

## SUBIC BAY

This document is reporting on toxic chemical cleanup at Subic Bay, former US Navy Base.

There are issues concerning dioxins as well as numerous toxins. Various test sites are included in this report.



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[Subic Bay Naval Base](#)  
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US Military

[Philippines](#)

[Alameda Point](#)

[Chemical Weapons](#)

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[Brownfields](#)

[Military](#)

[Cleanup](#)

## Military Bases: Philippine Bases

### Technical Review Report Environmental Baseline Survey Former United States Navy Installation Subic Bay, Philippines June 30, 1998

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## Table of Contents

1. [Introduction](#)
2. [Executive Summary](#)
3. [Sampling Sites](#)
4. [Ecological Baseline Study](#)

---

## 1.0 INTRODUCTION

Under contract to Arc Ecology, on behalf of the United States Working Group for Philippine Bases Cleanup and the People's Task Force for Bases Cleanup, Clearwater Revival Company (CRC) prepared this technical review report of the following document:

**Woodward-Clyde, 1997, Environmental Baseline Study, Final Report-Volume I, Executive Summary," prepared for Subic Bay Metropolitan Authority, February.**

**Woodward-Clyde, 1997, Environmental Baseline Study, Final Report-Volume II, Environmental Quality Survey," prepared for Subic Bay Metropolitan Authority, February.**

**Woodward-Clyde, 1997, Environmental Baseline Study, Final Report-Volume III, Environmental Quality Survey," prepared for Subic Bay Metropolitan Authority, February.**

**Woodward-Clyde, 1997, Environmental Baseline Study, Final Report-Volume IV,**

**Ecological Baseline Study," prepared for  
Subic Bay Metropolitan Authority, March.**

**The Environmental Baseline Study (EBS) for the Freeport Zone was completed for an area of the former US Navy Subic Bay Military Complex. The EBS consisted of an Environmental Quality Survey (EQS) and an Ecological Baseline Survey.**

**The purpose of CRC's technical review was to determine if the conclusions of the EBS are technically sound. CRC's reviewed the assessment methods, sampling plans, and risk screening methods used during the EBS for consistency with practices commonly used to perform environmental assessments on industrial property.**

**It is CRC's opinion that the EBS does not accurately characterize contamination at the Subic Bay Freeport Zone, and the potential for adverse impacts to human health and the environment.**

**CRC's opinion is based on the following facts:**

- 1. The EBS does not assess all areas of the Freeport Zone, and does not include known environmental hazards such as unexploded ordnance, asbestos, lead-paint, and radioactive materials.**
- 2. Site reconnaissance was not performed inside buildings during the EQS.**
- 3. The EBS does not adequately characterize historical land-uses and the potential for contamination relying instead on incomplete information.**
- 4. In the absence of complete historical information the EBS fails to perform a comprehensive sampling plan. Sample locations were limited to selected sites and sample densities as low as one sample per six acres were used.**
- 5. The Sampling plan was technically flawed. Samples were not collected at depths at which contamination would be expected to be found.**
- 6. The EQS failed to characterize the extent of soil and groundwater pollution.**
- 7. The risk screening results are not reported. The one summary of chemicals of concern does not reference petroleum hydrocarbons.**
- 8. The recommendations and cost estimates for remediation and further investigation should be viewed as preliminary. These proposed actions and associated cost figures cannot be accurately**

- determined with the existing investigation data.
9. The EQS contains numerous misrepresentations, errors and omissions which undermine the credibility of the conclusions reached within.

**It is CRC's opinion that the results of sampling performed during the EBS indicate that existing environmental conditions within the Freeport Zone present an imminent and substantial endangerment to human health and the environment.**

**CRC's opinion is based on the following facts:**

1. The potential for exposure to uncontrolled toxic waste sites identified throughout the Freeport Zone.
2. The potential exposure to unexploded ordnance (UXO) in the Freeport Zone and surrounding Subic Bay waters.
3. The potential presence of methane gas in explosive concentrations near landfill areas and other areas where extensive petroleum contamination is found.
4. The potential presence of toxic gases (such as the vinyl chloride found at Site 40) in landfill areas and other areas where extensive contamination is found.
5. The potential for health impacts to subsistence fisherfolk from the accumulation of toxics in fish and other marine life residing in Subic Bay waters.
6. The potential for health impacts from exposure to hazardous waste in fill used in reclaimed areas.
7. The potential for exposure to asbestos during construction and demolition activities.
8. The potential for health impacts from exposure to unidentified "hot spots."

