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SITE SUMMARY FOR PCB DISPOSAL-DRY DOCK AREA, ROOSEVELT ROADS (SITE NO. 9)

Prepared for:

Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia 23511

Prepared by:

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Springfield, Virginia 22151

Versar Job No. 5295.3

July 25, 1991

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SITE SUMMARY FOR PCB DISPOSAL-DRY DOCK AREA, ROOSEVELT ROADS (Site No. 9)

INTRODUCTION

The U.S. Naval Facilities Engineering Command (NAVFACENGCOM), Atlantic Division has contracted Versar, Inc. to provide environmental services to the Naval Station (NAVSTA) Roosevelt Roads, Puerto Rico. As part of these services, Versar has prepared site summaries for Site 9, PCB Disposal-Dry Dock Area, and other sites at NAVSTA Roosevelt Roads. This site summary has been developed based on the findings of the Initial Assessment Study (IAS) prepared by Greenleaf/Telesca (1986), and Confirmation Study prepared by Environmental Science and Engineering (1988).

This site summary has been prepared to highlight the results of previous investigations, briefly discuss fate and transport potential of site contaminants, and determine the need for further investigation, if warranted. If no further action is required for the protection of human health and the environment, the summary is intended to serve as part of the Navy's decision document to support the no action alternative.

BACKGROUND

In approximately 1968, 25 5-gallon cans containing Askarel (a PCB dielectric fluid) were reportedly disposed of by dropping them into Puerca Bay off the south side of the wharf at the dry dock (Figure 1). Some of the cans, which had been stored in Public Works Building 31, were in a rusty condition at the time of the disposal.

The site is located in an area designated as critical habitat for the Caribbean Manatee, and is also a known habitat for several Commonwealth and federally designated rare and endangered species, including several species of sea turtles. Potential receptors of PCB contamination from this site also include infaunal and sessile bethic organisms (polychaetes, corals, bivalves, clams, and annelides), predators of benthic organisms (fish), and ultimately the people who use the wharf for recreational fishing.

CONFIRMATION STUDY

A Confirmation Study was recommended for this site based on the conclusions of the IAS. A visual and magnetometer survey did not reveal the presence of 5-gallon cans or magnetic anomalies. Therefore, a randomized sediment sampling program was conducted to determine if PCBs were present or had been dispersed by tidal currents.

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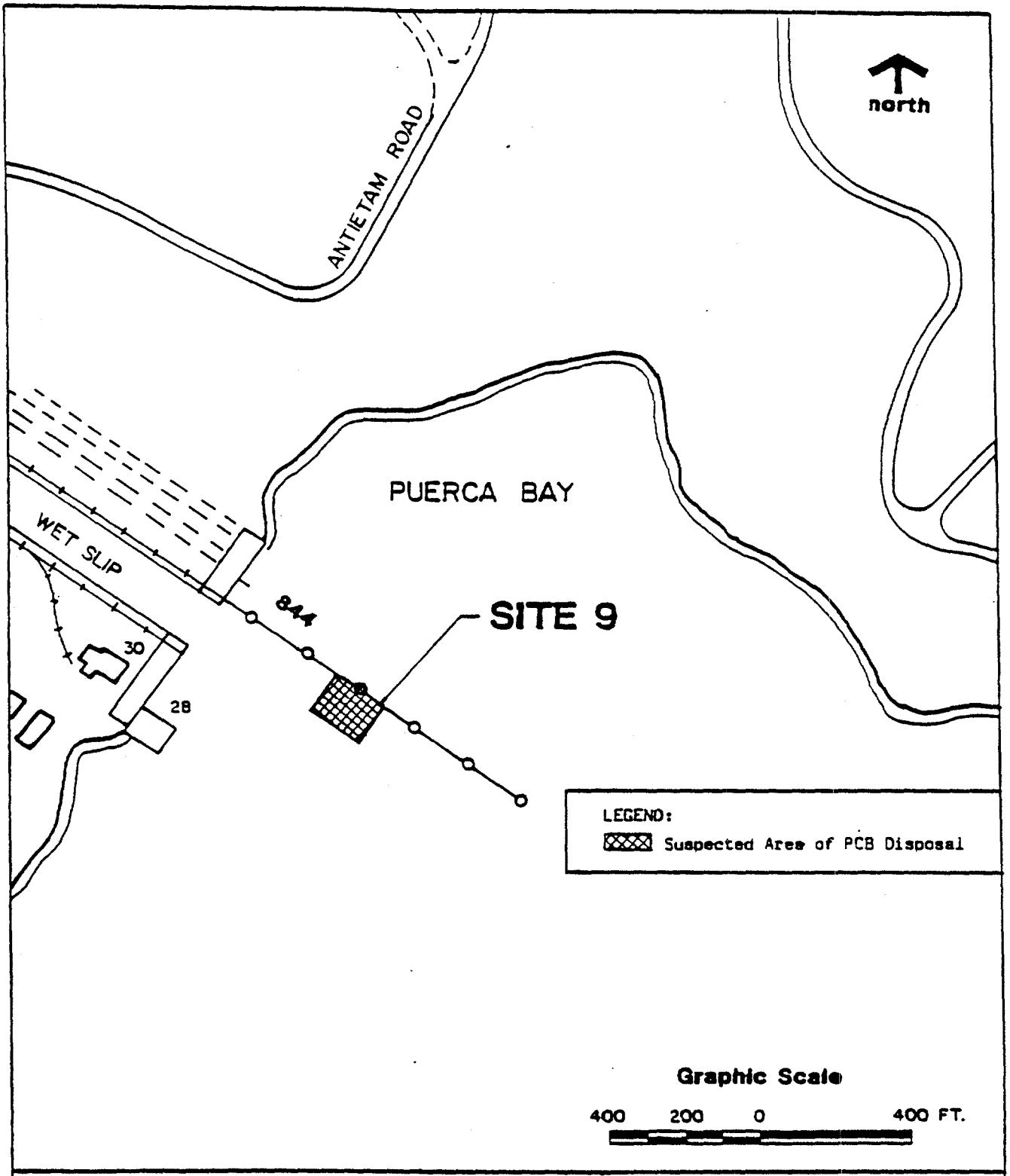

