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Record of Decision:**

**NAVAL SECURITY GROUP ACTIVITY  
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SABANA SECA, PR  
09/20/1996**

FINAL

RECORD OF DECISION  
SITE 6, FORMER PEST CONTROL SHOP

NAVAL SECURITY GROUP ACTIVITY  
SABANA SECA, PUERTO RICO

CONTRACT TASK ORDER 0279

SEPTEMBER 27, 1996

Prepared For:

DEPARTMENT OF THE NAVY  
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## LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COPC	contaminant of potential concern
DOD	Department of Defense
ELCR	Excess Lifetime Cancer Risk
FFA	Federal Facilities Agreement
FS	Feasibility Study
HI	hazard index
IAS	Initial Assessment Study
: tg/kg	micrograms per kilogram
: tg/L	micrograms per liter
mg/kg	milligrams per kilogram
MCL	Federal Maximum Contaminant Level
NPL	National Priorities List
NPW	net present worth
NSGA	Naval Security Group Activity
PCBs	polychlorinated biphenyls
PREQB	Puerto Rico Environmental Quality Board
RA	Risk Assessment
RAA	remedial action alternative
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SVOCs	semivolatile organic compounds
TBC	To Be Considered criteria
TRC	Technical Review Committee
TSCA	Toxic Substances Control Act
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
Versar	Versar, Inc.
VOCs	volatile organic compounds

## **DECLARATION**

### **Site Name and Location**

Site 6 - Former Pest Control Shop  
Naval Security Group Activity  
Sabana Seca, Puerto Rico

### **Statement of Basis and Purpose**

This decision document presents the selected remedy for Site 6 at the Naval Security Group Activity (NSGA) Sabana Seca. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record file for Site 6, the Former Pest Control Shop.

### **Assessment of the Site**

Navy investigation and study has found no unacceptable risk to human health or the environment from the pesticide contamination of soil that has occurred in this area. Nevertheless, the site is adjacent to a playground/picnic area and the enlisted housing area. Therefore, as a reassurance to the public, the Navy is conservatively selecting a remedial alternative that will limit the public's exposure to the minimal contamination that may remain in the soil at Site 6.

### **Description of Selected Remedy**

The selected remedy for Site 6 is an asphalt cap over the areas where pesticides were previously detected in the surface soils. The fence that is currently around portions of Site 6 will be removed. The area will be cleared and grubbed. An eight inch sub-base layer of gravel will be placed in the area to be capped. A four inch layer of asphalt will be placed over the gravel sub-base layer. The surface of the cap will be sloped to drain. The area around the cap will be leveled with clean fill and the site will be revegetated.

### **Statutory Determinations**

The selected remedy is protective of human health and the environment and complies with Federal and Commonwealth requirements that are legally applicable or relevant and appropriate, and is cost effective. Though there is no unacceptable risk to human health or the environment from Site 6, because of its proximity to adjacent playground/picnic and housing areas, this pro-active remedy is being selected to limit the public's exposure to the minimal contamination that may remain in soils at the site. Because this remedy will not result in hazardous substances remaining on site above health-based levels, the five year review will not apply to this action.

<IMG SRC 0296276>

Signature (Commanding Officer, NSGA Sabana Seca)

Date

<IMG SRC 0296276A>

Signature (Chairman, Puerto Rico Environmental Quality Board)

Date

<IMG SRC 0296276B>

Signature (Regional Administrator, USEPA Region 2)

Date

## **1.0 SITE NAME, LOCATION, AND DESCRIPTION**

The Naval Security Group Activity (NSGA) Sabana Seca provides communications and support for the U.S. Navy and other Department of Defense (DOD) elements. NSGA Sabana Seca is located approximately 14 miles west of the city of San Juan on the island of Puerto Rico. The Activity consists of a North and South Tract together covering over 2,200 acres of land. This Record of Decision (ROD) is for Site 6, the Former Pest Control Shop, in the South Tract.

Figure 1 presents a map of the South Tract and the location of Site 6 within the South Tract. As shown, the South Tract is bounded to the north by the village of Sabana Seca, to the east by Route 866, to the south by Route 22, and to the west by the Toa Baja and Bayamon Municipal Landfills and the U.S. Department of Health and Human Services Research Facility.

Figure 2 presents a map of Site 6 and shows the adjacent property uses. Site 6 covers an area of approximately 11,050 square feet. The site is surrounded by a chain link fence that was installed in 1988. Site 6 is bordered to the south by Stone Road which is the main road through the Activity. An access gate to the site is located along Stone Road. The enlisted base housing is south and across Stone Road from Site 6. A playground/picnic area is north and west of Site 6. The area northeast and east of the site and the immediate area around Site 6 are maintained lawns. Areas to the west outside of the maintained lawns are heavily vegetated and not developed. The Pest Control Shop building was formerly located in the north-central portion of the site. The site is currently overgrown with vegetation inside the fenced area.

Site 6 is located north of the geologic region known as the Haystack Hills. Haystack Hills is the local name given to an area featuring karst topography, characterized by steeply sloped limestone hills, sinkholes, and caves. The area around Site 6 is relatively flat.

The only surface water present at Site 6 results from the accumulation of rain water into a low area east of the site. There is no surface water present during the drier seasons. Groundwater flow in the area is generally to the north-northeast.

## **2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES**

NSGA Sabana Seca was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) on October 4, 1989. The United States Environmental Protection Agency (USEPA) Region II; the Puerto Rico Environmental Quality Board (PREQB); and the United States Department of the Navy then entered into a Federal Facilities Agreement (FFA) for NSGA Sabana Seca in March, 1992. The primary purpose of the FFA was to ensure that environmental impacts associated with past and present activities at the Station were thoroughly investigated and appropriate CERCLA response/Resource Conservation and Recovery Act (RCRA) corrective action alternatives were developed and implemented as necessary to protect public health and the environment.

The following sections describe history and previous investigations conducted at Site 6.

### **2.1 Site History**

Site 6 was operational as a pest control shop from the mid-1950s through 1979. Pesticides were accidentally spilled in and around the building during this time. Pesticides were stored in a small concrete building and on concrete pads adjacent to the building. Pesticides were mixed and application equipment cleaned in a sink outside the building which discharged directly to the ground. Drainage from the site flows north to the eastern perimeter of the Station's picnic/playground area. The pesticides reportedly used or stored at this site in the past included: DDT, lindane, chlordane, Paris Green, 2,4-D, malathion, diazinon, sevin, PRAMITOL,

and esteron (a mixture of 2,4-D and 2,4,5-T). Paris Green is an arsenic-based insecticide, and PRAMITOL is a non-selective herbicide of the triazine family that is adsorbed by foliage and roots and inhibits photosynthesis.