**CRC's comments have been organized into two sections. Section 2.0 specifically addresses Volume I, the Executive Summary and comments on the objectives, scope and limitation of the EQS. Section 2.0 also addresses the site history and site characterization, and how this information was used to evaluate the potential for, and significance of toxic contamination. Section 3.0 addresses the individual findings and recommendations for the 44 sites investigated during the EQS sampling. Section 4.0 addresses the findings and recommendations of the Ecological Baseline Study.**

**CRC's comments are limited to the first three volumes**

**of the EBS. Volume IV primarily contained the results of fauna and flora surveys, and the results of air and water quality studies that did not deal specifically with toxic materials.**

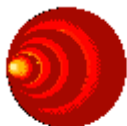
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[Section 1 Introduction](#) - [Section 2 Executive Summary](#) - [Section 3 Sampling Sites](#) - [Section 4 Ecological Baseline Study](#)

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June 1, 1999



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## Military Bases: Philippine Bases

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[How to help](#)

Clearwater Reports  
[Subic Bay Naval Base](#)  
[Clark Air Force Base](#)

### Technical Review Report Environmental Baseline Survey Former United States Navy Installation Subic Bay, Philippines June 30, 1998

## Section 3.0: SAMPLING SITES

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US Military

[Philippines](#)

[Alameda Point](#)

[Chemical Weapons](#)

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[Home Page](#)

[Brownfields](#)

[Military](#)

[Cleanup](#)

1. [Introduction](#)
  2. [Executive Summary](#)
  3. [Sampling Sites](#)
  4. [Ecological Baseline Study](#)
- 

### 3.0 SAMPLING SITES

- [Site 1 - Naval Air Station](#) - Fire Fighting Training Pit
- [Site 2 - Naval Air Station](#) - Crash Crew Training Tank
- [Site 3 - Naval Air Station](#) - Washrack Holding Tank,  
Structure 8415
- [Site 4 - Naval Air Station](#) - Washrack Holding Tank,  
Structure 8416
- [Site 5 - Naval Air Station](#) - Boat Shop, Building 8122
- [Site 6 - Naval Air Station](#) - Boton Wharf PWC Vehicle  
Maintenance Yard
- [Site 7 - Naval Air Station](#) - Construction Battalion Vehicle  
Maintenance
- [Site 8 - Naval Air Station](#) - Jet Engine Maintenance and  
Testing Facility
- [Site 9 - Naval Air Station](#) - General Industrial Area East of  
Boton Wharf
  
- [Site 10 - Naval Magazines](#) - Small Arms (Pistol) Range
- [Site 11 - Naval Magazines](#) - Ammunition Disposal  
Burning Pit
- [Site 12 - Naval Magazines](#) - Demilitarization Facility
- [Site 13 - Naval Magazines](#) - Wood Treatment Facility
  
- [Site 14 - Naval Station](#) - Suspected Former Dump
- [Site 15 - Naval Station](#) - Former Navy Exchange Taxi

## Compound

[Site 16 - Naval Station](#) - Spanish Wharf

[Site 17 - Naval Station](#) - Lower MAU

[Site 18 - Naval Station](#) - Boton Valley Dredge Spoil

## Stockpile Areas

[Site 19 - Naval Station](#) - Naval Hospital

[Site 20 - Naval Supply Depot](#)

[Site 21 - Public Works Center](#) - Vehicle Maintenance Center

[Site 22 - Public Works Center](#) - Former Pest Control Shop, Building 868

[Site 23 - Public Works Center](#) - Former Hazardous Waste Facility, Bldg. CA-16

[Site 24 - Public Works Center](#) - Cubi Point Power Station

[Site 25 - Public Works Center](#) - Defense Reutilization & Marketing Office Yard