FIGURE 1
SITE 9, PCB DISPOSAL DRY DOCK AREA

A sampling grid pattern measuring the length of the wharf (approximately 1,000 feet) by 25 feet to each side of the wharf was designated, and samples taken on a 10-foot grid to a depth of two feet. Five hundred hand-augered sediment samples were collected; two percent were selected at random for analyses. The remaining samples were held pending the results of the first analysis for PCBs.

The sampling was conducted starting at the assumed disposal point (the third stanchion from the shoreline) and working out to the ends of the wharf. The sediment cores were visually inspected for the presence of oily material or metal fragments; those samples containing this material were to be analyzed for PCB. No samples showed metal fragments or oily material. Therefore, a minimum of 2 percent of the samples were randomly selected and analyzed. Four surface water samples were also collected.

RESULTS

A visual inspection of the bottom of Puerca Bay directly adjacent to the pier in the dry dock area failed to locate any of the 5-gallon metal cans, which had been reportedly dropped in the water. Only metal and glass drink containers were found on the bottom, along with other miscellaneous metal scrap.

Because none of the 5-gallon metal cans allegedly disposed were located, the investigation proceeded using the randomized sampling program. Two sediment samples were also collected on both sides of the pier's third stanchion where the disposal reportedly took place. Surface water and sediment samples were collected at the site for PCB analysis. Figure 2 shows the sampling locations. No PCBs were detected in any of the surface water or sediment samples that were analyzed.

CONCLUSIONS

Because no PCBs were detected in any of the surface water and sediment samples analyzed for Site 9, no additional sampling and analysis was recommended by ESE (1988). Versar concurs with the recommendation for no further action. Assuming the reports of PCB disposal were correct, the cans apparently sank into soft sediment or were later buried by sediment. Because of the low solubility of PCBs in water, no migration is anticipated. Additionally, the ESE sampling indicated that the PCBs have not been dispersed from the area along the wharf where the cans were reportedly disposed. If present in the sediment adjacent to the wharf, the PCBs seem to be isolated from the surrounding environment and are not migrating. Under present conditions, the potential for environmental damage resulting from the alleged PCB disposal does not appear to present a risk to human health and the environment. PCBs strongly adsorb to sediment particles.