In October 1987, the materials stored in the pesticide shop were removed and taken to the Station's hazardous storage facility and the building was demolished. The demolition debris including concrete, shingles, etc., were taken to the nearby Bayamon/Toa Baja municipal landfill. A clean layer of topsoil was placed on the site, and the area was vegetated. As previously mentioned, the site was enclosed in a chain-link fence to limit public access. The fence gate is locked at all times. Warning signs are posted in English and Spanish. This area along Stone Road is patrolled regularly by military police.

In February and March 1989, the Station disposed of computers and communications equipment cabinets at Site 6. Electric components containing Polychlorinated Biphenols (PCBs) were removed from the equipment cabinets and disposed off site in accordance with the Toxic Substances Control Act (TSCA). The equipment (radio) cabinets were then stored at Site 6 on top of a heavy gauge plastic (Refer to Figure 2). PCB-bearing components were never stored at Site 6, and no PCBs have been detected at the site. The equipment cabinets are scheduled for removal and disposal in the third quarter of 1996.

## 2.2 Previous Investigations/Enforcement Activities

A summary of the previous investigations conducted at Site 6 is presented below.

### 2.2.1 Initial Assessment Study

In 1984, an Initial Assessment Study (IAS) was conducted for the Station. The purpose of the IAS was to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous material operations. This IAS involved reviewing historical records and aerial photographs, and conducting on-site inspections and personnel interviews.

During the IAS, one 55-gallon drum of 57-percent malathion was found stored inside the building, and one 55-gallon drum of chlordane was found stored outside on the concrete pad. Pesticide odors were noted. The IAS concluded the possibility of contaminants from the site could migrate via both surface water and groundwater. The IAS concluded that Site 6 warranted further investigation.

### 2.2.2 National Priorities Listing

NSGA Sabana Seca was proposed for inclusion on the NPL on June 24, 1988 and was included October 4, 1989. In March 1992, the Navy, USEPA, and the PREQB entered into a FFA for NSGA Sabana Seca.

### 2.2.3 Confirmation Study

Between 1986 and 1989, a Confirmation Study was conducted by Hunter/ESE. Two rounds of sampling were conducted for this study.

Round 1 consisted of collecting and analyzing 2 sediment and 34 soil samples. No surface water or groundwater samples were taken during Round 1. Round 2 consisted of installing one shallow groundwater monitoring well (S6GW01SL) east of the Former Pest Control Shop location and of collecting and analyzing two sediment, two surface water, and one groundwater sample. The sediment and surface water samples were taken from approximately the same location as the Round



1 sediment sample locations. No soil samples were taken during Round 2.

The soil analyses indicated that the pesticides aldrin, chlordane, DDD, heptachlor, and heptachlor epoxide were detected at concentrations ranging from 0.295 milligrams per kilogram to 41.0 milligrams per kilogram. Chlordane was detected in all soil samples. The sediment analyses indicated that the pesticides aldrin, BHC-D, chlordane, and heptachlor epoxide were detected at concentrations ranging from 0.0128 milligrams per kilogram (BHC) to 88.5 milligrams per kilogram (chlordane). No pesticides were detected in the groundwater or the surface water exceeding the analytical detection limits.

#### 2.2.4 Remedial Investigation/Feasibility Study

Between October 1991 and October 1993, Versar, Inc. (Versar) conducted the field sampling activities for the RI/FS at Site 6. Field activities included installing monitoring wells; conducting aquifer tests; collecting groundwater, soil, surface water and sediment samples; surveying; and collecting soil geotechnical samples. The sampling was conducted in four rounds. The results of the RI field investigation are summarized below with respect to the sampled media.

##### Groundwater

- A rising head slug test was conducted at monitoring well S6GW03SL. The data were evaluated using the method of Bouwer and Rice (1976) and Bouwer (1989). The hydraulic properties were calculated from this test include the hydraulic conductivity ( $1.9 \times 10^{-6}$  ft/min) and transmissivity ( $2.8 \times 10^{-4}$  ft<sup>2</sup>/min).
- After extensive groundwater level monitoring, the groundwater flow direction at Site 6 is generally toward the north. The RI concluded that groundwater at Site 6 is not impacted by the nearby Toa Baja/Bayamon Landfills, and that Site 6 does not impact the Station's water supply wells.
- The volatile organic compounds (VOCs), toluene, acetone and xylene, were detected at maximum concentrations of 12, 10, and 13 micrograms per liter, respectively.
- Three semivolatile organic compounds (SVOCs) were detected in four rounds: bis (2-ethylhexyl)phthalate, di-n-octylphthalate, and phenol at concentrations ranging from 1 to 70 micrograms per liter.
- No pesticides, PCBs, or herbicides were detected in any of the four sampling rounds.
- Two metals, iron and manganese, were detected in all four rounds of sampling in well S6GW01SL (located 60 feet northeast of the site). With only one minor exception, no metals were detected above Federal Maximum Contaminant Levels (MCLs) groundwater standards in four rounds of sampling. Chromium was detected at 119 micrograms per liter versus the MCL of 110 micrograms per liter.

##### Soil

- A VOC, toluene, was detected at concentrations ranging from 0.005 to 0.015 milligrams per kilogram.
- Three SVOCs were detected: di-n-butylphthalate, bis(2-ethylhexyl)phthalate, and di-n-octylphthalate at concentrations ranging from 0.086 to 1.40 milligrams per kilogram.

- No herbicides or PCBs were detected in the soil samples.
- Four pesticides were detected: heptachlor, heptachlor epoxide, alpha-Chlordane, and gamma-Chlordane. The detected concentrations ranged from 0.0037 milligrams per kilogram to 27 milligrams per kilogram.
- Six metals were detected: aluminum, arsenic, chromium, cobalt, selenium, and vanadium at concentrations ranging from 1.6 to 58,800 milligrams per kilogram. These detections were in the area of the former pest control shop.

