N00102.AR.000044
NSY PORTSMOUTH
5090.3a

ADDENDUM
TO
RCRA FACILITY INVESTIGATION
PROPOSAL
PORTSMOUTH NAVAL
SHIPYARD
KITTERY, MAINE

Prepared for:

United States Navy
Naval Facilities Engineering Command
Philadelphia, Pennsylvania

Prepared by:

McLaren/Hart Environmental Engineering Corp.
28 Madison Avenue Extension
Albany, New York 12203

February 28, 1991

INTRODUCTION

This addendum contains revisions to the RCRA Facility Investigation (RFI) Proposal. These revisions were required by the USEPA in order to fulfill the conditions set forth by the USEPA in their January 15, 1991 approval of the RFI Proposal.

This addendum is organized in a manner similar to the supplementary information "conditions" set forth in USEPA's letters dated January 15, 1991, and February 7, 1991 to Captain Thomas M. Hagge, Portsmouth Naval Shipyard. This letter and conditions are attached as an Appendix to this addendum for reference.

The Navy was required to respond to each "condition" which was marked by an asterisk in the USEPA's letter. The Navy's response to each asterisk condition is enclosed and is identified by section and number. The reader can refer to the actual USEPA letters in the Appendix for a more complete understanding of each condition set forth by the USEPA.

GENERAL COMMENTS

Comment 1.*

The EPA requested a plan for radiation monitoring of all samples collected at the site with a geiger counter; inclusion of a geiger counter in the monitoring of field activities; radiation monitoring of field personnel; and a radiation survey of SWMU 6 and 8 (DRMO and JILF).

The following historical summary was prepared by James Tayon, Portsmouth Naval Shipyard, in response to EPA's comment.

HISTORICAL SUMMARY OF YELLOW WRAPPING MATERIAL DISPOSAL AT JAMAICA ISLAND LANDFILL (SWMU 8) AND IN PROXIMITY OF BUILDING 298

Yellow plastic bags and sheet plastic materials (yellow wrapping materials) are used by the Naval Nuclear Propulsion Program as an aid to identify radioactively contaminated items and to prevent the spread of contamination.

The entire Shipyard workforce, including visitors, are indoctrinated in the significance of yellow wrapping materials when on Portsmouth Naval Shipyard and initial response actions to take if such materials are encountered. Because yellow materials have such special meaning within the Shipyard, even unused yellow materials are subjected to strict industrial controls to preclude unwarranted concern and responses.

Disposal of non-radioactive yellow wrapping materials (.g., scrap yellow wrapping materials generated when fabricating specific size and shape wrappings, unused yellow wrapping materials damaged during storage/movement/fabrication, etc.) was normally accomplished by incineration in an area in close proximity to the present Building 298. Incineration residue at times contained partially burned vice totally burned yellow wrapping materials at the time of burial. After the practice of incineration of shipyard solid waste trash was terminated due to air pollution concerns, non-radioactive discarded yellow wrapping materials were warehoused in segregated storage for several years while alternate disposal methods were developed.

During this period a substantial volume of non-radioactive discarded yellow wrapping material was accumulated and a portion of it buried in the Jamaica Island Landfill. Subsequent to this p riod, non-radioactive discarded yellow wrapping material has been industrially shredded and disposed of as industrial waste.

At no time since the overhaul and repair of Naval nuclear propulsion plants began at Portsmouth in 1958, has radioactiv ly contaminated yellow wrapping material, or any other type of radioactive solid waste been disposed of on the Shipyard. In fact, since the inception of the Naval Nuclear Propulsion Program in the 1950's, disposal of radioactive solid wastes from nuclear propulsion work by burial on site has been prohibited at any Naval shipyard. Documentation exists which verifies, on a continuous annual basis, that Portsmouth's radioactive solid wast has been disposed of off the Shipyard by licensed contractors.

To preclude inadvertent disposal of radioactive solid waste, once any material becomes radioactive, it is included in a unique accountability system which requires serialized tagging, marking, and signatures by radiologically trained personnel.

Enclosure (1)

Over the years, agencies independent of the Naval Nuclear Propulsion Program have conducted d tail d reviews of the Navy's, as w ll as Portsmouth's proc dures for controlling radioactive waste and for radiological environmental monitoring. Attachment (1) is a comprehensive report (Report NT-90-1 of February 1990) which provides an overview and summary of the Naval Nuclear Propulsion Program's environmental monitoring and disposal practices as well as performance. Solid radioactive waste disposal is addressed beginning on page eleven of this report. The second paragraph reiterates the Navy's prohibition for its shipyards and shore facilities to dispose of radioactive solid wastes by burial on their own sites.

Noteworthy is U.S. Public Health Service involvement and overview of the Naval Nuclear Propulsion Program, dating back into the early 1960's as indicated in attachment (2). On the second page of this report is further independent substantiation of the long standing radioactive solid waste disposal practices including prohibition of disposal on site. More recently, as indicated by reference (43) of attachment (1), is the compr hensive U.S. EPA report documenting Portsmouth Naval Shipyard's radiological environmental performance. Another similar in-depth survey was performed by the U.S. EPA in September of 1989 with the report in final publication stages. Both reports conclude that the procedures being utilized by the Navy to control the releases of radioactive material into the harbor are effective and that operations at the Portsmouth Naval Shipyard are not contributing significant radiation exposure to the public.

For these reasons, the Shipyard believes that monitoring for radioactivity during work performed under the Health and Safety Plan is unnecessary. To require such monitoring in the absence of any real need transmits the wrong impression to personnel directly involved with the work and/or to the general public. The Shipyard has <u>not</u> buried any radioactive solid waste at either site. By the Shipyard endorsing a document mandating monitoring for radioactivity, we are directly stating we believe there is reasonable likelihood that such materials will be encountered. This clearly is not the case. Paragraph 8.2.4 on page B-16 of the Site Safety Plan was specifically added to allow the contractor to monitor for radioactivity if he so desired. In fact, since drilling operations began at the Shipyard in the fall of 1989 the contractor has, on his own, been monitoring for radioactivity and encountered no materials or situations requiring control for radioactivity.

Based upon the above, we request deleting Attachment A General Comment 1.*.

Reprinted by the
U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
From RADIOLOGICAL HEALTH DATA AND REPORTS, Vol. 7, No. 5, May 1966

7113 COPIER

DISPOSAL OF RADIOACTIVE WASTES FROM U.S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES

J. W. Vaughan and *M. E. Miles*[1]

SYNOPSIS—This report presents data on disposal of radioactive wastes from U.S. Naval nuclear-powered ships and their support facilities and summarizes results of environmental monitoring performed to confirm adequacy of waste disposal limits and procedures. The waste disposal data presented show that the total long-lived radioactivity in liquid waste discharges associated with operation and maintenance of Naval nuclear-powered ships has been less than 2 curies per year in any harbor. Results of environmental surveys of harbor water and bottom sediment for gross radioactivity and for cobalt-60 have shown that (1) no increase in radioactivity above normal background levels has been detected in harbor water, (2) discharges of liquid wastes from U.S. naval nuclear-powered ships have not caused a measurable increase in the general external background radioactivity of the environment, and (3) low-level cobalt-60 radioactivity has been detected in localized areas of harbor bottom sediment around a few piers at operating bases and shipyards where maintenance and overhaul of Naval nuclear-powered ships have been conducted over a period of several years.

This report confirms that procedures issued by the Navy to control discharges of radioactivity from U.S. Naval nuclear-powered ships and their support facilities are effective in protecting the health and safety of the general public. These Navy procedures, which have been reviewed and concurred in by the U.S. Public Health Service and the U.S. Atomic Energy Commission, contain discharge limits which are consistent with applicable recommendations of the Federal Radiation Council, U.S. Atomic Energy Commission, and the International Commission on Radiological Protection.

The radioactivity in wastes discussed in this report originates in the pressurized water reactors of U.S. Naval nuclear-powered ships. As of January 1966, there were 56 nuclear-powered submarines and 3 nuclear-powered surface ships in operation. In these shipboard reactors, pressurized water circulating through the reactor core picks up the heat of nuclear reaction. Reactor cooling water circulates through a closed piping system including heat exchangers which transfer the heat to water in a separate secondary steam system; the steam is then used as the source of power for the propulsion plant as well as for auxiliary machinery. Discharges from ships occur primarily when reactor coolant water expands as a result of heating a reactor plant to operating temperature; this coolant passes through a purification system ion-exchange resin bed prior to discharge.

Construction, maintenance, overhaul, and refueling of these nuclear propulsion plants involve various shipyards, submarine tenders, and submarine bases. Liquid wastes discharged at these support facilities result from operations such as draining shipboard reactor

[1] Nuclear Propulsion Division, Bureau of Ships, Department of the Navy, Washington, D.C.

Attachment (2) to Enclosure (1)

systems, decontaminating radioactively contaminated piping systems, and laundering anti-contamination clothing worn by personnel. These facilities are equipped with processing systems to remove most f th radioactivity from liquid wastes prior to discharge into harbors.

Discharge limits for the low-level radioactive liquid wastes from U.S. Naval nuclear-powered ships and their support facilities are consistent with applicable recommendations issued by the Federal Radiation Council, U.S. Atomic Energy Commission (AEC), National Council on Radiation Protection and Measurements (NCRP), International Commission on Radiological Protection (ICRP), and National Academy of Sciences—National Research Council (*1–5*). In consonance with these recommendations the policy of the U.S. Navy is to minimize the amounts of radioactivity discharged into harbors. To implement this policy, the Navy has issued standard instructions defining the radioactive waste disposal limits nd procedures to be used by U.S. Naval nuclear-powered ships and their support facilities. These instructions have been reviewed and concurred in by the U.S. Public Health Service and the U.S. Atomic Energy Commission.

The principal source of radioactivity in liquid wastes is from trace amounts of corrosion and wear products from reactor plant metal surfaces. The most predominant long-lived radionuclide (i.e., half-life greater than 1 day) in these corrosion and wear products is cobalt–60, which has a 5.3 year half-life; cobalt–60 also has the lowest maximum permissible concentration value for water listed by the AEC, NCRP, and ICRP for these corrosion and wear radionuclides (*2–4*). Therefore, radioactive waste disposal is controlled by assuming that all the long-lived radioactivity is cobalt–60. Short-lived radionuclides decay rapidly and are therefore less limiting than long-lived radioactivity for waste disposal considerations.

Fission products produced by the fission process of the reactor are retained metallurgically bound within the fuel alloy. As a result, the total radioactivity attributed to l ng-lived fission product radionuclides strontium–90 and cesium–137 in discharges from U.S. Naval nuclear-powered ships and their support facilities has been less than 1 millicurie per year for all harbors combined.

Table 1 lists volumes of liquid and total amounts of long-lived radioactivity discharged into various U.S. harbors during the past 5 calendar years; included are data from U.S. Naval nuclear-powered ships and from supporting shipyards, tenders, and submarine bases. Locations listed in table 1 include operating bases and home ports which have been regularly visited by Naval nuclear-powered ships. The quantities of radioactivity listed in this table are reported as if the entire radioactivity consisted of cobalt–60, the predominant long-lived radionuclide.

Liquid waste discharges reported in table 1 vary with the amount of overhaul and maintenance work in progress at individual locations. In spite of a large increase in overhaul work in 1965, the total radioactivity discharged was kept to levels comparable with previous years by effecting improvements in waste processing techniques. The low amounts of radioactivity in table 1 discharged by each facility are comparable to amounts discharged into rivers by a number of other facilities in the United States involved in nuclear power programs where stringent waste disposal controls similar to those used by the Navy are enforced.

During maintenance and overhaul operations, solid low-level radioactive wastes consisting of contaminated rags, plastic bags, paper, and scrap materials are collected by nuclear-powered ships and their support facilities. Solid materials from ships are transferred to a shipyard or other shore facility for packaging and disposal. For ultimate disposal, solid radioactive wastes are shipped to AEC approved burial sites, since shipyards and shore facilities are not permitted to dispose of radioactive solid wastes by burial on their own sites. Table 2 summarizes total radioactivity and volumes of radioactive wastes disposed of in the past 5 years.

Environmental monitoring

Environmental monitoring surveys for radioactivity are periodically performed in harbors where U.S. Naval nuclear-powered ships are built or overhauled and where these ships have

Table 1. Radioactive liquid waste discharges to U.S. harbors from U.S. Naval nuclear-powered ships and their support facilities for 1961 through 1965

Location	1961		1962		1963		1964		1965		5-year total curies
	Thousand gallons	Curies	Thousand gallons	Curies	Thousand gallons	Curies	Thousand gallons	Curies	Thousand gallons	Curies	
1. Portsmouth, New Hampshire Naval Shipyard	20	0.01	1,344	0.07	112	0.03	407	0.13	204	0.54	0.48
2. Quincy, Massachusetts Electric Boat Division	89	0.01	22	0.05	104	0.09	0	0	0	0	0.15
3. Groton-New London, Connecticut Electric Boat Division, State Pier, and Submarine Base	166	0.87	110	1.40	101	1.89	201	1.92	229	1.29	7.18
4. Camden, New Jersey New York Shipbuilding Corp.	0	0	66	0.01	0	0	0	0	0	0	0.01
5. Newport News, Virginia Newport News Shipbuilding	445	0.18	460	0.18	21	0.01	965	0.34	3,560	1.70	2.81
6. Norfolk, Virginia Naval Shipyard and Base	0	0	0	0	300	0.07	237	0.61	1,166	0.44	1.17
7. Charleston, South Carolina Naval Shipyard and Base	11	0.01	21	0.01	246	0.14	294	0.36	717	0.67	1.19
8. Pascagoula, Mississippi Ingalls Shipbuilding Corp.	0	0	0	0	0	0	0	0	0	0	0
9. San Diego, California Navy Pier, Ballast Point	5	0.01	0	0	34	0.25	55	0.40	40	0.33	0.99
10. Vallejo, California S.F. Bay Naval Shipyard	14	0.09	100	0.93	65	0.55	63	0.62	128	0.21	2.33
11. Bremerton, Washington Puget Sound Naval Shipyard	0	0	0	0	1	0.07	0	0	196	0.01	0.03
12. Pearl Harbor, Hawaii Naval Shipyard and Base	25	0.10	256	0.72	594	0.92	405	0.98	548	0.48	3.20
13. Apra Harbor, Guam	0	0	0	0	0	0	0	0	69	0.01	0.01
Totals	784	1.21	2,391	3.37	1,579	3.77	2,707	5.57	7,236	5.33	19.06

Notes:
(1) U.S. harbors where shipyards and operating bases for nuclear-powered ships are located are included. Other U.S. harbors have had less than 20 thousand gallons and less than 0.1 curie discharged per year.
(2) Where discharges in one harbor for a year totaled less than 0.005 curies, "0" is reported in this table.
(3) Radioactivity data has been standardized to cobalt-60. Volumes are reported prior to dilution.

home ports or operating bases. These surveys are performed to verify the adequacy of liquid waste disposal procedures and limits.

Shipyards, tenders, and submarine bases have taken weekly samples of harbor water and bottom sediment in the vicinity of berths used by nuclear-powered ships, beginning in each harbor prior to operation of these ships. Radioactivity data from harbor water and sediment samples taken by individual facilities indicate that operation and maintenance of nuclear-powered ships have not caused significant changes in the gross radioactivity of harbor water or sediment. However, relatively large variations in gross radioactivity measured in environmental samples do occur from changes in natural and fallout sources. Because of these variations, monitoring for gross radioactivity in harbor water and sediment is not sufficient to detect small changes in environmental radioactivity which might be attributed to operation and maintenance of Naval nuclear-powered ships.

To monitor for these small changes in environmental radioactivity, specific analyses of water and sediment samples for cobalt–60 have been added to Navy monitoring programs in recent years. Cobalt–60 is a sensitive tracer to follow environmental distribution of radioactivity because it has the longest half-life and is the predominant long-lived radionuclide in liquid waste discharges; in addition, cobalt–60 has not been detected in significant concentrations in radioactivity from fallout or natural sources.

Therefore, starting in 1963, a bottom sedi-

Table 2. Radioactive solid waste disposed of by facilities supporting U.S. Naval nuclear-powered ships for 1961 through 1965

Facility	1961		1962		1963		1964		1965	
	Hundred cubic feet	Curies	Hundred cubic feet	Curies	Hundred cubic feet	Curies	Hundred cubic feet	Curies	Hundred cubic feet	Curies
1. Portsmouth, New Hampshire Naval Shipyard	4	0	80	0.5	18	0.5	80	2.6	150	2.6
2. Quincy, Massachusetts Electric Boat Division	0	0	0	0	0	0	0	0	0	0
3. Groton-New London, Connecticut Electric Boat Division, Tender at State Pier, and Submarine Base	188	99.1	85	1.5	108	1.1	90	3.3	188	253.0
4. Camden, New Jersey New York Shipbuilding Corp	0	0	0	0	0	0	0	0	0	0
5. Newport News, Virginia Newport News Shipbuilding	1	0	10	0.1	8	0.5	22	1.8	198	28.0
6. Norfolk, Virginia Naval Shipyard and Tender	0	0	0	0	3	0	5	0.5	32	1.6
7. Charleston, South Carolina Naval Shipyard and Tenders	5	5.0	9	1.1	35	0.4	47	1.0	78	111.5
8. Pascagoula, Mississippi Ingalls Shipbuilding Corp	0	0	0	0	0	0	0	0	0	0
9. San Diego, California Tenders at Ballast Point	0	0	0	0	2	0.1	7	7.5	3	0
10. Vallejo, California S.F. Bay Naval Shipyard	12	4.3	52	6.0	35	19.0	9	0.3	47	9.4
11. Bremerton, Washington Puget Sound Naval Shipyard	0	0	0	0	0	0	0	0	4	0.1
12. Pearl Harbor, Hawaii Naval Shipyard and Base	0	0	0	0	16	0.4	18	0.7	8	1.4
Totals	160	48.4	236	9.3	216	21.5	282	16.7	676	507.6

Notes:
(1) Where total radioactivity is less than 0.05 curies, "0" is reported in this table.
(2) This table also includes waste from tenders and nuclear-powered ships.

ment sample taken in each harbor from the vicinity of nuclear-powered ship berths was analyzed for cobalt–60 to supplement the gross radioactivity measurements described above. This additional sampling was performed in cooperation with the U.S. Public Health Service (USPHS), and analyses were performed at their Southeastern Radiological Health Laboratory. Results of USPHS analyses for cobalt–60 in harbor bottom sediment samples taken from the vicinity of nuclear-powered ship berths are shown in table 3. Since each number in table 3 is the result of a single sample, more extensive sampling, discussed below, was deemed necessary to determine whether the isolated data points were representative of the surrounding harbor bottom sediment.

To obtain more representative data and to evaluate the cumulative effect of liquid waste discharges over the preceding years, extensive environmental surveys were performed commencing in July 1965. Cobalt–60 analyses were performed on 20 to 70 bottom sediment samples taken from each harbor where Naval nuclear-powered ships have been most frequently based or overhauled; these samples were taken from the top layer of sediment (approximately 1 inch thick) in the immediate vicinity of and away from berthing areas used by Naval nuclear-powered ships. Results of these July 1965 surveys, which involved a total of 845 samples, are summarized in table 4. These surveys show that the total amount of cobalt–60 observed in bottom sediment near a few piers is small compared to natural radioactivity present in harbors.

In conjunction with the bottom sediment sampling surveys reported in table 4, nearby shoreline areas uncovered at low tide were surveyed with sensitive beta-gamma detectors to determine if any of the discharged radioactivity had washed ashore. No shoreline

Table 3. U.S. Public Health Service analyses of cobalt-60 in harbor bottom sediment in vicinity of berths used by U.S. Naval nuclear-powered ships [a]

Location	Picocuries of cobalt-60 per gram of ashed sediment						
	Nov 1963	July 1964	Oct 1964	Jan 1965	Apr 1965	July 1965	Oct 1965
1. Portsmouth, New Hampshire Naval Shipyard	1	6	4	8	0	3	0
2. Quincy, Massachusetts Electric Boat Division	1	1	0	0	0	0	0
3. Groton, Connecticut Electric Boat Division	4	7	12	26	6	320	8
4. Camden, New Jersey New York Shipbuilding Corp	0	0	0	0	0	0	0
5. Newport News, Virginia Newport News Shipbuilding	22	0	0	0	0	2	0
6. Norfolk, Virginia Naval Shipyard	0	0	0	0	0	0	14
7. Charleston, South Carolina Naval Shipyard	1	2	0	2	0	6	0
8. Pascagoula, Mississippi Ingalls Shipbuilding Corp	0	0	0	0	0	0	10
9. San Diego, California Navy Piers, Ballast Point	No sample	54	8	43	90	9	2
10. Vallejo, California S.F. Bay Naval Shipyard	1	1	0	122	3	2	0
11. Bremerton, Washington Puget Sound Naval Shipyard	1	0	0	0	0	0	0
12. Pearl Harbor, Hawaii Naval Shipyard	22	32	270	63	75	37	40
13. Apra Harbor, Guam [b]	No sample	No sample	No sample	0	0	0	0

[a] Each number is the result of a single sample and therefore may not be representative of the harbor bottom sediment around nuclear-powered ship berths. Results of more extensive sampling are in table 4. "0" indicates no cobalt-60 detected.
[b] Use of Apra Harbor, Guam as an operating base commenced January 1965.

radiation levels above the normal 0.01 to 0.03 millirem per hour background levels were detected in any of these locations.

In addition to the locations listed in table 4, environmental monitoring has been accomplished by U.S. Navy submarine tenders which serve as operating bases for U.S. Naval nuclear-powered submarines in Rota, Spain, and Holy Loch, Scotland. Data from these surveys have been exchanged with the host governments. Results of the surveys in the harbor at Rota, Spain, have not shown detectable cobalt-60 in harbor bottom sediment samples. In the Holy Loch, Scotland, anchorage more cobalt-60 radioactivity has been detected in harbor bottom sediment than was expected. Some slight increase in cobalt-60 radioactivity has also been found near the tender anchorage in Holy Loch on shoreline mud flat areas uncovered at low tide. However, there has been no increase of harbor water radioactivity in Holy Loch above normal background levels. Joint U.S. and British assessments of survey results have confirmed that radiation levels in the vicinity of the Holy Loch anchorage are still far below those which are at all likely to cause an individual to receive radiation exposure approaching limits for members of the general public.

Overall results of environmental surveys performed to date indicate the following:

(1) No increase in gross radioactivity above normal background levels has been detected in habor water where U.S. Naval nuclear-powered ships are based, overhauled, or constructed.

(2) Discharges of liquid wastes from U.S. Naval nuclear-powered ships have not caused a measurable increase in the general external background radioactivity of the environment.

(3) Low level cobalt-60 radioactivity in harbor bottom sediment is detectable around a few

Table 4. Summary of cobalt-60 in bottom sediment of U.S. harbors where U.S. Naval nuclear-powered ships have been regularly based or overhauled as surveyed in July 1965

Location	Total bottom area [a] with detectable cobalt-60 (square kilometers) [b]	Average cobalt-60 concentration in detectable area (picocuries cobalt-60/square centimeter)	Estimated total cobalt-60 on bottom (curies)
1. Portsmouth, New Hampshire Naval Shipyard	—	Not detectable	Not detectable
2. Groton-New London, Connecticut Electric Boat Division, State Pier, and Submarine Base	0.1	190	0.19
3. Newport News, Virginia Newport News Shipbuilding	—	Not detectable	Not detectable
4. Norfolk, Virginia Naval Base	—	Not detectable	Not detectable
5. Charleston, South Carolina Naval Shipyard and Base	—	Not detectable	Not detectable
6. San Diego, California Navy Piers at Ballast Point	0.01	30	0.003
7. Vallejo, California S.F. Bay Naval Shipyard	0.01	10	0.001
8. Pearl Harbor, Hawaii Naval Shipyard and Base	0.3	10	0.03
9. Apra Harbor, Guam	-	Not detectable	Not detectable

[a] All areas with detectable cobalt-60 were in immediate vicinity of piers used for berthing nuclear-powered ships.
[b] One square kilometer is approximately equal to 0.4 square miles; 1 picocurie = 10^{-12} curies.

specific piers at operating bases and shipyards where nuclear-powered submarine maintenance and ov rhauls have been conducted over a period of several years. Cobalt-60 is not detectable above background levels in general harbor bottom areas away from these piers. Maximum total radioactivity observed in a U.S. harbor is less than 1 curie of cobalt-60.

REFERENCES

(1) FEDERAL RADIATION COUNCIL. Federal Radiation Council memoranda, approved by President Eisenhower on May 13, 1960, and by President Kennedy on September 20, 1961.

(2) U.S. ATOMIC ENERGY COMMISSION. Standards for protection against radiation. Code of Federal Regulations, Title 10, Part 20.

(3) NATIONAL COUNCIL OF RADIATION PROTECTION AND MEASUREMENTS. Maximum permissible body burdens and maximum permissible concentrations of radionuclides in air and in water for occupational exposure. National Bureau of Standards Handbook 69 (June 1959).

(4) INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Report of Committee II on permissible dose for international radiation, 1959. Also ICRP Supplement 6 (1962); ICRP Publication 2 (1959).

(5) NATIONAL ACADEMY OF SCIENCES — NATIONAL RESEARCH COUNCIL. Radioactive waste disposal from nuclear-powered ships, Publication 658. National Academy of Sciences—National Research Council, Washington, D.C. (1959).

Radiological Health Data and Reports, a monthly publication of the Public Health Service, includes data and reports provided to the Division of Radiological Health by Federal agencies, State health departments, and foreign governmental agencies. Pertinent original data and interpretive manuscripts are invited from investigators. These are subject to review by a Board of Editorial Advisors with representatives from the following Federal agencies:

Department of Defense
Department of Agriculture
Department of Commerce
Department of Health, Education, and Welfare
Atomic Energy Commission

GPO 909-785

REPORT NT-90-1
FEBRUARY 1990

ENVIRONMENTAL MONITORING AND DISPOSAL OF RADIOACTIVE WASTES FROM U.S. NAVAL NUCLEAR POWERED SHIPS AND THEIR SUPPORT FACILITIES

NAVAL NUCLEAR PROPULSION PROGRAM
DEPARTMENT OF THE NAVY
WASHINGTON, D.C. 20362

Report NT-90-1
February 1990

ENVIRONMENTAL MONITORING AND DISPOSAL OF RADIOACTIVE WASTES FROM U.S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES 1989

Prepared by
J. J. Mangeno
J. M. Steele and J. V. Betschart
Naval Nuclear Propulsion
Department of the Navy

Approved by

B. DeMARS, ADM, USN
Director
Naval Nuclear Propulsion

ABSTRACT

The environmental effect of disposal of radioactive wastes originating from U. S. Naval nuclear propulsion plants and their support facilities is assessed. The total gamma radioactivity in liquids discharged to all ports and harbors from the more than one hundred fifty Naval nuclear-powered ships and supporting tenders, Naval bases and shipyards was less than 0.002 curie in 1989. This report confirms that procedures used by the Navy to control releases of radioactivity from U. S. Naval nuclear-power d ships and their support facilities are effective in protecting the environment and the health and safety of the general public. These procedures have ensured that no member of the general public has received measurable radiation exposure as a result of current operations of the Naval Nuclear Propulsion Program.

TABLE OF CONTENTS

SUMMARY 1

RADIOACTIVE LIQUID PROCESSING AND CONTROL 3

Policy and Procedures Minimizing Release of Radioactivity in Harbors 3
Source of Radioactivity 3
Radioactivity Removal From Liquid at Shore Facilities 4
Liquid Releases in Harbors 4
Short-Lived Radionuclides 5
Fission Product Radionuclides 5
Tritium 7
Carbon 14 8
Liquid Releases at Sea 8
Loss of USS THRESHER and USS SCORPION 9

SOLID RADIOACTIVE WASTE DISPOSAL 11

Deactivation of Ingalls Shipbuilding Radiological Facilities.....15

TRANSPORTATION OF RADIOACTIVE MATERIAL 15

ENVIRONMENTAL MONITORING 19

Navy Environmental Monitoring Program 19

ENVIRONMENTAL PATHWAYS ANALYSIS 28

AUDITS AND REVIEWS 34

CONCLUSIONS 36

REFERENCES 37

LIST OF TABLES

TABLE 1 RADIOACTIVE LIQUID RELEASED TO HARBORS FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES 2

TABLE 2 TOTAL RADIOACTIVITY IN LIQUID RELEASED AT SEA ORIGINATING FROM U. S. NAVAL NUCLEAR-POWERED SHIPS 9

TABLE 3 RADIOACTIVE SOLID WASTE FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES FOR 1985 THROUGH 1989 12

TABLE 4 SUMMARY OF 1989 SURVEYS FOR COBALT 60 IN BOTTOM SEDIMENT OF U. S. HARBORS WHERE U. S. NAVAL NUCLEAR-POWERED SHIPS HAVE BEEN REGULARLY BASED, OVERHAULED OR BUILT 22

TABLE 5 SUMMARY OF 1989 SURVEYS FOR COBALT 60 IN MARINE LIFE FROM U. S. HARBORS WHERE U. S. NAVAL NUCLER-POWERED SHIPS HAVE BEEN REGULARLY BASED, OVERHAULED OR BUILT.....26

TABLE 6 SUMMARY OF 1989 OFF-SITE AND PERIMETER RADIATION MONITORING OF HARBORS WHERE U. S. NAVAL NUCLEAR-POWERED SHIPS HAVE BEEN REGULARLY BASED, OVERHAULED OR BUILT.....27

TABLE 7 RADIONUCLIDE RELEASES ASSUMED FOR ENVIRONMENTAL PATHWAYS ANALYSIS 31

TABLE 8 ENVIRONMENTAL EXPOSURE TIMES, CONSUMPTION AND CONCENTRATION PARAMETERS ASSUMED FOR ENVIRONMENTAL PATHWAYS ANALYSIS 32

TABLE 9 ESTIMATED MAXIMUM RADIATION EXPOSURE TO AN INDIVIDUAL FOR ASSUMED LIQUID AND AIRBORNE RADIOACTIVITY RELEASES FROM SHIPYARDS ENGAGED IN NAVAL NUCLEAR PROPULSION WORK 33

TABLE 10 ESTIMATED TOTAL WHOLE BODY RADIATION EXPOSURE TO GENERAL PUBLIC WITHIN 50 MILES FOR ASSUMED LIQUID AND AIRBORNE RADIO-ACTIVITY RELEASES FROM SHIPYARDS ENGAGED IN NAVAL NUCLEAR PROPULSION PLANT WORK 33

LIST OF FIGURES

FIGURE 1 SIMPLIFIED DIAGRAM OF LIQUID PROCESSING SYSTEM 6

FIGURE 2 RADIOACTIVE SOLID WASTE DISPOSAL VOLUMES IN THE NAVAL NUCLEAR PROPULSION PROGRAM, 1961-1989 14

FIGURE 3 DREDGE FOR SAMPLING HARBOR SEDIMENT 20

FIGURE 4 GAMMA SPECTRA OF HARBOR BOTTOM SEDIMENT SAMPLES WITH A GERMANIUM DETECTOR.....24

FIGURE 5 PATHWAYS FOR EXTERNAL AND INTERNAL EXPOSURE OF MAN FROM AIRBORNE AND LIQUID RELEASES OF RADIOACTIVITY 30

APPENDIX ENVIRONMENTAL MONITORING SURVEY CHARTS 42

SUMMARY

The radioactivity in materials discussed in this report originates in the pressurized water reactors of U. S. Naval nuclear-powered ships. As of the end of 1989, the U. S. Navy had 132 nuclear-powered submarines and fifteen nuclear-powered surface ships in operation. Support facilities involved in construction, maintenance, overhaul and refueling of these nuclear propulsion plants include eight shipyards, eighteen tenders and four submarine bases. This report describes disposal of radioactive liquid, transportation and disposal of solid wastes, monitoring of the environment to determine the effect of radioactive releases, and updates reports on this subject issued by the Navy in references 1 through 5.* This report concludes that radioactivity associated with U. S. Naval nuclear-powered ships has had no significant or discernible effect on the quality of the environment. A summary of the radiological information supporting this conclusion follows:

From the start of the Naval Nuclear Propulsion Program, the policy of the U. S. Navy has been to reduce to the minimum practicable the amounts of radioactivity released into harbors. Navy procedures to accomplish this have been reviewed with the U. S. Department of Energy, the U. S. Nuclear Regulatory Commission and the U. S. Environmental Protection Agency. The total gamma radioactivity released within twelve miles from shore from all U. S. Naval nuclear-powered ships and their support facilities in recent years is shown in Table 1; this includes all harbors both U. S. and foreign entered by these ships.

* References are listed on page 37.

TABLE 1 RADIOACTIVE LIQUID RELEASED TO HARBORS FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES

Year	Number of Ships In Operation	Radioactivity-Curies (less tritium)
1971	100	less than 0.002
1972	104	less than 0.002
1973	107	less than 0.002
1974	111	less than 0.002
1975	113	less than 0.002
1976	115	less than 0.002
1977	120	less than 0.002
1978	124	less than 0.002
1979	126	less than 0.002
1980	126	less than 0.002
1981	133	less than 0.002
1982	137	less than 0.002
1983	142	less than 0.002
1984	144	less than 0.002
1985	147	less than 0.002
1986	149	less than 0.002
1987	148	less than 0.002
1988	148	less than 0.002
1989	147	less than 0.002

As a measure of the significance of these data, if one person were able to drink the entire amount of radioactivity discharged into any harbor in any of the last nineteen years, he would not exceed the annual radiation exposur permitted for an individual worker by the U. S. Nuclear Regulatory Commission.

Environmental monitoring is conducted by the U. S. Navy in U. S. and foreign harbors frequented by U. S. Naval nuclear-powered ships. This monitoring consists of analyzing harbor sediment, water and marine life samples for radioactivity associated with Naval nuclear propulsion plants, radiation monitoring around the perimeter of support facilities and effluent monitoring. Environmental samples from each of these harbors are also checked at least annually by a U. S. Department of Energy laboratory to ensure analytical procedures are correct and standardized.

Independent environmental monitoring has been conducted by the U. S. Environmental Protection Agency in U. S. harbors during the past several decades. The results of

these extensive, detailed surveys have been consistent with Navy results. These surveys have again confirmed that U. S. Naval nuclear-powered ships and support facilities have had no significant effect on the radioactivity of the environment.

RADIOACTIVE LIQUID PROCESSING AND CONTROL

Policy and Procedures Minimizing Release of Radioactivity in Harbors

The policy of the U. S. Navy is to reduce to the minimum practicable the amounts of radioactivity released to the environment, particularly within twelve miles from shor including into harbors. This policy is consistent with applicable recommendations issued by the Federal Radiation Council (incorporated into the Environmental Protection Agency in 1970), U. S. Nuclear Regulatory Commission, National Council on Radiation Protection and Measurements, International Commission on Radiological Protection, International Atomic Energy Agency, and National Academy of Sciences--National Research Council (references 6 through 15). Keeping releases small minimizes the radioactivity available to build up in the environment or to concentrate in marine life. To implement this policy of minimizing releases, the Navy has issued standard instructions defining radioactive release limits and procedures to be used by U. S. Naval nuclear-powered ships and their support facilities. These instructions were reviewed by the U. S. Department of Energy, the U. S. Nuclear Regulatory Commission and the U. S. Environmental Protection Agency.

Source of Radioactivity

In the shipboard reactors, pressurized water circulating through the reactor core picks up the heat of nuclear reaction. The reactor cooling water circulates through a closed piping system to heat exchangers which transfer the heat to water in a secondary steam system isolated from the primary cooling water. The steam is then used as the source of power for the propulsion plant as well as for auxiliary machinery. Releases from the shipboard reactors occur primarily when reactor coolant water expands as a result of being heated to operating temperature; this coolant passes through a purification system ion exchange resin bed prior to being transferred from the ship.

The principal source of radioactivity in liquid

effluents is trace amounts of corrosion and wear products from reactor plant metal surfaces in contact with reactor cooling water. Radionuclides with half-lives of approximately one day or greater in these corrosion and wear products include tungsten 187, chromium 51, hafnium 181, iron 59, iron 55, nickel 63, zirconium 95, tantalum 182, manganese 54, cobalt 58, and cobalt 60. The most predominant of these is cobalt 60, which has a 5.3 year half-life. Cobalt 60 also has the most restrictive concentration limit in water as listed by organizations which set radiological standards in references 6, 7 and 8 for these corrosion and wear radionuclides. Therefore, radioactivity is conservatively controlled by assuming that all the long-lived radioactivity is cobalt 60.

