4-D, MCPA, and MCPP were detected at levels exceeding 1 ppm. Other herbicides were detected at levels below 0.13 ppm. The elevated levels were detected in several soil samples, including many taken at 6 inches below ground surface. As such, 2,4-D, MCPA and MCPP are considered in Section 4.0, Risk Characterization.

Metals in a soil of neutral pH are for the most part naturally occurring, immobile, not readily translocated to flora shoots, or readily absorbed by faunal subjects. Therefore, aluminum, cadmium, cobalt, copper, vanadium, and zinc are excluded from further consideration. Nickel and chromium are excluded from further consideration because they naturally occur at elevated levels in serpentinite soils. Barium and manganese naturally occur in elevated concentrations in plants and are therefore excluded from further consideration. Of the list of residual concentrations, only lead and magnesium, with maximum concentrations of 178 ppm and 200,000 ppm respectively, have the potential to cause ecological risk. Lead is considered in Section 4.0, Risk Characterization. Magnesium, likely left as a residual of chemical fertilizers stored and/or mixed at PA-43, is also considered in Section 4.0, Risk Characterization; but, the toxicity of magnesium is not well reported in the literature and it is also a common constituent of serpentinite soil.

2.10 UST S-812 (Building 813)

The former UST S-812 was located underneath an asphalt parking lot approximately 20 feet east of Building 813. The tank was installed in 1976 and was used to store fuel oil for a boiler in the adjoining building. "Based on visual inspection after removal, the capacity of the UST was estimated to be between 18,000 and 20,000 gallons." (SI Report, 1993) According to the SI Report, after the tank removal, sloughed soil was removed from the sides of the pit leaving a final excavation pit of 21.8 feet wide, by 36.0 feet long, by 10.5 feet deep.

The SI reports that five soil samples and one groundwater sample were collected from the pit after excavation. The pit was then backfilled and reasphalted.

Since the site has been reasphalted, thereby interrupting any potential terrestrial exposure pathway, an assessment of UST S-812 is not included in the ERA.

2.11 Summary

A review of information and data contained in the Parcel A SI report identifies the following sites for consideration as part of the ERA: PA-50 (Sanitary Sewers), PA-41 (Building 816), PA-19 (Building Officers Club), and PA-43 (Gardening Tool House). From these sites, the chemicals which pose a potential ecological risk are: arsenic, lead, magnesium, 2,4-D, 4,4'-DDD, Aroclor 1260, MCPP, and MCPA. They are considered in Section 4.0, Risk Characterization, in conjunction with the site habitat, Section 3.0.

3.0 HABITAT ASSESSMENT

A site reconnaissance survey was conducted to qualitatively assess the site's floral and faunal biodiversity and identify sensitive habitats. It was conducted in the evening of November 23, 1993 and in the morning of November 24, 1993. The reconnaissance included site walks and selected transect walks across the non-developed grassy site slopes and behind Buildings 816 and 818. It was performed to supplement previous site investigations conducted by the Navy and its contractors.

Site vegetation in Parcel A for the most part is dominated by ornamental shrubs and non-native grasses that surround the housing development. A small strip of mature eucalyptus (*Eucalyptus* sp.) (canopy open, greater than 50%) occupies less than one acre of the ridge. Intermittent strips of pines (*Pinus* sp.) of less than one half acre appear on the site ridge. A spring is found in a topographical depression on the westside of Parcel A behind Buildings 816 and 818, including a small pocket of cattail (*Typha* sp.).

Open space is minimal, occupying approximately 15 acres of the site. The open area for the most part is steeply sloped; that is, greater than 55 degrees. Surface geology is dominated by serpentinite, sandstone, and shale bedrock. A thin layer of unconsolidated soil provides intermittent cover for the bedrock. Vegetative cover is dominated by non-native grasses [including: bermuda grass (*Cynodor dactylon*), wild oats (*Avena fatua*), soft brome (*Bromas mollis*) and ripgut (*Bromus dandrus*)] and opportunistic herbs [including: mustard (*Brassica* sp.), yellow star thistle (*Centawiea solstitialis*), field bindweed (*Convolvulus arrenensis*), and fennel (*Foeniculum vulgare*)].