[Site 26 - Public Works Center](#) - Transformer Reconditioning Shop

[Site 27 - Public Works Center](#) - Trash and Recycling Facility

[Site 28 - Public Works Center](#) - Fleet Mooring and Sand Blasting Yard

[Site 29 - Public Works Center](#) - Asphalt Plant

[Site 30 - Public Works Center](#) - Fleet Mooring Storage Yard

[Site 31 - Public Works Center](#) - Building 898, Transformer Storage Shed

[Site 32 - Public Works Center](#) - Materials Department Open Storage Yard

[Site 33 - Ship Repair Facility](#) - Sand Blasting Facility Causeway

[Site 34 - Ship Repair Facility](#) - Deltic Yard

[Site 35 - Ship Repair Facility](#) - Sheet Metal and Battery Shop

[Site 36 - Ship Repair Facility](#) - Battery Shop

[Site 37 - Ship Repair Facility](#) - Plating Shop

[Site 38 - Ship Repair Facility](#) - Foundry

[Site 39 - Ship Repair Facility](#) - Hazardous Material Storage Area

[Site 40 - Other](#) - Building 650 - Base Laundry and Dry Cleaner

[Site 41 - Other](#) - Binictican Golf Course Pesticide Area

Site 42 - site reference not used.

[Site 43 - Naval Magazines](#) - Air Underwater Magazine

[Site 44 - Public Works Center](#) - Subic Power Plant

[Site 45 - Public Works Center](#) - Sanitary Landfill

[Site 46 - Other](#) - Existing Monitoring Wells

[Site 47 - Other](#) - Sediment Samples

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[Section 1 Introduction](#) - [Section 2 Executive Summary](#) - [Section 3 Sampling Sites](#) - [Section 4 Ecological Baseline Study](#)

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## Military Bases: Philippine Bases: Subic Bay Public Works Center

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Philippine

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[How to help](#)

Clearwater Reports  
[Subic Bay Naval Base](#)  
[Clark Air Force Base](#)

US Military

[Philippines](#)

[Alameda Point](#)

[Chemical Weapons](#)

Toxicspot.com

[Home Page](#)

[Brownfields](#)

[Military](#)

[Cleanup](#)

### Section 3.0: SAMPLING SITES: Public Works Center

---

1. [Introduction](#)

2. [Executive Summary](#)

3. [Sampling Sites](#)

1. [Naval Air Station](#)

2. [Naval Magazine](#)

3. [Naval Station](#)

4. [Naval Supply Depot](#)

5. [Public Works Center](#)

[PWC21 - Vehicle Maintenance Center](#)

[PWC22 - Former Pest Control Shop, Building 868](#)

[PWC23 - Former Haz Waste Facility, Bldg. CA-16](#)

[PWC24 - Cubi Point Power Station](#)

[PWC25 - DRMO Yard](#)

[PWC26 - Transformer Reconditioning Shop](#)

[PWC27 - Trash and Recycling Facility](#)

[PWC28 - Fleet Mooring and Sand Blasting Yard](#)

[PWC29 - Asphalt Plant](#)

[PWC30 - Fleet Mooring Storage Yard](#)

[PWC31 - Building 898, Transformer Storage Shed](#)

[PWC32 - Materials Department Open Storage Yard](#)

[PWC44 - Subic Power Plant](#)

[PWC45 - Sanitary Landfill](#)

6. [Ship Repair Facility](#)

7. [Other](#)

#### 4. [Ecological Baseline Study](#)

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### 3.0 SAMPLING SITES

#### Public Works Center

##### 3.21 PWC21 - Vehicle Maintenance Center

###### **No site history is provided.**

All the site history information provided by the EQS could be gathered from the name of the site. In light of the lack of historical information an inadequate level of sampling was performed.

###### **Volatile Organic results in soils are inconclusive.**

The use of shallow soil samples to investigate sources such as underground tanks and fuel piping was inappropriate.

###### **Inconsistencies between text and tables.**

A total of 35 soil samples and three monitoring wells appear to have been performed on Site 21. Table E.1 indicates 31 soil samples and 2 monitoring wells.

The text of the EQS indicates 29 surface soil samples were collected from Site 21. The text also indicates that 30 surface soil samples were collected from Site 21.