Radioactivity Removal From Liquid at Shore Facilities

Radioactive liquids at shore facilities are collected in stainless steel tanks and processed through a processing system to remove most of the radioactivity (exclusive of tritium) prior to collection in a clean tank for reuse. Even after processing to approximately 10^{-8} microcuries of gamma radioactivity per milliliter, reactor coolant is reused rather than discharged. Figure 1 shows a simplified block diagram of the liquid processing system which consists of particulate filters, activated carbon bed filters, mixed hydrogen hydroxyl resin and colloid removal resin beds. This type of processing system has been developed and used successfully to produce high quality water containing very low radioactivity levels.

Liquid Releases in Harbors

The total amounts of long-lived gamma radioactivity released into harbors and seas within twelve miles from shore have been less than 0.002 curie during each of the last nineteen years. This total is for releases from U. S. Naval nuclear-powered ships and from the supporting shipyards, tenders and submarine bases, and at operating bases and home ports in the U. S. and overseas and all other U. S. and foreign ports which were visited by Naval nucl ar-powered ships. This quantity is conservatively reported as if it consisted entirely of cobalt 60, which is the predominant long-lived gamma radionuclide and also has the most stringent concentration limits.

To put this small quantity of radioactivity into perspective, it is less than the quantity of naturally

occurring radioactivity (reference 16) in the volume of saline harbor water occupied by a single nuclear-powered submarine.

Although volumes are of less significance than the amounts of radioactivity released, Table 1 of earlier reports has also shown that the total volume of liquids released within twelve miles from shore has been reduced from millions of gallons per year in the 1960's to less than 25 thousand gallons per year beginning in 1973. Thus, the Navy has achieved its policy of reducing releases of radioactive liquids in harbors to the minimum practicable amounts. Therefore, volumes have been deleted from this report.

Short-Lived Radionuclides

Reactor coolant also contains short-lived radionuclides with half-lives of seconds to hours. Their highest concentrations in reactor coolant are from nitrogen 16 (7 second half-life), nitrogen 13 (10 minute half-life), fluorine 18 (1.8 hour half-life), argon 41 (1.8 hour half-life) and manganese 56 (2.6 hour half-life). Total short-lived radioactivity released in water in a year to any harbor has been less than 0.001 curie. For the longest-lived of these, about one day after discharge from an operating reactor, the concentration is reduced to one thousandth of the initial concentration, and in about two days the concentration is reduced to one millionth. Therefore, since most of the water is transferred to shore facilities for processing and reuse rather than discharged, these short-lived radionuclides are not important for liquid release considerations.

Fission Product Radionuclides

Fission products produced in the reactor are retained within the fuel elements. The fission gases krypton and xenon are also retained within the fuel elements. However, trace quantities of naturally occurring uranium impurities in reactor structural materials release small amounts of fission products to reactor coolant. The concentrations of fission products and the volumes of reactor coolant released are so low, however, that the total radioactivity attributed to long-lived fission product radionuclides, strontium 90 and cesium 137, in releases from U. S. Naval nuclear-powered ships and their support facilities has been less than 0.001 curie per year for all harbors combined. Fallout of these

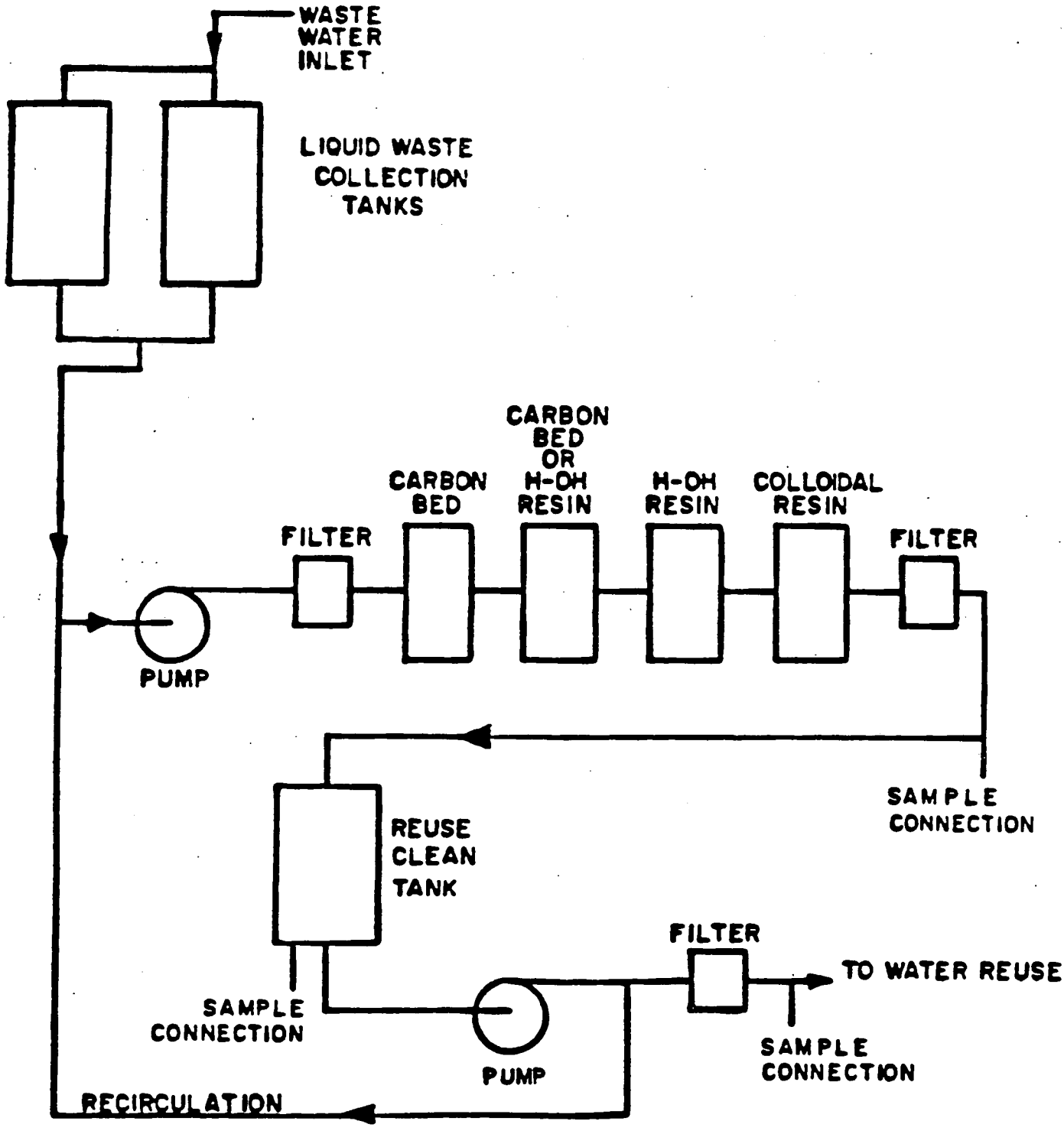


FIGURE 1
SIMPLIFIED DIAGRAM OF WASTE PROCESSING SYSTEM

same fission products has often been more than this in one rainfall in a single harbor.

Tritium

Small amounts of tritium are formed in reactor coolant systems as a result of neutron interaction with the approximately 0.015 percent of naturally occurring deuterium present in water, and other nuclear reactions. Although tritium has a 12 year half-life, the radiation produced is of such low energy that the radioactivity concentration guide issued by the International Commission on Radiological Protection, the National Council on Radiation Protection and Measurements, the U. S. Nuclear Regulatory Commission and by other standard-setting organizations is at least one hundred times higher for tritium than for cobalt 60. This tritium is in the oxide form and is chemically indistinguishable from water; therefore, it does not concentrate significantly in marine life or collect on sediment as do other radionuclides.

Tritium is naturally present in the environment because it is generated by cosmic radiation in the upper atmosphere. Reference 17 reports that the production rate from this source is about four million curies per year, which through rainfall causes a tritium inventory in the oceans of about seventy million curies. Because of this naturally occurring tritium, much larger releases of tritium than are conceivable from Naval nuclear reactors would be required to make a measurable change in the background tritium concentration.

The total amount of tritium released annually from all U. S. Naval nuclear-powered ships and their supporting tenders, bases and shipyards has been less than 200 curies. Most of this has been into the ocean greater than twelve miles from shore. The total tritium released from the entire nuclear Navy is less than single electrical generating nuclear power stations typically release each year (reference 18). Total tritium released into harbors within twelve miles from shore was less than one curie in 1989. Such releases are too small to increase measurably the tritium concentration in the environment. Therefore, tritium has not been combined with the data on other radionuclides in other sections of this report.

Carbon 14

Carbon 14 is also formed in small quantities in reactor coolant systems as a result of neutron interactions with nitrogen and oxygen. Carbon 14 decays with a half-life of 5,730 years; however, only low energy beta radiation is emitted as a result of this decay process. As a result, th radioactivity concentration guide for carbon 14 in its chemical form in air issued by the International Commission on Radiological Protection, the National Council on Radiation Protection and Measurements, the U. S. Nuclear Regulatory Commission and by other standard-setting organizations is at least three thousand times higher than for cobalt 60.

Carbon 14 occurs naturally in the environment. It is generated from cosmic radiation interactions with nitrogen and oxygen in the upper atmosphere and oxidized to form carbon dioxide. Carbon 14 is chemically indistinguishable from other isotopes of carbon. The carbon dioxide diffuses and convects throughout the atmosphere and enters the earth's carbon cycle. Reference 19 states that the earth's carbon 14 inventory is estimated to be about two hundred and fifty million curies. The total amount of carbon 14 released annually from the operation of all U. S. Naval nuclear-powered ships and their supporting tenders, bas s and shipyards has been less than 100 curies, most of which is released at sea beyond twelve miles from shore. The total carbon 14 radioactivity released in a year in any harbor has been less than 0.1 curie. Since the inventory of naturally occurring carbon 14 is so large, it is extremely unlikely that releases from Naval nuclear reactors could result in a measureable change in the background concentration of carbon 14. Therefore, carbon 14 has not been combined with the data on other radionuclides in other sections of this report.

Liquid Releases at Sea

Radioactive liquids incidental to the operation of the nuclear propulsion plants are released at sea under strict controls. These ocean releases are consistent with recommendations the Council on Environmental Quality made in 1970 to the President in reference 20, and consistent with the Marine Protection, Research and Sanctuaries Act, reference 21. Procedures and limits for ocean releases have been consistent with recommendations made by the National Academy of Sciences--National Research Council in reference

10 and by the International Atomic Energy Agency in reference 11. These releases have contained much less radioactivity than these reports considered would be acceptable. Total long-lived radioactivity released farth r than twelve miles from shore by U. S. Naval nuclear-powered ships and supporting tenders is shown in Table 2 for recent years. This is the total amount released from over 100 ships at different times of the year in the open sea at long distances from land in small incremental amounts, and under rapid dispersal conditions due to wave action. The quantity of radioactivity released to the open ocean in 1989 was 0.4 curie, which is less than the naturally occurring radioactivity (reference 16) in a cube of sea water approximately 100 yards on a side.

TABLE 2 TOTAL RADIOACTIVITY IN LIQUID RELEASED AT SEA ORIGINATING FROM U. S. NAVAL NUCLEAR-POWERED SHIPS

	Radioactivity-Curies (less tritium)
1975	0.4
1976	0.4
1977	0.4
1978	0.4
1979	0.4
1980	0.4
1981	0.4
1982	0.4
1983	0.4
1984	0.4
1985	0.4
1986	0.4
1987	0.4
1988	0.4
1989	0.4

Loss of USS THRESHER and USS SCORPION

Two U. S. Naval nuclear-powered submarines have been lost at sea in the Atlantic Ocean. The submarine THRESHER sank 10 April 1963, 100 miles from land in water 8,500 feet deep at latitude 41°45'N and longitude 65°00'W. The submarine SCORPION sank between 21 and 27 May 1968, 400 miles southwest of the Azores in more than 10,000 feet of water. The reactors used in all U. S. Naval submarines and surface ships are designed to minimize potential hazards to the environment even under the most severe casualty conditions such as the actual sinking of the ship. First,

the reactor core is so designed that it is physically impossible for it to explode like a bomb. Second, the reactor fuel elements are made of materials that are extremely corrosion resistant, even in sea water. The reactor core could remain submerged in sea water for decades without releases of fission products while the radioactivity decays, since the protective cladding on the fuel elements corrodes only a few millionths of an inch per year. Thus, in the event of a serious accident where the reactor is completely submerged in sea water, the fuel elements will remain intact for an indefinite period of time, and the radioactive material contained in these fuel elements should not be released. The maximum rate of release and dispersal of the radioactivity in the ocean, even if the protective cladding on the fuel were destroyed, would be so low as to be insignificant.

Radioactive material could be released from this type of reactor only if the fuel elements were actually to melt and, in addition, the high-strength, all-welded reactor system boundary were to rupture. The reactor's many protective devices and inherent self-regulating features are designed to prevent any melting of the fuel elements. Flooding of a reactor with sea water furnishes additional cooling for the fuel elements and so provides added protection against the release of radioactive fission products.

Radiation measurements, water samples, bottom sediment samples and debris collected from the area where THRESHER sank were analyzed for radioactivity shortly after the sinking and again in 1965 by various laboratories. Similarly, sea water and bottom sediment samples taken near SCORPION's hull were analyzed for radioactivity. In 1977, 1983 and 1986, followup samples of water, sediment, marine life and debris were collected from the immediate THRESHER debris areas. In 1979 and 1986, followup samples of water, sediment, marine life and debris were collected from the immediate SCORPION debris areas. None of these samples showed any evidence of release of radioactivity from the reactor fuel elements in either THRESHER or SCORPION. However, cobalt 60 released from both THRESHER and SCORPION coolant systems was detectable at low levels in the sediment samples in the debris areas. The amount of cobalt 60 radioactivity in these samples was small compared to the naturally occurring radioactivity in the sediments. Based on the samples, less than 0.001 curie of cobalt 60 was estimated to be present in the sedim nt at either site.

Cobalt 60 was not detectable in samples of water, marine life or debris. Thus, the THRESHER and SCORPION have not had a significant effect on the radioactivity in the environment. Additional information on the radiological surveys of the THRESHER and SCORPION debris areas is available in reference 22.

SOLID RADIOACTIVE WASTE DISPOSAL

During maintenance and overhaul operations, solid low-level radioactive wastes consisting of contaminated rags, plastic bags, paper, filters, ion exchange resin and scrap materials are collected from nuclear-powered ships and their support facilities. These low-level radioactive materials are required to be strictly controlled to prevent loss. These controls include Naval accountability procedures which require serialized tagging and marking and signatures by radiologically trained personnel.

Solid radioactive waste materials are packaged in strong tight containers, shielded as necessary and shipped to burial sites licensed by the U. S. Nuclear Regulatory Commission or a State under agreement with the U. S. Nuclear Regulatory Commission. Solid radioactive materials from Naval nuclear-powered ships have not been dumped at sea since 1970 when the Navy issued procedures prohibiting sea disposal of solid radioactive materials. Shipyards and other shore facilities are not permitted to dispose of radioactive solid wastes by burial on their own sites.

Table 3 summarizes the total radioactivity and volumes of radioactive solid waste disposed of during the last five years. Table 3 includes all waste generated by U. S. Naval nuclear-powered ships and the listed support facilities since all radioactive solid waste generated by U. S. nuclear-powered ships is transferred to the listed facilities. The quantity of solid radioactive waste in any one year from a particular facility depends on the amount and type of support work performed that year. Table 3 does not include fuel or other classified radioactive components shipped to Department of Energy facilities for processing and for disposal.

TABLE 3 RADIOACTIVE SOLID WASTE FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES FOR 1985 THROUGH 1989

Facility	1985 Thousand Cubic Feet	1985 Curies	1986 Thousand Cubic Feet	1986 Curies	1987 Thousand Cubic Feet	1987 Curies	1988 Thousand Cubic Feet	1988 Curies	1989 Thousand Cubic Feet	1989 Curies
Kitt ry, Maine Portsmouth Naval Shipyard	1	1	1	1	1	<1	1	2	9	3
Gr ton, New London, Conn., El ctric Boat Division, State Pier and Sub Base	1	<1	1	<1	2	<1	2	<1	1	1
Newport News, Virginia N wport News Shipbuilding	3	<1	4	<1	3	3	7	<1	15	<1
Norfolk, Virginia Naval Shipyard and Tenders	11	38	9	55	6	1	11	1	5	<1
Charleston, South Carolina Naval Shipyard and Tenders	7	7	6	18	7	4	8	51	10	11
San Diego, California T nders	1	2	--	--	--	--	--	--	--	--
Vall jo, California Mar Island Naval Shipyard	7	17	2	6	10	2	6	4	5	3
Br m rton, Washington Puget Sound Naval Shipyard	6	11	9	53	6	1	8	62	7	1
P arl Harbor, Hawaii Naval Shipyard & Sub Base	12	61	2	3	3	7	4	5	6	1
TOTAL	49	139	34	138	38	20	47	127	58	22

NOTES:

(1) This table includes all radioactive waste from tenders and nuclear-powered ships. This radioactivity is primarily cobalt 60. This radioactive waste is shipped to burial facilities licensed by the U. S. Nuclear Regulatory Commission or a State.

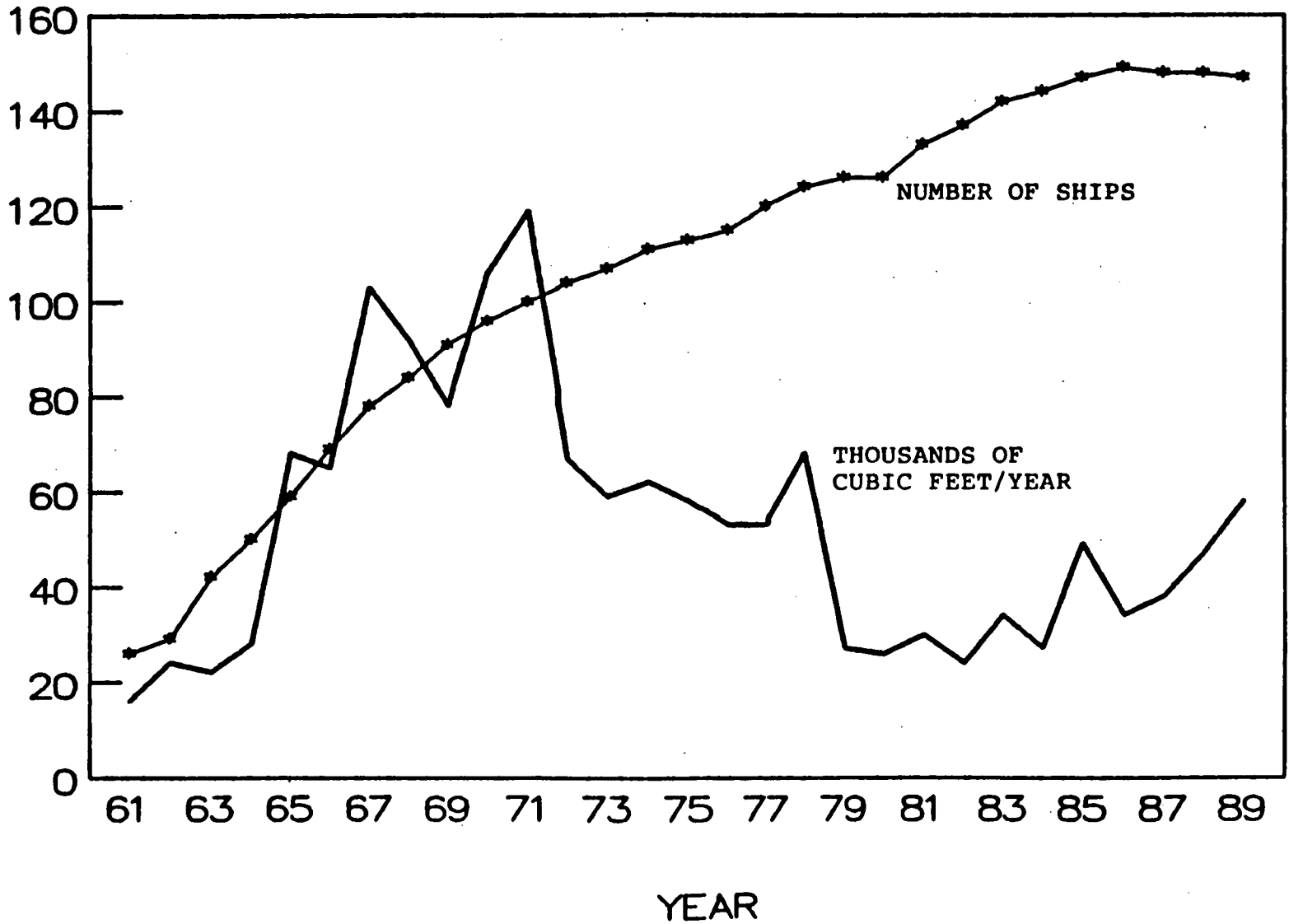
(2) Volum s l ss than 500 cubic feet ar reported as 1 thousand cubic f t and activiti s less than 0.5 curie are r ported as <1 curie.

Figure 2 shows that in the last several years the total annual volume of solid low-level radioactive waste has been substantially reduced, despite increasing numbers of ships. Most of the volume is generated during maintenance and overhaul operations in shipyards. This reduction has been accomplished simultaneously with reduction in personnel radiation exposure, as described in reference 23. This reduction has been accomplished by several techniques including a total containment concept for radiological work which minimizes the spread of radioactivity to non-radioactive materials, use of preplanning and mockups to minimize rework, reusing rather than disposing of tools and equipment, use of radioactive liquid processing procedur s which minimize depletion of processing media, use of compaction equipment and efficient packaging to fully use space in disposal containers, and separating solid waste that requires special disposal owing to its radioactive content from that which does not. The latter is achieved by work site controls and by use of sensitive detection equipment to detect radioactivity only slightly greater in concentration than that found in natural materials such as soil, rocks, water, and biological matter (see reference 22) thus requiring the material to be handled as radioactive for waste disposal purposes. Material which passes the screening provided by this sensitive detection equipment can be disposed of as ordinary waste. Challenging goals are set by each shipyard to ensure continuing management attention to minimizing generation of waste in radiological work.

The annual volume for the entire Naval Nuclear Propulsion Program could be contained in a cube measuring about thirteen yards on a side. The total annual volume of solid radioactive waste from the Naval Nuclear Propulsion Program listed in Table 3 is less than some individual electrical generating nuclear power stations have generated in a year (reference 18). The total annual volume is approximately six percent of the solid radioactive waste generated annually by all nuclear electric power reactors (reference 18) and approximately four percent of the total volume of radioactive solid waste buried in all U. S. commercial burial grounds each year (reference 24).

FIGURE 2

RADIOACTIVE SOLID WASTE DISPOSAL
VOLUMES IN THE NAVAL NUCLEAR
PROPULSION PROGRAM, 1961-1989



Deactivation of Ingalls Shipbuilding Radiological Faciliti s

From 1958 to 1980, Ingalls Shipbuilding was engaged in the construction and overhaul of Naval nuclear-powered ships in Pascagoula, Mississippi. The shipyard radiological facilities which supported this work were deactivated between 1980 and 1982 by removing and disposing of all radioactive material associated with Naval nuclear propulsion plants. Useful items, such as tools and equipment that were radioactively contaminated, were transferred to other organizations in the Naval Nuclear Propulsion Program. The remaining radioactive material was disposed of as solid waste.

Extensive radiological decommissioning surveys were performed to verify the removal of this radioactive material. Direct radiological surveys were performed on over 274,000 square feet of building and facility surfaces. Over 11,000 samples of these surfaces as well as soil, ground cover and concrete were taken from all areas where radioactive work was previously performed. These samples were analyzed using sensitive laboratory equipment. In addition, both the State of Mississippi and the Environmental Protection Agency (reference 25) perform d overcheck surveys of the deactivated facilities. After these surveys were completed, the Ingalls facilities were released for unrestricted use. Personnel who subsequently occupy these facilities will not receive measurable radiation exposure above natural background levels that exist in areas not affected by Naval nuclear propulsion plant work. Reference 25 is the report of the survey of the Ingalls facilities by the Environmental Protection Agency.

TRANSPORTATION OF RADIOACTIVE MATERIAL

Shipments of radioactive materials in the Naval Nucl ar Propulsion Program are required to be made in accordance with applicable regulations of the U. S. Department of Transportation, U. S. Department of Energy, and U. S. Nuclear Regulatory Commission. The purpose of these regulations is to ensure that shipments of radioactive material are adequately controlled to protect the environment and the health and safety of the general public. These regulations are applicable to all radioactive material shipments. The shipments discussed herein cover areas in addition to waste for completeness.

The above regulations provide requirements for the container design, certification, and identification as applicable for the specific quantity, type and form of radioactivity being shipped. Naval shipping container design requirements invoke shielding and integrity specifications and meet all regulatory requirements. They provide for testing of container designs, training and qualification of workers who construct containers, and quality control inspections during fabrication to ensure the containers will meet their design requirements.

In addition to imposing requirements of Federal transportation regulations, the Navy has issued standard instructions to further control shipments of radioactivity associated with U. S. Naval nuclear propulsion plants. These standard instructions result in a quality assurance program which includes inspections and assessments by independent organizations and senior management. Organizations making shipments are required to prepare local procedures which require use of compliance checklists and management review to ensure compliance with applicable Department of Transportation, Navy and burial ground requirements. Only specially trained, designated people, knowledgeable in shipping regulations, are permitted to authorize shipments of radioactive material.

Protective transportation service such as signature security service or sealed shipping vehicles are required for these shipments to ensure point-to-point control and traceability of each shipment from shipper to receiver. A readily accessible log of all shipments in transit is maintained to enable prompt identification and provide the basis for advice on the nature of the shipment. Return receipts are required to be made in writing by receivers to ensure that radioactive material has not been lost in shipment. Receipt inspection of containers of radioactive material and accompanying documents are required promptly after receipt to monitor compliance. Even minor discrepancies from detailed shipping regulations are required to be reported to the shipper so that correction can be made in future shipments. This is done to ensure compliance with shipping regulations.

Radioactive materials shipped in the Naval Nuclear Propulsion Program include anticontamination clothing for laundry, small sealed sources used for calibrating radiation monitoring instruments, tools and equipment used for radioactive work, low-level radioactive waste, radioactive

components and new and recoverable irradiated nuclear fuel. A total of approximately 1,000 shipments are made annually by Naval nuclear-powered ships and their support facilities, which is a small part of the more than two million shipments of radioactive materials made annually in the United States (Reference 26).

Nearly all radioactive shipments in the Naval Nuclear Propulsion Program contain only low-level radioactivity classified under Department of Transportation regulations as low specific activity or limited quantity shipments. Th predominant radionuclide associated with these shipments is cobalt 60 in the form of insoluble metallic oxide corrosion products attached to surfaces of materials inside shipping containers. Most low-level shipments are made by truck. Air transport is used no more than a few times per year for the Naval Nuclear Propulsion Program. These air shipments involve only very low-level radioactivity and are not shipped on passenger planes.

Approximately one quarter of the low-level radioactivity shipments are minute quantities in sealed instrument calibration check sources. These sources contain insignificant quantities of radioactivity which are comparable to the radioactivity in typical ionization type smoke detectors. Greater than one-half of these low-level shipments are anticontamination clothing, equipment and tools. The anticontamination laundry involves shipments of special outer clothing potentially contaminated with low levels of radioactivity while worn in controlled work areas. This laundry is shipped by Nuclear Regulatory Commission licensed contractors to their facilities for cleaning. On the average, one shipment of low-level radioactive waste per three months is made from each facility listed in Table 3.

The remaining few shipments are new and recoverable irradiated nuclear fuel and radioactive components associated with reactors and these are shipped by the U. S. Department of Energy. Such shipments are made infrequently since U. S. Naval nuclear-powered ships need refueling infrequently. Recoverable irradiated fuel shipments are made to Department of Energy facilities for disposition. Measures are carried out to assist in safeguarding these shipments and assuring they reach their destination. Each recoverable irradiated fuel shipment is escorted by U. S. Government representatives and each shipping container is specifically designed to withstand extreme accident impacts,

fire, or water immersion, and to prevent release of the material to the environment in the event of an accident. The cargo in the nuclear fuel and radioactive component shipments is non-explosive and non-flammable and, in addition, the radioactive material in the radioactive components is in an insoluble form that should not be dispersed even in the event of an accident.

Estimates of radiation exposure to transportation cr ws and the general public from shipments of radioactive materials in the Naval Nuclear Propulsion Program have b en made in a manner consistent with that employed by the U. S. Nuclear Regulatory Commission in reference 26. Based on comparisons of the types and numbers of radioactive shipments made, the total annual radiation exposure to all transportation crews for all shipments is estimated to be less than three man-rem. If one person were to receive all this exposure, he would not exceed the radiation exposure permitted for an individual worker by the U. S. Nuclear Regulatory Commission. The total estimated radiation exposure accumulated by the public along transportation routes is not more than a few times higher than the exposure to transportation workers. The maximum exposure to any individual member of the public would be far less than that received from natural radiation.

Shipments of radioactive materials associated with Naval nuclear propulsion plants have not resulted in any measurable release of radioactivity to the environment. There have never been any significant accidents involving release of radioactive material during shipment since the Naval Nuclear Propulsion Program began. In general, the few accidents that have occurred involved incidents such as broken truck axles or slight external damage to a shipping container with no release of radioactivity. In one incident a train collision resulted in minor denting of a new fuel shipping container with no loss of integrity of the container, no damage to the fuel and no release of radioactivity. In the only two instances that involved loss of contents, one quart containers holding samples were broken in shipment. In one case this occurred when a cargo aircraft crashed. The other container was lost from a commercial ship. Both containers were recovered and there was no measurable radioactivity released since the original contents were less than one millionth of a curie.

The requirements of the Naval Nuclear Propulsion Program specify that the carriers for all radioactive

material shipments shall have accident plans which identify the actions to be taken in the event the transportation vehicle is involved in an accident. These plans provide for notification of civil authorities and the originating facility. The U. S. Navy would communicate with and cooperate fully with State radiological officials in the event of occurrences involving shipment of radioactive materials.

ENVIRONMENTAL MONITORING

To provide additional assurance that procedures used by the U. S. Navy to control radioactivity are adequate to protect the environment, the Navy conducts environmental monitoring in harbors frequented by its nuclear-powered ships. Environmental monitoring surveys for radioactivity are periodically performed in harbors where U. S. Naval nuclear-powered ships are built or overhauled and where these ships have home ports or operating bases. Samples from each harbor monitored are also checked at least annually by a U. S. Department of Energy laboratory to ensure analytical procedures are correct and standardized. The Department of Energy laboratory results have been consistent with shipyard results.

Navy Environmental Monitoring Program

The current Navy environmental monitoring program consists of analyzing samples of harbor sediment, water and marine life, supplemented by shoreline surveys, posted dosimeters and effluent monitoring. Sampling harbor sediment and water each quarter year is emphasized since these materials would be the most likely affected by releases of radioactivity.

As discussed earlier, cobalt 60 is the predominant radionuclide of environmental interest resulting from Naval nuclear reactor operations. Therefore, Navy monitoring procedures require collecting in each harbor approximately 20 to 120 sediment samples once each quarter year for analysis to detect cobalt 60 and other gamma emmitting radionuclides. Locations and numbers of sediment samples for a particular harbor depend on the size of the harbor and the number and separation of locations where nuclear-powered ships berth. Sampling points are selected to form a pattern around ship berthing locations and to provide points in areas away from these berthing locations. The sampling locations are selected individually for each harbor

considering characteristics of the harbor. Sediment samples are collected using the dredge shown in Figure 3.

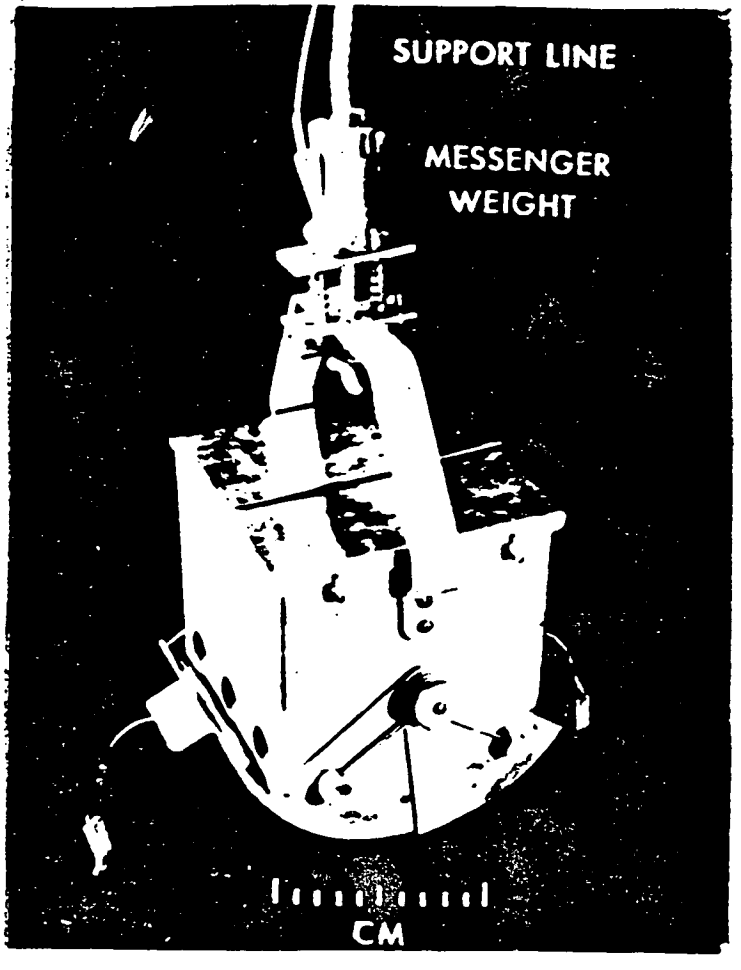


FIGURE 3
DREDGE FOR SAMPLING HARBOR SEDIMENT

The dredge samples a surface area of 36 square inches and has been modified to collect only the top one-half to one inch of sediment. The top layer was selected because it should be more mobile and more accessible to marine life than deeper layers. The samples are drained of excess water and placed directly into a Marinelli container for analysis. Each sediment sample is analyzed for gamma radioactivity in the container in which it is collected using a solid state germanium detector with a multichannel analyzer. The gamma data is analyzed specifically for the presence of cobalt 60. Results of the sediment samples from harbors monitored by the Navy in the U. S. and possessions for 1989 are summarized in Table 4.

Table 4 shows that most harbors do not have detectabl levels of cobalt 60. As reported in the past, low levels of cobalt 60, less than three millionths of a microcurie per gram, are detected around a few operating base and shipyard piers where nuclear-powered ship maintenance and overhauls were conducted in the early 1960's. These low levels are well below the naturally occurring radioactivity levels in the harbors. The radioactivity detected is from operations in the early 1960's since releases such as shown earlier in Table 1 are too small to be detectable in the harbors. Historically, low levels of cobalt 60 were also detectable as a result of world wide dispersion from atmospheric weapons testing. A measure of the significance of this range is that if all a person's food were to contain three millionths of a microcurie of cobalt 60 per gram, he would not exceed ten percent of the radiation exposure levels permitted in references 6, 7 and 8 for members of the general public. Cobalt 60 is not detectable in general harbor bottom areas away from these piers.

Low levels of cesium 137 were detected in some sediment samples. The cesium 137 detected is not related to Naval nuclear reactor operations because the high integrity of the Naval fuel retains fission products. The cesium 137 concentrations measured in the sediment are due to world wide dispersion from weapons testing and Chernobyl fallout.

For comparison, references 27 and 28 contain evaluations by laboratories of the Environmental Protection Agency and of the Department of Energy of the effects on the environment from the accumulation near points of discharge of radionuclides from several nuclear facilities. The referenced reports conclude that radioactivity levels much greater than shown in Table 4 for Naval Nuclear Propulsion

TABLE 4 SUMMARY OF 1989 SURVEYS FOR COBALT 60 IN BOTTOM SEDIMENT OF U. S. HARBORS WHERE U. S. NAVAL NUCLEAR-POWERED SHIPS HAVE BEEN REGULARLY BASED, OVERHAULED OR BUILT

	Range of Cobalt 60 Analytical Results (10^{-6}uCi/gm)	Number of Samples With Cobalt 60		Total Bottom Area With Cobalt 60 Over $3x10^{-6}$ uCi/gm (Square Kilometers)
		Less Than $3x10^{-6}$uCi/gm	Greater Than $3x10^{-6}$uCi/gm	
Kittery, Maine Portsmouth Naval Shipyard	<0.02 - <0.18	120	0	0
Groton, New London, Conn. Electric Boat Division, State Pier and Sub Base	<0.04 - 1.63	528	0	0
N wport News, Virginia Newport News Shipbuilding	<0.02 - <0.17	152	0	0
Norfolk, Virginia Naval Shipyard and Base	<0.03 - <0.18	280	0	0
Charleston, South Carolina Naval Shipyard and Bases	<0.01 - <0.13	280	0	0
Kings Bay, Georgia	<0.01 - <0.09	98	0	0
San Diego, California Navy Piers	<0.02 - <0.17	252	0	0
Vallejo, California Mare Island Naval Shipyard	<0.03 - <0.25	228	0	0
Bremerton, Washington Naval Shipyard and Base	<0.02 - <0.14	332	0	0
P arl Harbor, Hawaii Naval Shipyard and Sub Base	<0.02 - 0.23	192	0	0
Apra Harbor, Guam	<0.01 - <0.09	133	0	0
Port Canaveral, Florida	<0.01 - <0.10	80	0	0

NOTES:

(1) The "<" symbol indicates no cobalt 60 was detected in the sample. The number given is the minimum detectable activity (MDA) i.e., the concentration at which cobalt 60 could be detected if it were present. The MDA varies from sample to sample and location to location du to statistical fluctuations.