Shrub patches include coyote bush (*Baccharis pilularis*), blackberry (*Ruboo* sp.), Photina (*Photina arbutifolia*) and pampas grass (*Coraderia* sp.).

Parcel A is ruderal and impacted by urban development. The habitat provides marginal cover and food resources for faunal species. The soil cover is unstable and shallow to bedrock, limiting burrowing activities necessary to support a diverse rodent and/or small mammal species population. The grasses are non-native. Floral diversity has been limited by a metal-rich serpentinite substrata. Faunal diversity is further decreased by base facilities, urban development and the limited vegetative resources.

The reconnaissance survey identified fifteen avian subjects and four terrestrials. American kestrels (*Falco sparrerius*) were observed foraging the open grassy slope while red-shouldered hawk (*Buteo lineatus*) and red-tailed hawk (*Buteo jamacensis*) were observed resting within the eucalyptus canopy. Fox scat and tracks were observed on the slope in the area of the Botta's pocket gopher (*Thomomys bottae*) burrows. Introduced ornamentals around residences provided food resources for the Anna's Hummingbird (*Calypte anna*), western meadow lark (*Sturrella negleeta*), mourning doves (*Zenaida macroura*), northern mockingbirds (*Mimus polyglottis*), white-crowned sparrow (*Zonotrichia leucophays*) and ruby-crowned kinglet (*Regulus satrapa*).

3.1 Summary

In summary, Parcel A is a marginal habitat for both floral and faunal species. The naturally occurring serpentinite soil, which is high in both nickel and chromium, decrease vegetative diversity and faunal foraging resources.

The receptors chosen for this ERA allow for the assessment of the greatest potential ecological threat. The Botta's pocket gopher was selected as the primary receptor for the assessment of metals and PCBs because exposure may occur during: food uptake, grooming, incidental ingestion of soil and dermal absorption in the burrow. The American Kestrel was selected as a receptor for the assessment of DDT residuals since its reproductive success may be affected by exposure to DDT and its metabolites.

4.0 RISK CHARACTERIZATION

In the SI Report, PRC and HLA identified contaminated "hot spots" in Parcel A, amounting to less than one acre of the site. Contaminated soil from these areas was excavated and disposed of off-site. Food sources, as mentioned above, are limited within Parcel A as is exposure which is, for the most part, related to incidental predation of burrowing species.

Because of the presence of contaminant residuals and potential receptors, however limited, a qualitative toxicity assessment was performed on the contaminant soil residual levels identified in the SI, which include: arsenic, lead, magnesium, 2,4-D, 4,4'-DDD, Aroclor 1260, MCPP, and MCPA. The soil residual levels of concern were compared to NOAELs for surrogate site species obtained from the literature.

4.1 Arsenic

Arsenic is known to bioconcentrate in aquatic organisms such as fish and invertebrates but biomagnification has not been documented in upper trophic level subjects (Callahan, M.A., et. al., 1979). Arsenic uptake in plants is highly subject to soil type and arsenic speciation. The bioavailability of arsenic is further inhibited by soil pH and soil mineral content. A pH from 7 to 9, such as found in the HPA, and the presence of aluminum and iron oxides are supportive of soil absorption of arsenic (Pendias, A.K et. al., 1992). HPA specific aluminum concentrations have been reported at 49.4 X 10^3 mg/kg while iron has been reported at 65.7 X 10^3 mg/kg. (PRC, 1993)

The toxicity threshold for arsenic is highly variable with concentrations as low as 1 ppm to 20 ppm effecting reduction of yield in various plant species (Macnicol, R.D., et. al., 1985). The uptake from flora to faunal species, however, has not been demonstrated.