###### **Groundwater screening results are misstated.**

"The concentration of benzene 26 µg/L is below the WHO drinking water standard of 10 µg/L."

###### **Site 21 poses an imminent threat to the environment.**

"The free product appears to be emanating from underground storage tanks located in this area....Petroleum product was also observed seeping into the drainage canal at the time of the investigation." Action is necessary to address the ongoing source of this contamination.

###### **Site 21 poses an imminent threat to public health.**

Buildings and utility manholes in the vicinity of Site 21 have the potential for explosive atmospheres to develop from decomposing petroleum. Further investigation of the extent of contamination is warranted.

###### **Estimates cost of remediation maybe understated.**

Remediation at an estimated cost of \$100,000 to \$225,000 US dollars has been recommended for Site 21. This cost includes excavation of 4,000 to 9,000 cubic meters of petroleum contaminated soil which would be treated by landfarming. Only limited actions would address groundwater contamination.

### **3.22 PWC22 - Former Pest Control Shop, Building 868**

#### **Site history begins in 1980**

No information is given on activities conducted at Site 22 prior to 1980.

#### **Potential for contaminant migration from nearby sites.**

The potential for contaminant migration from nearby sites was not considered. Site 22 is located adjacent to Site 23, Hazardous Waste Facility and Site 32, Materials Department Open Storage Yard.

#### **More detailed investigation is needed.**

Despite soil samples which contain DDT and chlordane in excess of screening limits, and groundwater which contains lead and arsenic above screening limits, no further action was recommended for Site 22. A more detailed investigation is recommended only if a change in use occurs.

### **3.23 PWC23 - Former Hazardous Waste Facility, Building CA-16**

#### **No information provided on inventory.**

The EQS does not provide specific information on the volumes and locations of storage areas for different types of hazardous materials.

#### **Potential for contaminant migration from nearby sites.**

The potential for contaminant migration from nearby sites was not considered. Site 23 is located adjacent to Site 22, Pest Control Shop, and Site 32, Materials Department Open Storage Yard. **Volatile Organic results in soils are inconclusive.**

Only shallow soil samples were collected from this site.

#### **More detailed investigation is needed.**

Despite soil samples which contain DDT, dieldrin and chlordane in excess of screening limits, and groundwater which contains lead and arsenic above screening limits, no further action was recommended for Site 23. A more detailed investigation is recommended only if a change in use occurs.

### **3.24 PWC24 - Cubi Point Power Station**

#### **No information provided on hazardous material inventory.**

No specific information on volumes and locations of storage areas for different types of hazardous materials was provided in the EQS.

#### **Potential for contaminant migration to nearby sites.**

The potential for contaminant migration from Site 24 was not considered. Site 24 is located adjacent to Site 6, Site 7, and Site 8.

#### **Potential for contaminants in unlined drainage ditches near Site 24.**

Oil and water separators are reportedly located throughout the site. It is noted that these separators may have overflowed on occasion and released contaminated water to unlined drainage ditches on two sides of Site 24. Potential contamination in these drainage ditches was not investigated.

#### **Air pollutant deposition from hazardous waste incineration.**

Site 24 may have used hazardous wastes including waste oil, PCBs, solvent wastes and off-specification fuels to power electrical generators. Site 24 may have produced hazardous air emission containing heavy metals, polynuclear aromatics and dioxins. Hazardous pollutants present in air emissions may have been deposited in the areas downwind from Site 24. The cumulative affect of air pollutant deposition over the 30 year life of the power generating facility should be investigated.

#### **Dioxin sampling recommended.**

Given the concentrations and extent of PCBs detected in soils at Site 24, a high potential exists that dioxins maybe present. Site 24 should be sampled for the presence of dioxins.

**Remedial actions inappropriate.**

The EQS recommends that 9,000 cubic meters of petroleum contaminated soil be excavated from Site 24 and land-farmed to reduce petroleum concentrations. The recommendation ignores the presence of high levels of PCBs in soils which are not susceptible to treatment by land-farming. Soil excavated from Site 24 would require additional treatment prior to disposal to reduce the health and environmental impacts of PCBs.