(2) uCi/gm = microcuri p r gram. 1 uCi = $1x10^{-6}$ curie (Ci).

(3) One square kilomet r is approximately 0.4 square mile. Estimated total cobalt 60 in th top lay r of sediment is 0.01 Ci. Samples more than one foot deep from sev ral harbors show that total cobalt 60 present may be two to five times that measur d in the surface layer.

Program facilities have caused no significant radiation exposure to the general public.

The maximum total radioactivity observed in a U. S. harbor is less than 0.05 curie of cobalt 60. This radioactivity is small compared to background. Based on the typical concentrations of naturally occurring radioactivity such as potassium 40, radium, uranium and thorium which are described in reference 16 for marine sediment, the natural radioactivity in the sediment of a typical harbor amounts to hundreds of curies.

In addition to Navy analysis of environmental samples, at least ten sediment samples from each harbor monitored have been sent each year to a U. S. Department of Energy laboratory, as a check of Navy results. This Department of Energy laboratory provides a further check on the quality of environmental sample analyses by participating in the quality control programs sponsored by the Department of Energy and the Environmental Protection Agency.

The check samples were analyzed for gamma radionuclides in a manner similar to Navy procedures but with greater sensitivity. Figure 4 depicts the gamma spectra for two such samples. Both spectra show the presence of abundant naturally occurring radionuclides which contribute to measured radioactivity even if cobalt 60 were not present. The upper spectrum is for a sample to which cobalt 60 has been added to achieve a concentration of approximately three millionths of a microcurie per gram and shows easily recognizable energy peaks due to the presence of this small concentration of cobalt 60. The lower spectrum depicts the appearance of most of the sediment samples collected.

At least five water samples are taken in each harbor once each quarter year in areas where nuclear-powered ships berth and from upstream and downstream locations. These samples are analyzed for gamma radioactivity, including cobalt 60. A solid state germanium detector with a multichannel analyzer is used to measure gamma radioactivity and detect the presence of cobalt 60. Procedures for analysis will detect cobalt 60 if its concentration exceeds the U. S. Environmental Protection Agency drinking water limits of reference 14. No cobalt 60 has been detected in any of the water samples from all harbors monitored.

An Environmental Protection Agency evaluation in reference 29 shows that the cobalt 60 from Naval nuclear propulsion plants is in the form of metalic corrosion product particles which do not app ar to be conc ntrated in

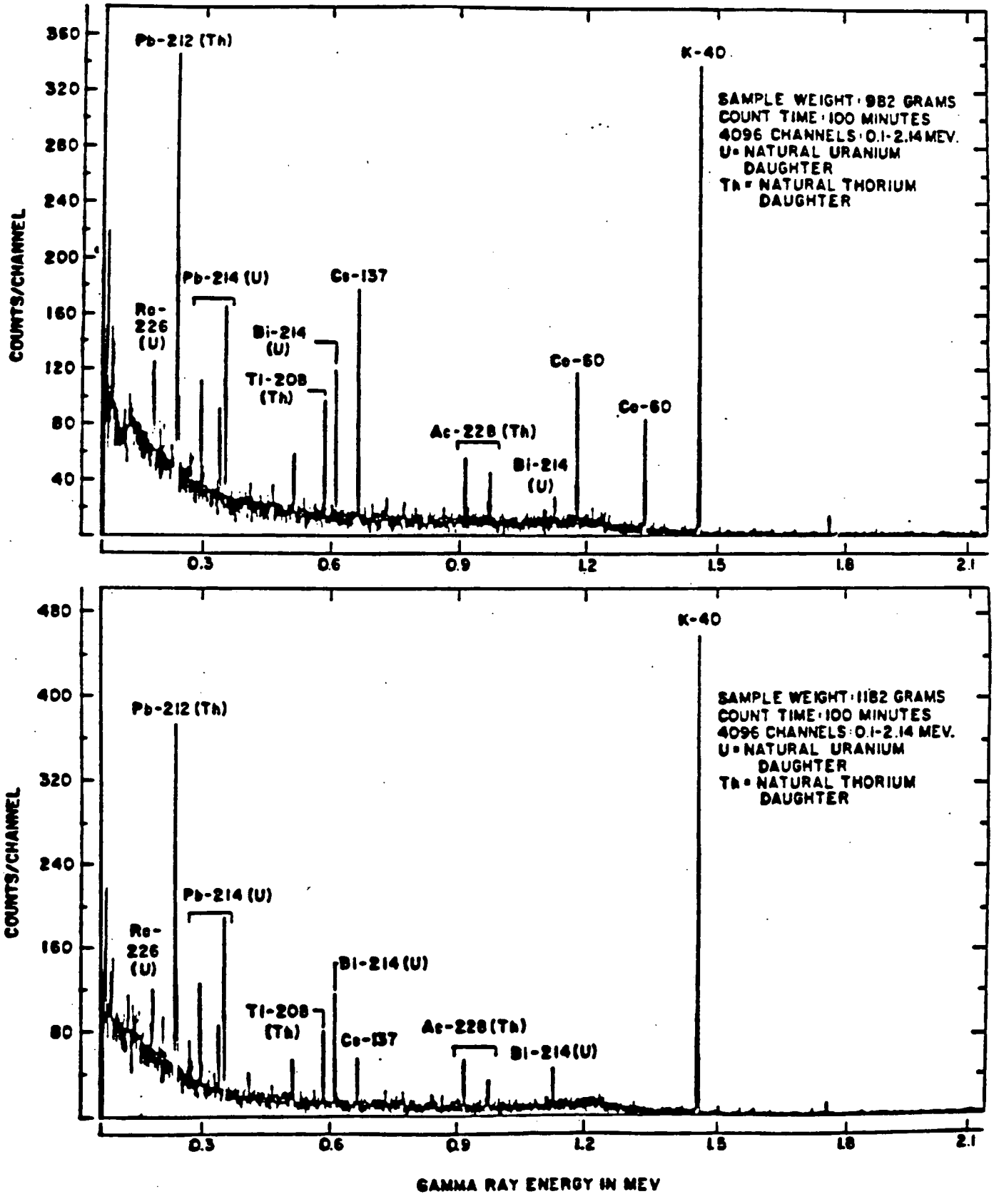


FIGURE 4

GAMMA SPECTRA OF HARBOR BOTTOM SEDIMENT SAMPLES WITH A GERMANIUM DETECTOR

the food chain. However, samples of marine life such as mollusks, crustaceans and marine plants have been collected in 1989 from all harbors monitored. Marine life samples are also analyzed using a germanium detector with a multi-channel analyzer. The results of the marine life samples from harbors monitored by the Navy in the U. S. and possessions for 1989 are summarized in Table 5. Table 5 demonstrates that no buildup of cobalt 60 associated with U. S. Naval nuclear-powered ships has been detected in thes samples of marine life.

In all monitored harbors, twice per year shoreline areas uncovered at low tide are surveyed for radiation levels with sensitive scintillation detectors to determine if any radioactivity from bottom sediment washed ashore. All results were the same as background radiation levels in these regions, approximately 0.01 millirem per hour. Thus, there is no evidence in these ports that these areas are being affected by nuclear-powered ship operations.

Ambient radiation levels are measured using sensitive thermoluminescent dosimeters continuously posted at locations outside the boundaries of areas where radiological work is performed. These dosimeters are also posted at locations remote from support facilities to measure background radiation levels from natural radioactivity. The results of dosimeters posted at support facilities between radiologically controlled areas and the general public and dosimeters posted at remote background locations up to several miles away are compared in Table 6. The range of dosimeter readings is also given since natural background radiation levels vary from location to location primarily due to the concentration of radionuclides in the soil (reference 30). The results of Table 6 show that Naval Nuclear Propulsion Program activities in 1989 had no distinguishable effect on normal background radiation levels at the site perimeter.

Naval nuclear reactors and their support facilities are designed to ensure there are no significant discharges of radioactivity in airborne exhausts. Radiological controls are exercised in support facilities to preclude exposure of working personnel to airborne radioactivity exceeding limits for the general population specified in reference 6. These controls include a total containment concept for radioactive materials and provide a barrier to prevent significant radioactivity from becoming airborne. Further, all air exhausted from these facilities is passed through high efficiency particulate air filters and monitored during discharge. Comparison of sensitive airborne radioactivity

TABLE 5 SUMMARY OF 1989 SURVEYS FOR COBALT 60 IN MARINE LIFE OF U. S. HARBORS WHERE U. S. NAVAL NUCLEAR-POWERED SHIPS HAVE BEEN REGULARLY BASED, OVERHAULED OR BUILT

	Mollusks Cobalt 60 Analytical Results (10^{-6} uCi/gm)	Crustaceans Cobalt 60 Analytical Results (10^{-6} uCi/gm)	Marine Plants Cobalt 60 Analytical Results (10^{-6} uCi/gm)
Kittery, Maine Portsmouth Naval Shipyard	<0.06	<0.06	<0.23
Groton, New London, Conn. Electric Boat Division, State Pier and Sub Base	<0.05	<0.05	<0.06
Newport News, Virginia Newport News Shipbuilding	<0.02	<0.05	<0.06
Norfolk, Virginia Naval Shipyard and Base	<0.05	<0.05	<0.04
Charleston, South Carolina Naval Shipyard and Bases	<0.03	<0.05	N/A
Kings Bay, Georgia	<0.03	<0.02	<0.02
San Diego, California Navy Piers	<0.03	<0.03	<0.04
Vallejo, California Mare Island Naval Shipyard	<0.06	<0.06	<0.05
Bremerton, Washington Naval Shipyard and Base	<0.05	<0.06	<0.06
Pearl Harbor, Hawaii Naval Shipyard and Sub Base	N/A	<0.16	<0.05
Apra Harbor, Guam	<0.03	<0.03	N/A
Port Canaveral, Florida	<0.03	<0.02	<0.02

NOTES:

(1) The "<" symbol indicates no cobalt 60 was detected in the sample. The number given is the minimum detectable activity (MDA) i.e., the concentration at which cobalt 60 could be detected if it were present. The MDA differs from sample to sampl and location to location du to statistical fluctuations.

(2) uCi/gm = microcuri per gram. 1 uCi = $1x10^{-6}$ curi (Ci).

(3) N/A = Not Availabl . Samples of marine lif from this location w re not availabe for coll cti n.

TABLE 6 SUMMARY F 1989 OFF-SITE AND PERIMETER RADIATION MONITORING OF U. S. HARBORS WHERE U. S. NAVAL NUCLEAR-POWERED SHIPS HAVE BEEN REGULARLY BASED, OVERHAULED OR BUILT

	Average Off-site Dosimeter (mrem/qtr)	Range of Off-site Dosimeter (mrem/qtr)	Average Perimeter Dosimeter (mrem/qtr)	Range of Perimeter Dosimeter (mrem/qtr)
Kittery, Maine Portsmouth Naval Shipyard	20	17 - 23	20	14 - 33
Groton, New London, Conn. Electric Boat Division, State Pier and Sub Base	26	14 - 38	23	14 - 44
Newport News, Virginia Newport News Shipbuilding	13	10 - 18	12	9 - 17
Norfolk, Virginia Naval Shipyard and Base	26	20 - 30	17	11 - 31
Charleston, South Carolina Naval Shipyard and Bases	23	17 - 29	22	11 - 31
Kings Bay, Georgia	21	18 - 27	21	15 - 30
San Diego, California Navy Piers	22	15 - 36	19	12 - 39
Vallejo, California Mare Island Naval Shipyard	19	12 - 22	18	11 - 27
Bremerton, Washington Naval Shipyard and Base	15	11 - 17	15	12 - 19
Pearl Harbor, Hawaii Naval Shipyard and Sub Base	15	12 - 20	15	11 - 25
Apra Harbor, Guam	17	13 - 20	16	8 - 20
Port Canaveral, Florida	17	13 - 22	18	14 - 21

NOTE:
(1) mrem/qtr = millirem per quarter year. 1 mrem = $1x10^{-3}$ rem.

measurements in shipyards demonstrates that air exhausted from facilities actually contained a smaller amount of radioactivity than this same air contained when it was drawn from the environment into the facilities. There were no discharges of airborne radioactivity from these facilities above concentrations normally present in the atmosphere.

ENVIRONMENTAL PATHWAYS ANALYSIS

Results of monitoring of environmental samples described above have shown that environmental radioactivity levels have not been changed appreciably and therefore radiation exposure to the public from operations of nuclear-powered ships and their support facilities is too low to measure. Nevertheless, a detailed analysis has been performed to provide a quantitative estimate of the radiation exposure to which any member of the general public might be exposed as a result of radioactivity in liquid and airborne effluents.

This analysis has been performed in a conservative manner which ensures that the estimated exposure is higher than any actual exposure would be. For example, the sites chosen for analysis were shipyards since the amount of radiological work at these facilities is considerably higher than at other types of support facilities. Quantities of radioactivity from shipyard releases used in this analysis are higher than have been measured from any shipyard in the last eight years. Values of environmental parameters, including meteorological conditions and radionuclide concentration factors, have been chosen to provide cons r-vative results. In addition, the analysis assumes the individual receiving the maximum exposure is located right at the site boundary. Thus, the actual exposures to members of the public are expected to be lower than the results of this analysis.

The environmental pathways which were considered are depicted in Figure 5, which is based on reference 8. The hypothetical releases assumed are listed in Table 7. Table 8 shows the assumed usage parameters which are based on reference 31. Concentration factors for radionuclides in the marine environment were assumed as published in reference 32 and are also in Table 8. The pathways analysis, including meteorology, population distribution and radiological exposure rates was performed in a manner consistent with that employed by the U. S. Nuclear Regulatory Commission in reference 31.

Results of the analysis are summarized in Tables 9 and 10. Table 9 compares the estimated maximum exposure to a member of the public with guidelines of the Nuclear Regulatory Commission, although these guidelines are not applicable to nuclear-powered ships and their support facilities. These numerical guidelines on calculated radiation exposures have been issued by the Nuclear Regulatory Commission in reference 13 for implementing the concept that radioactivity in effluents from light water nuclear electric power reactors should be limited to amounts and quantities as low as reasonably achievable. The estimated maximum radiation exposure to a member of the general public from releases of airborne radioactivity is also much less than the standard of 10 millirem per year established by the Environmental Protection Agency in reference 33. Table 10 presents the estimated total whole body radiation exposure to the total population within 50 miles from the assumed radioactivity releases compared with the radiation exposure received by the same population from natural background radioactivity, as reported in references 12, 30 and 34. As shown in Tables 9 and 10, conservative estimates of the exposures to members of the public from the Naval Nuclear Propulsion Program are far less than the Environmental Protection Agency standards, the guidelines of the Nuclear Regulatory Commission, or the exposure from natural background radioactivity.

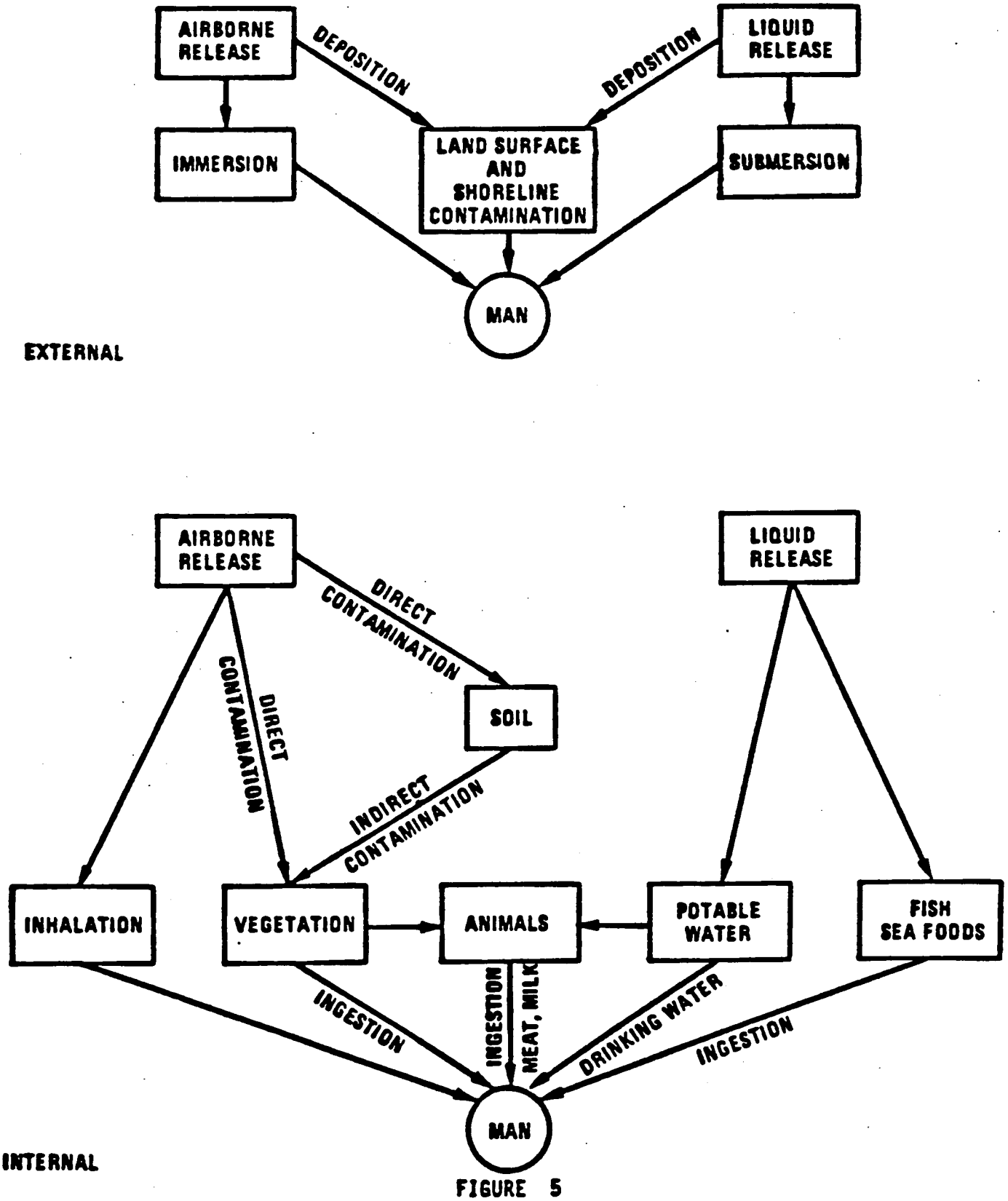


FIGURE 5

PATHWAYS FOR EXTERNAL AND INTERNAL EXPOSURE OF MAN FROM AIRBORNE AND LIQUID RELEASES OF RADIOACTIVE EFFLUENTS

TABLE 7 RADIONUCLIDE RELEASES ASSUMED FOR ENVIRONMENTAL PATHWAYS ANALYSIS

Radionuclide	Assumed Annual Release, Curie	
	Liquid Release	Airborne Release
Cobalt 60	0.001	0.001
Tritium	0.100	0.001
Carbon 14	*	0.100
Krypton 83m	*	0.020
Krypton 85m	*	0.024
Krypton 87	*	0.050
Krypton 88	*	0.020
Xenon 131m	*	0.005
Xenon 133m	*	0.010
Xenon 133	*	0.210
Xenon 135	*	0.250
Argon 41	*	0.410

*These gaseous radionuclides are released into the air, not into water.

TABLE 8 ENVIRONMENTAL EXPOSURE TIMES, CONSUMPTION AND CONCENTRATION PARAMETERS ASSUMED FOR ENVIRONMENTAL PATHWAYS ANALYSIS

Pathway Parameter*	Assumed Parameter Value For Highest Individual	For Average Individual
Fraction of Year Occupancy		
For Air Immersion	1	1
For Land Deposition	1	1
Along Shoreline	0.05	0.0005
Swimming	0.01	0.0001
Boating	0.01	0.0001
Food Consumption		
Leafy vegetables, Kg/year	72	18
Water, liters/year	730	180
Fish,** Kg/year	18	2.3
Mollusks,** Kg/year	9	0.25
Crustacea,** Kg/year	9	0.90
Sediment, Kg/year	1	0.10

* Refer to Figure 5

** Cobalt 60 was assumed to concentrate from sea water to the edible flesh of fish, mollusks, and crustacea by factors as follows: fish, 650; mollusks, 170; crustaceans, 1,700, based on reference 32.

TABLE 9 ESTIMATED MAXIMUM RADIATION EXPOSURE TO AN INDIVIDUAL FOR ASSUMED LIQUID AND AIRBORNE RADIOACTIVITY RELEASES FROM SHIPYARDS ENGAGED IN NAVAL NUCLEAR PROPULSION WORK

	Maximum Exposure To An Individual	
	NRC Guideline millirem/year	Estimated Value millirem/year
From Radionuclides In Liquid Releases	5 whole body, or any organ	less than 1
From Gaseous Radionuclides In Airborne Releases	5 whole body, or 15 skin	less than 1
From Other Radionuclides In Airborne Releases	15 any organ	less than 1

TABLE 10 ESTIMATED TOTAL WHOLE BODY RADIATION EXPOSURE TO GENERAL PUBLIC WITHIN 50 MILES FOR ASSUMED LIQUID AND AIRBORNE RADIOACTIVITY RELEASES FROM SHIPYARDS ENGAGED IN NAVAL NUCLEAR PROPULSION WORK

Exposure Due to Natural Background Radiation	Exposure Due to Assumed Radioactive Releases
Approximately 100,000 man-rem per year	less than 1 man-rem per year

AUDITS AND REVIEWS

The requirements and procedures for control of radioactivity is an important part of the training programs for everyone involved with radioactivity in the Naval Nuclear Propulsion Program. Such training is part of the initial qualification of shipyard workers and of Naval personnel assigned to ships and bases, and is required to be repeated regularly. Emphasis on this training is part of the concept that radiological control personnel alone cannot cause radiological work to be well performed; production and operations personnel and all levels of management are required to be involved in the control of radioactivity.

Checks and balances of several kinds are also set up to help ensure control of radioactivity. First, written procedures exist which require verbatim compliance. Radiological control personnel monitor various steps in radioactive waste processing. In each shipyard an independent organization, separate from the radiological control organization, audits all aspects of radioactive waste processing. Audits are performed by representatives from Naval Reactors headquarters who are assigned full time at each shipyard. Radiological control personnel from headquarters also conduct periodic inspections of each shipyard. In addition, shipyards have made detailed assessments of the environmental effects of shipyard operations and have published reports on the results of these assessments. Similarly, there are multiple levels of audits and inspections for the other Navy shore facilities, tenders, and nuclear-powered ships and for other radiologically controlled functions such as transportation. Even the smallest audit findings are followed up to ensure proper recovery and permanent corrective actions are taken and to help minimize the potential for future deficiencies.

The policy of the Navy is to provide for close cooperation and effective communication with state radiological officials involving occurrences that might cause concern because of radiological effects outside the ships or shore facilities. The Navy has reviewed radioactive waste disposal, radiological environmental monitoring, transportation and other radiological matters with state radiological officials in the states where Navy nuclear-powered ships are based or overhauled. Although there were no occurrences in 1989 which resulted in radiological effects to the public outside these facilities, states were notified when inquiries showed public interest in the possibility that such events had occurred. The Navy has encouraged states to conduct independent radiological environm ntal monitoring in harbors where Naval nuclear-powered ships are based or overhauled; the results of

monitoring by states have been consistent with Navy results.

The U. S. Environmental Protection Agency has conducted detailed reviews of the Navy's procedures for controlling radioactive waste and for radiological environmental monitoring. An Environmental Protection Agency laboratory has conducted detailed environmental surveys of selected U. S. harbors (references 25 and 35 through 43). This laboratory has performed these surveys in the harbors at Pascagoula, Mississippi; Charleston, South Carolina; Pearl Harbor, Hawaii; San Diego, Alameda, San Francisco and Vallejo, California; New London and Groton, Connecticut; Newport News, Portsmouth and Norfolk, Virginia; Bremerton and Bangor, Washington; Kings Bay, Georgia; and Kittery, Maine-Portsmouth, New Hampshire. Environmental Protection Agency results have been consistent with Navy results. The Environmental Protection Agency reports have concluded that operation of Naval nuclear-powered ships has had no adverse impact on public safety or health.

CONCLUSIONS

1. The total gamma radioactivity in liquids released into all ports and harbors from the U. S. Naval Nuclear Propulsion Program was less than 0.002 curie in 1989.

2. No increase of radioactivity above normal background levels has been detected in harbor water where U. S. Naval nuclear-powered ships are based, overhauled, or constructed.

3. Liquid releases from U. S. Naval nuclear-powered ships and their support facilities have not caused a measurable increase in the general background radioactivity of th environment.

4. Low-level cobalt 60 radioactivity in harbor bottom sediment is detectable around a few operating base and shipyard piers from low level liquid releases in the 1960's. Concentrations of cobalt 60 are less than the concentrations of naturally occurring radionuclides around these piers. Cobalt-60 is not detectable in general harbor bottom areas away from these piers. The maximum total radioactivity observed in a U. S. harbor of less than 0.05 curie of cobalt 60 is small compared to the naturally occurring radioactivity. Comparison to previous environmental data summarized in references 1 through 5 shows that these environmental cobalt 60 levels are continuing to decrease.

5. Conservative estimates of radiation exposures to memb rs of the public from the Naval Nuclear Propulsion Program are far less than either the Environmental Protection Agency environmental standards, the guidelines of the Nuclear Regulatory Commission or the exposure from natural background radioactivity.

6. Procedures used by the Navy to control releases of radioactivity from U. S. Naval nuclear-powered ships and their support facilities have been effective in protecting the environment and the health and safety of the general public. Independent radiological environmental monitoring performed by the U. S. Environmental Protection Agency and states have confirmed the adequacy of these procedures. These procedures have ensured that no member of the general public has received measurable radiation exposur as a result of current operations of the Naval Nuclear Propulsion Program.

REFERENCES

(1) U. S. Navy Reports, "Disposal of Radioactive Wastes from U. S. Naval Nuclear-Powered Ships and Their Support Facilities", M. E. Miles et al, for calendar years 1965 through 1969 published in Radiation Health Data and Reports; May 1966, December 1967, April 1969, September 1969 and August 1970.

(2) U. S. Navy Reports, "Environmental Monitoring and Disposal of Radioactive Wastes from U. S. Naval Nuclear-Powered Ships and Their Support Facilities", M. E. Miles et al, for calendar years 1970 through 1978 published with the following numbers and dates: NT-71-1, May 1971; NT-72-1, September 1972; NT-73-1, September 1973; NT-74-1, October 1974; NT-75-1, May 1975; NT-76-1, August 1976; NT-77-1, June 1977; NT-78-1, February 1978; NT-79-1, January 1979.

(3) U. S. Navy Reports, "Environmental Monitoring and Disposal of Radioactive Wastes from U. S. Naval Nuclear-Powered Ships and Their Support Facilities", P. D. Rice et al, for calendar years 1979 through 1981 published with the following numbers and dates: NT-80-1, March 1980; NT-81-1, February 1981; NT-82-1, February 1982.

(4) U.S. Navy Reports, "Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear-Powered Ships and Their Support Facilities", C. H. Schmitt et al, for calendar years 1982 and 1983 published with the following numbers and dates: NT-83-1, February 1983; NT-84-1, February 1984.

(5) U.S. Navy Report, "Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear-Powered Ships and Their Support Facilities", J.J. Mangeno et al, for calendar y ars 1984 through 1989 published with the following numbers and dates: NT-85-1, February 1985; NT-86-1, February 1986; NT-87-1, February 1987; NT-88-1, February 1988; NT-89-1, February 1989.

(6) Code of Federal Regulations, Title 10 (Nuclear Regulatory Commission), Part 20, "Standards for Protection Against Radiation".

(7) National Council on Radiation Protection and Measurements, Report No. 22, "Maximum Permissibl Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure", (Published as National Bureau of Standards Handbook 69, Issued June 1959, superseding Handbook 52).

(8) International Commission on Radiological Protection, Publication 2, "Report of Committe II on Permissible Dose for Internal Radiation (1959)", with 1962 Supplement Issued in ICRP Publication 6; Publication 9, "Recommendations on Radiation Exposure (1965)"; ICRP Publication 7 (1965), amplifying specific recommendations of Publication 9 concerning environmental monitoring; and ICRP Publication 26 (1977).

(9) Federal Radiation Council, "Radiation Protection Guidance for Federal Agencies", approved by President Eisenhower on May 13, 1960.

(10) National Academy of Sciences--National Research Council, Publication 658, "Radioactive Waste Disposal from Nuclear-Powered Ships", 1959.

(11) International Atomic Energy Agency, "Radioactive Waste Disposal into the Sea", Safety Series No. 5, Vienna 1961.

(12) National Council on Radiation Protection and Measurements, Report No. 39, "Basic Radiation Protection Criteria", January 1971.

(13) Code of Federal Regulations, Title 10 (Nuclear Regulatory Commission), Part 50, "Domestic Licensing of Production and Utilization Facilities, Appendix I, Radioactive Material In Light-Water Cooled Nuclear Power Reactor Effluents".

(14) Code of Federal Regulations, Title 40 (Environmental Protection Agency), Part 141, "National Primary Drinking Water Regulations".

(15) International Commission on Radiological Protection, Publication 30, "Limits for Intakes of Radionuclides by Workers".

(16) National Academy of Sciences--National Research Council, "Radioactivity in the Marine Environm nt", 1971.

(17) National Council on Radiation Protection and Measurements, Report No. 62, "Tritium in the Environment", March 1979.

(18) U. S. Nuclear Regulatory Commission Report--"Radioactive Materials Released from Nuclear-Power Plants (1987)", by J. Tichler, K. Norden and J. Congemi, NUREG/CR-2907, Vol. 8, October 1989.

(19) National Council on Radiation Protection and Measurements, Report No. 81, "Carbon-14 in the Environment", May 1985.

(20) Council on Environmental Quality Report to th President, "Ocean Dumping: A National Policy", October 1970.

(21) Marine Protection, Research and Sanctuaries Act of 1972, United States Public Law 92-532.

(22) U. S. Navy, "Final Environmental Impact Statement on the Disposal of Decommissioned, Defueled Naval Submarine Reactor Plants", May 1984.

(23) U. S. Navy Report, "Occupational Radiation Exposure from U. S. Naval Nuclear Propulsion Plants and Their Support Facilities - 1989", J. J. Mangeno, A. E. Tryon and C. W. Burrows, NT-90-2, February 1990.

(24) U. S. Department of Energy Report, "Integrated Data Base for 1989: Spent Fuel and Radioactive Waste Inventories, Projections, and Charactoristics", DOE/RW-0006, Rev. 5, November 1989.

(25) U. S. Environmental Protection Agency Report -- "Radiological Survey of ingalls Shipbuilding Division, Pascagoula, Mississippi, and Environs", Environmental Protection Agency Report 520/5-83-002, September 1983.

(26) U. S. Nuclear Regulatory Commission, "Final Environmental Statement on the Transportation of Material by Air and Other Modes", NUREG-0170, December 1977.

(27) U. S. Energy Research and Development Administration, ERDA 1537, Final Environmental Statement, "Waste Management Operations, Savannah River Plant".

(28) U. S. Environmental Protection Agency Report--"Environmental Radiation Effects of Nuclear Facilities in New York State", by M. S. Terpilak and B. L. Jorgensen, issued in Radiation Data and Reports, July 1974.

(29) U. S. Environmental Protection Agency Report--"Radiological Surveys of Pearl Harbor, Hawaii, and Environs", by D. F. Cahill, H. D. Harvey, Jr., et al, issued in Radiation Data and Reports, June 1972.

(30) National Council on Radiation Protection and Measurements, Report No. 45, "Natural Background Radiation in the United States", November 1975.

(31) U. S. Nuclear Regulatory Commission, Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I".

(32) "Concentration Factors in the Aquatic Environment", S. M. Jinks and M. Eisenbud, issued in Radiation Data and Reports, May 1972.

(33) Code of Federal Regulations, Title 40 (Environmental Protection Agency), Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations".

(34) U. S. Environmental Protection Agency Report--"Radiological Quality of the Environment in the United States, 1977", by Kurt L. Feldman et al, Environmental Protection Agency Report 520/1-77-009, September 1977.

(35) U. S. Environmental Protection Agency Report--"Radiological Survey Charleston Naval Base and Shipyard and the Charleston Naval Weapons Station", by J. M. Smith, Environmental Protection Agency Report 520/5-87-009, June 1987.

(36) U. S. Environmental Protection Agency Report--"Radiological Survey of Pearl Harbor Naval Shipyard and Environs, Honolulu, Hawaii", by R. S. Callis, Environmental Protection Agency Report 520/5-87-010, June 1987.

(37) U. S. Environmental Protection Agency Report--"Radiological Survey of San Diego Bay", by M. O. Semler and R. L. Blanchard, Environmental Protection Agency Report 520/5-88-019, June 1989.

(38) U. S. Environmental Protection Agency Report--"Radiological Survey of the Mare Island Naval Shipyard, Alameda Naval Air Station, and Hunters Point Shipyard", by M. O. Semler and R. L. Blanchard, Environmental Protection Agency Report 520/5-88-018, June 1989.

(39) U. S. Environmental Protection Agency Report--"Radiological Survey of New London Harbor, Thames River Connecticut and Environs", by S. T. Windham and C. R. Phillips, issued in Radiation Data and Reports, November 1973.

(40) U. S. Environmental Protection Agency Report--"Radiological Survey of the Norfolk Naval Station, the Norfolk Naval Shipyard, and Newport News Shipbuilding" by E. L. Sensintaffar and R. L. Blanchard, Environmental Protection Agency Report 520/5-88-017, October 1988.

(41) U. S. Environmental Protection Agency Report--"Radiological Surveys of Naval Facilities on Puget Sound", by V. D. Lloyd and R. L. Blanchard, Environmental Protection Agency Report 520/5-88-016, June 1989.

(42) U. S. Environmental Protection Agency Report--"Radiological Survey of King's Bay Submarine Support Facility", by S. T. Windham, Environmental Protection Agency Report 520/5-87-008, June 1987.

(43) U. S. Environmental Protection Agency Report--"Radiological Survey of Portsmouth Naval Shipyard, Kittery, Maine and Environs", by R. S. Callis, S. T. Windham and C. R. Phillips, Environmental Protection Agency Report 520/5-79-003, July 1979.

APPENDIX
ENVIRONMENTAL MONITORING SURVEY CHARTS

Environmental monitoring survey charts for harbors monitored for radioactivity associated with U. S. Naval nuclear-powered ships in the U. S. and possessions during 1989 are listed below and included in this Appendix. The sampling locations for harbor water and harbor sediment are shown. In addition, shoreline survey areas and the locations of posted dosimetry devices are shown on the figures.