#### Surface Water

- Surface water was only present during the wet season.
- The VOC, toluene, was detected in one round of surface water samples at concentrations of 95 micrograms per liter and 110 micrograms per liter.
- The SVOCs, phenol, 3-methylphenol, and 4-methylphenol were detected in one round of surface water samples. The detected concentrations ranged from 42 to 130 micrograms per liter.
- No pesticides, PCBs, or herbicides were detected in the surface water samples.
- Four metals were detected in the samples: antimony, arsenic, manganese, and zinc at concentrations ranging from 4.1 to 176 micrograms per liter. No trends were identified.
- Cyanide was detected with concentrations ranging from 1.8 to 2.3 micrograms per liter.

#### Sediment

- Surface water is only present during the wet season. When surface water was present the samples collected under the surface water were considered sediment. When the site is dry the sediment is considered to be soil.
- The only VOC detected in the sediment samples was methylene chloride at concentrations ranging from 0.008 to 0.010 milligrams per kilogram.
- No SVOCs, PCBs, or herbicides were detected in the sediment samples.
- Seven pesticides were detected: heptachlor epoxide; endosulfan I; 4,4'-DDE; 4,4'-DDD; endosulfan sulfate; alpha-Chlordane; and gamma-Chlordane. The detected concentrations ranged from 0.013 milligrams per kilogram to 0.500 milligrams per kilogram.
- The metals calcium (6.67 milligrams per kilogram) and zinc (0.493 milligrams per kilogram) were detected in the sediment samples at one station, which is located furthest from Site 6.
- Arsenic was detected at concentrations of 0.0007 to 0.0091 milligrams per kilogram.

### **3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION**

The RI/FS and Proposed Plan documents for Site 6 were released to the public in May 1996. These documents are available in an administrative record file at information repositories maintained at a local public library and at the Station library. The Proposed Plan is available in English and Spanish. Technical Review Committee (TRC) members have participated in the review of draft documents and have worked together to finalize these documents. The notice of availability of the Proposed Plan and RI/FS documents was published in the local papers in English and Spanish. A public comment period was held from May 15, 1996 to June 15, 1996. In addition, a Public Awareness Session, in lieu of a public meeting, was held on June 7, 1996, to respond to questions and to accept public comments on the Proposed Plan for Site 6. A Responsiveness Summary is included as part of this ROD. In the Responsiveness Summary, the Navy usually addresses public comments, however, no comments were received during the public comment period or at the Public Awareness Session.

### **4.0 SCOPE AND ROLE OF THE RESPONSE ACTION**

An asphalt cap over part of Site 6 is the only remedial action proposed for the various media. Though it has been concluded that there are no unacceptable risks at the site, a remedial action has been proposed. The remedial action will consist of clearing and grubbing the site, placing clean soil fill on the site, and installing an asphalt cap over areas where pesticides were formerly detected in the soil. This response action was selected due to the proximity of the site to playgrounds and housing areas. The goal of this selected remedy is to prevent human or environmental contact with soil that may contain minimal residual amounts of pesticide contamination.

### **5.0 SUMMARY OF SITE CHARACTERISTICS**

This section of the ROD presents an overview of the nature and extent of contamination with respect to the known or suspected sources of contamination, types of contamination, and affected media. Based upon the RI and the site history, the source of contamination is the Former Pest Control Shop that was located at the site. No additional sources of contamination were identified. In general, groundwater was encountered at 40 feet below the ground surface. Two water supply wells were identified within a one-mile radius of Site 6. Groundwater does not appear to have been impacted by past practices at Site 6. There is no pattern of site-related groundwater contamination identified. Federal groundwater standards were not exceeded in any sample collected from downgradient monitoring wells.

The metals detected during the groundwater sampling and their maximum detected concentrations are listed below:

aluminum	9,280 micrograms per liter
chromium	119 micrograms per liter
cobalt	33.6 micrograms per liter
iron	206,000 micrograms per liter
lead	14.5 micrograms per liter
manganese	1,080 micrograms per liter
mercury	0.43 micrograms per liter
nickel	31.8 micrograms per liter
potassium	108,000 micrograms per liter
vanadium	122 micrograms per liter
zinc	230 micrograms per liter

Metals were only found consistently in one well, S6OW01SL, which is not downgradient of Site 6. None of the metals detected in the downgradient wells (S6GW03SL and S6GW02SL) exceeded Federal MCLs. Metals concentrations cited were either detected in background wells, were isolated detections, were found in samples not downgradient from the site, or at low concentrations. Therefore, no trends of metals in the groundwater were attributed to former activities at Site 6.

The soils underlying the site generally consist of clay with some sand, silt, and weathered rock. The sediment and soil at Site 6 have been impacted by the activities at the former pest control shop. Soil contamination is dominantly pesticides with a minor contribution of toluene, phthalates and metals. The pesticides detected in the soil and sediment, and their maximum concentrations, included:

•	heptachlor epoxide	0.19 milligrams per kilogram -soil
•	heptachlor	0.0078 milligrams per kilogram - soil
•	endosulfan-I	0.061 milligrams per kilogram - sediment
•	endosulfan sulfate	0.035 milligrams per kilogram - sediment
•	4,4-DDD	0.14 milligrams per kilogram - sediment
•	alpha Chlordane	20 milligrams per kilogram - soil
•	gamma Chlordane	27 milligrams per kilogram - soil

Pesticides are generally highest in concentration in the immediate vicinity of the former shop. Data from the sediment samples are similar to that for soil data, but at lower concentrations. Figure 3 shows the approximate area of contaminated soil.

Rainfall water runoff sometimes ponds in a low area adjacent to the site. Where the intermittent ponding occurs, the soil samples have been called sediment samples and the water samples have been called surface water samples. Remediation of the soil and sediment would eliminate any potential surface water contamination problem.

## **6.0 SUMMARY OF SITE RISKS**

As part of the RI/FS, a human health Risk Assessment (RA) and an ecological RA were conducted for Site 6. These RAs evaluated the potential risks associated with Contaminants of Potential Concern (COPCs) detected at each site. The following subsections briefly describe the results of the RAs. The RI/FS report contains more extensive information pertaining to the RAs.

### **6.1 Human Health Risk Assessment**

A four-step process is used for assessing site-related human health risks for a reasonable maximum exposure scenario. Hazard Identification identifies COPCs at the site based on several factors such as toxicity, frequency of occurrence, and concentration. Exposure Assessment estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., drinking contaminated well water) by which humans are potentially exposed. Toxicity Assessment determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). Risk Characterization summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks.