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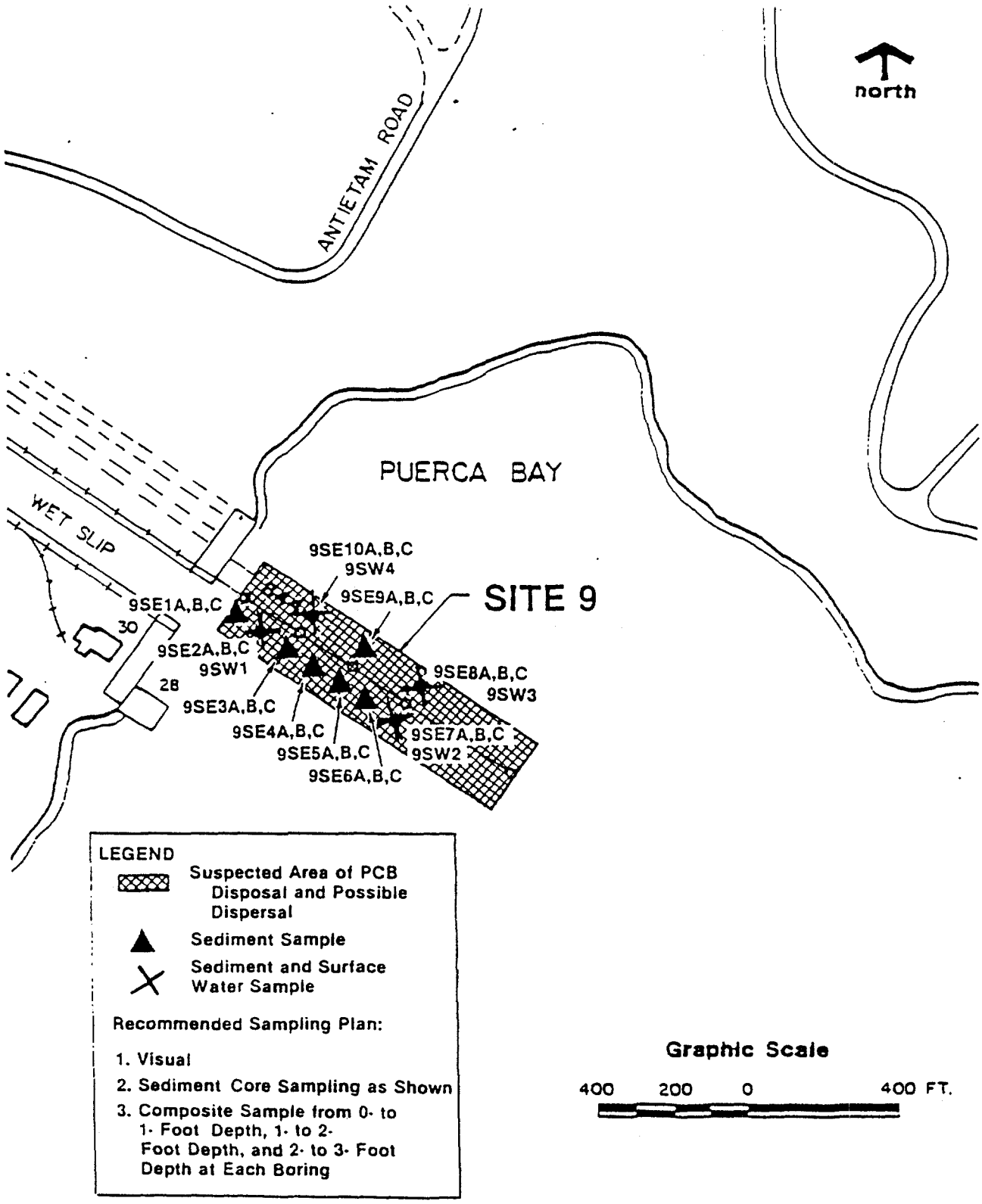

SOURCES: NEESA, 1984b; ESE, 1985.

FIGURE 2
SAMPLING LOCATIONS AT SITE 9, PCB DISPOSAL, DRY DOCK AREA

CONFIRMATION STUDY
U.S. NAVAL COMPLEX
PUERTO RICO

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There is relatively little activity (construction, etc.) in the area that would be expected to resuspend the sediment, except dredging activities. With time and additional deposition of sediment, the cans, if actually present, would be further isolated from the environment.

Because dredging activities could potentially disturb the disposal location and mobilize PCB-contaminated sediment, NAVSTA Roosevelt Roads should seriously consider such an effect in any future plans for the area. While no remediation is warranted under the current conditions, some institutional controls to limit dredging activities near the site should be adopted.

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REFERENCES

Environmental Science and Engineering, 1988. Confirmation Study to Determine Possible Dispersion and Migration of Specific Chemicals. U.S. Naval Station Roosevelt Roads, Puerto Rico, and U.S. Naval Ammunition Facility Viques: prepared for Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. (Navy Contract No. N62470-85B-7972).

Greenleaf/Telesca Planners, Engineers, and Architects. 1986. Initial Assessment Study, Naval Station Roosevelt Roads, Puerto Rico: prepared in conjunction with Ecology and Environment, Inc. for U.S. Naval Energy and Environmental Support Activity (Navy Contract No. N62474-82C-C357).