Figure No.	Location
	California
1	U. S. Naval Air Station, Alameda
2	Hunters Point Shipyard, San Francisco
3	Mare Island Naval Shipyard, Vallejo
4	San Diego Harbor
5	San Diego Harbor, Ballast Point Area
	Connecticut
6	Electric Boat Division, Groton
7	U. S. Naval Submarine Support Facility, New London Harbor
8	State Pier Area, New London
	Florida
9	Port Canaveral
	Georgia
10	U. S. Naval Submarine Support Facility, Kings Bay, St. Marys
	Guam
11	Apra Harbor
	Hawaii
12	Pearl Harbor Area
13	Pearl Harbor Naval Shipyard
14	U. S. Naval Submarine Base, Pearl Harbor
	New Hampshire/Maine
15	Portsmouth Naval Shipyard
	South Carolina
16	U. S. Naval Station and Naval Shipyard, Charleston
17	U. S. Naval Weapons Station, Charleston

Virginia

18 Newport News Shipbuilding and Dry Dock Co., Newport News

19 Norfolk Naval Shipyard, Portsmouth

20 U. S. Naval Station Norfolk, Destroyer and Submarine Piers

21 Norfolk--Portsmouth Virginia Area

Washington

22 Puget Sound Naval Shipyard

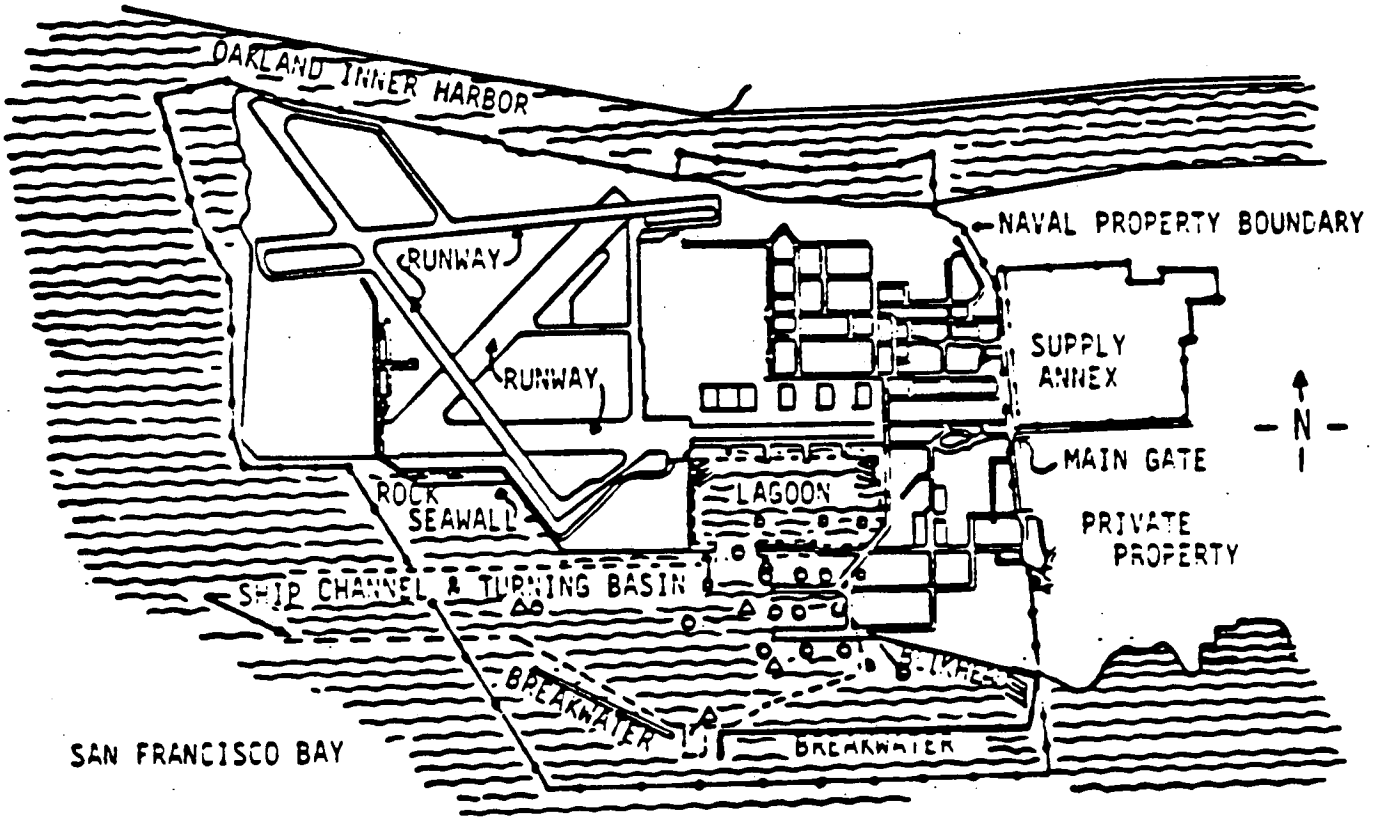
23 Bangor/Hood Canal

FIGURE 1

ENVIRONMENTAL MONITORING LOCATIONS

AT THE U. S. NAVAL AIR STATION

ALAMEDA, CALIFORNIA



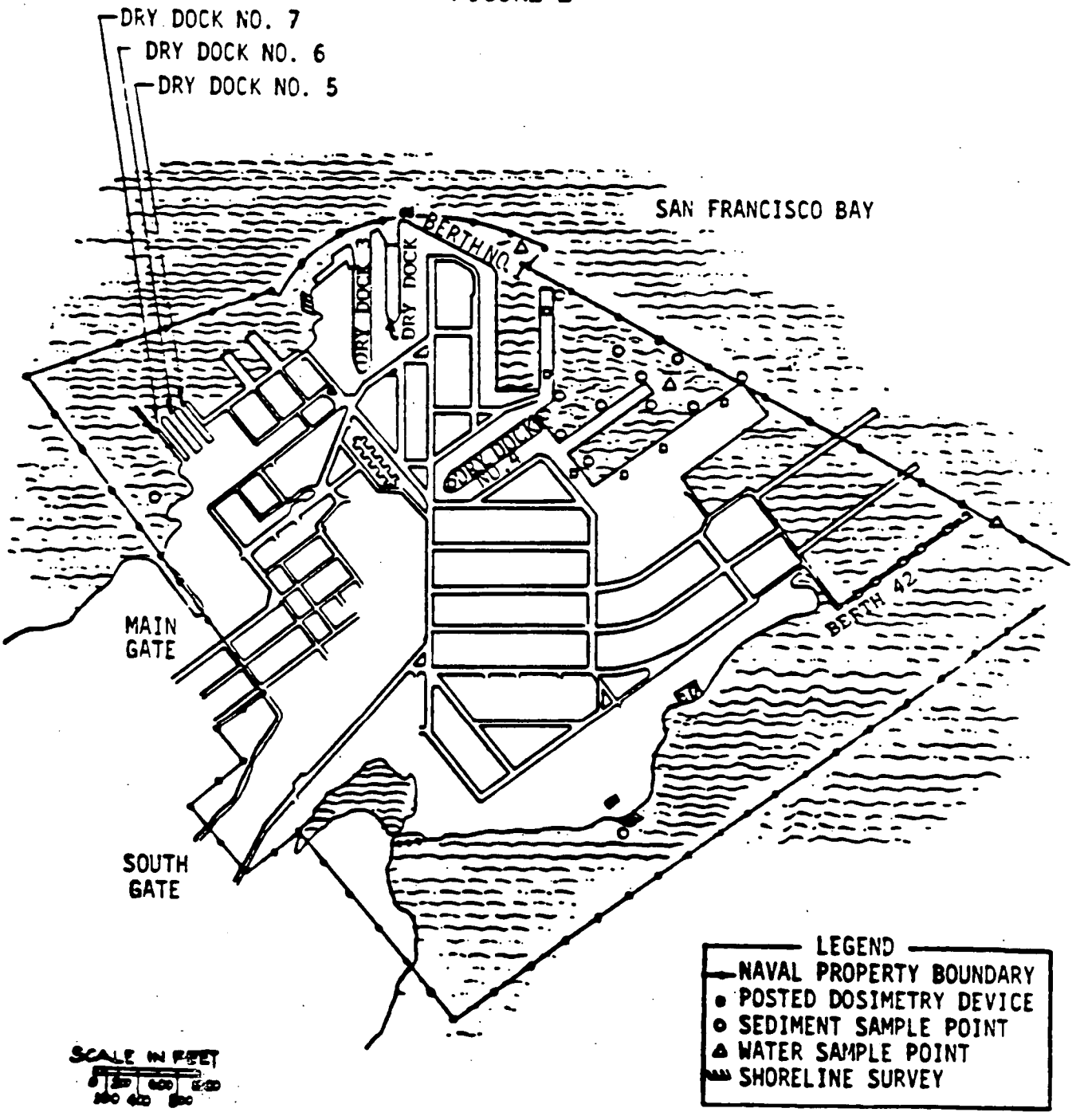
SCALE IN FEET

500 0 500 1000 1500 2000

LEGEND

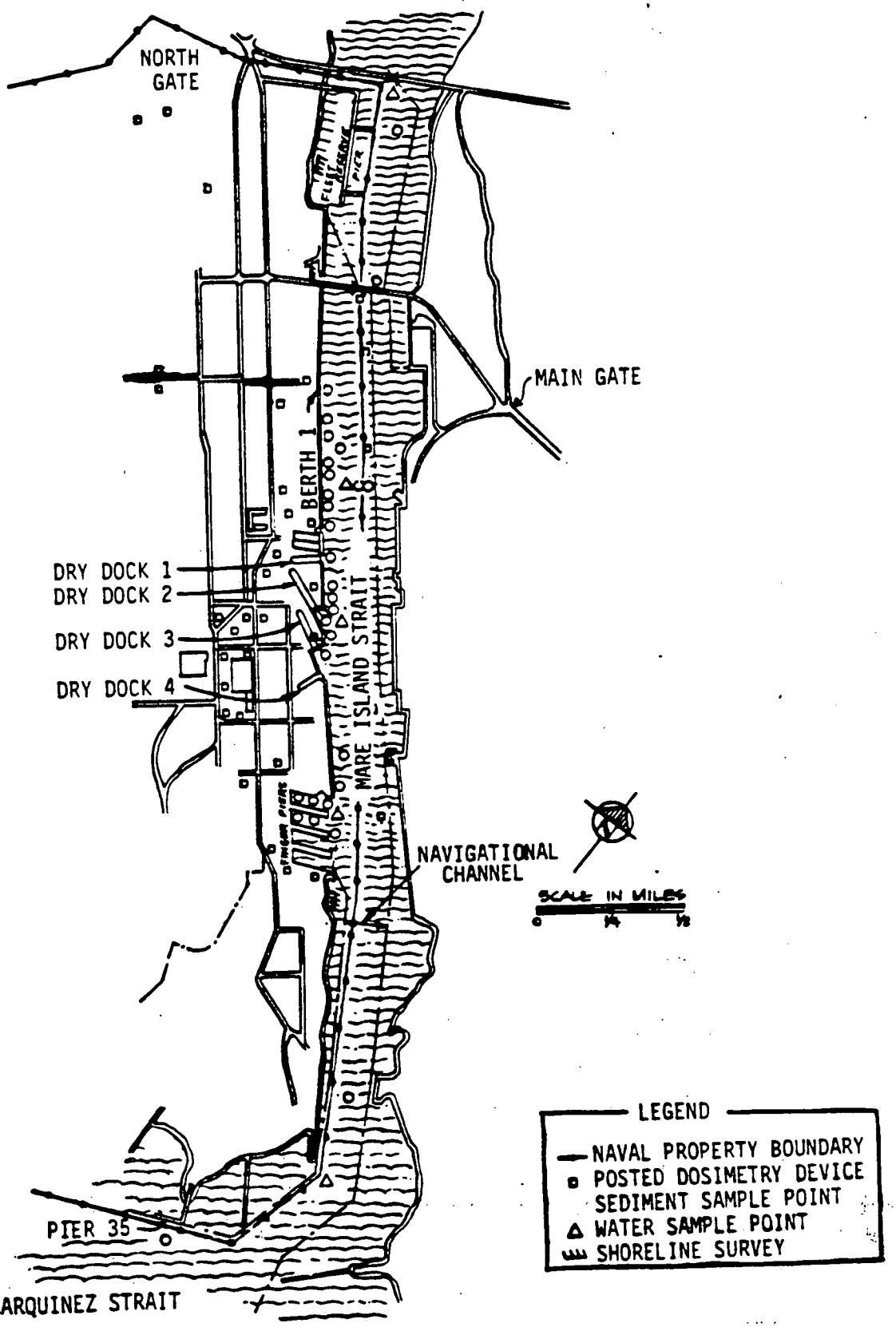
- ■ POSTED DOSIMETRY DEVICE
- ○ SEDIMENT SAMPLE POINT
- △ WATER SAMPLE POINT
- SHORELINE SURVEY

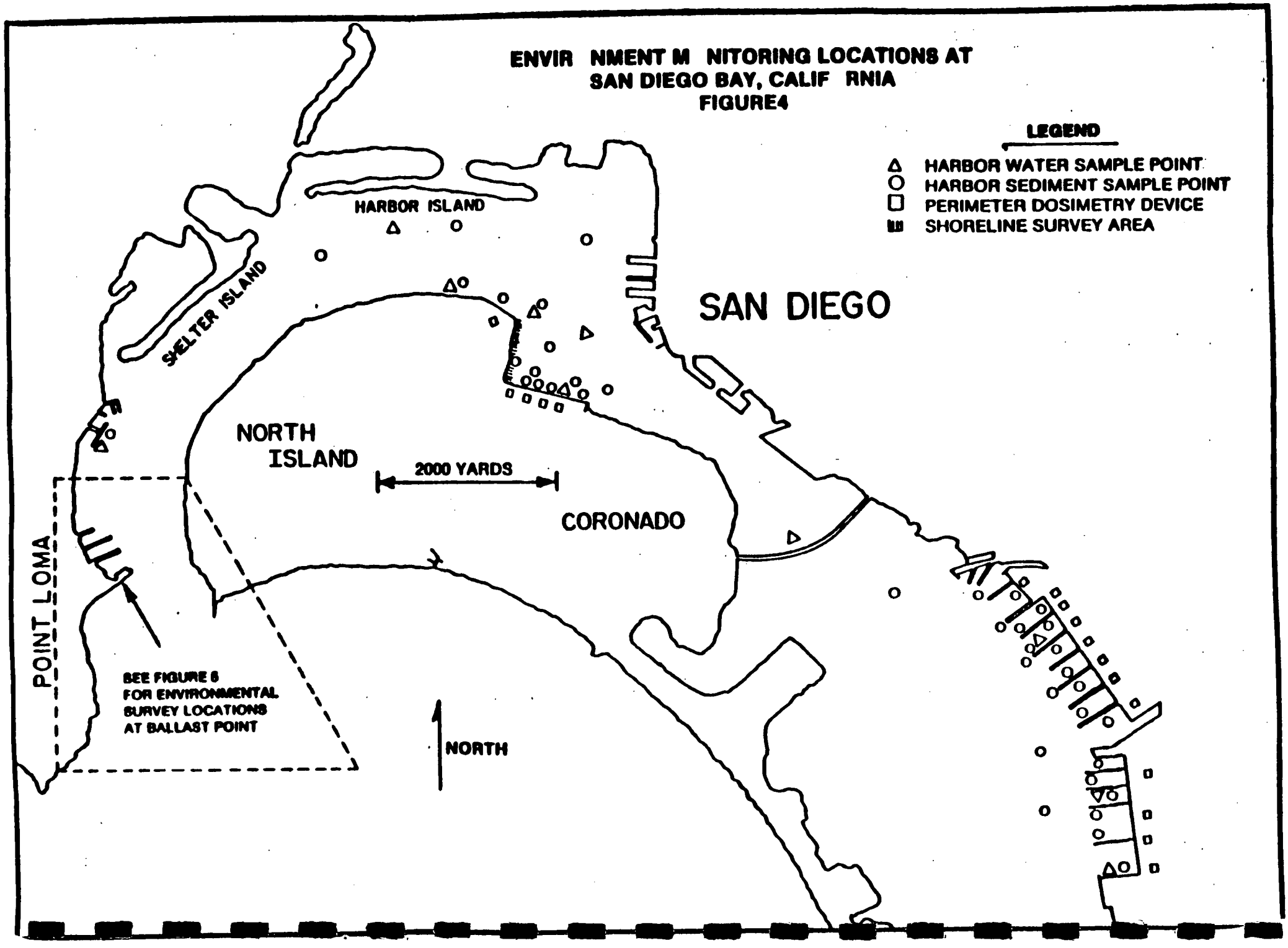
ENVIRONMENTAL MONITORING LOCATIONS AT THE
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
FIGURE 2

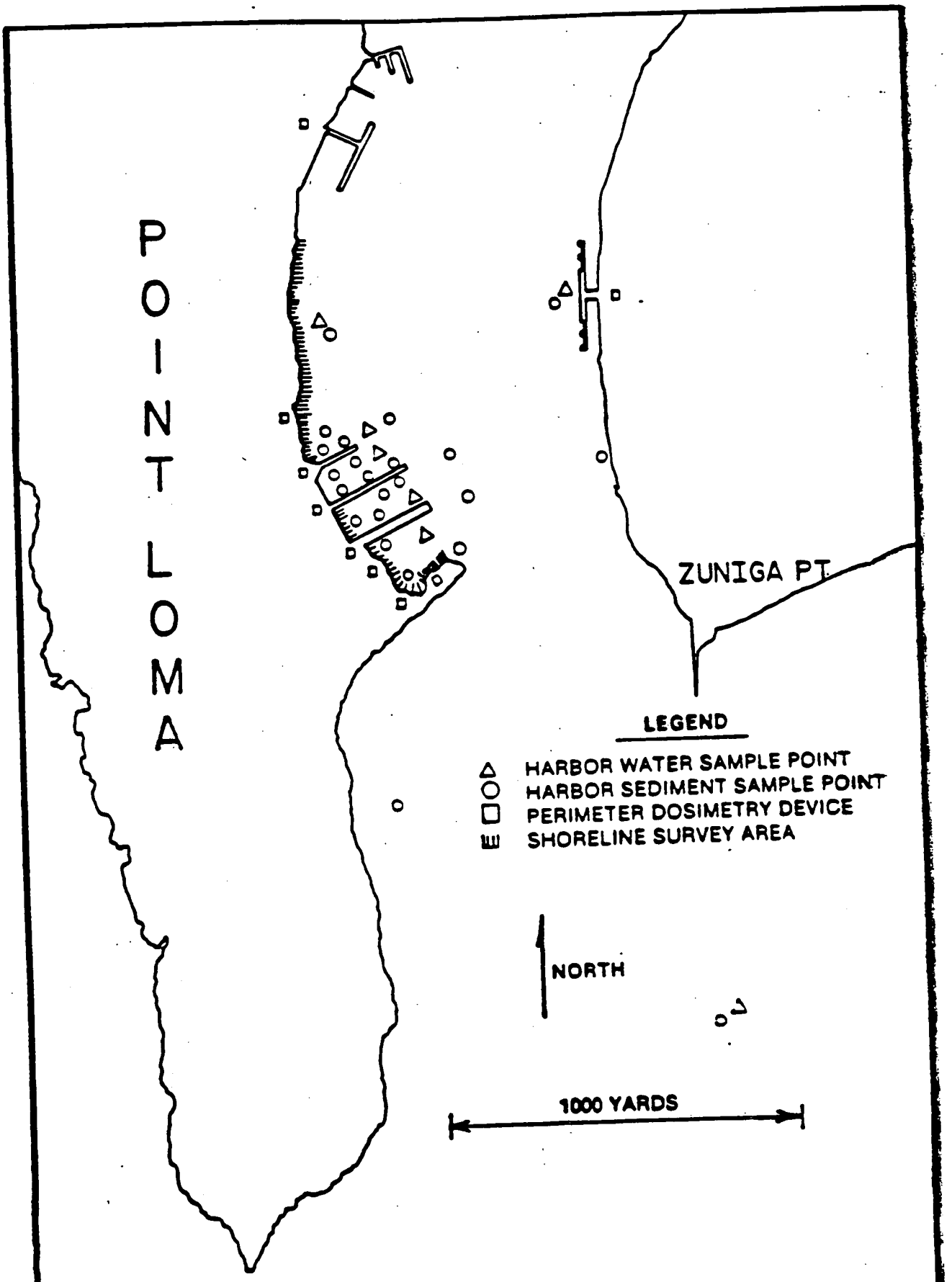


ENVIRONMENTAL MONITORING LOCATIONS AT THE
MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA

FIGURE 3

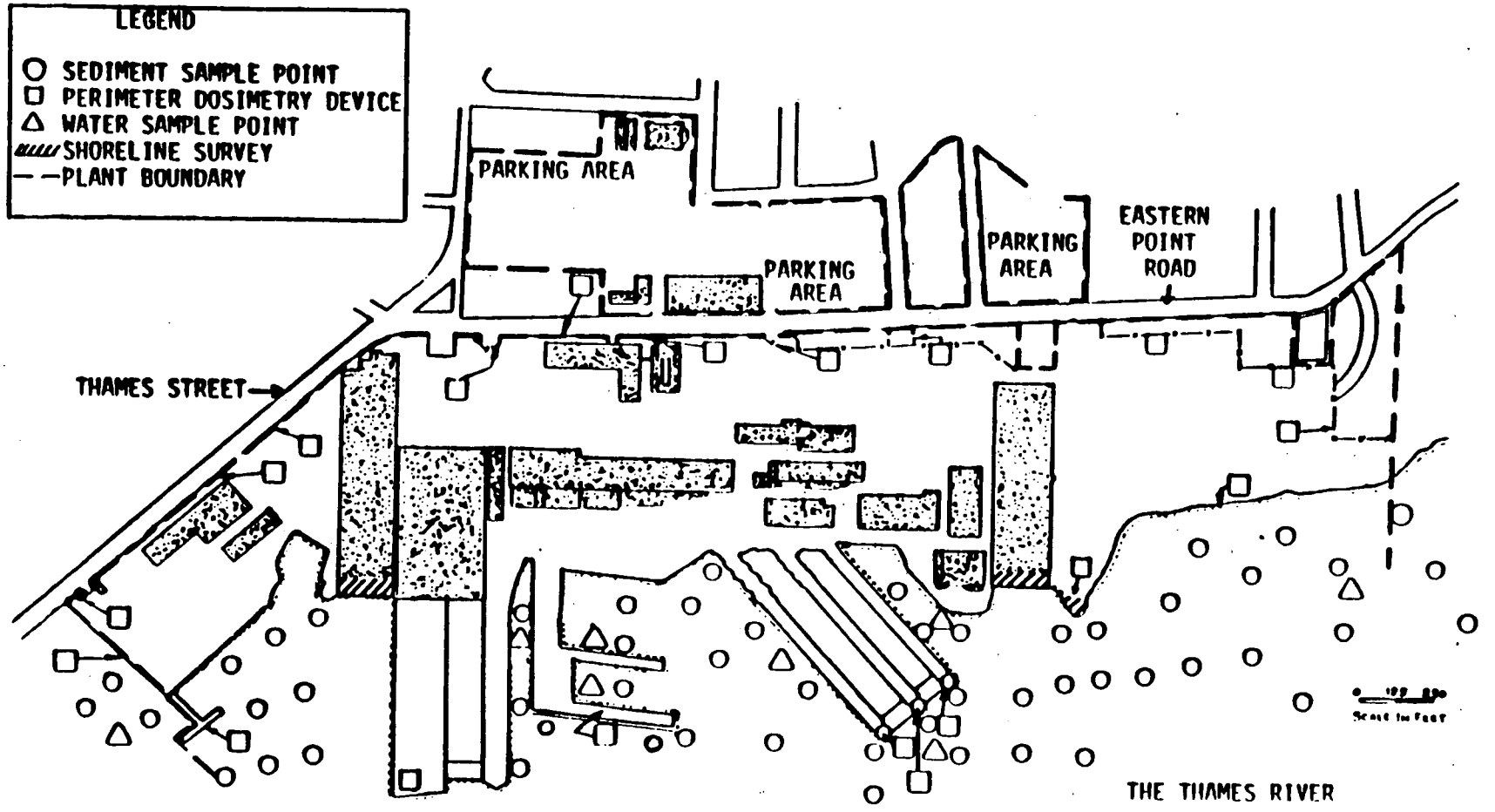


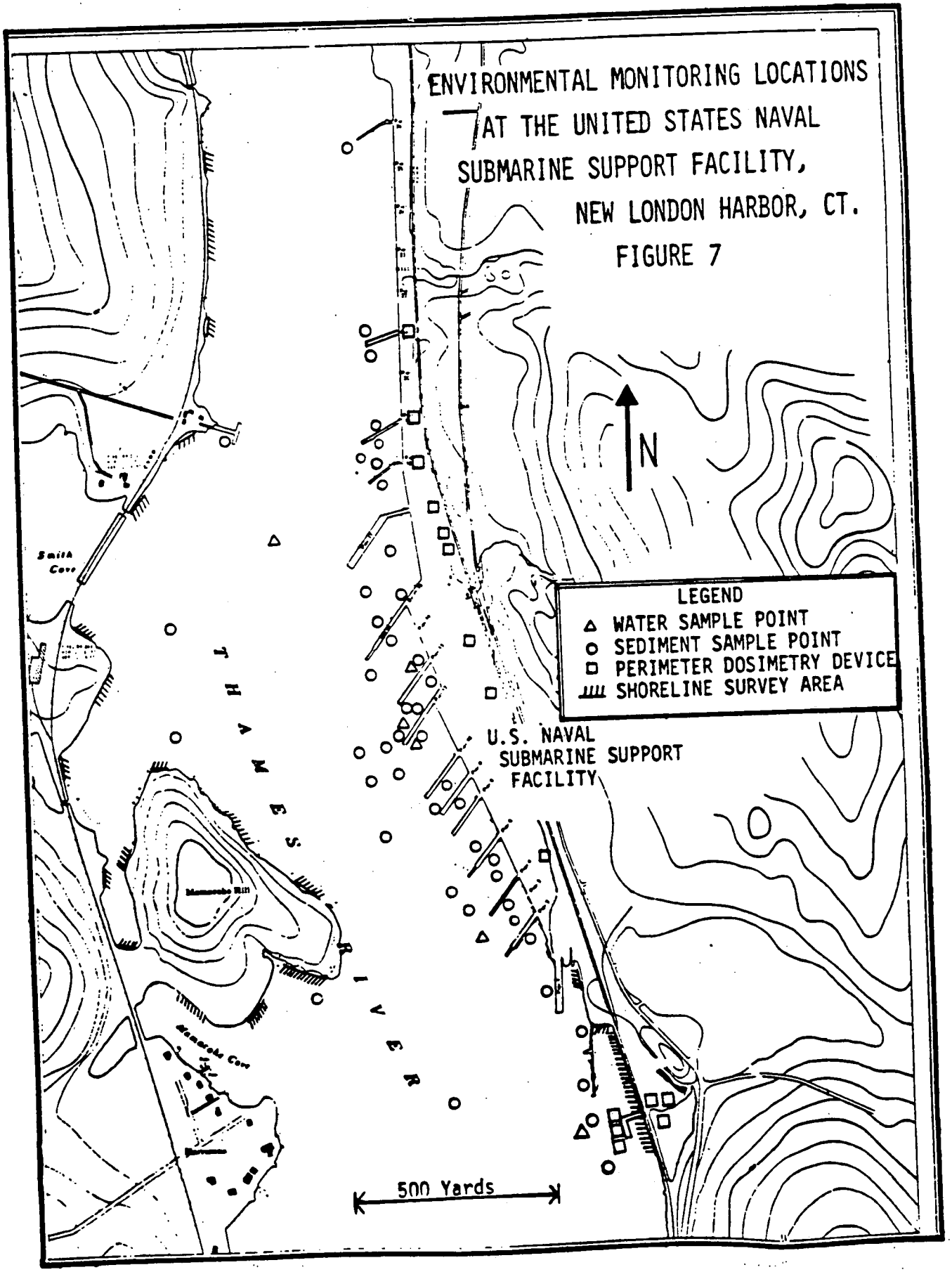

ENVIR NMENT M NITORING LOCATIONS AT
SAN DIEGO BAY, CALIF RNIA
FIGURE4
LEGEND
HARBOR WATER SAMPLE POINT
HARBOR SEDIMENT SAMPLE POINT
PERIMETER DOSIMETRY DEVICE
SHORELINE SURVEY AREA
HARBOR ISLAND
SHELTER ISLAND
SAN DIEGO
NORTH ISLAND
2000 YARDS
CORONADO
POINT LOMA
SEE FIGURE 6
FOR ENVIRONMENTAL
SURVEY LOCATIONS
AT BALLAST POINT
NORTH



ENVIRONMENTAL MONITORING LOCATIONS AT SAN DIEGO BAY, CALIFORNIA
FIGURE 5

ENVIRONMENTAL MONITORING LOCATIONS
AT GENERAL DYNAMICS/ELECTRIC BOAT
GROTON, CT.
FIGURE 6




ENVIRONMENTAL MONITORING LOCATIONS
AT THE UNITED STATES NAVAL
SUBMARINE SUPPORT FACILITY,
NEW LONDON HARBOR, CT.
FIGURE 7
N
LEGEND
WATER SAMPLE POINT
SEDIMENT SAMPLE POINT
PERIMETER DOSIMETRY DEVICE
SHORELINE SURVEY AREA
U.S. NAVAL
SUBMARINE SUPPORT
FACILITY
THAMES RIVER
Smith Cove
Mamacoke Cove
500 Yards

ENVIRONMENTAL MONITORING LOCATIONS
AT STATE PIER AREA, NEW LONDON, CT
FIGURE 8

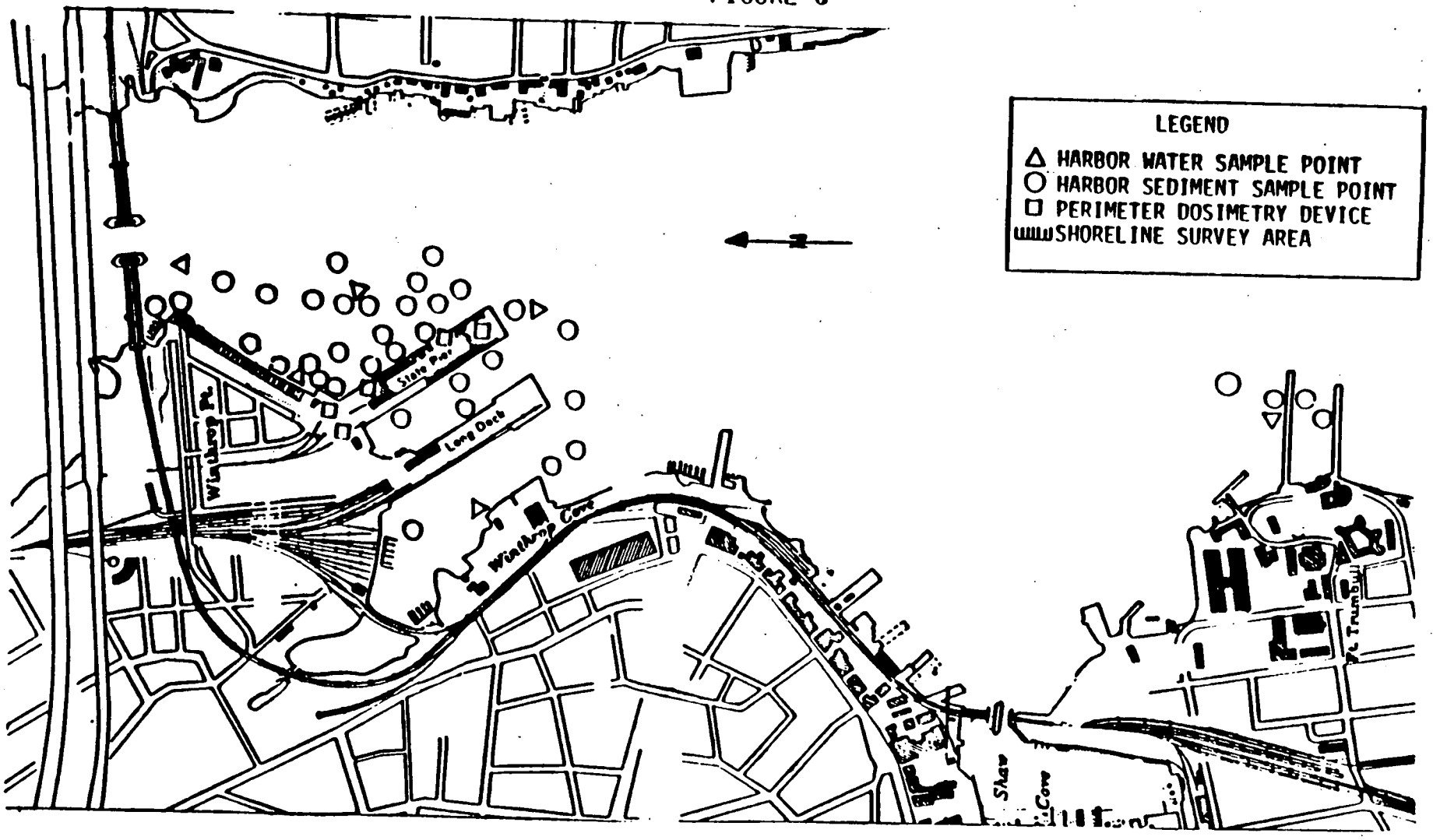
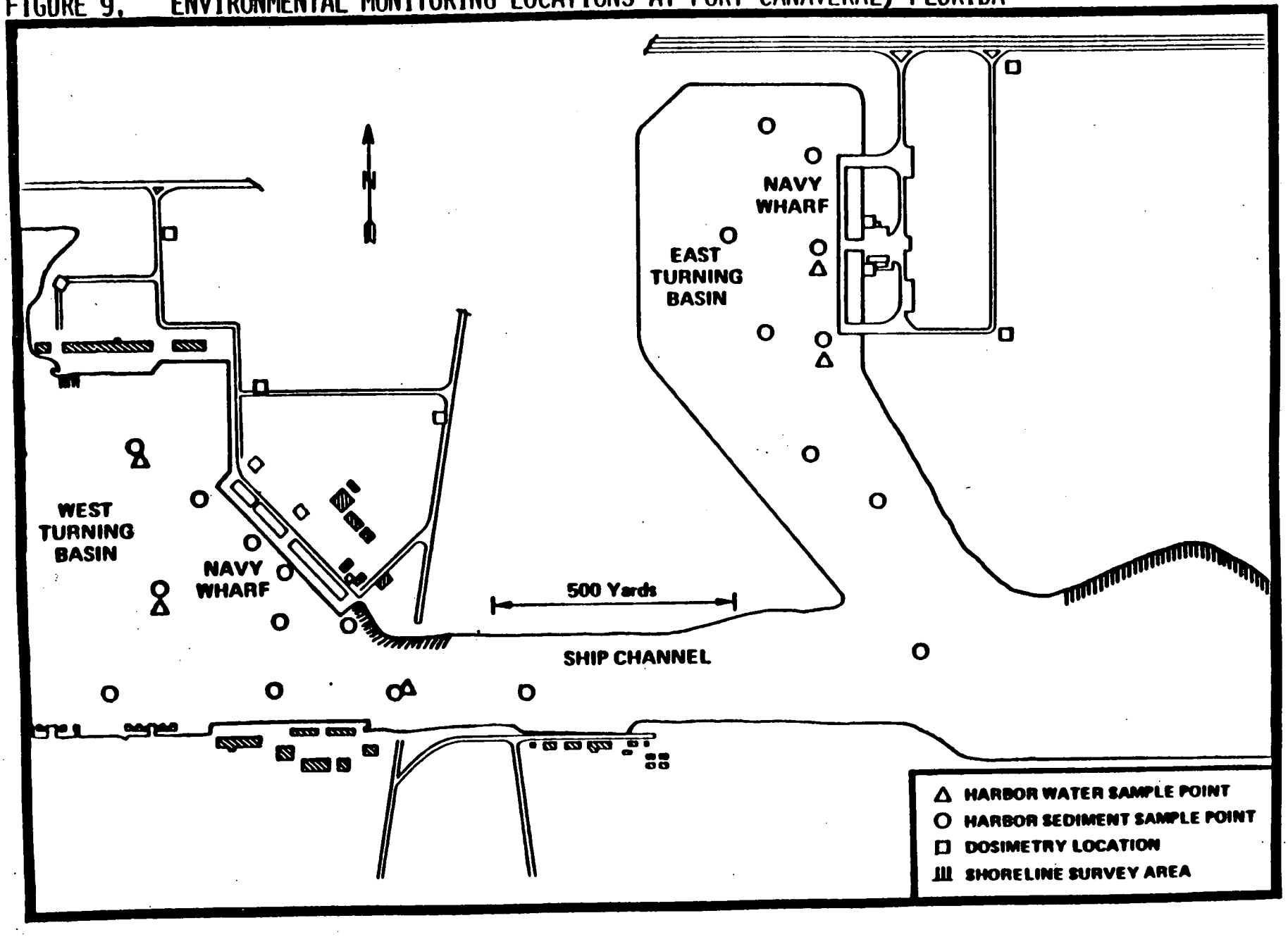
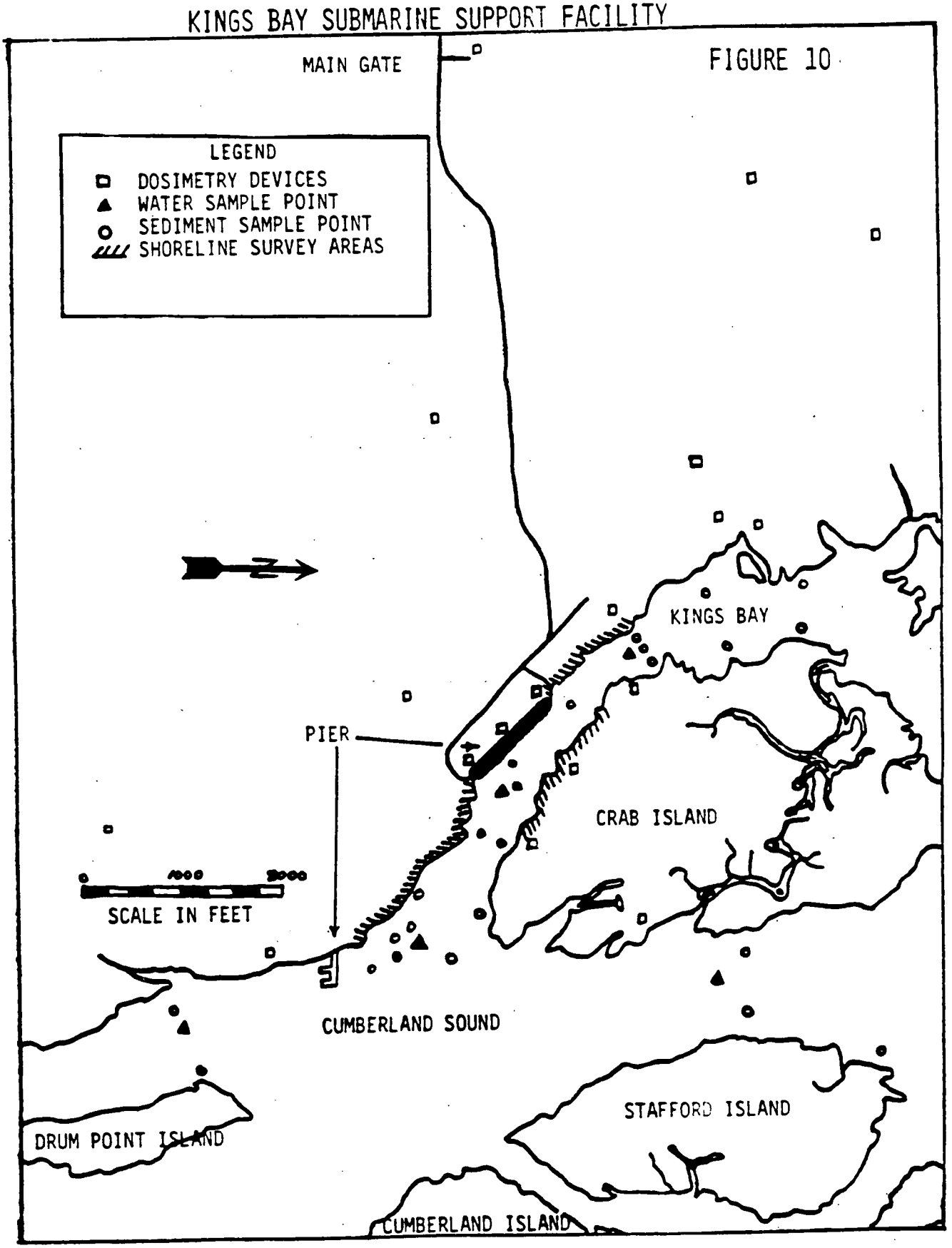