Toxicity studies performed with wildlife species are limited. The studies for the most part are confined to laboratory animals. In a mouse study performed by Hood (1977), a NOAEL for arsenic was reported at 100 mg/kg. The maximum residual level in Parcel A is 9.1 ppm, over ten times less than the mammalian NOAEL.

4.2 Lead

Lead is known to bioconcentrate within faunal species, however, biomagnification has not been documented. Lead concentrations are found to decrease in the upper trophic levels. Lead exposure is further inhibited as lead is not readily taken up by plants. When uptake does occur, root retention inhibits translocation. The root to shoot exclusion rate has been estimated to be a ratio of 62 to 6 (Fritter, A.H., 1981) while Wilson and Cline (1966) estimated the root absorption rate to be between 0.003% and 0.005%, thereby limiting potential food chain exposure to its selected receptors.

Population studies with invertebrate subjects reported no reduction in ant populations at lead soil concentrations of 132 mg/kg, in spiders at lead soil concentrations of 230 mg/kg

(Bengtsson, et. al., 1984) and in earthworms at lead soil concentrations of 146 mg/kg (Wright, 1984).

Toxicity studies with mammals, such as mice, exhibited relatively high toxicity threshold values. A NOAEL has been reported for mice dosed with inorganic lead at concentrations of 1000 mg/l (Barett, J., et. al., 1985).

The reported maximum residual lead concentration at Parcel A was 186 ppm, a value 5 fold less than the NOAEL for mice and within the range of levels in which invertebrate populations are expected to be unaffected.

4.3 Magnesium

Magnesium is a naturally occurring essential nutrient for plant life. It is reported to comprise as much as 7% of native soils in the U.S. (70,000 ppm). It is not, however, readily absorbed either dermally or through the gastrointestinal system of faunal subjects. Further, the toxicity literature is bereft of studies regarding the effects of magnesium. It is unlikely that magnesium, even elevated as it is to a maximum concentration of 200,000 ppm, poses a significant ecological risk. Nonetheless, given the limited toxicity data relevant to magnesium exposure, the presence of this compound at elevated levels represents a site uncertainty.

4.4 2,4-D

2,4-D is an herbicide product that is mobile in sandy soils. Sorption is likely to occur with a pH of greater than 8 and with soils of high organic content. The lowest reported oral LD50 for the rock dove is 668 mg/kg (USFWS, 1970). Of the sub chronic developmental feeding studies, the lowest reported NOAEL for rats is 375 mg/kg (Rodwell, et al., 1989). Of the chronic reproductive feeding studies, the lowest reported NOAEL for mice is 1,300 mg/kg (NTP, 1989). The highest reported surface soil concentration in Parcel A is 1.3 mg/kg or nearly three hundred times less than the NOAEL for rodents.

4.5 4,4'-DDD

The species most affected by DDT are spiders, aquatic beetles, frogs, and crayfish. Low levels of DDT have also been found to cause egg shell thinning in numerous avian species. Declining populations of raptors have been linked to DDT exposure.

Feeding studies using American Kestrels and Common Barn Owls have established a toxicity threshold for DDE, a related metabolite of DDT, to be greater than 2.75 ppm (Mendenhall, E.K., et al., 1983) (Weimyer, S.N., et al., 1970) This level caused

egg shell thinning in the study subjects.

The average site soil concentration was less than 0.2 ppm or nearly 14 times less than the threshold for the American Kestrel and Common Barn Owl. The maximum soil concentration, however, was 2.1 ppm, approaching the threshold of concern. This 4,4'-DDD findings represents a de minimus risk in Parcel A since the extent of contamination is limited. The Navy, however, will investigate as part of the Phase 1A basewide ecological risk assessment whether or not a significant pathway links site contaminants with raptors that inhabit Parcel A and forage throughout the site. Raptors who inhabit Parcel A and forage throughout the site may be exposed to a cumulative risk worthy of additional consideration.