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APPENDIX

ANALYTICAL RESULTS (ESE, 1988)

ENVIRONMENTAL SCIENCE & ENGINEERING 05/12/86 STATUS: FINAL PAGE# 1

PROJECT NUMBER 85275 3000
FIELD GROUP PRSW1
NAVPCW

PROJECT NAME PUERTO RICO CONFIRMATION STUDY
PROJECT MANAGER RUSS BOWEN
LAB COORDINATOR LISA BARE

SAMPLE ID/#

PARAMETERS	UNITS	STORET # METHOD	9SW1 PRSW1 17	9SW2 PRSW1 18	9SW3 PRSW1 19	9SW4 PRSW1 20
DATE TIME			12/02/85 08:30	12/02/85 08:45	12/02/85 09:30	12/02/85 10:00
PCB-1016	UG/L	34671 0	<0.206	<0.206	<0.206	<0.206
PCB-1221	UG/L	39488 0	<0.430	<0.430	<0.430	<0.430
PCB-1232	UG/L	39492 0	<0.333	<0.333	<0.333	<0.333
PCB-1242	UG/L	39496 0	<0.286	<0.286	<0.286	<0.286
PCB 1248	UG/L	39500 0	<0.197	<0.197	<0.197	<0.197
PCB-1254	UG/L	39504 0	<0.224	<0.224	<0.224	<0.224
PCB-1260	UG/L	39508 0	<0.358	<0.358	<0.358	<0.358

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ENVIRONMENTAL SCIENCE & ENGINEERING 05/12/86 STATUS: FINAL PAGE# 1

PROJECT NUMBER 85275 3000 PROJECT NAME PUERTO RICO CONFIRMATION STUDY
FIELD GROUP PRSE1 PROJECT MANAGER RUSS BOWEN
NAVPMS LAB COORDINATOR LISA BARE

SAMPLE ID/#

PARAMETERS	STORET #	9SE1A	9SE1B	9SE1C	9SE2A	9SE2B	9SE2C	9SE3A	9SE3B	9SE3C	9SE4A	9SE4B	9SE4C	9SE5A	9SE5B	9SE5C
		PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1	PRSE1
UNITS	METHOD	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
DATE		12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85	12/02/85
TIME		09:40	09:40	09:40	10:00	10:00	10:00	10:20	10:20	10:20	10:40	10:40	10:40	11:00	11:00	11:00
PCB 1016,SED	98140	<1.16	<1.70	<1.58	<1.92	<1.75	<1.58	<2.04	<1.87	<2.26	<2.26	<1.74	<1.43	<2.30	<1.76	<1.75
UG/G-DRY	0															
PCB-1221,SOIL	98351	<1.16	<1.70	<1.58	<1.92	<1.75	<1.58	<2.04	<1.87	<2.26	<2.26	<1.74	<1.43	<2.30	<1.76	<1.75
UG/G-DRY	0															
PCB-1232,SOIL	98352	<1.16	<1.70	<1.58	<1.92	<1.75	<1.58	<2.04	<1.87	<2.26	<2.26	<1.74	<1.43	<2.30	<1.76	<1.75
UG/G- DRY	0															
PCB-1242,SOIL	98353	<1.16	<1.70	<1.58	<1.92	<1.75	<1.58	<2.04	<1.87	<2.26	<2.26	<1.74	<1.43	<2.30	<1.76	<1.75
UG/G-DRY	0															
PCB1254-SOIL	98354	<1.16	<1.70	<1.58	<1.92	<1.75	<1.58	<2.04	<1.87	<2.26	<2.26	<1.74	<1.43	<2.30	<1.76	<1.75
UG/G- DRY	0															
PCB-1248 SOIL	98802	<1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1	<2	<2	<2
UG/G-DRY	0															
PCB 1260,SED	98139	<1.16	<1.70	<1.58	<1.92	<1.75	<1.58	<2.04	<1.87	<2.26	<2.26	<1.74	<1.43	<2.30	<1.76	<1.75
UG/G-DRY	0															
MOISTURE	70320	48.1	41.0	36.8	48.0	42.8	36.9	50.9	46.5	55.7	55.7	42.7	30.0	56.4	43.1	42.7
%WET WT	0															

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Versar INC.

SITE SUMMARY FOR IRFNA/MAF-4 DISPOSAL SITE, VIEQUES ISLAND (SITE NO. 3)

Prepared for:

Atlantic Division
Naval Facilities Engineering Comman
Norfolk, Virginia 23511

Prepared by:

Versar, Inc.
6800 Versar Center
Springfield, Virginia 22151

Versar Job No. 5295.3

July 25, 1991

RR-CC079
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Versar INC.