FIGURE 9. ENVIRONMENTAL MONITORING LOCATIONS AT PORT CANAVERAL, FLORIDA



ENVIRONMENTAL MONITORING LOCATIONS AT
KINGS BAY SUBMARINE SUPPORT FACILITY

FIGURE 10



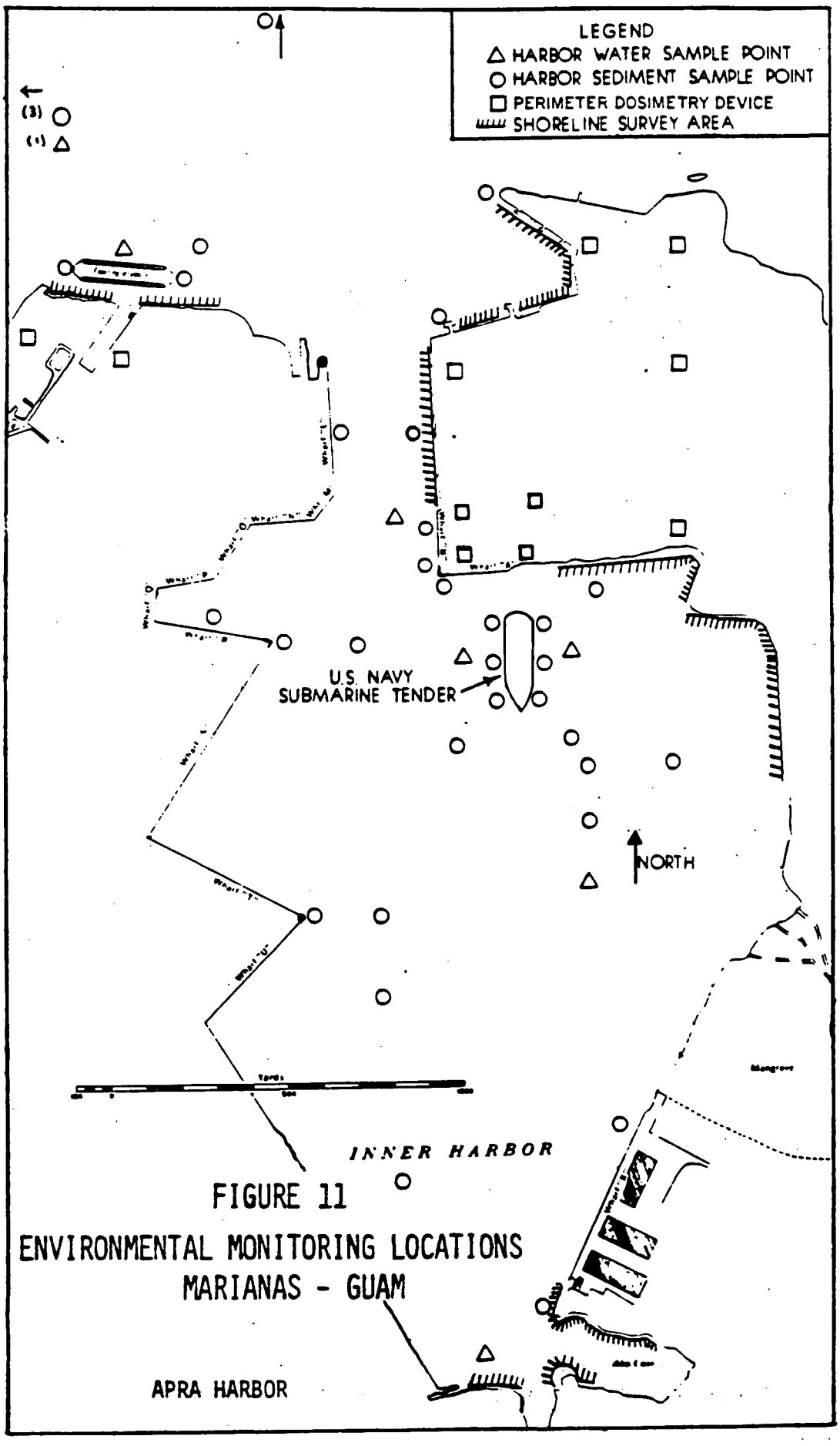
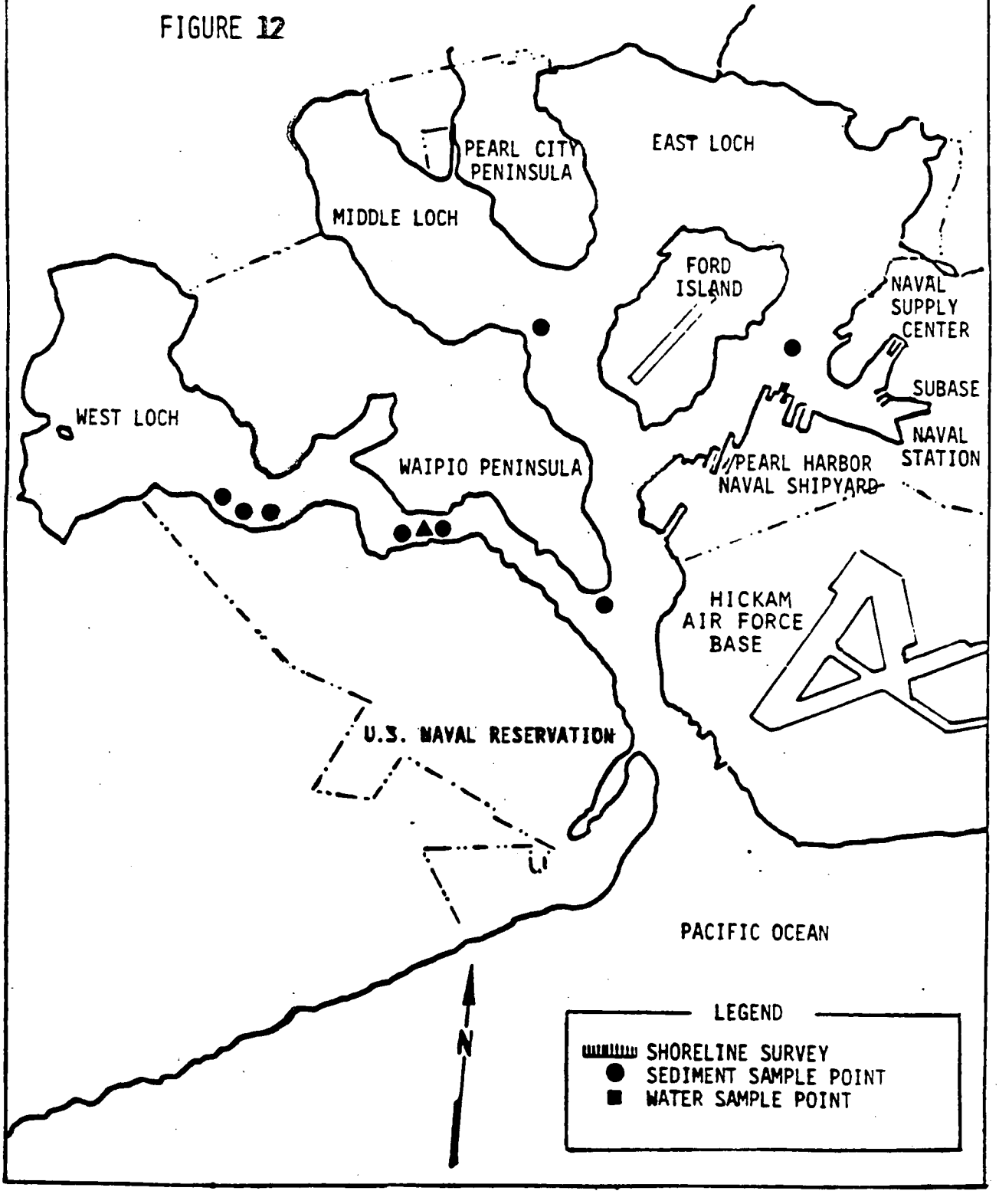


FIGURE 11

ENVIRONMENTAL MONITORING LOCATIONS
MARIANAS - GUAM

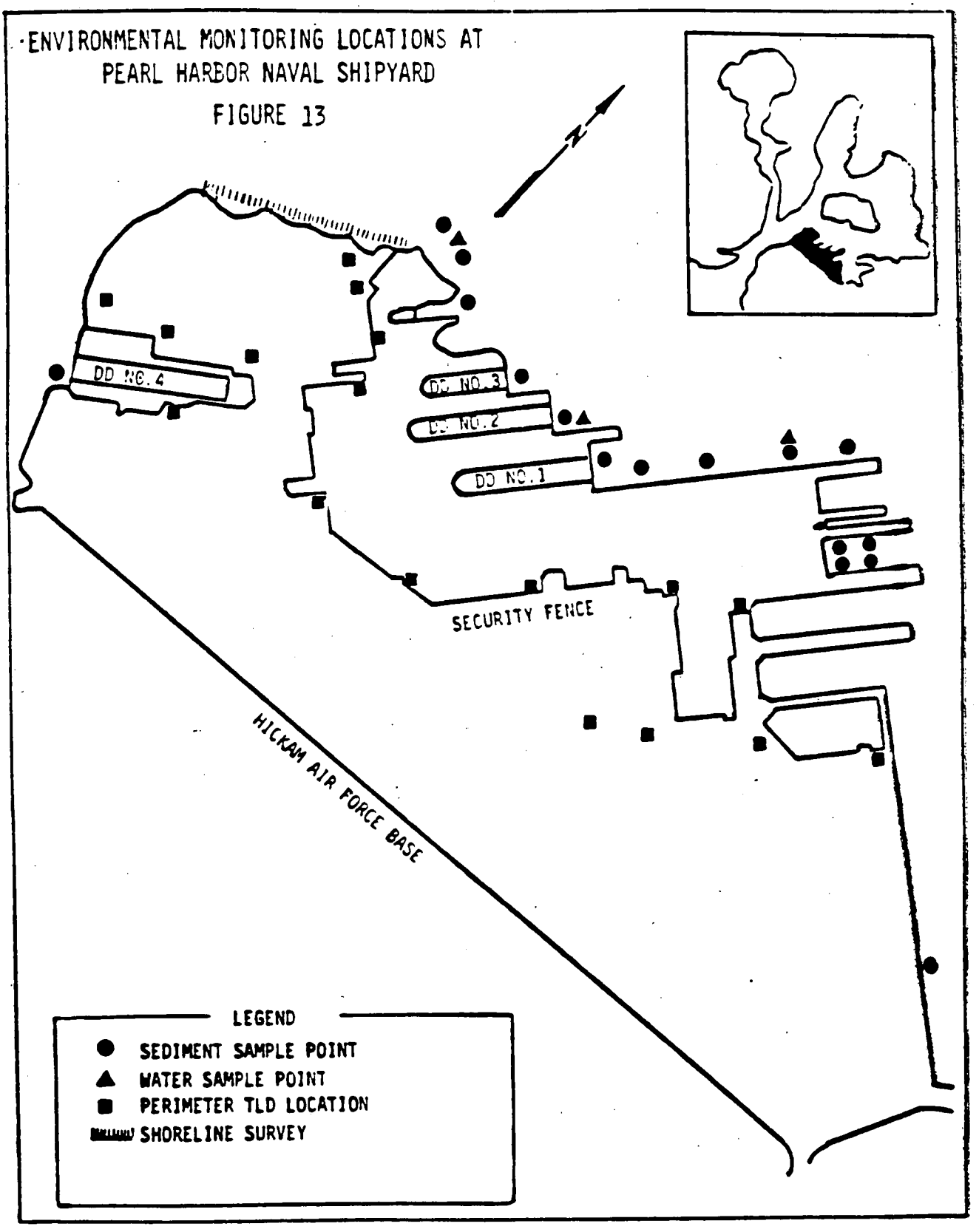
OVERALL MAP OF PEARL HARBOR SHOWING ENVIRONMENTAL MONITORING LOCATIONS IN OTHER AREAS OF PEARL HARBOR

FIGURE 12



ENVIRONMENTAL MONITORING LOCATIONS AT
PEARL HARBOR NAVAL SHIPYARD

FIGURE 13



ENVIRONMENTAL MONITORING LOCATIONS AT PEARL HARBOR NAVAL SUBMARINE BASE

FIGURE 14

ENVIRONMENTAL MONITORING LOCATIONS
AT PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH-KITTERY HARBOR
FIGURE 15

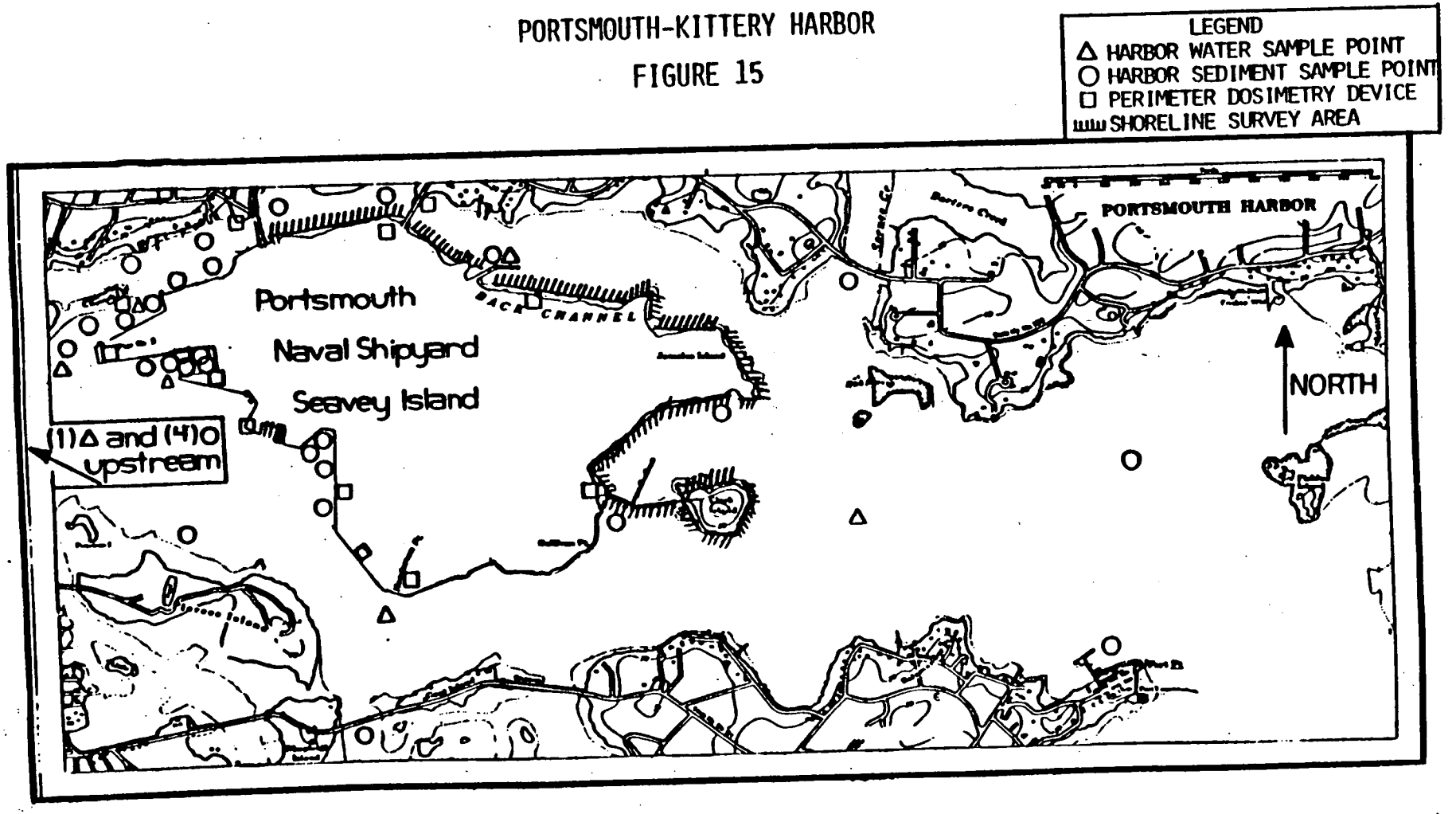


FIGURE 16 U.S. NAVAL STATION & NAVAL SHIPYARD, CHARLESTON, SC.

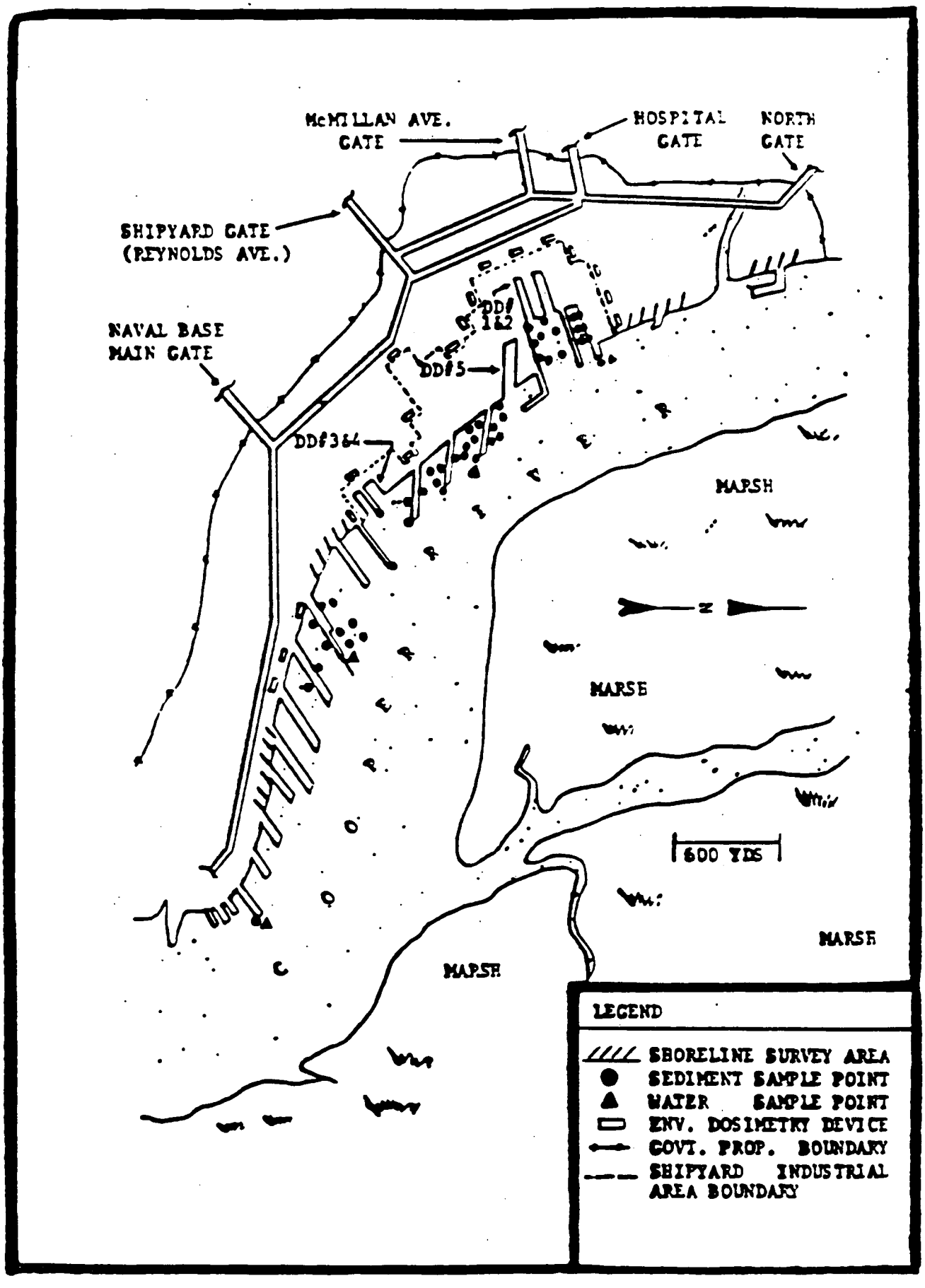
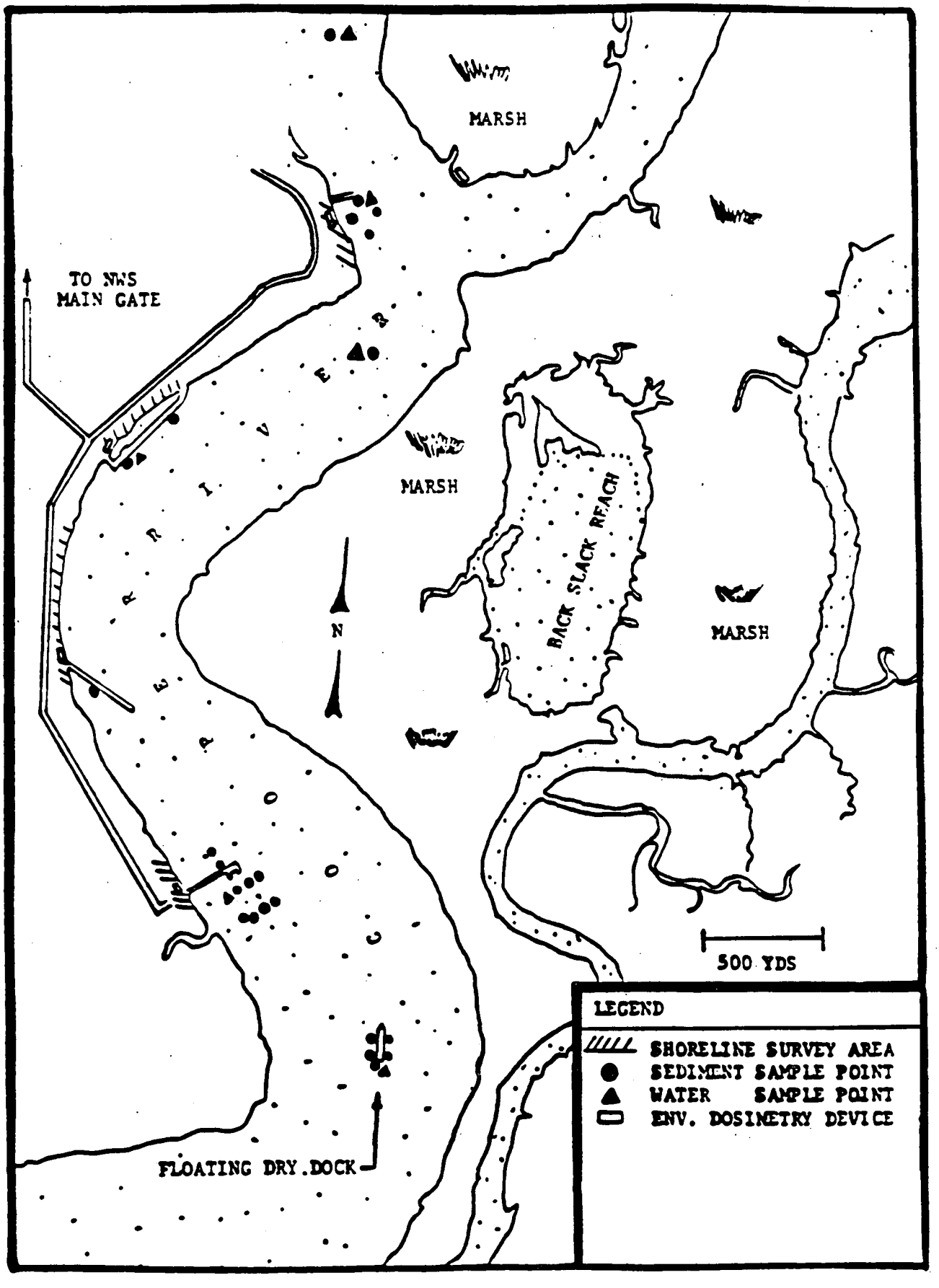


FIGURE 17. ENVIRONMENTAL MONITORING, U.S. NAVAL WEAPONS STATION, CHARLESTON



ENVIRONMENTAL MONITORING LOCATIONS
AT NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY
FIGURE 18

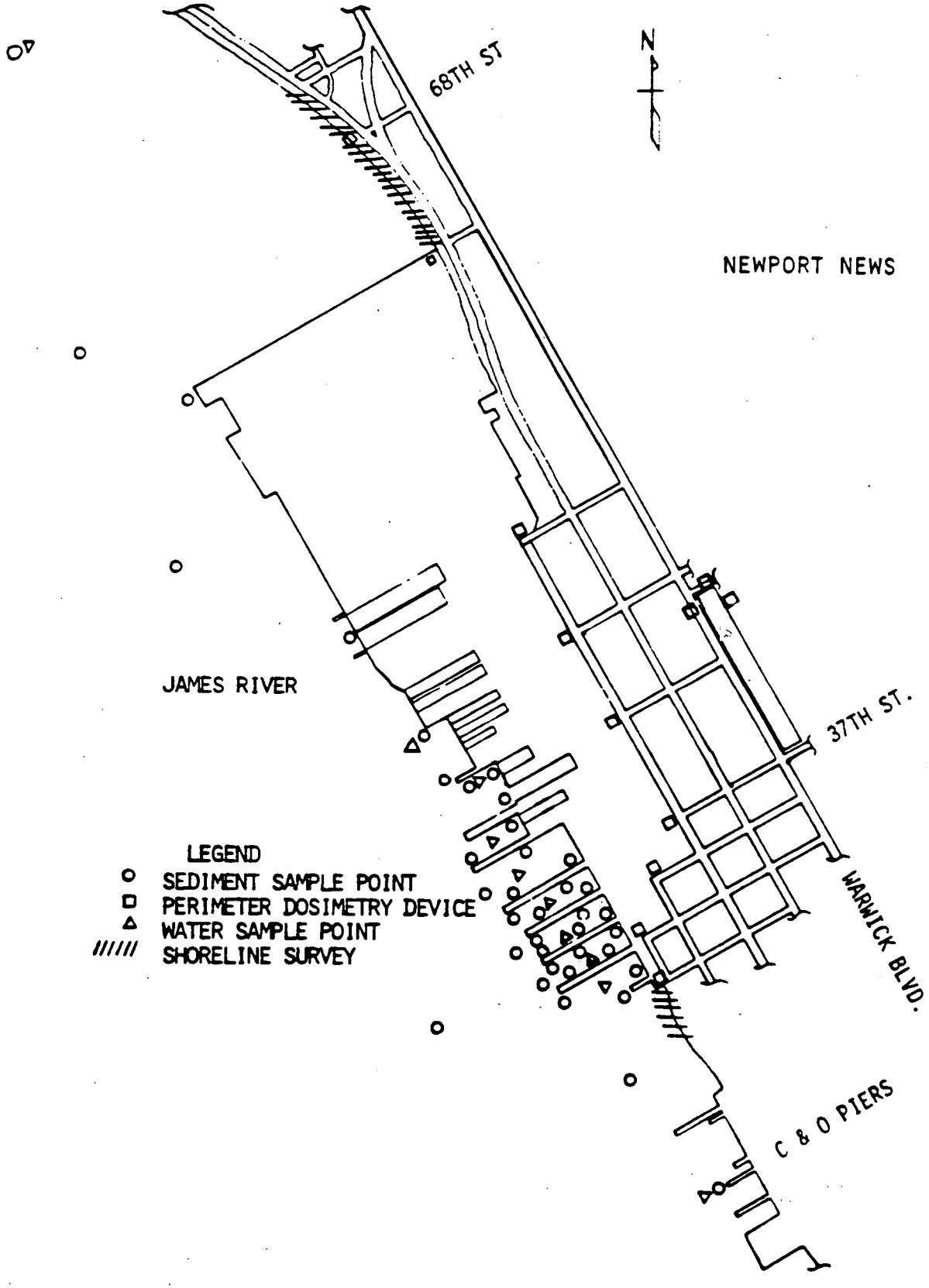


FIGURE 21

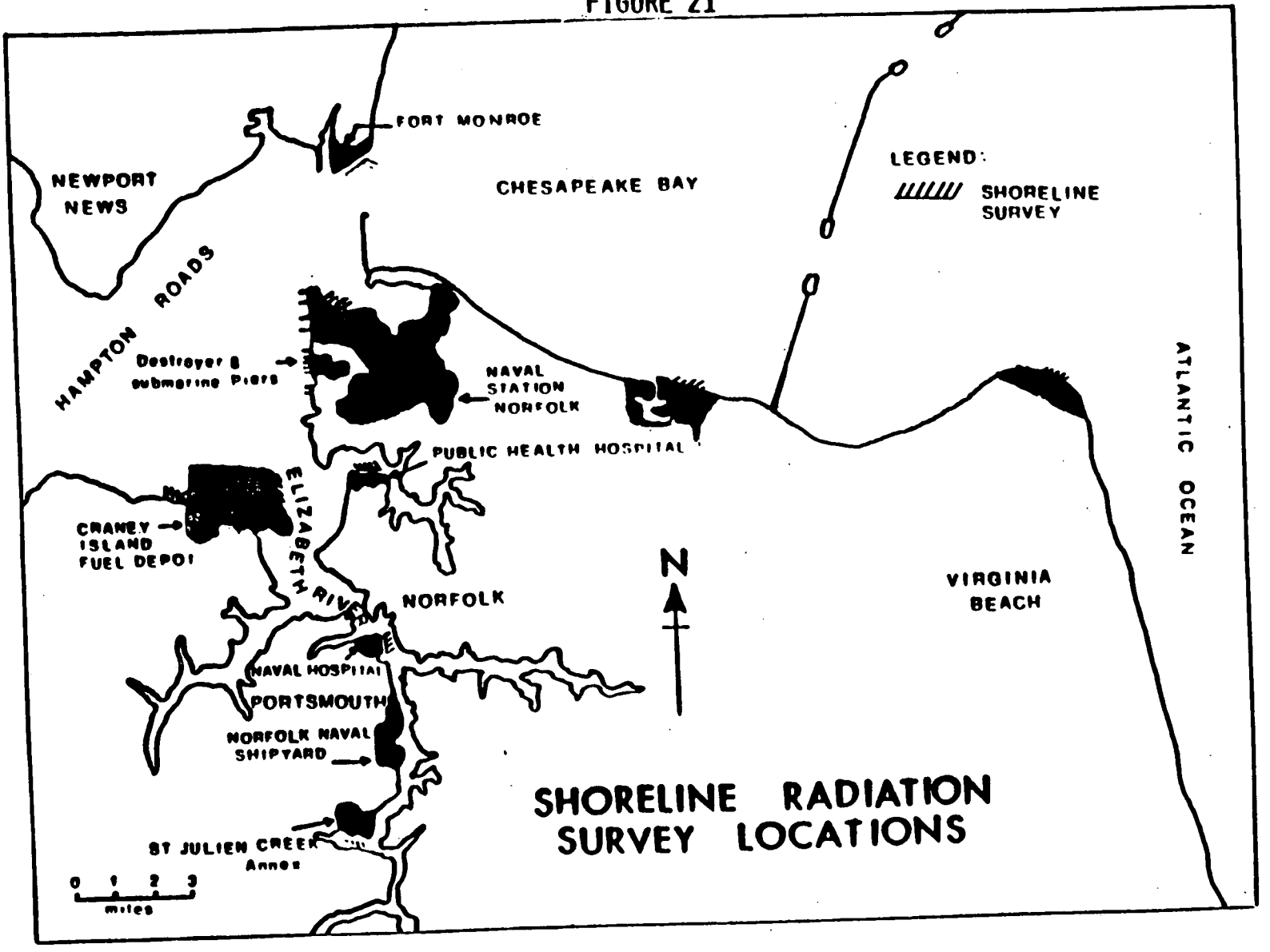
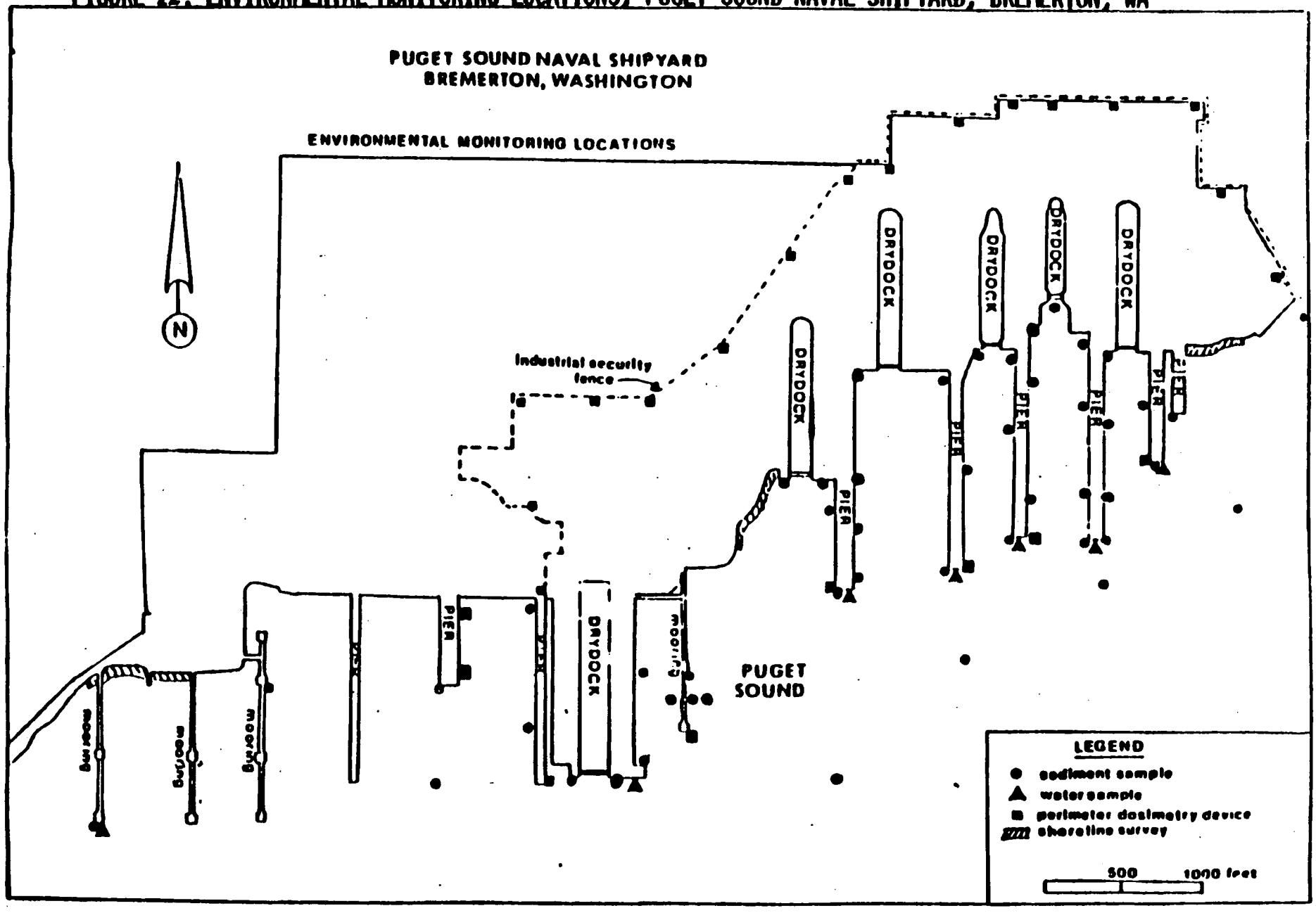