**No recommendations to address groundwater contamination.**

The EQS does not recommend further action to address groundwater contamination at Site 24. Site 24 groundwater contains arsenic, lead, and manganese in excess of screening limits. Petroleum contamination was also found in both groundwater monitoring wells installed at the site. Investigation of the extent and magnitude of groundwater contamination is recommended.

**3.25 PWC25 - Defense Reutilization and Marketing Office Yard****Collapse of hazardous material storage buildings.**

The Mt. Pinatubo eruption resulted in the collapse of two hazardous waste storage warehouses. The fate of the buildings is described in the EQS but not the fate of the hazardous waste stored within.

**Potential for contaminant migration to nearby sites.**

The potential for contaminant migration from Site 24 was not considered. Site 25 is located adjacent to Site 15 and Site 34.

**Volatile Organic results in soils are inconclusive.**

Only shallow soil samples were collected from this site.

**Potential to overlook a toxic hot-spot.**

A total of 36 soil samples were collected from an approximate grid pattern of 30 meters by 35 meters. The sample density is about three samples per acre throughout the 11 acre site. There is about a 10 percent chance a toxic hot-spot with the size of 30 by 35 meters may have been overlooked.

**Dioxin sampling recommended.**

Given the concentrations and extent of PCBs detected in soils at Site 25, a high potential exists that dioxins maybe present. Site 25 should be sampled for the presence of dioxins.

**Example of US Navy's tidy operations.**

"Weathering caused the drums and equipment to deteriorate, and numerous leaks and spills of petroleum oils, solvents, acids, and PCBs were reported to have occurred." These observations indicate that the Navy neglected hazardous waste management responsibilities.

**Remedial actions inappropriate without further investigation.**

The EQS recommends that petroleum contaminated soil be scraped from Site 25 and sampled to determine if the levels of PCBs and metals require the soil to be stabilized prior to land-filling. PCBs were detected in over half of the 36 surface soil samples at concentration as high as 36 ppm.

The EQS assumes that contamination is not present beneath the heavily contaminated surface soils that were collected. It is entirely likely that contamination extends from the ground surface to the groundwater surface. Further investigation of Site 25 is required to determine the area and depth for which soil remediation is required.

**No recommendations to address groundwater contamination.**

The EQS does not recommend further action to address groundwater contamination at Site 25. Site 25 groundwater contains lead in excess of screening limits. Petroleum contamination was also found in all the groundwater monitoring wells installed at the site. Investigation of the extent and magnitude of groundwater contamination is recommended.

**3.26 PWC26 - Transformer Reconditioning Shop****History determined from name of site.**

No specific information on dates of operation or storage areas for hazardous materials are provided in the EQS.

**Gridded sample pattern was used.**

Twenty-one surface soil samples were collected from approximate 15 meter by 27.5 meter grid. There is an approximate 10 percent potential that a toxic hot-spot greater than 15 by 27.5 meters will be over-looked with the given sample density.

**Dioxin sampling recommended.**

Given the concentrations and extent of PCBs detected in soils at Site 26, a high potential exists that dioxins maybe present. Site 26 should be sampled for the presence of dioxins.

**Potential for contaminant migration to nearby sites.**

The potential for contaminant migration to Site 26 was not considered. Site 26 is located adjacent to Site 21 where floating product was found over a large area of the groundwater surface.

**Extensive petroleum contamination at site needs to be further investigated.**

The results of TPH analysis of groundwater samples from Site 26 were not reported in a Table 26.3.1. Discussion in the text indicates that high levels of TPH were found in samples from both monitoring wells.

**Chlorobenzene in groundwater requires further investigation.**

Transformer oils are generally a mixture of PCBs and chlorobenzenes. The presence of high levels of chlorobenzene in groundwater at the site indicate serious and widespread contamination by transformer oil.

The EQS does not recommend further action to address groundwater contamination at Site 26. Site 26 groundwater contains lead, manganese, benzene and chlorobenzene at concentrations that exceed screening limits. Petroleum contamination was also found in all the groundwater monitoring wells installed at the site. Investigation of the extent and magnitude of groundwater contamination is recommended.