The human health RA was conducted to estimate the potential risks to human health resulting from contaminant releases from Site 6. Groundwater was eliminated as a pathway of concern because pesticides were not detected during the four rounds of sampling and no trends were noted in the other detected compounds. The media of potential concern identified at the site were surface

soil, surface water, and sediment. Analytical results from the RI identified VOCs, SVOCs, pesticides, metals, and cyanide as COPCs. Table 1 contains a summary of the COPCs for each media of concern. Table 2 lists the exposure pathways. Tables 3 and 4 show Toxicity Values. The Summary of Pathway - Specific Risks is shown on Table 5.

The exposure routes evaluated for this RA included: incidental ingestion and dermal absorption of surface soils by future potential recreational and residential children and adults; incidental ingestion of surface soils by future potential commercial adult workers; dermal absorption during contact with surface water by future potential recreational pre-adolescent children; and dermal absorption during contact with sediments by future potential recreational pre-adolescent children. Recreational scenarios were evaluated since the site is located next to a playground/picnic area.

As part of this RA, the potential carcinogenic and noncarcinogenic risks were estimated for the COPCs at the site. Carcinogenic risks are the estimated incremental probability of an individual developing cancer over a lifetime because of exposure to a potential carcinogen. Current federal guidelines for acceptable carcinogenic risks are in the range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$  (one in ten thousand to one in one million). A noncarcinogenic risk is the likelihood of developing adverse health effects other than cancer resulting from a long-term (chronic) exposure to a noncarcinogenic COPC. Noncarcinogenic risk is expressed as a hazard index (HI), which is the ratio of the level of exposure to an acceptable level for all COPCs within a particular exposure pathway. If the HI is less than 1.0, the hazard is not considered a public health threat. The Excess Lifetime Cancer Risk (ELCR) calculated for Site 6 ranged from  $4.0 \times 10^{-6}$  (four in one million) to  $3.8 \times 10^{-5}$  (3.8 in one hundred thousand). The HIs calculated for the site ranged from 0.0024 to 0.993. These ELCRs and HIs are within the acceptable ranges.

The human health RA concluded that no media at Site 6 posed unacceptable risks or hazards to human health for the current or future use scenarios.

## 6.2 Uncertainty Analysis

Despite recent advances in risk assessment methodology, uncertainties are inherent in the risk assessment process. In order to appreciate the limitation and significance of the risk estimates, it is important to have an understanding of the sources and magnitudes of uncertainty. Sources of uncertainty in this risk assessment, as in any risk assessment, include:

- Sampling and analysis error,
- Chemical transport and fate modeling,
- Toxicity data,
- Exposure assessment, and
- Risk estimates.

## Environmental Media Sampling and Analysis

Sampling was conducted using accepted procedures in an attempt to collect samples that were representative of environmental media. Analyses were performed in accordance with the USEPA procedures. Data were subsequently reviewed in a data validation process; however, current analytical procedures may not identify all potentially hazardous contaminants at a site, and analytical errors may have occurred despite stringent QA/QC procedures. In conducting this risk assessment, it was assumed that the reported chemical concentrations were representative of actual site conditions.

## Chemical Transport and Fate Modeling

The 95th percentile upper confidence limit (UCL) (or maximum) concentrations of chemicals of potential concern found in soil, dust, sediment, and water on site were used as exposure point concentrations. Migration, dispersion, dilution, retardation, degradation, and other attenuation or transformation processes may occur over time that could change the chemical concentrations in various on-site medias. It has been conservatively assumed that the concentrations observed at Site 6 will remain relatively unchanged with time because, with the exception of the VOC toluene, all chemicals of concern are relatively persistent and immobile.

## Toxicity Data

The available scientific data on subchronic and chronic toxic effects in humans for the chemicals of concern found at Site 6 are limited. Consequently, varying degrees of uncertainty surround the assessment of adverse health effects in potentially exposed populations. Sources of uncertainties for toxic effects in humans include:

- Use of dose-response data from experiments on homogeneous, sensitive animal populations to predict effects in heterogeneous human populations with a wide range of sensitivities;
- Extrapolation of data from high doses in animals to "real-world" low doses, from acute or subchronic to chronic exposure, and from one route to another, (e.g., from ingestion to dermal absorption); and
- Use of single chemical data that do not account for possible antagonistic or synergistic responses from multiple chemical exposures.

Toxicity data are largely derived from laboratory animals. Experimental animal data have historically been relied upon by regulatory agencies and other expert groups to assess the hazards of chemicals to humans. Although this reliance has been supported by empirical observations, there may be slight or marginal interspecies differences in the absorption, metabolism, excretion, detoxification, and toxic responses to specific chemicals of concern. There may also be uncertainties concerning the relevance of animal studies using exposure routes that differ from human exposure routes. In addition, the frequent necessity to extrapolate results of short-term or chronic animal studies to humans exposed over a lifetime has inherent uncertainties. In order to adjust for many of these uncertainties, USEPA often adjusts the reference dose (RfD) for noncarcinogenic effects using uncertainty and modifying factors on the most sensitive animal species.

There is also uncertainty as to whether animal carcinogens are also carcinogenic in humans. While many chemical substances are carcinogenic in one or more animal species, only a small number of chemical substances are known to be human carcinogens. The fact that some chemicals are carcinogenic in some animals, but not in others, raises the possibility that not all animal carcinogens are carcinogenic in humans. USEPA assumes that humans are as sensitive to carcinogens as the most sensitive animal species. This policy decision, designed to prevent underestimating risk, may introduce the potential to overestimate carcinogenic risk for some chemicals.

The model used by USEPA to determine slope factors is the linearized multistage model that provides a conservative estimate of cancer risk at low doses and may overestimate the actual slope factor. Inadequate knowledge of the validity and accuracy of the linearized multistage model may increase the uncertainty and the tendency to overestimate actual cancer risks.

When dealing with exposures to chemical mixtures, USEPA assumes dose additivity and does not account for potential synergisms, antagonisms, differences in target organ specificity, or mechanisms of action.

Despite these many limitations, animal experiments are widely believed to be a necessary part of toxicity assessment, especially in the absence of human epidemiological data. The safety factors used in RfD derivations for single chemicals may compensate for any unknown effects of synergistic exposures.