FORT MONROE
NEWPORT NEWS
CHESAPEAKE BAY
LEGEND:
SHORELINE SURVEY
HAMPTON ROADS
Destroyer & submarine Piers
NAVAL STATION NORFOLK
PUBLIC HEALTH HOSPITAL
ATLANTIC OCEAN
CRANEY ISLAND FUEL DEPOT
ELIZABETH RIVER
NORFOLK
N
VIRGINIA BEACH
NAVAL HOSPITAL
PORTSMOUTH
NORFOLK NAVAL SHIPYARD
ST JULIEN CREEK Annex
0 1 2 3
miles
SHORELINE RADIATION SURVEY LOCATIONS

FIGURE 22. ENVIRONMENTAL MONITORING LOCATIONS, PUGET SOUND NAVAL SHIPYARD, BREMERTON, WA



ENVIRONMENTAL MONITORIING LOCATIONS AT
NAVAL SUBMARINE BASE
BANGOR, WA
FIGURE 23

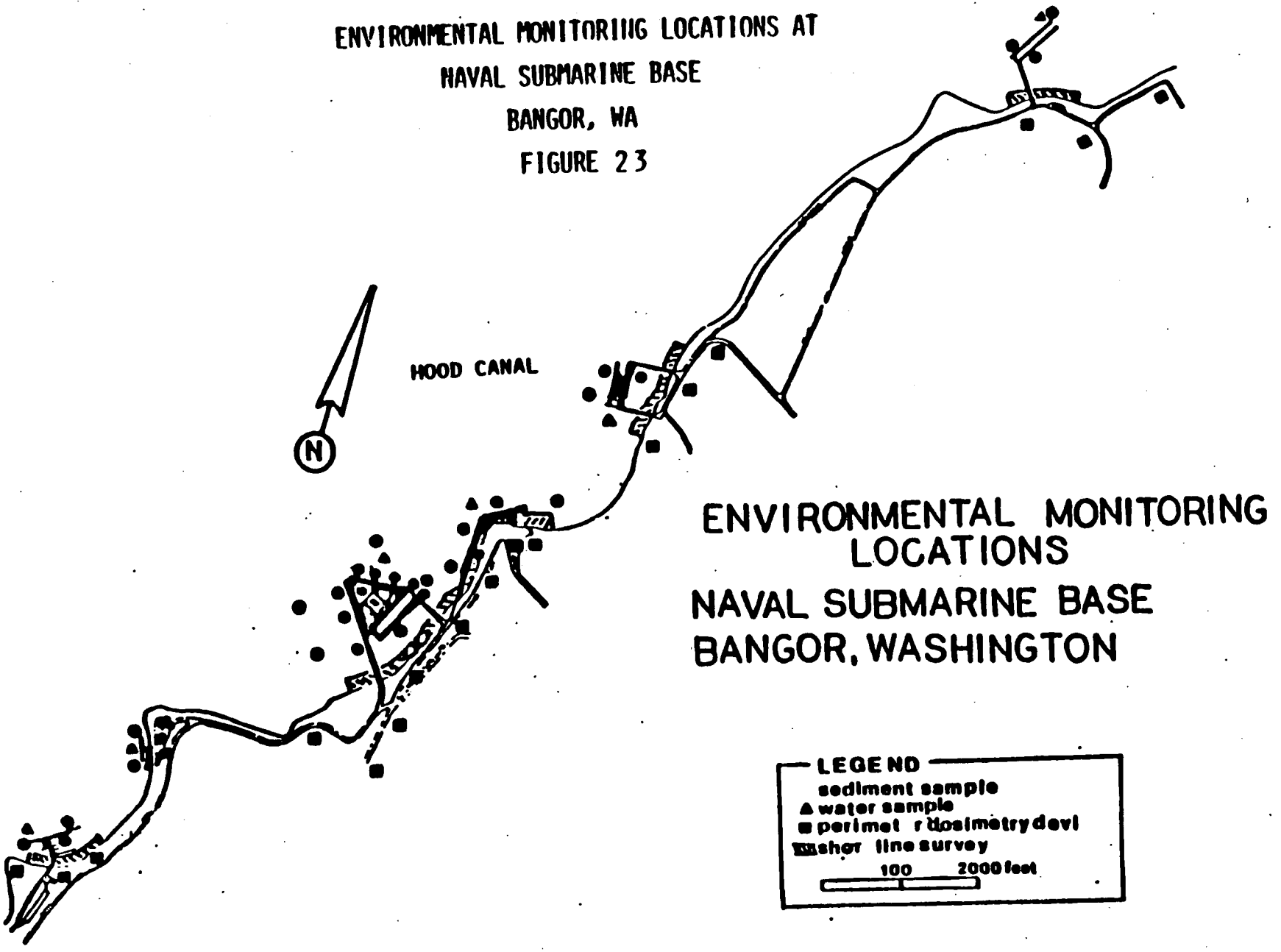


FIGURE 20: ENVIRONMENTAL MONITORING LOCATIONS AT NORFOLK NAVAL STATION

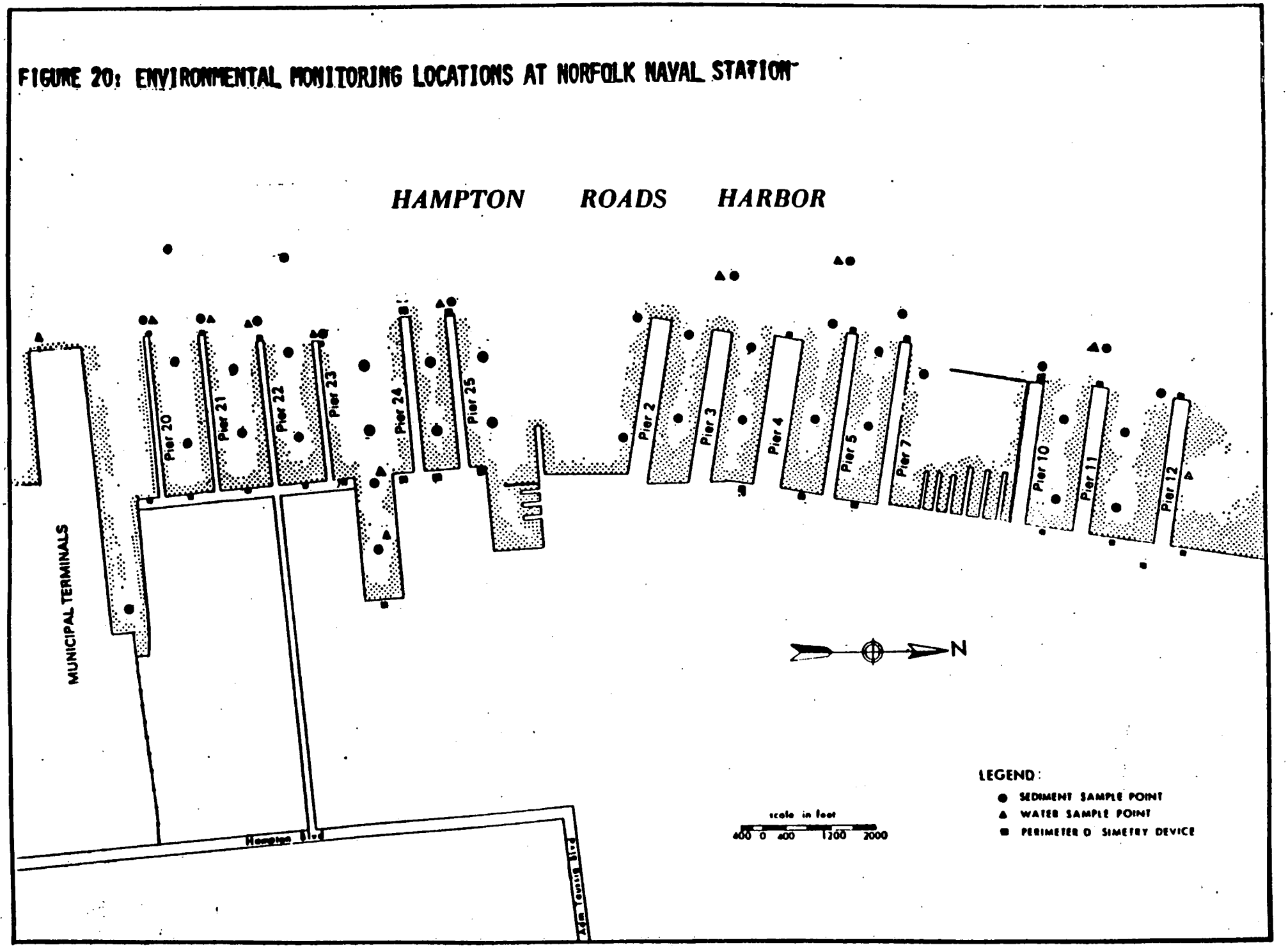
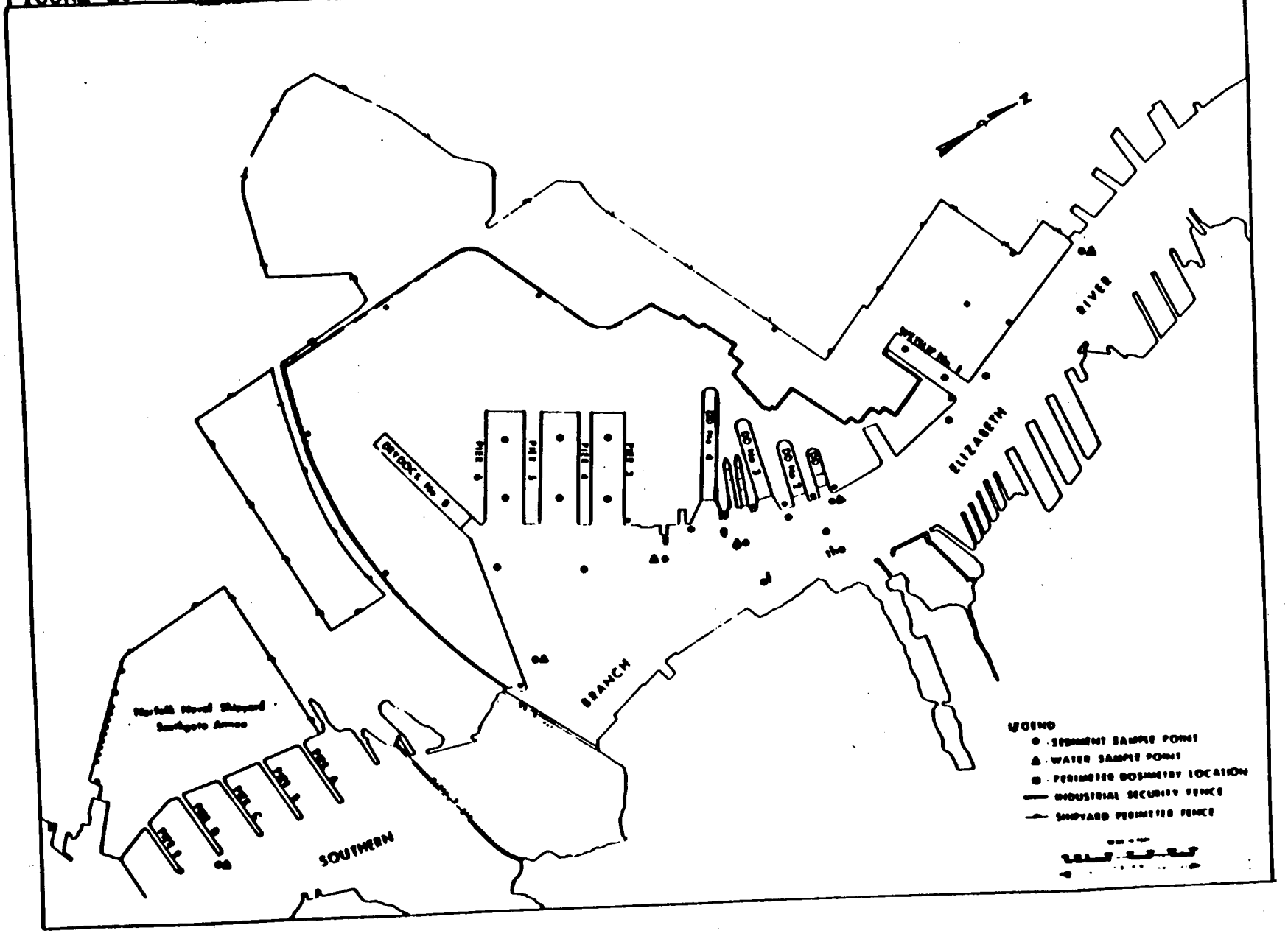


FIGURE 19 ENVIRONMENTAL MONITORING LOCATIONS AT NORFOLK NAVAL SHIPYARD, PORTSMOUTH, VA



SECTION 1.0 INITIAL FACILITY CHARACTERIZATION REPORT

Comment 2.*

The EPA requested the sentence on page 1-25 of the RFIP which reads "Hart will study whether the water flow in the portion of the estuary near the shipyard may be successfully modeled, if information from the RFI indicates that contaminants have been released from the shipyard to the estuary," be removed and replaced with "The Navy will study whether the water flow in the portion of the estuary near the shipyard may be successfully modelled".

Comment 3.*

The EPA has requested the statement on page 1-29 "till will be found only above the high tide line" be removed.

Comment 4.*

The EPA requested that the sentence on page 1-38 which reads "Hart will address contaminant affects on species within the food chain if it is determined that contaminants are being released from the shipyard to the estuary and that these contaminants have the potential to affect estuary species", be revised to read "The Navy will address potential contamination effects on species within the food chain and the relationship to contamination found at PNSY".

Comment 5.*

The EPA has requested the following statement on page 1-40 be removed "While discharges of Shipyard industrial wastes prior to the construction of the Industrial Waste Water Treatment Plant in 1974, conceivably may have contributed to the contamination in some form, it is not feasible to isolate the various sources up and down to Piscataqua River and delineate the proportional share". The following statement should be inserted: "Prior to the construction of the Industrial Waste Water Treatment Plant in 1974, past acceptable industrial practices allowed for discharges of the Shipyard industrial waste into the Piscataqua. While the discharges conceivably have contributed to the contamination in some form the determination of the Shipyard's proportional share may be infeasible".

A detailed historical review of the estuary conditions as well as point and non-point sources of contamination will be conducted in an effort to define the potential historic and current impact of Navy operations on the estuary.

Comment 6.*

The EPA requested that the discussion on pages 1-40 to 1-43 be revised to include identification of potential releases to soil and sediment, in addition to air, groundwater, surface water, and subsurface gas. Revisions are as follows:

1.2.7 Potential Receptors

SWMU Nº 5: Industrial Waste Outfalls

Soils: There is the potential for past releases from the industrial waste outfalls along the western end of the island to affect soils in the vicinity of the JILF if leaching of landfill material is occurring. Analyses of sediment in the outfall areas in 1976 indicated the presence of oil and grease, PCBs, cyanide, phenols and heavy metals including cadmium, copper, chromium, lead, mercury and zinc. Dredging operations that were conducted to deepen the berthing areas, also removed contaminated sediment around the outfalls. Dredged spoils were disposed of in the Jamaica Island Landfill. Discharges from these outfalls have ceased.

Sediment: The potential exists for contaminated sediment along the abandoned outfalls even though sediment has been dredged and disposed at the JILF. Contaminants that can be anticipated are identical to those stated under the Soils Section for SWMU Nº5 above.

SWMU Nº6 DRMO (Previously called DPDO) Storage Yard

Soils: The facility characterization report conducted previously indicated elevated concentrations of cadmium, chromium, lead and nickel in the soils at the DRMO. No soil remediation has been conducted. Modifications of the storage and handling operations have been made to prevent the potential for further releases of lead, however, soils are still believed contaminated with heavy metals.

Sediments: The potential exists for sediments along the DRMO shoreline to be contaminated with the same heavy metals as specified in the Soils discussion above. Both leaching and runoff from the DRMO area are the likely routes of contamination for sediment around the shoreline.

SWMU Nº 8: Jamaica Island Landfill (JILF)

Soils: There is a potential for soil contamination around the JILF. Potentially hazardous materials reported to have been deposited in the JILF include river sediment contaminated with oil and grease, PCBs, cyanides, phenols, cadmium, copper, chromium, lead, mercury and zinc; incinerator ash; asbestos insulation, plating sludges containing cadmium, chrome and lead; organic solvents including trichloroethylene (TCE), methylene chloride, methyl ethyl ketone and toluene; acetylene and chlorine gas cylinders; waste paints; and spent sandblasting grit likely contaminated with heavy metals. Waste oils containing PCBs are also believed to be buried at the JILF.

Sediments: The potential exists for the contaminants discussed above (Soils) to have been released from the JILF to sediment in the Piscataqua River. Sampling and testing of sediments along the river have indicated elevated levels of chromium, lead and nickel.

SWMU Nº 9: Mercury Burial Sites

Soils: The potential for mercury releases to the soil is low since the mercury containing wastes were completely encapsulated in concrete prior to burying.

Sediments: The potential for mercury releases to sediment is low since the mercury containing wastes were completely encapsulated in concrete prior to disposal.

SWMU Nº 10: Battery Acid Tank Nº 24

Soils: The battery acid tank had been excavated and removed in 1986. The State DEP and Shipyard personnel performed soil sampling at the time of the excavation; no adverse findings resulted and no clean-up action was required by the State.

Sediments: Since soil sampling conducted during the tank excavation and removal did not yield adverse results, sediment contamination from this SWMU is not anticipated. Investigations will probably reveal no significant attenuation of contaminants in soil and sediment has occurred during the years lapsed since leak occurred and use of the tank was terminated.

SWMU Nº 11: Waste Oil Tanks (Nº 6 and 7)

Soils: Tank testing conducted on both tanks in 1986 indicated that both tanks were tight and not leaking waste oil. Both tanks have since been removed, and soil around the tanks was excavated and disposed as hazardous waste due to the elevated lead content found in the soils. Soils in the vicinity of the excavations may be contaminated with low levels of lead and waste oils due to spillage and overfilling of the tanks before removeing.

Sediments: The excavation is not in proximity to the shore line. Contamination is likely confined to the soil in the local area.

SWMU Nº 12: Boiler Blowdown Tank Nº 25

Soils: Not applicable. The blowdown tank utilizes a gravity drain with dual-pump lift station backup that provides a nearly continuous flow-through process for eliminating boiler blowdown water. The tempered water is drained directly into the Shipyard's sanitary sewer system which discharges to the Kittery Sewage Treatment Plant. Minor amounts of boiler water treatment chemicals and mineral deposits which are non-hazardous are found in boiler blowdown water.

Sediments: Not applicable. Sediments in river water near SWMU Nº 12 should not be affected by the boiler blowdowns since the discharges tie directly into the Shipyard's sanitary sewer system which ultimately ties into the Kittery Publicly Owned Treatment Work (POTW).

- SWMU Nº 13: Rinse Water Tank Nº 27

Soils: There is the potential for contaminants in the rinse water to contaminate soils surrounding the tank based on the fact that leak testing conducted on the tank in 1985 was inconclusive. Potential contaminants could include oils, metals, cyanide and solvents.

Sediments: Should soils around the tank be contaminated, there is the potential that the contaminants could migrate via groundwater and reach the surface waters of the river.

SWMU Nº 16: Rinse Water Tank Nº 34

Soils: There is the potential for contaminants in the rinsewater to contaminate soils surrounding the tank based on the fact that leak testing conducted on the tank in 1985 was inconclusive. Potential contaminants could include oils, metals, cyanide and solvents.

Sediments: Should soils around the tank be contaminated, there is the potential that the contaminants could reach groundwater and migrate to the surface water of the river.

SWMU Nº 21: Acid/Alkaline Drain Tank

Soils: There is the potential for contaminants in the acid/alkaline cleaning solution to contaminate soils surrounding the tank based on the fact that leak testing conducted on the tank in 1985 was inconclusive. Potential contaminants could include acids, caustics, metals, cyanides and oils.

Sediments: Should soils around the tank be contaminated, there is the potential that the contaminants could reach groundwater and migrate to the surface water of the river.

SWMU Nº 23: Chemical Cleaning Facility Tank

Soils: There is the potential for contaminants in the chemical cleaning facility to contaminate soils surrounding the tank based on the fact that leak testing previously conducted on the tank was inconclusive. Potential contaminants could include acids, caustics, metals, cyanide, oils and solvents.

Sediments: Should soils around the tank be contaminated, there is the potential that the contaminants could reach groundwater and migrate to the surface water of the river.

SWMU Nº 26: Portable Oil/Water Tanks

Soils: There is no potential for soils surrounding these tanks to be contaminated with oils, diesel fuel and solvents, due to asphalt or concrete pavement.

Sediments: There is the potential for sediments along the shoreline in the vicinity of the six to ten portable oil/water tanks used in locations near the shoreline, to be contaminated with oils, diesel fuel and solvents.

- SWMU Nº 27: Fuel Oil Spillage Area Southeast of Berth 6

Soils: A ruptured pipeline in 1978 resulted in Nº 6 fuel oil contaminating soils in the vicinity of the pipe. Contaminated soils were excavated, however, low levels of contamination in the soils may still remain in the area.

Sediments: Should soils in the area of the fuel oil spill still remain contaminated, there is the potential that the contaminants could reach groundwater and migrate to the surface water of the river.

Comment 7.*

The EPA requested a revision of the statements on page 1-41 that SWMUs 10 and 11 have no current potential for release of contaminants to groundwater or surface water to reflect the opposite. This revision is as follows:

Groundwater: There is little potential for additional releases since the tank has been removed. However, there is the possibility that adjacent soil remains contaminated and may be a source of additional groundwater contamination.

Surface Water: Prior....

There is little potential for additional releases since the tank has been removed. The release of contaminants to surface water prior to tank removal does indicate the possibility that surrounding soil may have been contaminated and may be a source of groundwater contamination today.

Comment 8.*

An Air Monitoring Proposal for the collection of air and meteorological monitoring data as requested by the EPA is attached.

Comment 10.*

No detailed Naval records relating to the exact placement of acetylene and chlorine gas cylinders in SWMU 8 apparently exist. According to the June 1983, Initial Assessment Study of Portsmouth Naval Shipyard, NEESA 13-032, prepared by Roy F. Weston, Inc., 100 to 200 full cylinders of acetylene and chlorine were buried in the Jamaica Island Landfill in 1955. It is not known whether the cylinders were mixed or segregated when buried.

AIR MONITORING PROPOSAL

Prepared for:

United States Navy
Naval Facilities Engineering Command
Philadelphia, Pennsylvania

Prepared by:

McLaren/Hart Environmental Engineering Corp.
28 Madison Avenue Extension
Albany, New York 12203

February 19, 1991

AMBIENT AIR MONITORING

Ambient air monitoring for volatile organic compounds (VOCs) will be conducted around the Jamaica Island Landfill (JILF) Solid Waste Management Unit (SWMU #8) as part of the Public Health and Environmental Risk Evaluation (PHERE) at the Portsmouth Naval Shipyard (PNS). Parameters that have been selected are based upon preliminary screening conducted at the site and guidance information found in EPA's Risk Assessment Guidance for Superfund--Volume 1. Human Health Evaluation (Part A) Interim Final (Dec. 1989, EPA/540/1-89/002) and The Air/Superfund National Technical Guidance Study Series EPA 450/1-89-001 to 004.

Air monitoring parameters for the JILF will include volatile organic compounds (aromatics and halogenated). In lieu of ambient air monitoring for particulate-bound chemicals around the DRMO and JILF, surface soil analyses in conjunction with available ambient air monitoring data for particulates for the area will be used to model suspended chemical and elemental particulate concentrations in the immediate area. If no Total Suspended Particulate (TSP) or Respirable Suspended Particulate (RSP) data is available from the state, or other sources, then Hi-vol air samplers will be used to collect particulate data for both the DRMO and JILF areas.

The intent of this ambient air monitoring investigation is to provide data to support the Human Health Risk Assessment. Locations for VOC monitoring have been selected around portions of the JILF and near the entrances to the base. Preliminary ambient air screening monitoring conducted in 1990 by McLaren/Hart and others was reviewed as well as existing meteorological data for the area prior to developing this ambient air monitoring program. The ambient air monitoring program will include on-site meteorological monitoring during the sampling period so that dispersion modelling may be conducted if

needed later for risk assessment purposes. Representative meteorological conditions and actual volatile organic compound concentrations found at the PNS will yield more meaningful modelling information.

If an existing Navy met tower on top of Building 240 proves to be inadequate, then a temporary ten (10) meter meteorological tower is proposed to be erected and operated in an open area between the public works storage building (#69) and public quarters (M, Q and #192). This is an elevated area between SWMU #6 and SWMUs #8 and #9. One (1) mobile "back-ground" ambient air monitoring site is proposed on the property. Wind direction information from the meteorological tower will be used to decide where the "background" monitoring station will be located for each monitoring period. Five (5) ambient air monitoring sites are proposed around the JILF for VOCs. If sampling is needed to monitor TSP/RSP levels, air monitoring stations will be needed around the DRMO and the JILF. The locations and proposed monitoring parameters are included in the attached ambient air monitoring station location map and parameters table.

The monitoring program is proposed over a maximum of a three (3) week period. Samples will be collected during a twenty-four (24) hour period and collected every other day to ensure that everyday of the week is covered (Table II). Chain-of-Custody forms will be utilized and will accompany samples to an American Industrial Hygiene Association (AIHA) accredited laboratory for analysis. Meteorological data will be collected over this period and one week prior to the start of the sampling period. A two (2) day site visit will be required for the coordination with the Navy and siting of the ambient air monitoring stations and meteorological tower early in the project. Visitors will include the Project Manager, Certified Industrial Hygienist and his assistant. It is anticipated that it will take up to three (3) weeks to acquire and assemble necessary field equipment prior to

installation at the PNS. If possible, sampling should not be conducted in the winter or early spring time when grounds around the SWMUs are frozen. The sampling program should cover periods when potential contaminant releases from the SWMUs are expected, such as late spring, summer and early autumn.

It is currently anticipated that normal laboratory turn around time will be three (3) to four (4) weeks after receipt of sample. Laboratory results will be used to prepare a summary report for the Public Health and Environmental Risk Evaluation for these SWMUs at the Portsmouth Naval Shipyard.

Volatile organic compounds will be collected using Summa passivated canister sampling at each sampling location and analyzed according to the EPA TO-14 methodology. Samples will be analyzed by gas chromatography (GC). Respirable and total suspended particulate samples if needed, will be collected using a high volume (PM_{10} method) air sampler and analyzed gravimetrically. The particulates could also be analyzed for heavy metals and other contaminants, if required. For quality assurance/quality control purposes daily sets of samples will include one duplicate per analysis parameter and one field blank per analysis parameter. A detailed QA/QC sampling protocol will be adhered to.

TABLE I

AMBIENT AIR MONITORING STATION LOCATIONS AND PARAMETERS

SWMU	Station Nº	General Location	Parameters
DRMO	1	West of Public Quarters, S	(TSP, PM_{10})
	2	South of Supply Storage #146	(TSP, PM_{10})
JILF	3	South Side of JILF	VOC, (TSP, PM_{10})
	4	West Side of JILF	VOC, (TSP, PM_{10})
	5	East Side of JILF	VOC, (TSP, PM_{10})
	6	North Side of JILF on Playing Field	VOC, (TSP, PM_{10})
	7	South of Public Quarters H27	VOC, (TSP, PM_{10})
Background	8	Mobile	VOC, (TSP, PM_{10})

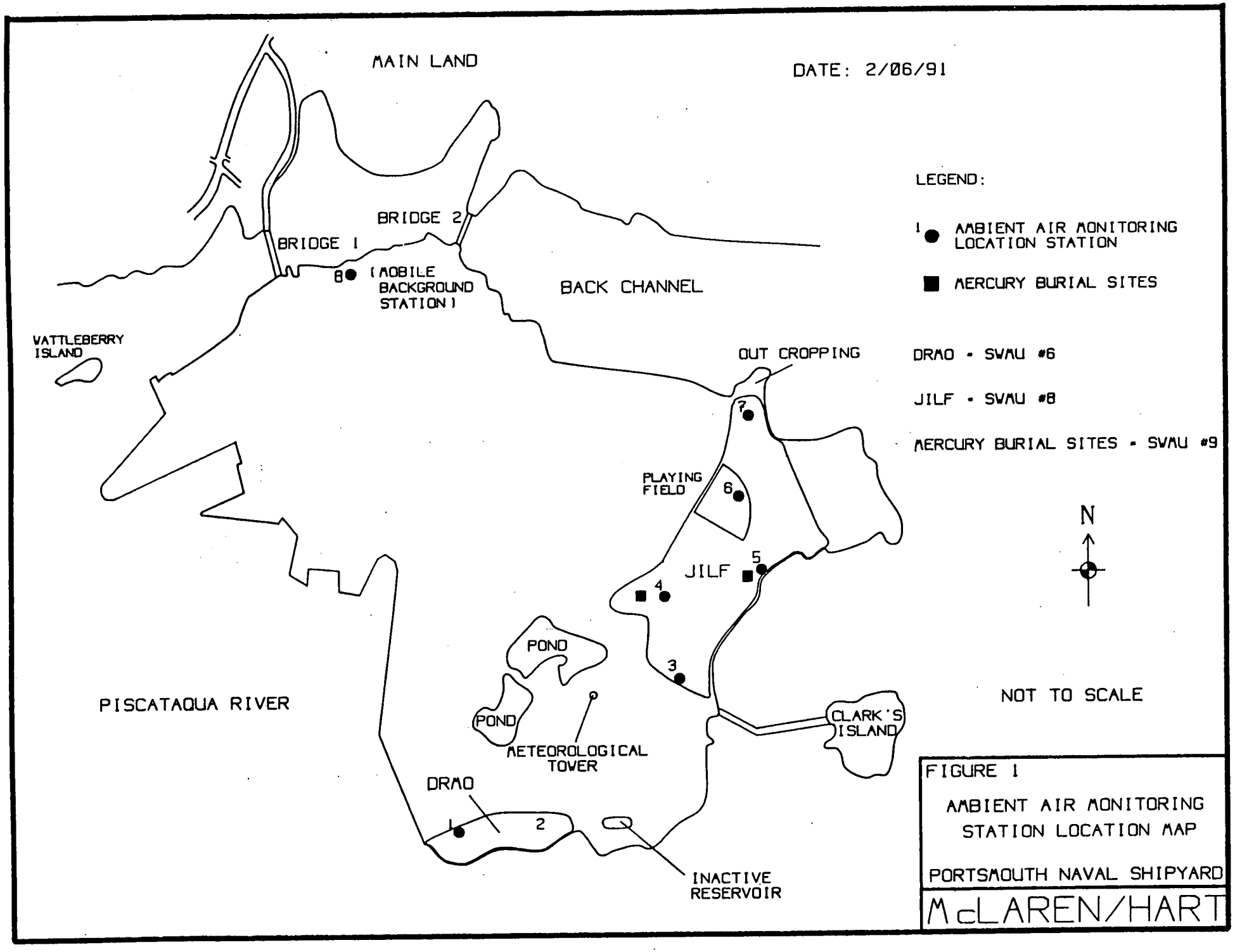
VOC - Volatile Organic Compounds (TCL and Appendix IX Volatiles Measured by EPA Methodology TO-14)
PM_{10} - Respirable Suspended Particulates
( ) - Optional Sampling
TSP - Total Suspended Particulate

NOTE: For QA/QC purposes, each daily set will include one duplicate sample and one field blank.

TABLE II

AMBIENT AIR MONITORING SCHEDULE

Week Nº	MON	TUES	WED	THURS	FRI	SAT	SUN
1		X		X		X	
2	X		X		X		X
3		X		X		X	


MAIN LAND
DATE: 2/06/91
LEGEND:
AMBIENT AIR MONITORING LOCATION STATION
MERCURY BURIAL SITES
DRMO - SWMU #6
JILF - SWMU #8
MERCURY BURIAL SITES - SWMU #9
BRIDGE 2
BRIDGE 1
8
(MOBILE BACKGROUND STATION)
BACK CHANNEL
VATTLEBERRY ISLAND
OUT CROPPING
7
PLAYING FIELD
6
JILF
5
4
3
N
POND
POND
METEOROLOGICAL TOWER
PISCATAQUA RIVER
CLARK'S ISLAND
NOT TO SCALE
DRMO
1
2
INACTIVE RESERVOIR
FIGURE 1
AMBIENT AIR MONITORING STATION LOCATION MAP
PORTSMOUTH NAVAL SHIPYARD
McLAREN/HART

Aerial photographs of the island were reviewed dating back to 1945. Figure 1, History of Filled Land at the Jamaica Island Landfill, is attached and indicates three areas where the gas cylinders may have been buried. These areas are south-southwest of the landfill, north-northeast of the baseball diamond, and west and southwest of the ball diamond.

The material of construction for the gas cylinders is unknown. The present condition of the cylinders is uncertain, however, the cylinders are likely to have deteriorated over the thirty-five year period.

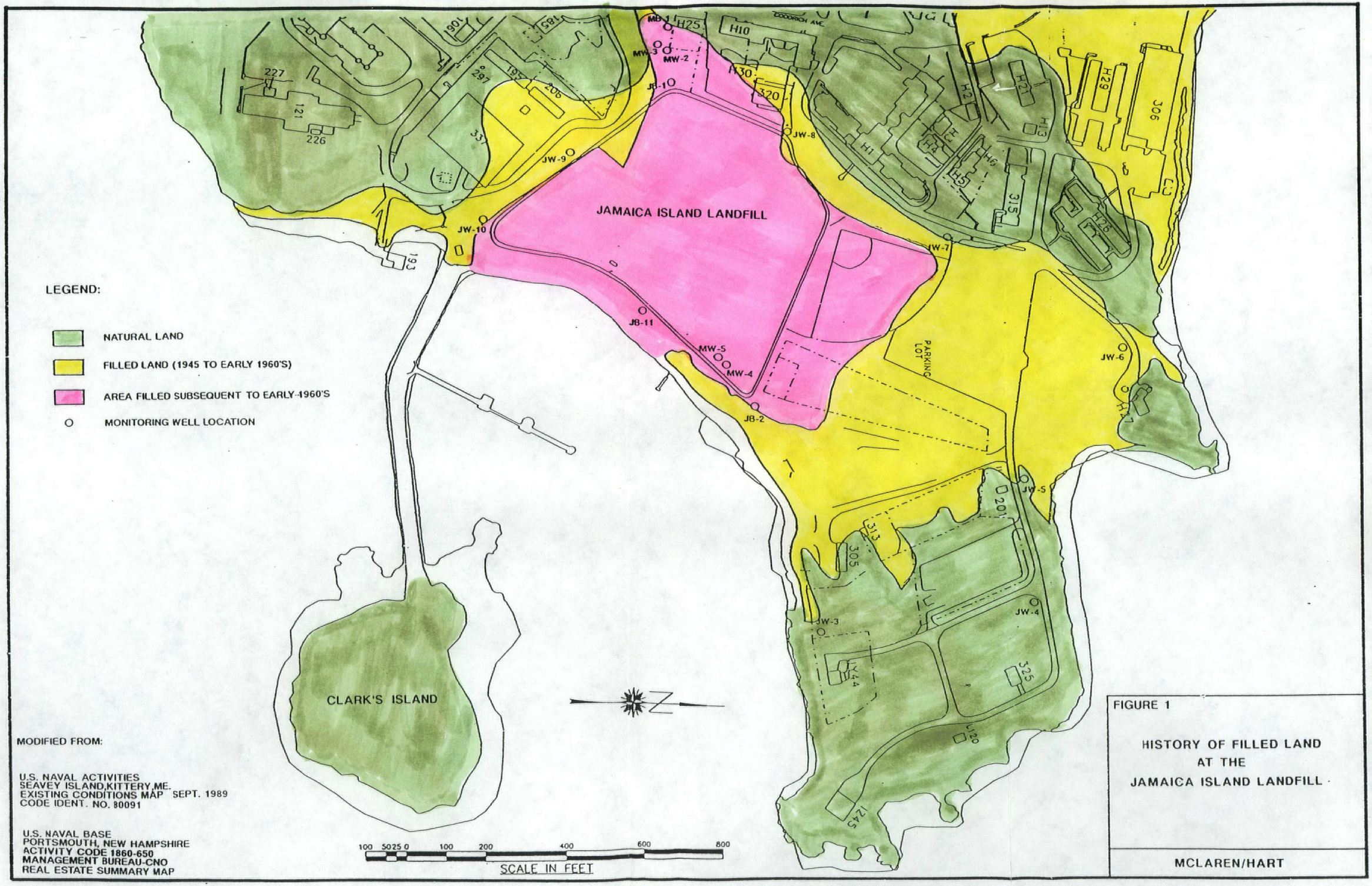
Comment 13.*

The EPA requested more detailed information for SWMUs 10, 11, 12, 13, 16, 21, 23, 26 and 27. The additional information requested is provided below (from RFA Phase II Report prepared July 1, 1986 by AT Kearney, Inc.).