4.6 Aroclor 1260 (Polychlorinated biphenyls)

Aroclor 1260 was surveyed within the devegetated surface soils of PA-19. The maximum residual concentration of Aroclor 1260 in Parcel A was reported at 0.61 ppm. Terrestrial receptor exposure is limited since vegetative uptake is not a significant exposure pathway. The uptake of PCBs from soil to root and subsequent translocation to shoots is minimal. The Bioconcentration Factor for this translocation has been estimated to be less than 0.02 (O'Conner, et. al., 1990).

Acute systemic exposure studies performed by Bruckner (1973) using rats resulted in a NOAEL value of 4000 mg/kg. While sub-chronic exposure studies with rats have reported a NOAEL value of 100 mg/kg (Ibid., 1973), a value three orders of magnitude greater than the maximum concentration detected in Parcel A.

4.7 MCPP/MCPA

MCPP/MCPA are herbicides for which there is limited ecotoxicity data. The contaminants are relatively non-toxic. The reported LD50 for oral exposure in rats is 1500 mg/kg, while reproductive inhibition for mice has been reported to occur at 200 mg/kg (Verschueren, K., 1983). The MCPP NOAEL for rats has been reported to be 65 mg/kg (HSDB, 1993-three week feeding study), while a chronic feeding study with rats established the threshold for effect at 100 ppm (HSDB, 1993). The maximum residual concentration detected for MCPA was 23 ppm while the maximum for MCPP was 40 ppm. These concentrations are lower than the literature values of concern.

5.0 CONCLUSIONS

The EPA conducted a screening-level Ecological Risk Assessment on Parcel A of the Hunters Point Annex to confirm the initial findings of PRC and HLA. The ERA consisted of a review of the site's history, a habitat assessment, and a qualitative

risk characterization.

Four sites investigated as part of the SI were considered in the ERA: PA-50 (Sanitary Sewers), PA-41, PA-19, and PA-43. The other SI sites were not considered in the ERA either because the contamination was below the ground surface and therefore presented no significant exposure risk or negligible levels of contamination were identified by the Navy's contractors.

In conclusion, Parcel A can be seen as a marginal habitat that has largely been impacted by urban and industrial development. Parcel A open space is limited to less than 15 acres. The open space available is steeply sloped and dominated by opportunistic weeds and introduced ornamentals. Floral diversity has been impacted by high, naturally occurring, surface soil concentrations of chromium and nickel. Further, faunal activity is limited because of the minimal: cover, escape corridors and food resources in Parcel A.

PRC and HLA conducted an SI which resulted in the excavation of contaminated soil from three sites within Parcel A. Contaminant residuals remain in Parcel A, including: arsenic at a maximum of 9.1 ppm, lead at a maximum of 186 ppm, magnesium at a maximum of 200,000 ppm, 2,4-D at a maximum of 1.3 ppm, 4,4'-DDD at maximum of 2.1 ppm, Aroclor 1260 at a maximum of 0.610 ppm, MCPA at a maximum of 23 ppm, and MCPP at a maximum of 40 ppm.

Toxicity data reported in the literature was reviewed for rats and mice, surrogates for the resident Botta's Pocket Gopher which is a food resource of owls and American Kestrels. A comparison of site data to these literature values suggests that residual concentrations are significantly less than the NOAELs for these surrogate species and therefore no do not appear to pose a significant ecological risk.

Limited ecotoxicity data is available to compare to the magnesium levels identified on Parcel A. Since magnesium is a naturally occurring constituent and is not readily absorbed either dermally or through the gastrointestinal system, the ecological risk posed by site magnesium residuals is expected to be minimal. However, the lack of literature data for comparison to site values represents an uncertainty within the ERA process.