#### Exposure Assessment

Exposure assessment is perhaps the most critical step in achieving a reliable estimate of health risks to humans. In this assessment, a number of assumptions were made concerning the human populations that could come into contact with Site 6 media and the frequencies and durations of these contacts. The exposure parameters used in this assessment were largely based on USEPA's Risk Assessment Guidance for Superfund (RAGS) and Exposure Factors Handbook, and may not be representative of the current and future receptor populations. There is also the presumption that interim and institutional measures at the site would not lead to changes in exposure conditions and receptor behaviors.

In accordance with USEPA Headquarters and USEPA Region 2 guidance, reasonable maximum exposures were calculated to provide estimates of potential exposures. Because reasonable maximum exposure estimates are based on a combination of conservative assumptions, these estimates are likely to be overestimates of typical exposures and risks at Site 6.

#### Risk Estimates

The actual risks associated with a given exposure result from a complex set of interactions, which are not understood and cannot be quantitatively estimated with the current state of knowledge. Examples of such interactions include synergism or antagonism of different substances, effects on single versus multiple organ systems, and mechanisms of carcinogenesis. In addition, potential differences in sensitivities of various subpopulations to various chemicals are poorly understood at this time.

Because there may be small individual uncertainties at each step of the risk assessment process, these uncertainties may become magnified in the final risk characterization. The final quantitative estimates of risk may be as much as an order of magnitude different from the actual risk associated with a given site. In an attempt to minimize the consequences of uncertainty, Agency guidance typically relies upon use of conservative estimates of hazards in the absence of appropriate comprehensive data. The overall result is that risk estimates presented in this report are more likely to overestimate the actual risks than to underestimate them.

This assessment has been prepared in a manner consistent with that generally used in the consulting community and Agency guidance at the time it was prepared. It is likely that risk assessment methods and the data identifying and quantifying the toxicity of chemicals will improve with time. Consequently, unsuspected hazards at this site may be identified at a later date. This assessment was based upon available data, using currently available risk assessment methodology.

#### 6.3 Ecological Risk Assessment

A four-step process is utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario. Problem Formulation qualitatively evaluates contaminant release

migration, and fate; identifies COPCs, receptors, exposure pathways, and known ecological effects of the contaminants; and selects endpoints for further study. Exposure Assessment evaluates contaminant release, migration, and fate; characterizes exposure pathways and receptors; and measures or estimates exposure point concentrations. Ecological Effects Assessment includes literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. Risk Characterization is the measurement or estimation of both current and future adverse effects.

The ecological RA for Site 6 began with evaluating the contaminants associated with the site in conjunction with the site-specific biological species/habitat information. The purpose of this RA was to determine if past activities at the former pest control shop are adversely impacting the San Pedro Swamp, the Bayamon River, or the Haystack Hills region.

The COPCs used in the ecological RA included: chlordane, 4,4'-DDD, endosulfan I, endosulfan sulfate, heptachlor, heptachlor epoxide, arsenic, selenium, lead, and mercury. These COPCs were selected because they are the only chemicals for which toxicity data is available. The mallard duck was chosen to represent aquatic birds (surrogate species) at the site since no toxicological data exists on the specific species found at the site and because extensive toxicity testing has been conducted on the mallard duck.

The ecological RA concluded that no potential ecologic risks were present to the surrogate species, the mallard duck, and therefore, no potential risks were assessed to be present for local species. Also, risks due to bioaccumulation were not expected.

## **7.0 REMEDIAL ACTION OBJECTIVES**

Remedial action objectives are specific goals to protect human health and the environment; they specify the COPCs, the exposure routes, receptors, and acceptable contaminant levels for each exposure route. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs). At this time, there are no ARARs established for the cleanup of soil. In the absence of ARARs, chemical-specific To Be Considered (TBC) criteria were evaluated, instead. A chemical-specific TBC of 500 micrograms per kilogram for gamma-Chlordane was obtained from the RCRA Corrective Action Levels listed in 40 CFR Part 264.521, Appendix A and Appendix C (Proposed Rule). Chlordane is a mixture of chlorinated hydrocarbons consisting of isomers of chlordane and closely related compounds and byproducts. Gamma-chlordane is an isomer of chlordane, so gamma-chlordane makes up a part of chlordane. Therefore, the chlordane listing can be used for gamma-chlordane. In general, the chlordane mixture is comprised mostly of the gamma-chlordane isomer. Therefore, gamma-chlordane is not listed in either Appendix A or Appendix C as gamma-chlordane; gamma-chlordane is listed as chlordane. Since Site 6 poses no unacceptable risk to human health or the environment and there are no ARARs established for the cleanup of soil; no action is necessary. Nevertheless, the Navy prefers to implement a pro-active remedial action. The Navy's decision to implement a remedy has been based upon the sensitive location of the site which is adjacent to playground and residential areas. The Navy's remedial action objective for this site is to prevent exposure to the concentrations of gamma-Chlordane in the soil which are greater than the TBC criteria.



## 8.0 DESCRIPTION OF ALTERNATIVES

In the process of selecting a response action for Site 6, Remedial Action Alternatives (RAAs) were developed for the contaminated media at each site. Three RAAs were developed for the soil at Site 6:

- RAA No. 1 - No Action
- RAA No. 2 - Capping
- RAA No. 3 - Excavation and Off-Site Incineration

The following subsections briefly describe the RAAs developed. The RI/FS report contains more detailed information pertaining to each RAA.

- Alternative 1: No Action

Capital Cost: \$0  
Operation and Maintenance (O&M) Cost: \$0  
Present Worth Cost: \$0  
Construction Time: None

CERCLA requires that the No Action Alternative be considered as a baseline for comparison of other alternatives. Under the No Action Alternative, no remedial actions would be taken at Site 6 for the remediation of pesticide-contaminated soil. There would be no reduction in the toxicity, mobility, or volume of contaminants. There are no costs associated with the implementation of this alternative.

- Alternative 2: Capping

Capital Cost: \$43,000  
O&M Cost: \$1,000 per year  
Present Worth Cost: \$74,000 (assuming cap replacement at Year 20)  
Construction Time: One year or less

The Capping Alternative includes the installation of an asphalt cap (4 inches thick) over the area of approximately 2,190 square feet of surface contaminated above the TBC criteria. Soil excavation will not be included. The cap will reduce the potential for dermal exposure to the pesticide-contaminated soil within the site. The use of caps and their reliability has been proven. The life expectancy of an asphalt cap is approximately 20 to 25 years with routine maintenance. This alternative could be easily implemented since the Site 6 area is flat and open. Materials and equipment should be easily obtained. Long-term groundwater monitoring will be easily accomplished due to the existing monitoring wells at the site.