SWMU #10. Unit Name: Tank No. 24

Description: This unit was an underground, 9680-gallon steel holding tank for waste battery acid resulting from battery disposal operations. The unit was located outside of Building 238. The unit has been closed and wastes are now collected in a portable chemical tank. As part of a Consent Agreement and Order (15), the Part B Application has been amended to include this activity.

Period of Operation: 1974 to 1984



MODIFIED FROM:

U.S. NAVAL ACTIVITIES
SEAVEY ISLAND,KITTERY,ME.
EXISTING CONDITIONS MAP SEPT. 1989
CODE IDENT. NO. 80091

U.S. NAVAL BASE
PORTSMOUTH, NEW HAMPSHIRE
ACTIVITY CODE 1860-650
MANAGEMENT BUREAU-CNO
REAL ESTATE SUMMARY MAP

FIGURE 1

HISTORY OF FILLED LAND
AT THE
JAMAICA ISLAND LANDFILL

MCLAREN/HART

Wastes: Sulfuric acid contaminated with lead (pH <2).

Release Controls: Not provided.

History of Releases: In 1984 a 2-inch hole was discovered at the bottom of the tank due to groundwater inflow when empty. The period of potential release is not known. The tank has since been taken out of service and was removed in 1986 according to a closure plan approved by the State of Maine.

Condition: The tank was excavated and removed in 1986. Soils were tested and reportedly no clean-up action was required by the State.

SWMU #11. Unit Name: Waste Oil Tanks (2) No. 12

Description: These units were railroad tank cars, two 8000-gallon underground tanks constructed of steel. The tanks were buried side by side at the northeastern end of the Jamaica Landfill Area. The tanks were used to store oily wastes prior to off-site disposal.

Period of Operation: 1943 to 1986

Wastes: Waste Oils from facility shops including cooling and cutting oils, motor oils, transmission oils, and hydraulic oils. A Consent and Agreement Order (15) has indicated that degreaser solvents have in the past been labeled as waste oils and may have been stored in these tanks. In addition, a February 1985 Industrial Survey Report (13) indicated that plant personnel have admitted placing small quantities of waste cleaning solvents into dumpsters which were emptied into the underground waste oil tanks at Jamaica Island. Waste oils may also contain various metals.

Release Controls: There were no known releases from this unit.

History of Releases: In 1979 the tanks were excavated and inspected. There was no evidence of releases at that time. In 1986, both tanks were precision tested and found to be tight.

Condition: These tanks were excavated and removed sometime after 1986. Soil sampling by the shipyard and State was conducted; results unknown.

SWMU #12. Unit Name: Boiler Blowdown Tank No. 25

Description: This unit is a 3800-gallon underground, steel tank, located adjacent to Building 72. Limited information was available.

Period of Operation: 1974 to Present

Wastes: Boiler blowdown consisting of minor quantities of boiler water treatment chemicals and mineral deposits.

Release Controls: The liquid is pumped directly into the Shipyard sanitary sewer and eventually into the Kittery Sewage Treatment Plant.

History of Releases: Not provided. Historically, this practice has not caused any adverse effects to either the Shipyard or the Kittery Sewer Systems.

Condition: Mechanically sound, intact and stable. However, a request will be made to remove this system as a SWMU based on the fact that non-hazardous liquids pass directly through Tank No. 25 and are ultimately treated by the Kittery Sewage System.

Aerial photographs of the island were reviewed dating back to 1945. Figure 1, History of Filled Land at the Jamaica Island Landfill, is attached and indicates three areas where the gas cylinders may have been buried. These areas are south-southwest of the landfill, north-northeast of the baseball diamond, and west and southwest of the ball diamond.

The material of construction for the gas cylinders is unknown. The present condition of the cylinders is uncertain, however, the cylinders are likely to have deteriorated over the thirty-five year period.

Comment 13.*

The EPA requested more detailed information for SWMUs 10, 11, 12, 13, 16, 21, 23, 26 and 27. The additional information requested is provided below (prepared in part from RFA Phase II Report prepared July 1, 1986 by AT Kearney, Inc.).

SWMU #10. Unit Name: Tank No. 24

Description: This unit was an underground, 9680-gallon steel holding tank for waste battery acid resulting from battery disposal operations. The unit was located outside of Building 238. The unit has been closed and wastes are now collected in a portable chemical tank. As part of a Consent Agreement and Order (15), the Part B Application has been amended to include this activity.

Period of Operation: 1974 to 1984

Wastes: Sulfuric acid contaminated with lead (pH <2).

Release Controls: Unavailable.

History of Releases: In 1984 a 2-inch hole was discovered at the bottom of the tank due to groundwater inflow when empty. The period of potential release is not known. The tank was taken out of service and removed in 1986 according to a closure plan approved by the State of Maine.

Condition: The tank was excavated and removed in 1986. Soils were tested and no clean-up action was required by the State.

SWMU #11. Unit Name: Waste Oil Tanks (2) No. 12 (later numbered "6" and "7")

Description: These units were, two 8000-gallon underground steel tanks from railroad cars. The tanks were buried side by side at the northeastern end of the Jamaica Landfill Area. The tanks were used to store oily wastes prior to off-site disposal.

Period of Operation: 1943 to 1986

Wastes: Waste Oils from facility shops including cooling and cutting oils, motor oils, transmission oils, and hydraulic oils. A Consent and Agreement Order (15) has indicated that degreaser solvents have in the past been labeled as waste oils and may have been stored in these tanks. In addition, a February 1985 Industrial Survey Report (13) indicated that plant personnel have admitted placing small quantities of waste cleaning solvents into dumpsters which were emptied into the underground waste oil tanks at Jamaica Island. Waste oils may also contain various metals.

Release Controls: Standard Operating Procedures existed, but there was occasional spillage due to overfilling or misalignment of fill hose with neck of tanks.

History of Releases: In 1979 the tanks were excavated, inspected and reburied. There was no evidence of leakage at that time. In 1986, both tanks were precision tested and found to be tight.

Condition: These tanks were excavated and removed sometime after 1986. Soil sampling by the shipyard and State was conducted; elevated levels of lead were found in excavated material. Contaminated soil was disposed of in a RCRA approved SWLF.

SWMU #12. Unit Name: Boiler Blowdown Tank No. 25

Description: This unit is a 3800-gallon underground, steel tank, located adjacent to Building 72. Limited information was available.

Period of Operation: 1974 to Present

Wastes: Power Plant Boiler blowdown consisting of minor quantities of the following water additives: Disodium phosphate, Sodium sulfite, and Betz Balanced Polymer BP5205.

Release Controls: The liquid is drained directly into the Shipyard sanitary sewer and eventually into the Kittery Sewage Treatment Plant.

History of Releases: Unavailable. Historically, this practice has not caused any adverse effects to either the Shipyard or the Kittery Sewer Systems.

Condition: Mechanically sound, intact and stable. A request will be made to remove this system as a SWMU based on the fact that non-hazardous liquids pass directly through Tank No. 25 and are ultimately treated by the Kittery Sewage System.

SWMU #13. Unit Name: Rinse Water Tank No. 27 (outside of 6/76)

Description: This unit is a 700-gallon underground tank constructed of steel. The tank is located in the northwestern portion of the facility adjacent to Building 76.

Period of Operation: 1974 to Present. Tank is out of service, having had only one connection to one rinse tank. Piping connection to tank has been removed and abandoned. Tank was last pumped on June 1989.

Wastes: Unspecified rinse water believed to be slightly acidic and may contain oil contaminants from an oil quench, metals and cyanide.

Release Controls: Unavailable.

History of Releases: Unavailable.

Condition: Good; currently inactive. Future plans are to excavate and remove this tank and all associated piping. Confirmation soil sampling will be conducted. A request to eliminate this tank as a SWMU will be made after verification of proper closer.

SWMU #16. Unit Name: Rinse Water Tank No. 34 (outside of 6/174)

Description: This unit is a 750-gallon underground tank constructed of steel. The tanks located adjacent to Building 174 in the northwestern portion of the facility.

Period of Operation: 1978 to Present. Tank is out of service, having only one connection to one rinse tank. Piping connection to tank has been removed and abandoned. Tank has not been pumped at least for the past six years.

Wastes: Rinse waters may contain dilute hydrochloric acid, acetic acid, sodium hydroxide and metal residue from a descaling process.

Release Controls: Unavailable.

History of Releases: Unavailable. A series of wash and rinse tanks inside the building can overflow into a large concrete shallow sump which drains into the 750 gallon underground tank.

Condition: Unknown. Future plans are to excavate and remove this tank and all associated piping and equipment. Confirmation soil samples will be collected and analyzed. A request will be made to eliminate Tank No. 34 as a SWMU after verification of proper closure.

SWMU #21. Unit Name: Acid/Alkaline Drain Tank (outside of 6/76)

Description: A 695-gallon underground tank is located outside the Sheet Metal Shop, Building 75.

Period of Operation: 1974 to Present. all connections except floor drain have been removed or equipment has been taken out of service. The use of tank is being phased out and removal of tank is being planned.

Wastes: Discharge from two clothes wasing machines used to clean air filters. Water rinse from three deburring machines. Minor volumes of overflow wastes consist of: unspecified waste acid and alkaline metal surface-cleaning solutions, solid residues and cyanide.

Release Controls: Unavailable.

History of Releases: Unavailable.

Condition: Presumed intact. However, tank testing results were reportedly inconclusive. Future plans are to remove this tank and all associated piping and equipment. Confirmation soil samples will be collected and analyzed. A request will be submitted to eliminate this tank as a SWMU after verification of proper closure.

SWMU #23. Unit Name: Chemical Cleaning Facility Tank (outside of Building 174)

Description: This unit is a 2270-gallon underground tank located between Building 174 and Dry Dock 3. The tank is part of a chemical cleaning facility.

Period of Operation: 1978 to Present. Tank is not now in normal service with piping connections to all rinse tanks having been removed and capped. The only existing connection is to floor drains in containment pit. The drains are scheduled to be plugged and abandoned. Tank was last pumped in July 1990.

Wastes: Unspecified waste acid and alkaline metal surface-cleaning solutions and solid residues. Cleaning solutions may contain hydrochloric acid, acetic acid and sodium hydroxide.

Release Controls: Unavailable.

History of Releases: Unavailable. A series of wash and rinse tanks inside the building can overflow into a large concrete shallow sump which is believed to drain into this tank.

Condition: Unknown. Presumed intact. However, pressure testing has proved inconclusive. Future plans are to excavate and remove this tank and all associated piping and equipment. Confirmation soil samples will be collected and analyzed. A request will be made to eliminate this tank as a SWMU after verification of proper closure.

SWMU #26. Unit Name: Portable Oil/Water Tanks

Description: Oil/water tanks at the submarine berths are used for the cleanout of submarine bilges and various tanks. Resulting oil wastes are pumped to railroad tank cars and properly disposed.

Period of Operation: 1960 to Present

Wastes: Acidic and alkaline cleaning solutions and oil water mixtures.

Release Controls: Unavailable.

History of Releases: During the past ten years, numerous spills from waste oil tanks have occurred at the shipyard berths. These waste oil tanks are used for the temporary storage of waste oil, bilge water, and other solutions; these tanks have overflowed in the past as a consequence of operator negligence.

On-going training, critiques of spills and examination of standard operating procedures and alternative solutions, are all being used to minimize spill occurrences. The shipyard maintains a professional spill team which is activated for the clean-up of industrial spills

A request will be made to eliminate the oil/water tanks as a SWMU when SOPs have been developed to the satisfaction of PNS officials.

Condition: Unknown. Presumed intact.

SWMU #27. Unit Name: Fuel Oil Spill

Description: A pipe line which carried #6 fuel oil (Bunker "C") previously ran parallel to Berth 6. The pipe line was used for fueling operations and ran from Berth 6 to the pump house, Building 151.

Period of Operation: Early 1920s to 1978

Wastes: #6 fuel oil contaminated soils.

Release Controls: Unavailable.

History of Releases: There was a release of #6 oil (Bunker "C") oil from a ruptured underground pipeline near Berth 6 in 1978. The pipeline was excavated and removed by a contractor. No additional information on the release is available.

Condition: Pipeline and soils were excavated.

Comment 14.*

The EPA has requested that Table 1-6 be revised to note that tank content information is based on only two years of information and is insufficient to properly characterize tank contents. The Navy believes that the EPA may have misinterpreted the Table 1-6. The information reviewed for preparing this table extended beyond a two year period. The EPA may have interpreted the "condition" comment for SWMU 13 that indicated the tank was used once during the previous two years. Therefore, the Navy believes the table should not be changed to reflect EPAs comment. Any information available, in addition to that provided on page 1-72, will be submitted in March.

Comment 15.*

The EPA requested that the permissible concentration of hexavalent chromium and lead be replaced with the National Interim Primary Drinking Water Regulation and a proposed MCL, respectively.

The references have been updated to reflect current Ambient Water Quality Criteria and MCLs. Revisions to pages 1-68 and 1-69 are shown below:

Page 1-68

Toxicity: Permissible concentrations in water. (ug/l)

Trivalent:	10,300	acute to protect saltwater aquatic life
	50	to protect human health (National Interim Primary Drinking Water Regulation)
Hexavalent:	18	24 hour average to protect saltwater aquatic life
	1260	never to exceed to protect saltwater aquatic life
	50	to protect human health (National Interim Primary Drinking Water Regulation)

Page 1-69

Toxicity: Permissible concentrations in water. (ug/l)

668	acute to protect saltwater aquatic life
25	chronic to protect saltwater aquatic life
5	to protect human health (Proposed MCL for lead)

Comment 16.*

The Navy has requested a letter from MEDEP rescinding the information regarding closure of the landfill in 1982.

SECTION 2.0 PRELIMINARY INVESTIGATION OF CORRECTIVE MEASURES

Comment 2.*

The EPA requested a revision of the sentence on page 2-12 which reads, "Current USEPA policies and guidance, including the Superfund Exposure Assessment Manual (September 1987) and the Superfund Public Health Evaluation Manual (October 1986)" to read "Current USEPA policies and guidance, including the Superfund Exposure Assessment Manual (September 1987) and the Risk Assessment Guidance for Superfund, Human Health Evaluation (EPA, December 1989)".

SECTION 3.0

Comment 1.*

The EPA requested that the specific information the Navy needs to collect to decide whether or not seismic refraction work will be performed at the JILF be identified and that a schedule be set for the collection of this information. In addition, the EPA requested that the Navy explain what information will be collected to replace seismic refraction survey data if such a survey is not conducted.

Seismic refraction surveying was planned as part of the RFI of SWMU #8, JILF. The survey was postponed because of health and safety concerns revolving around historic information that indicates that 100 to 200 full acetylene and chlorine gas cylinders were buried in the JILF in 1955. Specifically, the health and safety concerns revolve around the possibility that a seismic survey may cause a release of these gases. In order for the survey to proceed, the Navy must define the location of the buried cylinders and determine the risk involved with performing the seismic survey over, or around, the buried cylinders. If the exact location of the cylinders cannot be determined, then the Navy must assess whether the seismic survey shot points and geophone line locations can be altered to avoid those areas of greatest concern and still provide useful information.

The Navy can install soil borings around the boundary of the JILF to provide much of the information which may be provided by a successful seismic survey. Subsurface conditions at the JILF are such that a seismic survey may not provide as much information as desired and may need to be supplemented with direct observation through the use of soil borings anyway. A review of historic aerial photographs of the JILF has begun and the Navy is attempting to determine the exact location of the buried cylinders through interviews with knowledgeable shipyard employees and records reviews. The Navy's consultant is looking at alternate shot point and geophone placements which will skirt the primary fill areas and still provide useful information. In addition, the Navy will be contacting the subcontractor to the primary consultant to determine if lower energy sources can be successfully employed to reduce the risk of damaging the buried cylinders. Once the Health and Safety issues have been resolved, a decision regarding the performance of a seismic survey will be made in March.

Comment 2.*

The EPA requested that the Navy specify that seismic lines be keyed into soil borings. If the seismic program is conducted, it will use soil borings and bedrock outcrop as points of reference for the validation of seismic interpretation.

Comment 3.*

The EPA requests that a schedule be prepared which clarifies the timing of surface geophysical investigations.

Magnetometry will be conducted during the first phase of field investigations at the PNS. If magnetic anomalies are discovered, ground penetrating radar (GPR) will be employed in an attempt to define the exact location and nature of the magnetic anomalies. GPR may be conducted during the first phase or as part of a following phase of field work, if deemed necessary. Seismic refraction surveying will not be performed until both magnetometry and GPR are complete so that every effort will have been made to locate the buried cylinders and other subsurface interferences prior to attempting seismic. This will allow subsequent phases of field work to be designed with information provided from earlier phases and will lead to a more efficient and complete RFI. The complete RFI will be performed within 18 months of approval of the RFIP.

SECTION 4.0 SOILS INVESTIGATION

Comment 1.*

The RFIP stated that soil samples collected at the DRMO will be analyzed for TPH, PCBs, and PP Metals along with a representative sample for Appendix IX. The soil samples at the JILF will be analyzed for TCL Organics and TAL Inorganics, along with representative samples for Appendix IX. Soil samples at the Mercury Burial sites will be analyzed for RCRA Metals. Analytical parameters were selected by identifying the potential contaminants of concern at each SWMU based on the historical information.

EPA requested that all soil samples, except for tank related SWMUs be analyzed for TCL Organics, TAL Inorganics, compounds found during Appendix IX sampling, pH, grain size for each critical stratigraphic unit, and total organic carbon. If the analytical results of the field work performed prior to the approval of the RFIP warrent more extensive analysis, then more sampling will be conducted for the expanded parameter lists during subsequent phases of the field work. At a minimum, a representative number of samples will be analyzed for the parameters requested by EPA. If the analytical results indicate that a subset of this list will cover all the contaminants of concern, then an appropriate subset will be recommended to the EPA for approval for future sampling events.

Comment 2.*

The EPA has requested that Section 4.0 be revised to specify that all exploratory borings be continuously split-spoon sampled. On previous borings performed in advance of the RFIP Approval where there is a well nest, or well pair, continuous split-spoon sampling will be conducted on the deepest boring. Any future borings will be continuously split-spoon sampled.

Comment 3.*

The variability in the elevation of the water table can be attributed to the wide variety of the fill material encountered since it is believed that porous nature of the fill is allowing the water table to fluctuate with the tide in some wells, whereas in other locations fine-grained material may restrict fluid flow allowing relative differences in water table elevations between wells. If all wells were able to reach equilibrium before a subsequent tidal change, these water table elevation differences may not be present.

Comment 4.*

As stated under Subsurface Soil Sampling, page 4-9 and page 4-10 of Section 4.0, Soils Investigation of the RFIP, only the most highly contaminated sample will be retained for Appendix IX analyses. It is assumed, based on the Phase II Report, RCRA Facility Assessment issued July 1, 1986 by A.T. Kearney, Inc. and Baker/TSA, Inc., that soils throughout the DRMO are significantly contaminated with specific heavy metals. Soil screening with an HNu or Organic Vapor Analyzer (OVA) and visual inspection will

aid in selecting soils that are likely to also be contaminated with organic compounds and petroleum hydrocarbons which should be evaluated by Appendix IX analysis. Realistically, no screening methodology will yield every contaminant of concern that is found on the Appendix IX list. However, visual observations for staining, discoloration, and soil compositional changes, coupled with organic vapor screening will help to identify the soil samples that are relatively more contaminated and, therefore, should have a more thorough analyses performed. Visual inspection will not be the exclusive technique used in selecting samples. If there is no visual or measurable field evidence of contamination, then the sample for Appendix IX will be chosen from a depth where there is sufficient soil recovery for the analytical methods to be performed. Having sufficient recovery is obviously a necessary criteria for collection of visibly contaminated soils as well.

Comment 5.*

The EPA has requested that Section 4.0 Soils Investigation, be revised to specify that the HNu lamp used in screening soil samples will be an 11.7 eV lamp. The Navy opposes this request and proposes that the 10.2 eV lamp can be used to screen for the majority of the volatile constituents potentially present at the SWMU sites. The 10.2 eV lamp can detect anticipated volatiles with ionization potentials less than or equal to 10.2 eV such as 1,2-dichloroethene, trichloroethylene, methyl-isobutal ketone, toluene, ethyl benzene, xylene, benzene, carbon disulfide and vinyl chloride. These anticipated volatiles were found during a soil boring and a soil gas survey performed during field work prior to RFIP Approval.

The HNu used as a screening device would not pick up single bonded halogenated volatile organic compounds such as 1,1-dichloroethane or 1,1,2,2-tetrachloroethane. These halogenated volatiles would be detected, however, in the TCL volatile analysis planned for soil samples.

The Navy has also requested that the manufacturer, HNu Systems, Inc., explain why a 10.2 eV lamp was recommended for the field.

Comment 6.*

The EPA requested a revision to Section 4.0 to specify that all surface soil samples will include the top twelve inches of soil from the current top six inches of soil. This change will provide additional information for risk assessment.

Comment 7.*

The EPA has requested that locations for background surface and subsurface soil samples be identified. Selection of a truly representative background soil sample at the Portsmouth Naval Shipyard is difficult because of the widespread use of fill to develop the Shipyard and numerous industrial facilities scattered throughout the island. The natural till on the island(s) would not have the same mineral composition or physical characteristics of the fill used to connect the islands. The two areas most likely to be considered background soil for this investigation would be the area containing the pine trees in the park located at the northeast of the JILF on Jamaica Island, or Clark's Island (inland). Figure 4-1A indicates Potential Background Soil Sampling Locations at the Portsmouth Naval Shipyard.

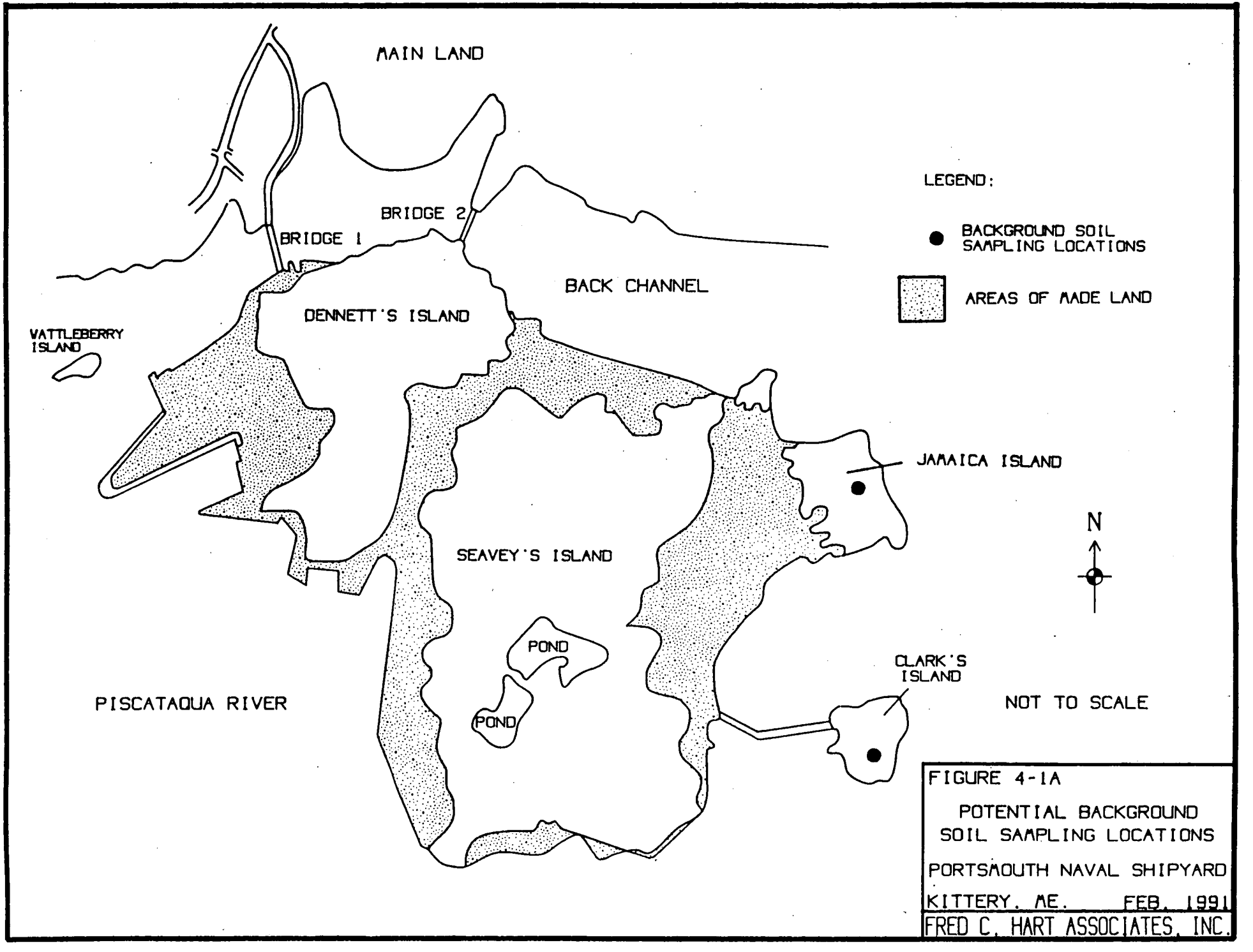


FIGURE 4-1A

POTENTIAL BACKGROUND SOIL SAMPLING LOCATIONS

PORTSMOUTH NAVAL SHIPYARD

KITTERY, ME. FEB. 1991

FRED C. HART ASSOCIATES, INC.

Comment 9.*

The EPA has requested that a surface soil sample be collected inside the DRMO and analyzed for the Appendix IX analytical parameters. The soil sampling location has been tentatively identified in Figure 4-5A, DRMO Off-Site and On-Site Surface Soil Sampling Locations, which is attached.

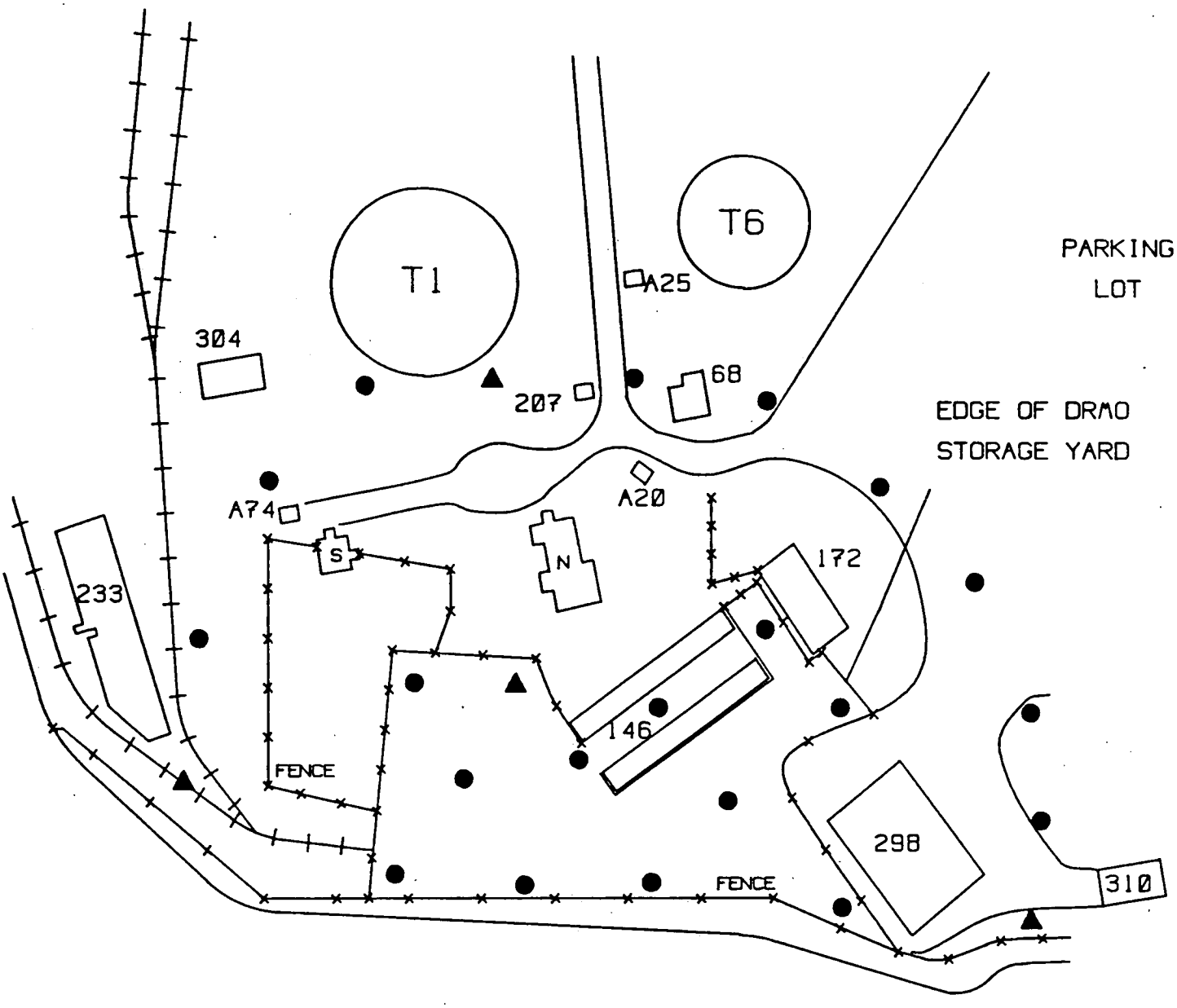
Comment 10.*

The EPA has requested that Section 4.1 be revised to include surface soil sampling inside the perimeter of SWMU 6. Page 4-16, 4.1.2 Surface Soil Sampling Plan, Introduction; page 4-17, Sampling Locations; and page 4-21, Soils Analyses, are revised as follows:

4.1.2 Surface Soil Sampling Plan (page 4-16)

Introduction

The soil sampling plan for the DRMO Storage Yard involves a systematic surface soil sampling program. The objectives include evaluating the extent of parameters TCL organics, TAL inorganics, pH, total organic carbon and Appendix IX (for several samples) in surface soil as well as assessing whether the DRMO has had a negative environmental impact on the adjoining property. The sampling plan will allow for characterization and estimation of the extent and concentration of inorganic and organic constituents in surface soils.



N

NOT TO SCALE

LEGEND:

● SURFACE SOIL SAMPLING LOCATIONS

▲ SURFACE SOIL SAMPLING LOCATIONS FOR APPENDIX IX PARAMETERS

FIGURE 4-5A

DRMO ON AND OFF-SITE SAMPLING LOCATIONS

PORTSMOUTH NAVAL SHIPYARD
KITTERY, ME. FEB. 1991

FRED C. HART ASSOCIATES, INC

The proposed soil sampling program involves the collection of soil samples from the upper twelve inches of the soil column. This approach is recommended based on the results of the FCS, which documents elevated levels of metals in soils adjacent to the storage yard at higher topographic elevations. Based on these analytical results, elevated concentrations of metals are also noticeable in the eastern portion of the DRMO Storage Yard. These sample locations are shown in Figure 4-5A. Wind dispersal is suspected to be a migration pathway, therefore, it is likely that the contaminants will be present near the ground surface. The implementation of this sampling plan is described in the following sections which include details of sample collection, handling, shipment and documentation.

Sampling Locations (page 4-17)

A total of 12 locations have been proposed for the collection of off-site (exterior to the storage yard) and 12 locations are proposed for the collection of on-site surface soil samples. These locations are noted in Figure 4-5A. These locations were chosen in order to evaluate the extent of TCL organics, TAL inorganics, compounds found during Appendix IX sampling, pH and total organic carbon, in surface soil as well as assess whether the DRMO has had a negative impact on the adjoining property. Surface soils will be sampled along an approximately 300-foot band east, north, and west of the storage yard, thus covering all possible landward wind dispersal directions. Specific sample locations will be determined in the field. No sampling grid will be established for soil samples to be collected in and around the DRMO. Instead, the samples will be

collected from locations which are equidistant from one another (if possible) and which are in or surround the storage yard. Sampling locations may have to be moved due to obstructions such as concrete surfaces, steep slopes, or buildings.

In the event that significant contamination is discovered at these locations, the sampling program will be expanded to further identify the extent of contamination.

Soils Analyses (page 4-21)

Samples obtained during the surficial soil sampling program shall be sent to RAI and Ceimic, CLP laboratories, for chemical analyses. All but four soil samples will be analyzed for TAL inorganics, TCL organics, pH and total organic compounds. The remaining soil samples will be analyzed for Appendix IX parameters to identify all contaminants of concern. It is felt that the three soil samples outside the DRMO boundary to have Appendix IX analyses will be representative of the overall samples collected. These surface soil samples will be visually inspected and three samples that appear to be most contaminated will be submitted for Appendix IX analyses. HART will not composite samples subject to volatile compound analysis. All analyses will be conducted in accordance with CLP protocols and applicable Standard Operating Procedures (SOPs). In addition, grain size analysis will be performed on all of the surface soil samples.

Comment 11.*

The EPA requested a revision of the sentence on page 4-22 which reads "If visible contamination extends to the water table a groundwater investigation may be necessary" to read "If contamination extends to the water table or if contaminants found at SWMU 27 are likely to have leached to groundwater, a groundwater investigation will be necessary".

Comment 12.*

The EPA has requested that Section 4.2.2 be revised to include the installation and sampling of at least three soil borings at SWMU 27 (Fuel Oil Pipeline). This condition will be satisfied. The Navy field work at SWMU 27 will include borings to refusal and test pits to bedrock which satisfies EPA's request for borings. The proposed analytical parameters are sufficient unless the Petroleum ID shows inconclusive evidence concerning the presence of #6 fuel oil, and shows the possibility of BTEX present at SWMU #27.

Comment 13.*

The EPA has requested that the locations of the three proposed test pits at SWMU 27 be specified. These proposed locations are identified in Figure 4-6 as TP-1, TP-2 and TP-3. These locations were approximated from the RCRA Facility Assessment, Phase II Report, prepared in July 1986 by A.T. Kearney, Inc. and

Baker/TSA, Inc.. A release from an underground pipeline near Berth 6 in 1976 was reportedly excavated and repaired. The proposed test pits are not fully adequate to characterize the release at SWMU 27 and to determine the volume of contaminated soil, if any. However, if the test pits indicate soil contamination, then a number of soil borings will be drilled in an attempt to further identify the extent of contamination.

Comment 14.*

The EPA has requested the removal of the following sentence on page 4-27, "Because the spatial distribution of the six continuously sampled borings includes both upgradient and downgradient perimeters of the JILF, the borings will be indicative of both SWMU related and non-SWMU related conditions".

Comment 15.*

The EPA requested a revision of the sentence on page 4-29 which reads "Samples which are representative of the subsurface stratigraphy, particularly those which may form a confining layer, will be selected for analysis" to read, "Samples which are representative of the subsurface stratigraphy, particularly those which may form a confining layer or high conductance zone, will be selected for analysis".