SITE SUMMARY FOR IRFNA/MAF-4 DISPOSAL SITE, VIEQUES ISLAND (Site No. 3)

INTRODUCTION

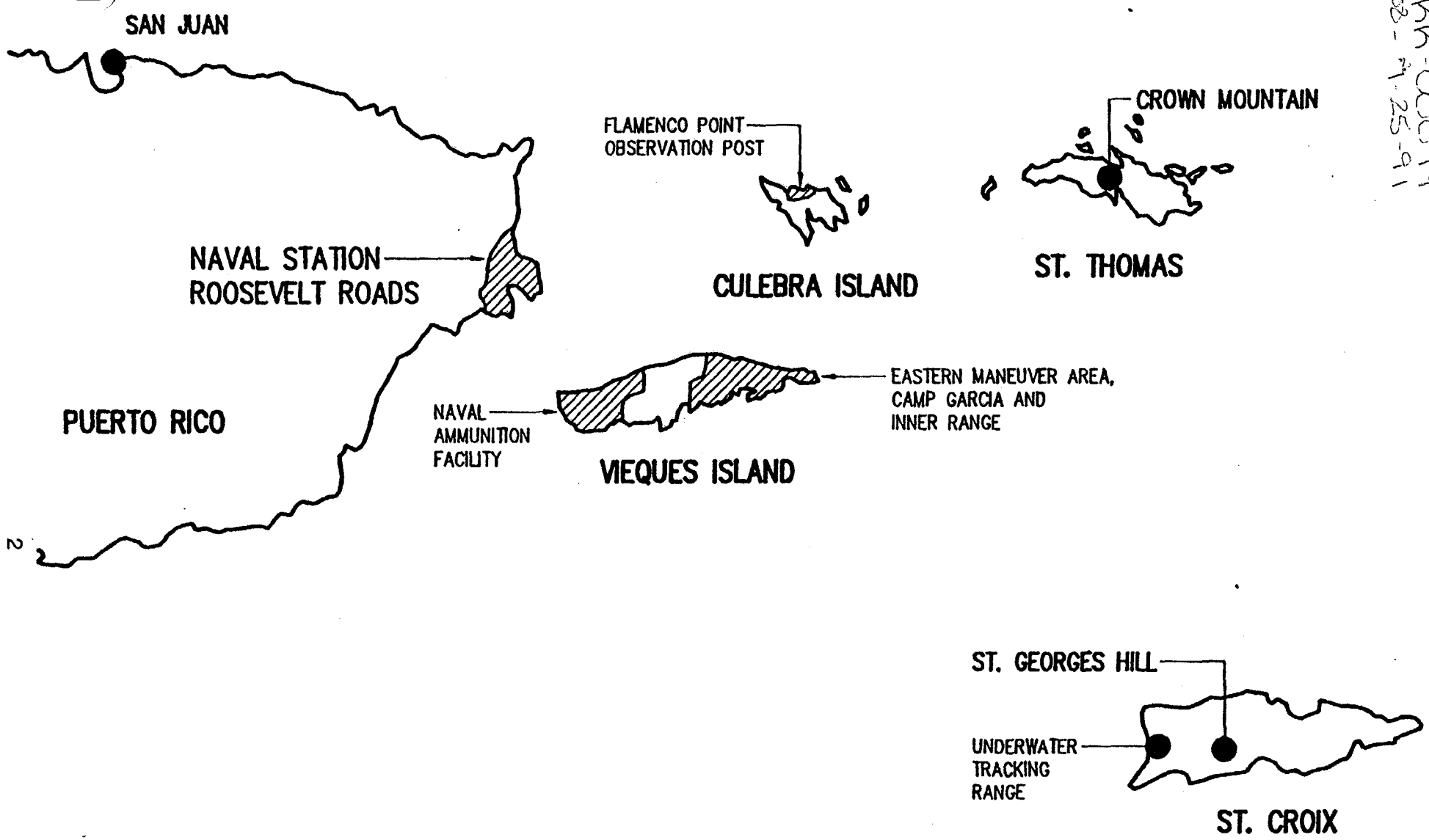
The U.S. Naval Facilities Engineering Command (NAVFACENGCOM), Atlantic Division has contracted Versar, Inc. to provide environmental services to the Naval Station (NAVSTA) Roosevelt Roads, Puerto Rico. As part of these services, Versar has prepared site summaries for Site 3, IRFNA/MAF-4 Disposal Site, Vieques Island, Puerto Rico, and other sites at NAVSTA Roosevelt Roads. This site summary has been developed based on the findings of the Initial Assessment Study (IAS) prepared by Greenleaf/Telesca (1986), and Confirmation Study prepared by Environmental Science and Engineering (1988).