- Alternative 3: Off-Site Incineration

Capital Cost: \$580,000  
O&M Cost: \$0  
Present Worth Cost: \$580,000  
Construction Time: One year or less

The Off-Site Incineration Alternative includes the excavation, removal, and off-site incineration of soil with pesticide concentrations exceeding the remediation level. The approximate quantity of soil to be removed is 250 cubic yards. This volume includes soil with concentrations of gamma-Chlordane greater than 500 micrograms per kilogram. The maximum depth of excavation will be three feet. The excavation will be backfilled with certified clean soil

and revegetated. The contaminated material will be loaded into approved containers and transported by barge to the Port of Texas under a hazardous waste manifest. The soil will then be trucked to a licensed incineration facility, tentatively identified in Morgan City, Louisiana. All ash remaining after incineration will be disposed of by the incineration facility. There are currently no licensed facilities in Puerto Rico capable of receiving pesticide-laden wastes.

## **9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES**

During the detailed evaluation of RAA, each alternative is assessed against nine evaluation criteria, namely: Overall Protection of Human Health and the Environment; Compliance with ARARs; Long-Term Effectiveness and Permanence; Reduction of Toxicity, Mobility, or Volume through Treatment; Short-Term Effectiveness; Implementability; Cost; USEPA/Commonwealth Acceptance; and, Community Acceptance.

A comparative analysis of the RAAs was based on nine evaluation criteria, and how well the RAAs met the Navy's remedial action objective of preventing exposure to gamma-Chlordane concentrations above the TBC criteria of 500 micrograms per kilogram. The evaluation criteria are summarized below.

- Overall Protection of Human Health and the Environment - addresses whether or not an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering or institutional controls.
- Compliance with ARARs - addresses whether or not an alternative will meet the applicable or relevant and appropriate requirements (ARARs), criteria to-be-considered (TBCs), and other federal and commonwealth environmental statutes, and/or provide grounds for invoking a waiver.
- Long-Term Effectiveness and Permanence - refers to the magnitude of residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.
- Reduction of Toxicity, Mobility, or Volume Through Treatment - refers to the anticipated performance of the treatment options that may be employed within an alternative.
- Short-Term Effectiveness - refers to the speed with which the alternative achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may occur during the construction and implementation period of the remedy until the cleanup goals are achieved.
- Implementability - refers to the technical and administrative feasibility of an alternative, including the availability of materials and services required to implement the chosen solution.
- Cost - includes capital and operation and maintenance costs. For comparative purposes, present worth values are provided.
- USEPA/Commonwealth Acceptance - Indicates whether, based on its review of the RI/FS reports and Proposed Plan, the Commonwealth concurs, opposes, or has no comment on the preferred alternative. This criterion is addressed in this ROD based on the comments that have been received on the RI/FS report and Proposed Plan.

- Community Acceptance - Evaluates the issues and concerns the public may have regarding each of the alternatives. This criterion is addressed in this ROD based on the comments that have been received on the RI/FS report and the Proposed Plan.

#### 9.1 Overall Protection of Human Health and the Environment

All alternatives are protective of human health and the environment. Based on the risk assessment results, the no action alternative is protective of human health and the environment because there is no unacceptable risk at the site from former practices.

#### 9.2 Compliance with ARARs

As there are no ARARs established for the cleanup of soil that must be complied with, this evaluation criteria is not applicable. However, in the absence of ARARs, the Navy will use the TBC criteria to delineate areas of contamination. Alternative 1 does not prevent exposure to soil exceeding the TBC criteria. Alternatives 2 and 3 will prevent exposure to soil exceeding TBCs.

#### 9.3 Long-Term Effectiveness and Permanence

The no action alternative may not be effective in the long term and has no indications of permanence. With proper maintenance, Alternative 2 - Installation of an Impermeable Cap, would be effective and permanent in the long term. Alternative 3, Off-Site Incineration, would also be effective and permanent in the long term.

#### 9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1 would not reduce the toxicity, mobility, or volume of known contamination. Alternative 2 would reduce the mobility, but not the toxicity or volume of known contamination. Alternative 3 would reduce the toxicity, mobility, and volume of the contaminated soil.

#### 9.5 Short-Term Effectiveness

Alternatives 2 and 3 are effective in the short-term.

#### 9.6 Implementability

All three alternatives can be easily implemented.

#### 9.7 Cost

Alternative 1 can be implemented at negligible costs. Costs for Alternative 2 were estimated to be \$42,723 (estimated in 1994) and Alternative 3 at \$582,000 (estimated in 1994).

#### 9.8 USEPA/Commonwealth Acceptance

By signing this ROD, PREQB, and USEPA have accepted the selected remedy for Site 6.

#### 9.9 Community Acceptance

No comments were received from the public during the Public Comment Period or during the Public Awareness Session.

## **10.0 SELECTED REMEDY**

This section of the ROD presents the selected remedy for Site 6. A description of the selected remedy is presented along with the estimated costs to implement the remedy. In addition, the remediation levels to be attained at the conclusion of the remedy are discussed.

### **10.1 Remedy Description**

Based upon an evaluation of the various alternatives, the Navy has selected a variation of Alternative 2 -Capping as the choice for the Site 6 remedy. The Navy's remedy is to place one rectangular asphalt cap of 11,000 square feet minimum that will cover the two areas above the TBC criteria, their immediate surroundings, and a portion of the low, wet grassy area to the northeast of the site. A plan view of this alternative is shown on Figure 4. The capital cost of this remedy is approximately \$215,000 in 1994 dollars.

This cap was selected because it eliminates potential exposure to the soils that may have limited residual pesticide contamination in the vicinity of the Former Pest Control Shop. Although the RA indicated that the site poses no unacceptable risks, and that no action was needed, capping was nevertheless selected to reassure the public by limiting public exposure because of the site's proximity to the playground/picnic and family housing areas.

### **10.2 Estimated Costs**

The following costs are estimated for Site 6:

Capital Cost: \$215,000  
Annual O&M: \$1,000 per year  
NPW: \$246,000 (assuming cap replacement at Year 20)

## **11.0 STATUTORY DETERMINATIONS**

A selected remedy should satisfy the statutory requirements of CERCLA Section 121 which include: (1) protect human health and the environment; (2) comply with ARARs; (3) achieve cost-effectiveness; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element, or provide an explanation as to why this preference is not satisfied. The evaluation of how the selected remedy, an asphalt cap over Site 6, satisfies these requirements is presented below.