A comparison of 4,4'-DDD data to the toxicity threshold for the American Kestrel suggests that the average residual concentrations are less than the Kestrel's threshold; but, the maximum concentration approaches the level of concern. While the eucalyptus stand on PA-43 provides resting habitat for the Kestrel and other raptors, the foraging opportunities around PA-43 in particular and across Parcel A in general are limited as discussed in Section 3.0, Site Habitat. Thus, the ecological risk associated with elevated levels of 4,4'-DDD appear to be de

minimis at Parcel A. The Navy, however will consider cumulative risk to raptors as part of the Phase 1A base wide ecological risk assessment.

While the SI Report contains uncertainties and the ERA is limited by those uncertainties, this screening-level assessment concludes that the combination of the urban-based habitat and generally reduced contaminant levels pose a de minimis risk to ecological receptors on Parcel A.

As with any Ecological Risk Assessment, should new information or data indicate changes in the current characterization of contaminant condition, ecological receptors or exposure pathways, such that the bases for this assessment are significantly altered, then the ecological risk at this site must be reassessed.

Bibliography

Hunters Point

Barett, J. et al., Low Level Lead Effects on Activity Under Varying Stress Conditions in the Developing Rat, Pharmacol. Biochem. Behav., Volume 22, pp.107-118 (1985).

Bruckner, J.V. et al., Biological Responses of the Rat to PCBs, Toxicol. Appl. Pharmacol., Volume 24, pp. 434-448 (1973).

Callahan, M.A., Slimak, M.W., Gabel, N.W., et al., Water-related Environmental Fate of 129 Priority Pollutants, Report to US Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C. by Versar Inc., Springfield, VA., Volume I., EPA-440/4-79-029a, (1979).

Fitter, A.H. et al., Environmental Physiology of Plants, Academic Press, New York, NY. (1981).

Hazardous Substance Data Base (HSDB) (Access December 1993).

Hoffman, D.J., Biochemical and Hematological Effects of Lead Ingestion in Nesting American Kestrels, Comp. Biochem. Physiol., Volume 80C, No. 2, pp. 431-439 (1985).

Hoffman, D.J., Survival, Growth and Accumulation of Ingested Lead In Nesting American Kestrels, Arch. Environ. Contam. Toxicol., Volume 14, pp. 89-94 (1985).

Hood, R.D., Harrison, W.P., Effects in the Mouse and Rat of Prenatal Exposure to Arsenic, Envir. Health Perspect., Volume 19, pp. 219-222 (1977).

Niethammer, K.R. et al., Metals in Riparian Wildlife of the Lead Mining District of Southeastern Missouri, Arch. Environ. Contam. Toxicol., Volume 14, pp. 213-223 (1985).

Pendias, A.K., Trace Elements in Soils and Plants, CRC Press, London (1992).

PRC, Hunters Point Site Investigation Report (Draft) (1993).

Verschueren, K., Handbook of Environmental Data on Organic Chemicals, Van Nostrand Reinhold Co., New York, NY (1983).

Wilson, D.O., and J.F. Cline, Removal of Plutonium 239, Tungsten 185 and Lead from Soils, Nature, London, Volume 209, pp.941 (1966).

Wright, M.A. et al., Lead, Zinc and Cadmium Content of Earthworms from Pastures in the Vicinity of an Industrial Smelting Complex, Environ. Pol. Series (A), Volume 23, pp. 313-321 (1980).

ATTACHMENT A

Table F-26

Statistical Data Summary of Chemical Analyses for Remaining Soil Samples
Hunter's Point Annex - Site PA-43