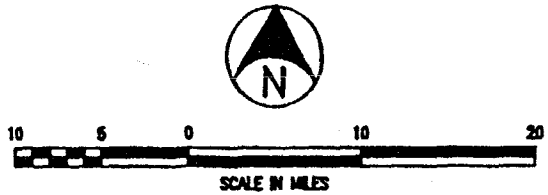
This site summary has been prepared to highlight the results of previous investigations, briefly discuss fate and transport potential of site contaminants, and determine the need for further investigation, if warranted. If no further action is required for the protection of human health and the environment, the summary is intended to serve as part of the Navy's decision document to support the no action alternative.

BACKGROUND

In 1975, Weapons department personnel at NAVSTA Roosevelt Roads disposed of 25 AQM-37As, which were stored in a bunker on the island of Vieques (Figure 1). The AQM-37A is a target drone capable of supersonic speeds. The 25 drones were found to be leaking. The fuel used by these drones is a binary fuel composed of two highly reactive components. The fuel consisting of 71 pounds of mixed amine fuel (MAF-4) and 211 pounds of inhibited red fuming nitric acid (IRFNA) per drone, was drained into a "quebrada" (a Puerto Rican term for a sharp ravine of an intermittent stream) at the low spot in the road near Building 422 on the Naval Ammunition Facility (NAF), Vieques. A maximum of 1,775 pounds of MAF-4 and 5,275 pounds of IRFNA were emptied into the quebrada (a dry stream bed), and the drone bodies were disposed of by dropping them into the ocean off a deep water ledge, where other ordnance items had been disposed of in the past.

The exact composition of MAF-4 fuel cannot be released in this report. However, this mixed fuel is similar to hydrazine in composition. Red fuming nitric acid is 86 percent nitric acid, 6 to 15 percent nitrogen dioxide, and less than 5 percent water. Hydrazine-like compounds are strong reducing agents and they are very reactive (Condensed Chemical Dictionary, 1977).





LEGEND

- ● CITIES
- ▨ U.S. NAVAL FACILITIES

NAVAL STATION ROOSEVELT ROADS

DESIGNED FLOWERS	DATE 12/13/90	FIGURE 1 LOCATION OF ROOSEVELT ROADS NAVAL STATION	
DRAWN CAROLINO	12/14/90		
CHECKED			
Versar INC. 6850 VERSAR CENTER SPRINGFIELD, VIRGINIA 22151 (703) 750-3000		APPROVAL	DATE
		PROJECT NO. 5295.001.01	SCALE: AS NOTED
		DRAWING NO. FIG1.DWG	FIGURE 1

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Hydrazine weighs 8.4 pounds per gallon, and nitric acid weighs approximately 12.2 pounds per gallon (Condensed Chemical Dictionary, 1977). Using the weight of fuel known to have been spilled, the volume of the fuel spilled is approximately 645 gallons. In view of the relatively small volume of material released, and no physical evidence of harm, no soil sampling in the spill area was proposed.

Residual fuel components from the drones at the NAF on Vieques could potentially migrate by both surface water and ground water. The most likely pathway for surface water migration is runoff in the quebradas, which are intermittent drainage areas (Figure 2). Runoff in the northern quebradas near Site 3 would enter the Vieques Passage. Runoff in the southern portion of the quebradas would enter the Caribbean Sea. Other potential pathways include ground-water migration to the areas of mangrove swamp that are subject to tidal inundation.

The quebrada where the disposal took place is downgradient of the surface recharge area and in the opposite divide for one of the few naturally occurring springs on Vieques that flows year-round. The spring is currently used by the Cooperativa de los Ganaderos, a livestock raising cooperative, and is supplemented by water obtained from the Vieques water supply pipeline. The spring is frequently used by cattle, horses, and various birds and other wildlife, but is located 2,000 feet downgradient of the divide separating the spring's ground-water system from the ground-water system where fuel materials were disposed. When the cooperative wants to roundup the livestock, which generally occurs during the dry season, all supplemental water sources are shutoff so that the livestock are attracted to the spring where they can be easily captured.

Site 3 and the spring used by the cattlemen's cooperative are located in a narrow valley, the Valle de Resolucion, that runs northwest by southeast at the western end of Vieques Island. A drainage divide exists within this valley (Figure 2). Northwest of this divide, surficial streams flow towards Laguna Kiani. On the southeast side of the divide, all streams drain toward Laguna Playa Grande.

Bedrock below the Valle de Resolucion is composed of deeply weathered plutonic rocks, largely granodiorites and quartz diorites. Igneous rocks such as these initially have no porosity and permeability. The larger valleys of Vieques Island, such as the Valle de Resolucion are blanketed by alluvial deposits consisting of clay, silt, sand, and gravel derived from the parent igneous rocks. The soil near Site 3 consists of a relatively fine grained clay loam.