### **11.1 Protection of Human Health and the Environment**

Because there is no unacceptable risk at the site due to former or current practices, protection of human health and the environment is not necessary. As a pro-active measure to reassure the public, the Navy has chosen to implement an asphalt cap over the areas where pesticides were detected above the TBC criteria. The cap will eliminate the potential for any contact, human or environmental, with any remaining minimal pesticide contaminated soils and; therefore, is protective of human health and the environment.

### **11.2 Compliance with Applicable or Relevant and Appropriate Requirements**

There are no ARARs established for the cleanup of soil. In the absence of ARARs, the Navy elected to use TBC criteria to delineate areas of soil contamination. Alternative 2, an asphalt cap over Site 6, prevents exposure to soils containing pesticides above the TBC criteria.

### 11.3 Cost-Effectiveness

The selected remedy affords overall effectiveness proportional to its costs. This alternative was the most cost effective of the active alternatives.

### 11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy represents a permanent solution with respect to the principal threats posed by soil contamination. Treatment has not been selected because the RA dictated that no action was necessary.

### 11.5 Preference for Treatment that Reduces Toxicity, Mobility, or Volume as a Principal Element

Treatment of soil contaminated above the TBC criteria has not been retained as a principal element of the selected remedy. Treatment has not been selected because the RA dictated that no action was necessary. As a pro-active measure to reassure station residents, the Navy has elected to install a permanent asphalt cap over areas of contaminated soil to eliminate all contact with any remaining minimal pesticide contaminated soil.

## 12.0 RESPONSIVENESS SUMMARY

### 12.1 Overview

A Public Comment Period was held from May 15, 1996 through June 15, 1996. A Public Awareness Session, in lieu of a public meeting, was held on June 7, 1996. These public participation events were announced in English and Spanish to military and local personnel. No written or oral comments were received from the public on the selected remedy for Site 6.

### 12.2 Background on Community Involvement

A record review of the NSGA Sabana Seca files indicates that the community involvement centers mainly on a social nature, including the community outreach programs and Station/community clubs.

Community relations activities to date are summarized below:

- Prepared a Community Relations Plan for all sites at the Station.
- Prepared a Draft Information/Photo Album, June 7, 1996, for all sites at the Station.
- Prepared a Draft Site Brochure, June 1993, for all sites at the Station.
- Established two information repositories at a local library and the Station's library.
- Established the Administrative Record for all of the sites at the Station.
- Held Technical Review Committee meetings to review the status of the remedial activities on the Station.
- Released a Proposed Plan in English and Spanish for public review in repositories, May 1996.
- Released a public notice in English and Spanish announcing a public comment period and requesting attendance at the Public Awareness Session.
- Held a Public Awareness Session on June 7, 1996, to solicit comments and provide information to the community.

#### 12.3 Summary of Comments Received During the Public Comment Period and Agency Responses

No written or oral comments were received from the public during the Public Comment Period.

TABLE 1

**CHEMICALS OF POTENTIAL CONCERN  
FOR THE HUMAN HEALTH RISK ASSESSMENT**

COPC (mg/kg)	Surface Soil	Surface Water	Sediment
VOCs:			
Toluene	1.02E-02	1.10E-01	--
SVOCs:			
bis(2-ethylhexyl)phthalate	7.63E-01	--	--
Di-n-butylphthalate	2.20E-01	--	--
Di-n-octylphthalate	2.90E-01	--	--
Phenol	--	5.00E-02	--
3 and 4-Methylphenol	--	1.30E-01	--
PESTICIDES:			
alpha-Chlordane	5.75E-01	--	1.98E+00
gamma-Chlordane	1.58E+00	--	2.67E+00
Endosulfan I	--	--	6.10E-02
Endosulfan Sulfate	--	--	3.50E-02
Heptachlor	7.80E-03	--	--
Heptachlor Epoxide	4.80E-03	--	1.80E-02
4,4-DDD	--	--	1.40E-01
METALS AND CYANIDE:			
Aluminum	2.23E+04	--	--
Antimony	--	5.67E-02	--
Arsenic	1.24E+01	4.10E-03	6.10E+00
Manganese	--	1.76E-01	--
Zinc	--	4.68E-02	--
Cyanide	--	2.30E-03	--

X = Indicates a COPC for the specified media.

TABLE 2															
EXPOSURE PATHWAYS															
Variables Used for Human Intake Calculations															
Site 6, NSGA Sabana Seca, Puerto Rico															
Potentially Exposed Population	Exposure Route	CW (mg/L)	CA (mg/m3)	CS (mg/kg)	SA (cm2/event)	PC (cm/hr)	IR(a)	ABS (unitless)	AF (mg/cm2)	ET (hr/day)	EF (events/yr)	ED (yrs)	CF(b)	BW (kg)	AT(c) (years)
Surface Soil															
Future Residents															
Noncarcinogens Adult	Ingestion	.	.	El Data(d)	.	.	100	.	.	.	350	30	1.0E-6	70	30,70
Noncarcinogens Children	Ingestion	.	.	El Data(d)	.	.	200	.	.	.	350	6	1.0E-6	15	6,70
Time-weighted Average (Carcinogens)	Ingestion	.	.	El Data(d)	.	.	114	.	.	.	350	6/24	1.0E-6	15/70	70
Adult	Dermal	.	.	El Data(d)	5,700(f)	.	.	(e)	1.0	.	350	30	1.0E-6	70	30,70
Children	Dermal	.	.	El Data(d)	2,295(f)	.	.	(e)	1.0	.	350	6	1.0E-6	15	6,70
Future Recreational															
Noncarcinogens Adult	Ingestion	.	.	El Data(d)	.	.	100	.	.	.	52	30	1.0E-6	70	30,70
Noncarcinogens Children	Ingestion	.	.	El Data(d)	.	.	200	.	.	.	52	6	1.0E-6	15	6,70
Time-weighted Average (Carcinogens)	Ingestion	.	.	El Data(d)	.	.	114	.	.	.	350	6/24	1.0E-6	15/70	70
Adult	Dermal	.	.	El Data(d)	5,700(f)	.	.	(e)	1.0	.	52	30	1.0E-6	70	30,70
Children	Dermal	.	.	El Data(d)	2,295(f)	.	.	(e)	1.0	.	52	6	1.0E-6	15	6,70
Future Commercial															
Adult	Ingestion	.	.	El Data(d)	.	.	50	.	.	.	250	25	1.0E-6	70	30,70