Parameter	Unit	Number of Detects/ Valid Samples	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Mean of log-Transformed Data	Standard Deviation of log-Transformed Data	95% Upper Confidence Limit of the Arithmetic Mean (UCL)	Lesser of 95% UCL or Maximum Detected Value
VOLATILE ORGANICS											
2-HEXANONE	µg/kg	2/28	11.00	14.00	1.00	16.00	6.09	1.75	0.40	7.14	7.14
4-METHYL-2-PENTANONE	µg/kg	1/28	11.00	14.00	8.00	8.00	5.96	1.78	0.08	6.10	6.10
BENZENE	µg/kg	2/2	12.00	12.00	0.20	0.20	0.20	-1.61	0.00	0.20	0.20
TOLUENE	µg/kg	2/2	11.00	11.00	0.50	0.70	0.60	-0.52	0.24	0.70	0.70
XYLENE (TOTAL)	µg/kg	1/1	12.00	12.00	0.40	0.40	0.40	-0.92	N/A	N/A	0.40
SEMIVOLATILE ORGANICS											
2-METHYLNAPHTHALENE	µg/kg	3/3	380.00	1400.00	25.00	130.00	60.33	3.78	0.94	238493.58	130.00
ACENAPHTHENE	µg/kg	2/2	370.00	380.00	24.00	54.00	39.00	3.58	0.57	54.00	54.00
ANTHRACENE	µg/kg	1/26	360.00	450.00	320.00	320.00	198.27	5.28	0.11	205.60	205.60
BENZO(A)ANTHRACENE	µg/kg	8/30	360.00	1400.00	42.00	1600.00	230.60	5.15	0.73	299.63	299.63
BENZO(A)PYRENE	µg/kg	2/30	360.00	1400.00	220.00	1200.00	245.67	5.39	0.38	269.49	269.49
BENZO(B)FLUORANTHENE	µg/kg	6/30	360.00	1400.00	39.00	1400.00	240.30	5.32	0.51	278.50	278.50
BENZO(G,H,I)PERYLENE	µg/kg	1/30	360.00	1400.00	1100.00	1100.00	258.33	5.43	0.42	289.07	289.07
BENZO(K)FLUORANTHENE	µg/kg	5/30	360.00	1400.00	29.00	1100.00	227.33	5.28	0.53	274.23	274.23
CARBAZOLE	µg/kg	2/29	360.00	800.00	27.00	420.00	208.52	5.27	0.44	250.94	250.94
CHRYSENE	µg/kg	9/30	360.00	1400.00	57.00	1300.00	232.00	5.25	0.59	281.35	281.35
DIBENZ(A,H)ANTHRACENE	µg/kg	1/26	360.00	450.00	300.00	300.00	197.50	5.28	0.10	204.00	204.00
DIBENZOFURAN	µg/kg	4/4	380.00	1400.00	43.00	130.00	66.00	4.07	0.54	223.24	130.00
FLUORANTHENE	µg/kg	11/30	360.00	1400.00	34.00	3000.00	285.17	5.20	0.78	334.68	334.68
FLUORENE	µg/kg	2/2	380.00	380.00	29.00	150.00	89.50	4.19	1.16	150.00	150.00
INDENO(1,2,3-CD)PYRENE	µg/kg	1/30	360.00	1400.00	1000.00	1000.00	255.00	5.43	0.41	285.36	285.36
NAPHTHALENE	µg/kg	1/26	360.00	1400.00	220.00	220.00	193.08	5.26	0.04	194.14	194.14
PHENANTHRENE	µg/kg	8/30	360.00	1400.00	110.00	2800.00	324.50	5.41	0.64	348.82	348.82
PYRENE	µg/kg	13/30	360.00	1400.00	27.00	3300.00	290.03	5.19	0.79	337.08	337.08
PESTICIDES/PCBs											
4,4'-DDD	µg/kg	18/31	3.50	18.00	0.16	2100.00	76.47	1.31	1.85	68.05	68.05

Table F-26 (CONTINUED)

Statistical Data Summary of Chemical Analyses for Remaining Soil Samples
Hunter's Point Annex - Site PA-43