**Remedial actions inappropriate without further investigation.**

The EQS recommends that petroleum contaminated soil be scraped from Site 26 land-farm to reduce petroleum concentrations prior to land-filling. Contaminants found in

soils at the site including PCBs, lead, and chlorobenzene are not susceptible to treatment by landfarming. The costs to address the further investigation and remediation of this site have been underestimated.

### **3.27 PWC27 - Trash and Recycling Facility**

#### **History determined from name of site.**

No specific information on dates of operation or storage areas for hazardous materials are provided in the EQS.

#### **Potential for contaminant migration to nearby sites.**

The potential for contaminant migration to Site 27 was not considered. Site 27 is located adjacent to Site 30.

#### **Location of groundwater monitoring well.**

The monitoring well does not appear to be located to intercept contaminant migration from any known sources at the site. Groundwater flow has been described to flow in a westerly direction throughout the Freeport Zone. MW-1 is located to the south of known or suspected contaminant source areas.

#### **Potential Asbestos Containing Material located at site.**

Construction debris including metal ducts and insulation material are found at the south-side of the facility. Asbestos wastes may have been handled at the facility throughout its operating life. The EQS maintains that asbestos was not included within the scope of environmental assessments because all asbestos is located either in buildings or securely buried in a land-fill. Conditions at Site 27 contradict the EQS characterization of asbestos risk and the need to evaluate asbestos risks throughout the Freeport Zone.

#### **Further investigation of soil and groundwater contamination is warranted.**

Arsenic, PAHs, manganese and PCBs are all detected above the screening levels in soils at the site. Manganese is detected above the screening level in groundwater. Petroleum contamination is also present in soils and groundwater. The EQS has recommended further action at the site only if the site is redeveloped.

### **3.28 PWC28 - Fleet Mooring and Sandblasting Yard**



**Site history begins in 1969.**

Previous uses of the property was not provided. Information on hazardous material use is unavailable. In the absence of this information an inadequate number of samples were collected.

**Soil sample locations.**

It appears that neither a random sample grid nor targeted sample locations were used at Site 28. Only three of the 12 soil sample locations were located in an area where there was not pavement. Evidence paint chips and sand-blasting residues were observed throughout the unpaved area.

**Potential for contaminant migration to nearby sites.**

The potential for contaminant migration to Site 28 was not considered. Site 28 is located adjacent to Site 29 and Site 32.

**Scope of analysis did not target suspected contaminants.**

PAHs, tri-butyl tin, and TPH were not included in the scope of analysis for Site 28. PAHs are associated with paint residues, tri-butyl tin with marine paints, and TPH with a variety of paint related products.

**Results of volatile organic analysis is inconclusive.**

Volatile organics are not generally found in surface soil samples.

**Further investigation of metals in soils.**

Arsenic, chromium, lead and manganese each exceeded their respective screening limits in soils at the site. High levels of copper and zinc relative to background concentrations were found in shallow soils too. Further investigation on the extent of metal contamination is warranted. The EQS has recommended further investigation only if a change in property use occurs. The current property condition however has a potential to impact stormwater quality and results in environmental impacts including the poisoning of marine life.

**3.29 PWC29 - Asphalt Plant**

**No historical information is provided in the EQS.**

Given the limited historical information, an inadequate number of samples were collected during the EQS.

**Potential for contaminant migration to nearby sites.**

The potential for contaminant migration to Site 29 was not considered. Site 29 is located adjacent to Site 28.

**Location of soil samples not provided**

The "not to scale" map does not reference sampling locations to known landmarks. The size of the gridded sampling plan that was used is unknown.

**Groundwater well not located in area of greatest contamination.**

Preliminary sampling indicated high levels of TPH were found in four locations above the screening level. Groundwater characterization indicates that groundwater flow is towards the west and Subic Bay waters. The groundwater monitoring well is located hydraulically upgradient and to the North of the area with identified contamination. The low levels of TPH in groundwater samples is not representative of groundwater conditions in the most likely area of contamination at Site 29.