TABLE 3						
TOXICITY VALUES - RFD						
Summary Table of Reference Doses and Concentrations						
Site 6, NSGA Sabana Seca, Puerto Rico						
Constituent	Oral Chronic RfD (mg/kg-day)	Chronic Uncert. Factor	Mod. Factor	Confi- dence	Oral Subchronic RfD (mg/kg-day)	Target Organ
Volatile Organic Compounds						
Toluene	0.2 a	1,000	1	Medium	2.0 b	Liver, kidneys, and CNS
Semivolatile Organic Compounds						
Bis(2-ethylhexyl)phthalate	0.02 a	1,000	1	Medium	0.02 b	Liver
Di-n-butylphthalate	0.1 a	1,000	1	Low	1.0 b	Entire body
Di-n-octylphthalate	0.02 b	1,000	UR	UR	0.02 b	Kidneys, liver
Phenol	0.6 a	100	1	Low	0.6 b	Kidneys
3-and 4-Methylphenol	0.05 a	1,000	1	Medium	0.5 b	CNS
Pesticides						
a-Chlordane*	0.00006 a	1,000	1	Low	0.00006 b	Liver
g-Chlordane*	0.00006 a	1,000	1	Low	0.00006 b	Liver
Endosulfan	0.006 b	NA	NA	NA	0.006 b	Kidneys
Endosulfan sulfate**	0.006 b	NA	NA	NA	0.006 b	NA
Heptachlor	0.0005 a	300	1	Low	0.0005 b	Liver
Heptachlor Epoxide	0.000013 a	1,000	1	Low	0.000013 b	Liver
4,4-DDD	NA	NA	NA	NA	NA	Liver
Metals and Cyanide						
Aluminum	2.9 c	NA	NA	NA	NA	NA
Antimony	0.0004 a	1,000	1	Low	0.0004 b	Longevity, blood glucose
Arsenic	0.0003 a	3	1	Medium	0.0003 b	Hyper- pigmentation
Manganese	0.005 a	1	1	Varied	0.005 b	CNS effects

TABLE 3

TOXICITY VALUES - RFD

Summary Table of Reference Doses and Concentrations  
Site 6, NSGA Sabana Seca, Puerto Rico

Constituent	Oral Chronic RfD (mg/kg-day)	Chronic Uncert. Factor	Mod. Factor	Confi- dence	Oral Subchronic RfD (mg/kg-day)	Target Organ
Mercury	0.0003 b	1,000	NA	NA	0.0003 b	Kidneys
Zinc	0.3 a	3	1	Medium	0.3 b	Blood
Cyanide	0.02 a	100	5	Medium	0.02 b	Kidneys

Notes:

a - IRIS (EPA, 1994).

b - HEAST, FY1992 (EPA, 1992b).

c - EPA Region III RBC (6/10/93) (EPA, 1993b).

\* - Toxicity values were unavailable for alpha-and gamma-chlordane; chlordane values were used for evaluation.

\*\* - Toxicity values were unavailable for endosulfan sulfate; endosulfan values were used for evaluation.

NA - Not available.

UR - Under review.

CNS - Central nervous system.

TABLE 4

## TOXICITY VALUES - SLOPE FACTORS

Summary Table of Carcinogenic Slope Factors  
Site 6, NSGA Sabana Seca, Puerto Rico

Constituent	Oral Slope Factor (mg/kg-day)	Unit Risk (: g/L)	Class
Volatile Organic Compounds			
Toluene	NA	NA	D
Semivolatile Organic Compounds			
Bis(2-ethylhexyl)phthalate	0.014 a	0.0000004a	B2
Di-n-butylphthalate	NA	NA	D
Di-n-octylphthalate	UR	UR	NA
Phenol	NA	NA	D
3- and 4-Methylphenol	NA	NA	C
Pesticides			
a-Chlordane*	1.3 a	0.000037 a	B2
g-Chlordane*	1.3 a	0.000037 a	B2
Endosulfan	NA	NA	NA
Endosulfan sulfate	NA	NA	NA
Heptachlor	4.5 a	0.00013 a	B2
Heptachlor epoxide	9.1 a	0.00026 a	B2
4,4-DDD	0.24 a	0.0000069 a	B2
Metals and Cyanide			
Aluminum	NA	NA	NA
Antimony	NA	NA	D
Arsenic	1.75 b	-NA	A
Manganese	NA	NA	O
Mercury	NA	NA	D
Zinc	NA	NA	D
Cyanide	NA	NA	O

## Notes:

a - IRIS (EPA, 1994).

b - EPA Region III Risk-Based concentration Table (EPA, 1993b).

\* - Toxicity values were unavailable for alpha- and gamma-chlordane; chlordane values were used for evaluation.

NA - Not available.

UR - Under review.

Class: Carcinogenic weight of evidence classification.

TABLE 5							
SUMMARY OF PATHWAY - SPECIFIC RISKS							
Summary Table of Carcinogenic Risks Site 6, NSGA Sabana Seca, Puerto Rico							
Media	Receptors	Pathways				Commercial Ingestion	
		Residential Ingestion	Dermal Contact	Recreational Ingestion	Dermal Contact		
Soil	Adults	3.84E-05	NA	5.71E-06	NA	4.30E-06	
	Children	2.69E-05	NA	4.00E-06	NA	--	
Surface Water	Pre-adolescent	--	--	--	7.61E-09	--	--
Sediment	Pre-adolescent	--	--	--	NA	--	

Notes:  
NA - Not applicable.

Summary Table of Noncarcinogenic Hazards Site 6, NSGA Sabana Seca, Puerto Rico							
Media	Receptors	Pathways				Commercial Ingestion	
		Residential Ingestion	Dermal Contact	Recreational Ingestion	Dermal Contact		
Soil	Adults	1.17E-01	NA	1.74E-02	NA	4.18E-02	
	Children	9.93E-01	NA	1.48E-01	NA	--	
Surface Water	Pre-adolescent	--	--	--	2.44E-03	--	
Sediment	Pre-adolescent	--	--	--	NA	--	

## FIGURES

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