Parameter	Unit	Number of Detects/ Valid Samples	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Mean of log-Transformed Data	Standard Deviation of log-Transformed Data	95% Upper Confidence Limit of the Arithmetic Mean (UCL)	Lesser of 95% UCL or Maximum Detected Value
4,4'-DDE	µg/kg	16/31	3.50	18.00	0.14	85.00	12.25	1.24	1.46	22.70	22.70
4,4'-DDT	µg/kg	21/31	3.50	18.00	0.09	610.00	45.78	1.52	2.24	311.36	311.36
ALPHA-BHC	µg/kg	2/2	2.00	4.00	0.02	0.34	0.18	-2.43	1.91	0.34	0.34
ALPHA-CHLORDANE	µg/kg	16/31	1.80	9.40	0.13	31.00	4.27	0.51	1.27	7.06	7.06
AROCLOR-1260	µg/kg	5/31	35.00	180.00	19.00	190.00	38.71	3.31	0.72	46.84	46.84
DELTA-BHC	µg/kg	2/2	2.00	3.90	0.42	0.60	0.51	-0.69	0.24	0.60	0.60
DIELDRIN	µg/kg	5/5	3.50	4.20	0.11	0.84	0.42	-1.09	0.78	2.15	0.84
ENDOSULFAN SULFATE	µg/kg	13/28	3.50	7.90	0.08	2.30	1.31	-0.09	1.06	2.67	2.30
ENDRIN	µg/kg	5/29	3.50	7.90	0.60	5.60	2.01	0.63	0.37	2.29	2.29
ENDRIN KETONE	µg/kg	8/29	3.50	18.00	0.04	3.10	1.67	0.21	1.11	3.93	3.10
GAMMA-BHC (LINDANE)	µg/kg	8/31	1.80	9.40	0.13	7.50	1.22	-0.05	0.72	1.62	1.62
GAMMA-CHLORDANE	µg/kg	16/31	1.80	9.40	0.07	27.00	3.70	0.38	1.31	6.80	6.80
HEPTACHLOR	µg/kg	1/30	1.80	9.40	2.20	2.20	1.11	0.07	0.23	1.18	1.18
HEPTACHLOR EPOXIDE	µg/kg	1/24	1.80	9.40	1.00	1.00	0.98	-0.02	0.04	0.99	0.99
METHOXYCHLOR	µg/kg	2/3	3.80	39.00	1.30	2.10	1.77	0.55	0.25	3.49	2.10
HERBICIDES											
2,4,5-T	µg/kg	1/33	11.00	15.00	14.00	14.00	6.32	1.83	0.17	6.63	6.63
2,4-D	µg/kg	9/33	54.00	76.00	80.00	1300.00	174.27	4.07	1.22	218.04	218.04
2,4-DB	µg/kg	2/33	54.00	76.00	130.00	130.00	36.36	3.50	0.36	39.65	39.65
MCPA	µg/kg	6/33	5400.00	7600.00	7000.00	10000.00	3954.55	8.20	0.38	4424.12	4424.12
MCPP	µg/kg	9/33	5400.00	7600.00	6400.00	40000.00	5956.06	8.39	0.66	6963.69	6963.69
TOTAL PETROLEUM HYDROCARBONS - EXTRACTABLES											
DIESEL RANGE ORGANICS	mg/kg	1/5	5.60	6.40	140.00	140.00	30.34	1.85	1.73	33122.71	140.00
TPH - MOTOR OIL	µg/kg	20/26	11000.00	14000.00	5300.00	570000.00	77315.38	10.33	1.37	176621.44	176621.44
TOTAL PETROLEUM HYDROCARBONS - PURGEABLES, PLUS BTEX											
OTHER COMPONENTS *	µg/kg	3/26	5.00	7.00	180.00	920.00	68.68	1.58	1.77	82.40	82.40
TPH - TOLUENE	µg/kg	2/26	5.00	7.00	4.00	8.00	3.21	1.14	0.21	3.44	3.44

Table F-26 (CONTINUED)

Statistical Data Summary of Chemical Analyses for Remaining Soil Samples
Hunter's Point Annex - Site PA-43