Site 3 and the spring used by the Cattlemen's Cooperative are located on opposite sides of a major drainage divide within the Valle de Resolucion (Figure 2). Ground water typically flows away from major topographic divides and the potentiometric surface (water

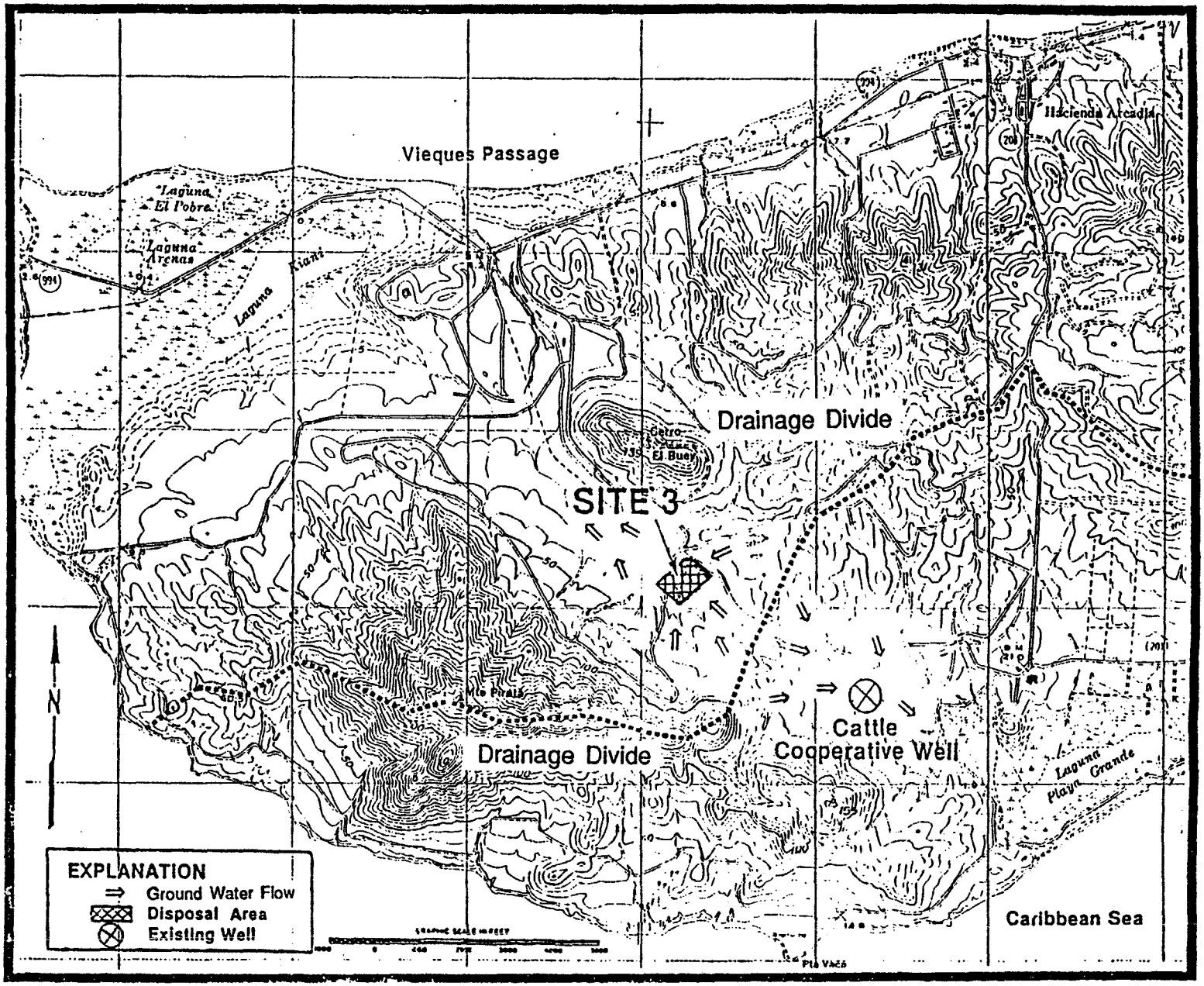

FIGURE 2
LOCATION OF SITE 3, THE IRFNA/MAF-4
DISPOSAL SITE, VIEQUES ISLAND

table) mimics the topographic surface. Because Site 3 is located northwest of the divide, ground water would flow towards Laguna Kiani, and away from the spring used by the cattlemen's cooperative. Nevertheless, the spring was sampled during the Confirmation Study to verify that the ground water used by the livestock had not been impacted.