**Petroleum contamination of soils and groundwater warrant further investigation.**

The single groundwater monitoring well contained petroleum contamination. Petroleum contamination was wide-spread in soil samples being detected in 11 of 12 surface samples. In four of the 12 samples petroleum screening levels were exceeded. The EQS recommends removal of 2,000 to 3,000 cubic meters of soil for land-farming and landfill disposal. The EQS does not recommend further action to address groundwater contamination at Site 29.

**3.30 PWC30 - Fleet Mooring Storage Yard**

**No historical information is provided.**

"No information regarding the type or quantity of materials stored at the facility is available." (Vol. 2, p. 31-1). Given the site history does not include dates of operation, and no inventory of hazardous materials exists, an inadequate number of samples were collected from the site.

**Potential for contaminant migration to nearby sites.**

The potential for contaminant migration to Site 30 was not considered. Site 30 is located adjacent to Site 27 and Site 31.

**Potential Asbestos Containing Material located at site.**

Demolition debris was dumped in a corner of Site 30. This debris may potentially contain asbestos. Conditions at Site 30 indicate the need to evaluate asbestos risks throughout the Freeport Zone.

**Potential source of contamination ignored during sampling.**

No samples were collected from a large area of the site because it was covered in metal scrap. This scrap included drums of hazardous materials and batteries.

**Results of volatile organic analysis is inconclusive.**

Volatile organics are not generally found in surface soil samples.

**Petroleum contamination warrants further investigation.**

Petroleum was found in 10 of the 11 surface soil samples. It is highly probable that these petroleum hydrocarbons may contain a PAH fraction and represent greater risk. No PAH analysis was performed on samples from Site 30 to evaluate this potential health risk. Further investigation is only recommended if the use of the site changes. Groundwater may also be impacted by the contamination identified in soil samples. A groundwater investigation should be performed at Site 30.

**3.31 PWC31 - Building 898, Utilities Department Yard and Transformer Storage Shed**

**No historical information.**

The only historical information presented in the EQS for Site 31 is the fact that the site was used during the Navy's PCB elimination program. Given that is the extent of information presented on hazardous material uses at the site, an inadequate number of samples were collected from the site.

**Results of both analysis and risk screening are misstated.**

"SVOC and PCB were not detected in either the initial or confirmation surface soil samples." PCBs are reported in SS02, SS08, and SS10, at concentrations in excess of screening limits.

**Further investigation of the extent of PCB contamination is warranted.**

PCB contamination should be further investigated to determine corrective action requirements. The EQS has not recommended future investigation or remedial work at this site.

**3.32 PWC32 - Materials Department Open Storage Yard**

**No historical information.**

Given the limited historical information reported in the EQS an inadequate number of samples were collected from this parcel

**Potential for contaminant migration to nearby sites.**

The potential for contaminant migration to Site 30 was not considered. Site 30 is located adjacent to Site 27 and Site 31.

**The impact of a fire at Site 32 was not investigated during the EQS.**

Building 794, used for flammable material storage, reportedly was gutted by fire. It is expected that an effort would have been made to extinguish the fire, and the resulting run-off would likely have contained both the hazardous materials stored in the building but any combustion products that may have been formed. One surface soil sample was collected within 50 feet of this building. One monitoring well was installed at an unknown distance from the building in the presumed upgradient groundwater flow direction.

**Discussion does not refer to petroleum in groundwater, makes inaccurate statements about analytical results.**

Significant contamination of groundwater is present according to Table 32.4.1. This fact is not referenced in the text discussing groundwater results or in discussing the need for further action. Benzene is present above drinking water standards at 54 µg/L. Chlorobenzene is present at 1,205 µg/L. Both benzene and chlorobenzene

concentrations exceed groundwater screening limits. The text states "HVOCs and SVOCs were not found in any of the groundwater samples." Chlorobenzene is a HVOC. The presence of chlorobenzene indicates that PCBs would likely be present at the site. The text also indicates that arsenic exceeded drinking water standards in PWC32-MW2-GW1, Table 32.4.4 indicates that arsenic was not detected in that sample.

**Severe and widespread contamination should be investigated.**

Results from Site 32 indicate severe and widespread contamination at this site. Further investigations of soil and groundwater quality should be performed to determine appropriate corrective action at the site. The EQS recommends future investigations of the facility only if the use of the property is changed.

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