Parameter	Unit	Number of Detects/ Valid Samples	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Mean of log-Transformed Data	Standard Deviation of log-Transformed Data	95% Upper Confidence Limit of the Arithmetic Mean (UCL)	Lesser of 95% UCL or Maximum Detected Value
TPH - TOTAL XYLENES	µg/kg	1/26	5.00	7.00	10.00	10.00	3.25	1.14	0.24	3.50	3.50
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH)											
OIL AND GREASE	mg/kg	14/24	27.00	34.00	35.00	5000.00	591.33	4.45	1.97	3006.83	3006.83
TRPH BY IR	mg/kg	1/1	30.00	30.00	140.00	140.00	140.00	4.94	N/A	N/A	140.00
METALS											
ALUMINUM	mg/kg	26/26	3.00	9.40	3220.00	49400.00	16889.62	9.56	0.64	22749.82	22749.82
ANTIMONY	mg/kg	11/26	5.80	8.50	7.40	17.80	6.48	1.70	0.58	8.18	8.18
ARSENIC	mg/kg	26/38	0.29	5.50	0.47	8.90	3.56	1.01	0.80	4.99	4.99
BARIUM	mg/kg	26/26	0.43	1.10	18.60	130.00	75.80	4.19	0.58	98.79	98.79
BERYLLIUM	mg/kg	14/26	0.04	0.27	0.22	0.67	0.28	-1.47	0.62	0.36	0.36
CADMIUM	mg/kg	10/26	0.66	1.10	1.00	2.00	0.79	-0.42	0.60	1.01	1.01
CALCIUM	mg/kg	26/26	1.70	5.90	418.00	72900.00	10246.00	8.39	1.21	17885.14	17885.14
CHROMIUM	mg/kg	26/26	0.64	0.82	26.90	994.00	360.51	5.50	1.02	686.17	686.17
COBALT	mg/kg	26/26	0.43	0.59	9.90	147.00	49.05	3.57	0.82	72.72	72.72
COPPER	mg/kg	18/26	0.43	1.50	18.80	83.60	33.43	3.34	0.63	44.40	44.40
IRON	mg/kg	26/26	1.10	12.00	335.00	65700.00	39374.42	10.39	0.98	85524.63	65700.00
LEAD	mg/kg	38/38	0.22	11.50	0.26	178.00	23.20	2.29	1.29	40.49	40.49
MAGNESIUM	mg/kg	26/26	4.50	50.40	7360.00	200000.00	63630.38	10.40	1.19	129298.77	129298.77
MANGANESE	mg/kg	26/26	0.21	0.31	248.00	1550.00	669.27	6.39	0.48	809.33	809.33
MERCURY	mg/kg	1/26	0.11	0.14	0.15	0.15	0.06	-2.81	0.19	0.07	0.07
MOLYBDENUM	mg/kg	18/26	0.64	1.70	0.65	4.00	1.75	0.40	0.62	2.34	2.34
NICKEL	mg/kg	26/26	1.50	2.50	36.90	3270.00	949.32	6.26	1.25	2303.35	2303.35
POTASSIUM	mg/kg	11/26	21.20	172.00	223.00	1940.00	498.25	5.79	0.99	876.31	876.31
SELENIUM	mg/kg	5/26	0.40	0.82	0.79	1.50	0.51	-0.87	0.59	0.63	0.63
SILVER	mg/kg	1/14	0.43	0.48	0.59	0.59	0.26	-1.40	0.25	0.29	0.29
SODIUM	mg/kg	26/26	3.80	19.80	111.00	1380.00	368.38	5.70	0.62	467.80	467.80
VANADIUM	mg/kg	26/26	0.43	0.89	15.80	113.00	60.53	4.03	0.43	72.21	72.21
ZINC	mg/kg	26/26	0.21	1.50	29.20	218.00	78.68	4.22	0.52	95.63	95.63