Potential receptors in and around Vieques include such endangered species as the Caribbean manatee (Trichechus manatus) and the hawksbill, leatherback, green, and loggerhead sea turtles, all of which are found in the Vieques Passage.

CONFIRMATION STUDY

A confirmation study was recommended for this site based on the conclusions of the IAS. A ground-water sample from Cattlemen's Cooperative spring was collected and analyzed for all Priority Pollutants to determine whether the water source had been impacted. Because there was no visible evidence of stressed vegetation or other environmental degradation of the disposal area, and given the highly reactive nature of the fuel, no soil sampling was proposed.

RESULTS

During the IAS examination of the area where the fuel had been disposed, no areas of stressed vegetation or other indications of the incident were observed and reported. Observations recorded in previous reports indicated that livestock were seen drinking standing water in the area where fuel had been released. The site was visited by Versar and LANTDIV NAVFACENGCOM personnel during August 1990. No odors, stained soil, stressed vegetation, or other evidence of the MAF-4 fuel release could be discerned in vicinity of the site. Tropical vegetation was dense and healthy throughout the area surrounding Building 422.

A ground-water sample from the spring used by the cattle cooperative was taken during the Confirmation Study that indicated the concentrations of all metals (except zinc), volatile and semivolatile organic compounds, and pesticides/PCBs were below detection limits. The concentration of zinc detected (469 µg/l) was well below the National Secondary Drinking Water Standard of 5,000 µg/l. A review of the detection limits indicates that all contaminant concentrations were well below available applicable or relevant and appropriate environmental standards.

CONCLUSION

Analytical results from the ground-water sample collected from the cattlemen's cooperative spring indicated no contaminants are present in this water supply.

Hydrogeological information indicates that it is not possible for this spring to be impacted by disposal of the MAF-4/IRFNA fuel because of an intervening drainage divide.

The binary nature of the AQM-37A fuel does much to mitigate the environmental effects of a release of its two components when these components are mixed. Using hydrazine as a model for the composition of MAF-4, a mixture of the fuel's two components would be expected to react with each other spontaneously. Hydrazine (H_2NNH_2) is a very strong reducing agent; red fuming nitric acid is a strong oxidizer. When mixed, the reaction produces free nitrogen and water as follows:

$$H_2NNH_2 + 2HNO_3 \rightarrow 2N_2 \uparrow + 3H_2O.$$

In terms of the fuel mixture contained in the drones (71 lbs MAF-4 to 211 lbs IRFNA), there was more than an ample supply of IRFNA available to completely react the MAF-4. Given the reactivity of hydrazine and other hydrazine-derived rocket fuels, the MAF-4 would be expected to decompose in air as follows:

$$H_2NNH_2 + O_2 \rightarrow 2H_2O + N^2.$$

In both instances, the non-gaseous reaction product is simply water.

The information reported in the IAS that cattle were seen drinking surface water from puddles in the vicinity of the rocket fuel release strongly supports that the two binary components reacted and dissipated following disposal. Livestock would not be expected to even approach hydrazine-like compounds because the compound is a strong irritant to skin and eyes and highly toxic by ingestion, inhalation, or skin absorption. Similarly, cattle could not tolerate a highly concentrated acid such as the IRFNA. Any unreacted components are both highly soluble and are readily degraded by nitrogen seeking plants and indigenous bacteria.

Based on analytical results from the sample from the cattlemen's cooperative spring that indicate no contaminants are present, the chemistry of the fuel disposed, and the nature of ground-water flow within the Valle de Resolucion, no migration potential exists for the contaminants to move to sensitive environmental areas. Present day vegetation is thriving, and anecdotal information collected in interviews indicates that the fuel largely or completely reacted shortly after disposal. These findings indicate that the release poses no threat to human health or the environment. Versar therefore recommends no further action at this site is warranted.

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REFERENCES

Environmental Science and Engineering, 1988. Confirmation Study to Determine Possible Dispersion and Migration of Specific Chemicals. U.S. Naval Station Roosevelt Roads, Puerto Rico, and U.S. Naval Ammunition Facility Viques: prepared for Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. (Navy Contract No. N62470-85B-7972).

Greenleaf/Telesca Planners, Engineers, and Architects. 1986. Initial Assessment Study, Naval Station Roosevelt Roads, Puerto Rico: prepared in conjunction with Ecology and Environment, Inc. for U.S. Naval Energy and Environmental Support Activity (Navy Contract No. N62474-82C-C357).

Hawley, G.G. 1977. The Condensed Chemical Dictionary: Van Nostrand Reinhold Company, Ninth edition.