Comment 16.*

The EPA requests the removal of the sentence on page 4-31 which reads "Bedrock characteristics in borings which are not cored will be easily extrapolated from nearby cored boreholes". They felt that extrapolations of this type were usually not very accurate. This sentence should be revised to "Bedrock characteristics in borings which are not cored will be extrapolated from nearby cored boreholes".

SECTION 5.0 GROUNDWATER HYDRAULICS

Comment 1.*

The RFIP stated on page 5-1 that "Accurate interpretations regarding the rate of groundwater flow and contaminant migration in the shallow aquifers at the DRMO and JILF are dependent upon a thorough understanding of the variables which define each aquifer system". EPAs comment was to identify the variables referred to in the statement and EPA also provided a minimal list of the variables that should be collected to describe groundwater flow and contaminant migration. An attempt will be made to collect these variables through laboratory and/or field analysis. An attempt will be made to collect information on additional variables such as salinity, specific conductivity, and tidal fluctuations to assist in assessing potential contaminant migration and groundwater flow.

Comment 2.*

The RFIP stated on page 5-2 that some of the monitoring wells at both the JILF and DRMO will be continuously monitored over a forty-eight hour period to determine head differences caused by tidal influence prior to slug testing. EPA requested that tide gauges also be installed and monitored during the forty-eight hour continuous water level monitoring. Tide gauges will be installed and monitored in conjunction with the continuous water level monitoring of the wells.

Comment 3.*

The RFIP stated on page 5-1 that slug tests will be performed on each critical stratigraphic unit. EPA requested that the phrase "critical stratigraphic unit" be changed to "each lithologic unit identified in the soils investigation".

Comment 4.*

This comment referred to the same statement concerning slug tests being performed on each critical stratigraphic unit as in Comment 3. In addition to the above statement, EPA also requested that the RFIP specifically state that monitoring wells will be screened in each unit which is to undergo slug tests. Monitoring wells will be installed in the stratigraphic (lithologic) units to undergo slug testing. However, the installation of monitoring wells and slug testing will only occur the units where well installation and testing is feasible (i.e. units that produce water).

Comment 5.*

The RFIP stated on page 5-1 that both rising and falling head measurements will be made on the monitoring wells. EPAs comment suggested that the RFIP select either rising or falling head measurements as a primary means of conducting slug testing to allow for meaningful comparisons between wells. Falling head measurements will be the primary method of slug testing on all wells to undergo slug testing. Rising head tests may also be performed on some of the wells if field conditions warrant the collection of additional data for the wells. The rising head tests may be very useful on those wells affected by tidal fluctuations to double-check the accuracy of the tests.

Comment 6.*

The RFIP stated on page 5-1 that analyses of the slug test data through solutions developed by Cooper, Bouwer, Bredehoeft, Papadopulos, Rice and others will provide estimates of the hydraulic conductivity of the aquifer in the vicinity of the well. EPA requested that the documentation of the analysis methods to be used for slug testing be submitted and that the RFIP include the specific equations for estimating hydraulic conductivity, the conditions under which each method may be validly applied and the assumptions made in the development of the analysis method.

As stated in the response to Comment 5, the falling head measurements will be the primary method of slug testing for the monitoring wells. Two methods for analyzing the slug test data, the Hvorslev method and the Bouwer and Rice method, have been chosen to reduce the slug test data and calculate hydraulic conductivity. These methods were selected based on their applicability to partially or fully penetrating wells in unconfined aquifers. Information, to date, concerning subsurface material at the site indicates that this will be the case. Another possible solution was the Cooper, Bredehoeft and Papadopulos method which was discarded since this method applies to fully penetrating wells in confined aquifers.

Basic assumptions of the Hvorslev and Bouwer and Rise methods is that the aquifer to be analyzed is homogeneous and isotropic. Since this rarely occurs in the field and information concerning the subsurface materials at the site consist of various fill material, the calculated hydraulic conductivity for each well will provide only an estimate for the material in the immediate vicinity of the tested well.

The Hvorselv method may be applied to fully or partially penetrating wells in unconfined aquifers. This method can only be applied when the well, screen and sand pack, is completely below the water table. The data collected during the falling head test is graphed on semilogarithmic graph paper with time (t) on the arithmetic scale and the head ratio (h/h_o) on the logarithmic scale (note: h_o is the water level immediately after the slug is inserted and h is the water level above the static level at any time (t)). Provided the total length of the well is greater than eight times the radius of the well screen, the following formula can be applied to estimate hydraulic conductivity:

$$K = \frac{r^2 \ln (L/R)}{2 L T_o}$$

Where:

K = hydraulic conductivity
r = radius of the well casing or riser
R = radius of the well screen
L = length of the well screen
T_o = the time it takes for the water level to rise of fall to 37% of the initial change. This is obtained from the graph.

Note: If the well is installed in a fairly low permeability unit, the R is the radius of the well screen and sand pack and L is the entire length of the sand pack.

This method of analysis is discussed further in Fetter, 1988, and will be applied to analyze all slug test data collected.

The Bouwer and Rise method may also be used to analyze the data to confirm the results of the Hvorslev method analysis. This method can be applied to fully or partially penetrating wells in confined or unconfined aquifers.

The data is plotted as in Hvorslev method and the hydraulic conductivity can be calculated by the following formula:

$$K = \frac{r_c \ln (R_e / r_w)}{2L} \frac{1}{t} \ln \frac{y_o}{Y_t}$$

Where:

K = hydraulic conductivity
r_c = radius of the well casing
L = length of the well screen
$\ln(R_e/r_w)$ = dependent on a number of other factors which were determined using an electrical resistance network analog.
t = anytime during the test at which a water level was recorded.
Y_o = initial water level after slug is added or removed.
Y_t = water level at anytime, t, during test.

This method applies specifically to rising head tests, although, it has been applied to falling head tests also. For a complete description of the method and formulas used for calculating hydraulic conductivity, refer to Bouwer and Rice, 1976.

Comment 7.*

EPA requested that the methods for the calculation of hydraulic conductivity based on slug test data for bedrock wells be specified. Information collected, to date, indicates that the shallow bedrock beneath the shipyard is a fractured media and, barring

the presence of an overlying confining layer, is probably in direct communication with the overburden aquifer. For this reason, the shallow bedrock will be considered part of the unconfined overburden aquifer for the purpose of slug testing and analysis. Slug test data collected from bedrock wells will be analyzed by the same methods as described in the response to Comment 6.

Comment 8.*

EPA requested that the technique to be followed in correcting slug test data for tidal influences by specified and that hypothetical examples of its application be provided. Prior to slug testing, the water levels will be continuously monitored for forty-eight hours to record tidal fluctuations. Local tidal charts supplemented with data manually read from PNS tidal gauges will be used in an effort to determine optimum times for slug testing on the wells by reducing the possibility of tidal fluctuation (i.e. conduct slug testing during the lag time following high tide).

If tidal fluctuations are expected during slug testing of a particular monitoring well, then that well will be continuously monitored prior to and following the slug test to provide additional information on tidal influence as close to the time of the slug test as possible.

Comment 9.*

The RFIP states on page 5-3 that no water will be generated during aquifer hydraulic conductivity testing. EPA requested that this statement be replaced since some rinse water may be generated by the decontamination of the slug between well testing. The statement on page 5-3 should read the following:

"Rinse water from aquifer hydraulic testing will be contained in suitable DOT approved 55 gallon drums, tested and evaluated as to whether the contents meet the definition of a hazardous waste under 40 CFR Part 261. The containers will be properly identified, marked and labeled per 40 CFR Part 262.31 and 49 CFR Part 172. Any rinse water meeting the definition for a hazardous waste under 40 CFR Part 261 will be handled and managed in accordance with applicable Federal and State of Maine regulations".

SECTION 6.0 HYDROGEOLOGIC MONITORING PLAN

Comment 1.*

The RFIP stated on page 6-15 that groundwater samples collected at the DRMO will be analyzed for Priority Pollutant Metals, PCBs and TCL Volatiles along with representative samples for Appendix IX. Groundwater samples at the JILF will be analyzed for TCL Organic and TAL Inorganics, along with representative samples for Appendix IX. Groundwater samples at the Mercury Burial Sites will be analyzed for RCRA Metals. Analytical parameters were selected by identifying the potential contaminants of concern at each SWMU based on the historical information available. EPA requested that this section be revised to specify that all groundwater samples will, at a minimum, be analyzed for TCL Organics, TAL Inorganics, other compounds found during Appendix IX sampling, and field parameters (pH, temperature, specific conductance, salinity and turbidity). If the analytical results of the field work performed prior to RFIP approval warrant more extensive analysis, then more sampling will be conducted for the expanded parameter lists during subsequent phases of the field work at the Shipyard. At a minimum, a representative number of samples will be analyzed for the parameters requested by the EPA. If the analytical results indicate that a subset of this list will cover all the contaminants of concern, then an appropriate subset will be recommended to the EPA for approval for future sampling events.

Comment 2.*

The RFIP stated that the objective of the proposed groundwater monitoring programs at each SWMU was to provide information needed to characterize groundwater contamination peripheral to each SWMU and assess the potential for contaminant migration. A phased approach was suggested whereby additional well placement would be contingent upon the results of successive rounds of groundwater sampling. EPA requested that this section be revised to include provisions for the installation of additional wells and discuss the triggering criteria for the placement of new wells as the RFI progresses.

The borings and monitoring wells to be installed during the initial phase of field work will be located to obtain baseline datasets and to attempt to determine the impact of the potential release of contaminants to groundwater from SWMUs 6, 8 and 9. Additional wells may need to be installed to further evaluate contaminant plumes should analytical results confirm contaminants in the groundwater. Additional wells may also be needed to evaluate the vertical and lateral extent of potential contamination and monitor migration pathways. The following is a list of criteria which, if they apply to the Shipyard, could trigger the installation of additional wells:

> Contamination discovered in the shallow groundwater could result in the installation of deeper wells to assess the vertical extent of contamination. Other shallow wells may be placed in the same stratigraphic unit to assess the lateral extent of contamination and attempt to define the location of potential plumes.

- Contamination discovered in wells screened in any stratigraphic unit, regardless of depth, could result in the installation of more wells in the same unit to assess the lateral extent of contamination and determine the possible migration pathways. Contamination discovered in any well in which the aquifer is in contact with bedrock (i.e. no confining layer) could result in the installation of bedrock wells to assess bedrock groundwater quality and assess the potential for vertical migration of the contaminants above.

  If no contamination is discovered in wells where the shallow overburden aquifer is in contact with bedrock (i.e. no confining layer), the installation of bedrock wells may be necessary to assess the bedrock groundwater quality in that vicinity.
- If no contamination is discovered in wells screened in, the shallow overburden aquifer above a confining layer, then additional wells may need to be installed and screened at the confining layer to monitor for contamination and contaminant migration along the top of the confining layer.

Comment 4*

The RFIP stated on pg. 6-10 that if contamination is found in groundwater above the confining layer then no bedrock well would be installed at that location in order to eliminate the risk of vertical cross-contamination. EPA requested that those portions of the RFIP which state that bedrock wells will not be placed where confining layers are encountered or where confining layers and contamination are encountered be removed

from the RFIP citing that bedrock wells below a confining layer may be necessary to assess the possibility that contamination may be migrating through the confining layer. If contamination is found in groundwater above the confining layer, an attempt will be made to install a bedrock well in an area where contamination might be expected within bedrock, if present. This bedrock well location will be chosen to minimize the risk of vertical cross-contamination.

Comment 5.*

The RFIP specified upgradient and downgradient well placements at each SWMU based on available hydrogeological information as a reference tool for the purposes of discussion. EPA requested that all references to specific wells being upgradient or downgradient of SWMU 6, 8 or 9 be removed citing that tidal fluctuation and possible radial flow from the JILF make it difficult to accurately identify a flow gradient. The EPA is correct in stating that a flow gradient has not yet been accurately defined. "Landward" and "seaward" may be better terms for the sake of discussion until more information can be provided.

Comment 6.*

The EPA has requested that future locations for the installation of background (or reference) wells for use in comparing data from SWMUs 6, 8, and 9 be identified. The area identified on Jamaica Island in Figure 4-1A, Potential Background Soil Sampling Locations Portsmouth Naval Shipyard, could serve as a background location for installing a monitoring well.

Comment 7.*

EPA requested that Section 6.0 of the RFIP be revised to include provisions for the detection and possible sampling of immiscible layers in all of the monitoring wells. The following section describes the methods for immiscible layer detection and sampling. The monitoring well will be checked for immiscible layers, floaters and sinkers, prior to purging and sampling of each well. Each well will be opened and the head space will be monitored with an HNu photoionization analyzer. A clean, graduated, clear plexiglass, bottom-filling bailer will be carefully lowered into each well to check the water surface in the well for the presence of an immiscible floater. The same bailer will be lowered to the bottom of each well to check for an immiscible sinker.

Since the bailer is graduated, the thickness of any immiscible layers will also be known. The thickness of immiscible layers, should they be present, is an important factor in selecting the most effective procedure for sampling the layers. If immiscible layers are discovered in any of the monitoring wells, sampling of these layers will occur prior to groundwater purging and sampling. Sampling methods that may be employed include bottom loading and/or bailer pump depending on the thickness of the immiscible layer.

Comment 8.*

The RFIP stated on pg. 6-1 that the objective of the Hydrogeologic Monitoring Plan was to supply information concerning depth to groundwater on-site, the number of subsurface aquifers and their general characteristics, groundwater flow directions and their relationships to surface water conditions, the concentration and extent of contaminants in groundwater, and the direction of contaminant migration. As per EPA's request, groundwater flow velocity and groundwater contaminant fate will be included as objectives of the Hydrogeologic Monitoring Plan.

Comment 9.*

The RFIP stated on pg. 6-4 that "This fine slot size will restrict the migration of silt sized material into the wells". EPA requested that this statement be removed from the RFIP citing that the maximum median grain size diameter for silt is 0.003 inches which is smaller than the 0.01 inch slot size of the screen. The 0.010 inch slot size was selected because this slot size will be small enough to retain at least forty percent of the aquifer material surrounding the screen.

Comment 10.*

EPA requires the revision of the discussion of general well construction, presented in Section 6.1.1 of the RFI Proposal, to include a discussion of how filling and sealing of the annular space around wells will be modified if the top of the well screen is too close to the ground surface.

In wells with limited room between the top of the well screen and ground surface, the filling and sealing of the annular space will be modified as necessary according to the following:

1) A six-inch, instead of 1.0-foot, "sand choker collar" will be emplaced directly above the sand pack.

2) The silica sand pack will be extended to a height of 1.5 feet, instead of 2 feet, above the top of the screen.

3) A 1.5-foot, instead of 2-foot, bentonite seal will be installed above the "sand choker collar".

Comment 11.*

EPA requires the modification of the design of wells in high traffic areas (presented on page 6-5) to prevent contamination by surface runoff.

On page 6-5, following "9) In high-traffic areas secure curb boxes will be installed instead of the casing stick-up". The following statement should be inserted: "Curb boxes will be set approximately six inches above the surrounding ground level and a concrete pad will be built up and sloped away from the curb box".

Comment 12.*

EPA requires revision of the well development criteria presented on page 6-5 to include at least three complete well purgings before stabilization of turbidity is accepted as proof of successful well development. Also, EPA requires the use of 5% or less variation in turbidity as a criteria rather than 10% or less variation stated in the RFIP.

The sentence on page 6-5 which states "Development will be considered complete...when three consecutive measurements for turbidity indicate 10% or less variation" should be changed to reflect the EPA requirement of 5% or less variation. In addition, the following sentence should be inserted immediately after the previously discussed sentence. "At least three well volumes will be removed before stabilization of turbidity is accepted as proof of successful well development".

Comment 13.*

EPA requested that an additional sentence discussing turbidity measurement stabilization as a test for well development be added to page 6-5 of the RFIP. The sentence is as follows: "Stabilization of turbidity will be used as a test of well development for wells containing brackish or saline water". This sentence should be inserted in the RFIP on the bottom of page 6-5 following the sentence that ends "indicate 10% or less variation".

Comment 14.*

The RFIP stated on page 6-8 that twenty-one to twenty-seven test borings will be installed around the JILF and that eighteen to twenty-four of the borings will be completed monitoring wells. EPA requested that the rationale behind the selected range of completed monitoring wells be identified. The rationale behind the selected range of completed monitoring wells stems from site history and current conditions. The given

range of wells was based on the size of the JILF, the history of fill procedures and the fact that safety precautions prevent drilling within the landfill. The purpose of the given range is to have an adequate number of wells appropriately spaced to outline the perimeter of the landfill and assess potential contaminant concentrations and other subsurface features including depth to groundwater, stratigraphy and depth to bedrock. This range is subject to alteration based on the findings of each phase of work in the suggested phased approach. Additional wells will be installed if site conditions warrant additional well installation to further assess contaminant concentrations, extent of plumes, migration pathways, etc.. Criteria for the installation of new wells are given in the response for Comment 2 of this section.

Comment 15.*

The RFIP states on pages 6-8 and 6-9 that the number and location of the proposed monitoring wells may differ from what is proposed, if data from the geophysical survey or the soil gas survey indicates particular areas where contaminants may be sourced. Some of the borings/monitoring wells would be placed downgradient of the potential source areas or within contaminant plumes (if present) to assess the nature and extent of contamination. EPA requested that this be revised to include provisions for locating wells in potential contaminant pathways (such as bedrock topographic lows and zones of high hydraulic conductivity) in addition to the conditions already cited in the RFIP. Additional monitoring wells may be installed in bedrock topographic lows and

zones of high hydraulic conductivity if conditions warrant their installation. For instance, if on-site investigations suggest the potential for a bedrock low where contamination may be "pooling", monitoring wells may be installed to confirm or deny the presence of contaminants in the bedrock low. Similarly, should the progressing investigation indicate contamination in a high hydraulic conductivity zone (i.e. beach deposits) then additional wells screened within this lithologic zone may be necessary to confirm the presence of contamination and define the extent and, if possible, the direction of flow of contamination.

Comment 16.*

The RFIP states on page 6-10 that historic photographs and maps suggest that the majority of the JILF is underlain by tidal flat deposits which may form a continuous layer and inhibit the vertical migration of contaminants in this area. In order to investigate the potential for contaminants to concentrate immediately above the tidal flat deposits, deep overburden wells will be installed and screened immediately above the tidal flat. EPA requested specification concerning how tidal channel deposits will be located for the installation of groundwater monitoring wells. The locations for drilling and potentially installing groundwater monitoring wells immediately above the tidal flat deposits will be based on historical photographs and maps available. The historical information will be used to approximately outline the old tidal channels on current site maps and the drilling locations will be selected accordingly. Drilling and split-spoon sample collection will confirm or deny the presence of tidal flat deposits and whether or not deep overburden wells need to be installed.

Comment 17.*

The EPA noted a discrepancy between the tables referenced in Section 6.5.1 and the tables found in the QAPP. The correct reference in Section 6.5.1 should be Table 9-2, Summary of JILF QA/QC samples; and Table 9-3, Summary of DRMO QA/QC samples.

Comment 18.*

The EPA requested the sentence on page 6-15 which reads "All sampling procedures will conform to EPA protocols (RCRA Groundwater Monitoring TEGD, 1986 and EPA SW-846)" should be revised to read "ALL sampling procedures will conform to EPA protocols (RCRA Groundwater Monitoring TEGD, 1986 and EPA SW-846, 3rd Edition with updates)".

Comment 19.*

The EPA has requested that the sentence on page 6-15 which reads "Water level measurements will be obtained with a factory calibrated electronic water level indicator (Mode 3000 T-L-C meter) or a steel measuring tape to the nearest 0.01 of a foot and converted to common datum" to read "Water level measurements will be obtained with a factory calibrated electronic water level indicator (Model 3000 T-L-C meter) or a steel measuring tape to the nearest 0.01 of a foot and converted to Mean Sea Level from a known benchmark".

Comment 20.*

The EPA requested that a sentence which reads "Bailers will also be decontaminated before and after each use" should be added to the end of the first paragraph on page 6-16.

Comment 21.*

The EPA requested further clarification on where bailers will be stored at PNS and what practices will be employed to insure these bailers remain clean and unexposed to contaminants between uses.

The Standard Operating Procedure (SOP) is to decontaminant each dedicated bailer after use and wrap each bailer individually in fresh aluminum foil. Wrapped bailers are stored in the field trailer during sampling events and in the McLaren/Hart equipment storage building between sampling events. Before the bailer is used, it is again decontaminated. To insure this SOP is adequate, an equipment rinseate blank is analyzed for each batch of bailers. At a minimum, this would mean one rinseate for every twenty bailers.

Comment 22.*

The EPA requested the sentence on page 6-17 which reads "Field parameters will be measured immediately upon completion of sampling" should be changed to read "Field parameters will be measured immediately before and upon completion of sampling with VOC samples being collected before the initial set of field parameters are measured".

Comment 23.*

The EPA requested the removal of the sentence on page 6-17 which reads "No samples will be subjected to field measurements before or after being placed in sample bottles" and replacing it with a sentence which reads "Field parameters will be measured on samples separate from those collected for laboratory analysis".

Comment 24.*

The EPA requested the sentence on page 6-17 which reads "Accurate records will be kept of all sampling activities and will include, at a minimum, the following information: date, time, location, sample identification code, depth to water measurement, method and volume of water evacuation and sampling technique" should be revised to read "Accurate records will be kept of all sampling activities and will include at a minimum, the following information: date, time, weather conditions, tidal conditions, air temperature, sample identification code, depth to water measurement, depth to any immiscible layers, depth to bottom of well, method and volume of water evacuation, and sampling technique".

SECTION 7.0 SUBSURFACE GAS CHARACTERIZATION

Comment 1.*

The EPA requested that Section 7.0 and the Quality Assurance Project Plan (QAPP) be revised to specify the QA/QC techniques to be applied to the soil gas sampling and analysis.

The following QA/QC techniques will be employed during the soil gas sampling and analysis to ensure valid analytical results.

1) All Petrex soil gas sampling tubes are precleaned and verified to be clean using Curie Point desorption mass spectrometry.
2) It is anticipated that between one and five trip blanks will be taken and analyzed.
3) Ten percent of the samples collected will be duplicates.
4) Matrix spikes discussed by the EPA cannot be applied to the Petrex soil gas measuring techniques.

SECTION 8.0 SEDIMENT CHARACTERIZATION

Comment 1.*

The EPA requested that Section 8.0 be revised to specify that all sediment samples will, at a minimum, be analyzed for TCL organics, TAL inorganics, other compounds found during Appendix IX sampling, TOC and grain size.

Sediment sample parameter lists will be defined in the Off-Shore Investigation Proposal (Draft copy attached). The Off-Shore Investigation Proposal will be finalized for the March submission.

Comment 2.*

The EPA requests that Section 8.0 be revised to specify that all surface water samples will, at a minimum, be analyzed for TCL organics, TAL inorganics, other compounds found during Appendix IX sampling, and field parameters (pH, temperature, specific conductance, salinity, turbidity).

Surface water sample parameter lists will be defined in the Off-Shore Investigation Proposal (Draft copy attached). The Off-Shore Investigation Proposal will be finalized for the March submission.

Comment 3.*

The EPA requested that Section 8.0 be revised to specify that the following elements will be part of the surface water sampling plan developed for PNS:

a) At least one surface water sample for Appendix IX analysis will be collected from at least one of the storm drains and other outflows from the shipyard to Piscataqua River which receive runoff from any of the SWMUs at the shipyard.

b) Surface water samples will be collected from all storm drains and other outflows from the shipyard to the Piscataqua River which receive runoff from any of the SWMUs at the shipyard.

c) Data from storm drain sampling work will be used to calculate rates and amounts of contaminant loading from the SWMUs to the Piscataqua River.

d) No fewer than six water samples will be collected from the main channel of the Piscataqua River and four samples from the back channel of the Piscataqua River to support a baseline risk assessment of conditions in the river.

(Note: EPA encourages the collection of data from all storm drains and other outflows as this data will be useful in obtaining a more global characterization of the shipyard and would be essential in the selection of Alternate Contamination Levels during the setting of Media Protection Standards).

All elements of the surface water sampling plan will be defined in the Off-Shore Investigation Proposal (Draft copy attached). The Off-Shore Investigation Proposal will be finalized for the March submission.

Comment 4.*

The EPA requested that Section 8.0 be revised to specify that sediment samples from surface grabs and the top samples from cores will be withdrawn from the oxygenated layer of the sediment not from 0 to 4 inches.

The surface sediment layer to be sampled is described in the Off-Shore Investigation Proposal (Draft copy attached). The Off-Shore Investigation Proposal will be finalized for the March submission.

Comment 6.*

The EPA requested that off-shore sediment sampling be performed both upstream and downstream of the PNS as shown in the figure attached to Appendix A.

All aspects of the sediment sampling, including sample locations and core intervals to be samples, are described in the Off-Shore Investigation Proposal (Draft copy attached). The Off-Shore Investigation Proposal will be finalized for the March submission.

OFF-SHORE INVESTIGATION
PROPOSAL

Prepared for:

United States Navy
Naval Facilities Engineering Command
Philadelphia, Pennsylvania

Prepared by:

McLaren/Hart Environmental Engineering Corp.
28 Madison Avenue Extension
Albany, New York 12203

February 8, 1991

INTRODUCTION

This proposal discusses the scope of investigation for an off-shore study to be conducted by the U.S. Navy as a compliment to the on-shore RCRA Facility Investigation (RFI) currently in progress at the Portsmouth Naval Shipyard (PNS).

The RFI as defined under the existing final HSWA permit requires that both on-shore and off-shore investigations be conducted by the Navy to determine and evaluate all releases of hazardous waste and/or hazardous constituents from the SWMUs previously identified by the USEPA. The permit requires that the Navy evaluate both historic and current releases from the facility.

APPROACH

Development of the off-shore investigation presented below resulted from review of readily available off-shore information including the Candidate Environmental Impact Statement (CEIS) (Parsons et. al., 1978), the Final Confirmation Study (FCS) (Loureiro, 1986), a preliminary survey of shell fish from the Great Bay Estuary (Isaza, 1989) and a preliminary evaluation of analytical results from sediment sampling performed by McLaren/Hart Environmental Engineers in August, 1990.

1) Historic Review

Purpose: To develop an understanding of historic and current estuary conditions in order to assess the environmental impact of PNS SWMU releases.

Approach: A literature survey and review will be performed to develop a preliminary understanding of surface water, sediment and biota "quality" within the estuary. In addition, the survey will provide information regarding point sources and non-point sources of contamination to the estuary system. A summary report will be prepared which discusses the results and findings of the literature survey. It is anticipated that this work can be completed by mid May, 1991.

2. Near Shore Sediment Sampling/Mapping

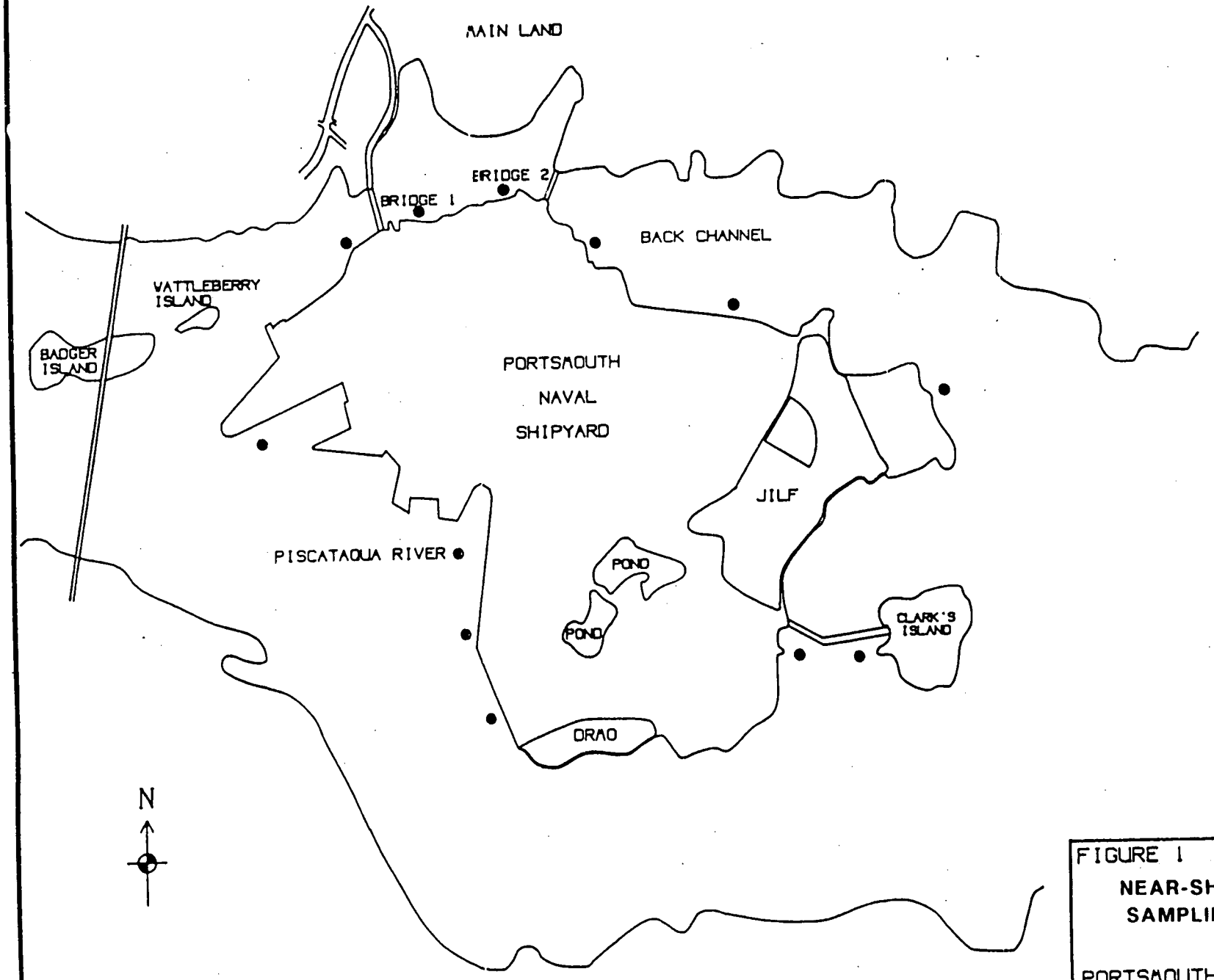
Purpose: To map the distribution and determine the nature and extent of contamination within sediment deposited immediately adjacent to the PNS. Sediment deposited immediately adjacent to the PNS is most likely to have been adversely impacted by current or historic releases from the PNS.

Approach: Sediment sampling and sediment mapping will be performed in areas where sediment has accumulated around PNS. Specific areas to be investigated include the Clark's Island embayment, near-shore backchannel and near-shore main channel.

Surface sediment samples will be collected from the upper oxygenated layer and analyzed for TCL organics, TAL inorganics, grain size and TOC. Samples will be collected for QA/QC purposes and all analyses will be performed using EPA SW-846 guidelines and as otherwise described in the RFIP Quality Assurance Project Plan (QAPP). The proposed sediment sampling locations are shown in Figures 1 and 2.

3) Far-Shore Sediment Sampling

Purpose: Sediment sampling is proposed in areas of sediment deposition upriver and downriver from the PNS in order to assess sediment quality in areas less likely to be



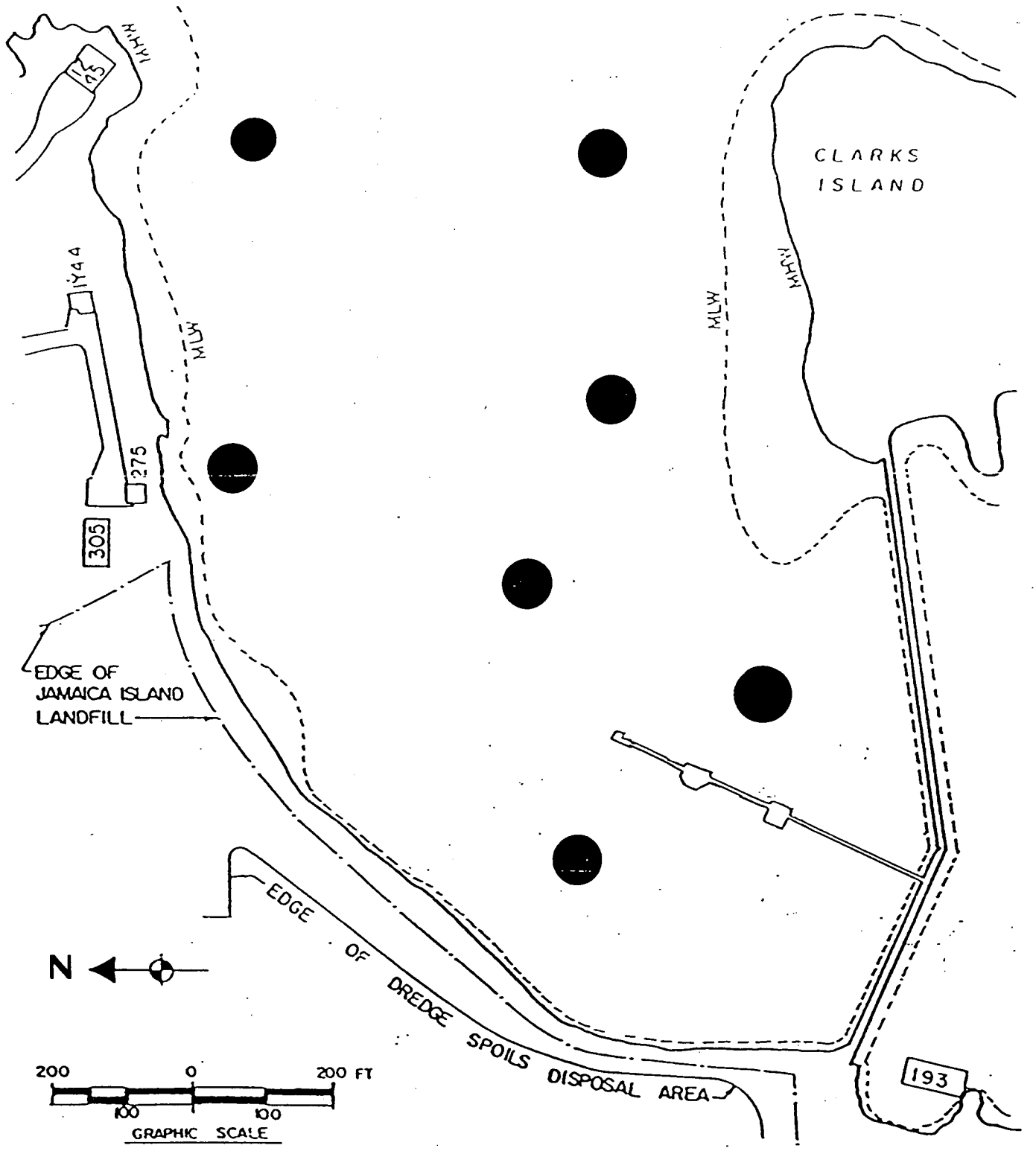
NOT TO SCALE

SEDIMENT SAMPLING LOCATIONS

FIGURE 1
NEAR-SHORE SEDIMENT SAMPLING LOCATIONS

PORTSMOUTH NAVAL SHIPYARD

McLAREN/HART



KEY

SEDIMENT SAMPLE LOCATION

FIGURE 2

CLARKS ISLAND EMBAYMENT
SEDIMENT SAMPLES
(APPROXIMATE LOCATIONS)

MODIFIED AFTER LOUREIRO

MCLAREN/HART

adversely impacted by current or historic releases from the shipyard. This data will provide a comparison with the near shore sampling data and will improve our understanding of existing estuary conditions.

Approach: Sediment samples will be collected from the uppermost oxygenated layer in select areas of sediment deposition in the main channel and backchannel of the river. Sampling locations will be selected based on availability of sediment, understanding of the sources of contamination within the estuary and random selection. Those locations selected at random will provide useful unbiased baseline information on estuary sediment quality. Quality control will be provided as described for the near-shore sampling and as otherwise outlined in the RFIP QAPP. Figure 3 shows the proposed far-shore sediment sampling locations. These locations have been tentatively selected based on preliminary data and available reports. Final location selection will be made after completion of the Historic Review and with approval of the US Navy, USEPA and Maine DEP.

4) Surface Water Sampling

Purpose: Surface water samples will be collected to provide data on current water quality within the estuary. It will provide a limited means of assessing variations in water quality which may exist in the estuary due to both man-made and natural factors.

Approach: Surface water samples will be collected from locations shown in Figure 4. Samples will be analyzed for TCL organics, TAL inorganics, BOD, TOC, COD, fecal coliform, TKN, nitrite, nitrate, dissolved oxygen, phosphate, pH, turbidity, salinity and temperature. Twenty (20) water samples will be collected in each of four (4) sampling rounds. Two (2) rounds would be performed during periods of high tide and two (2)

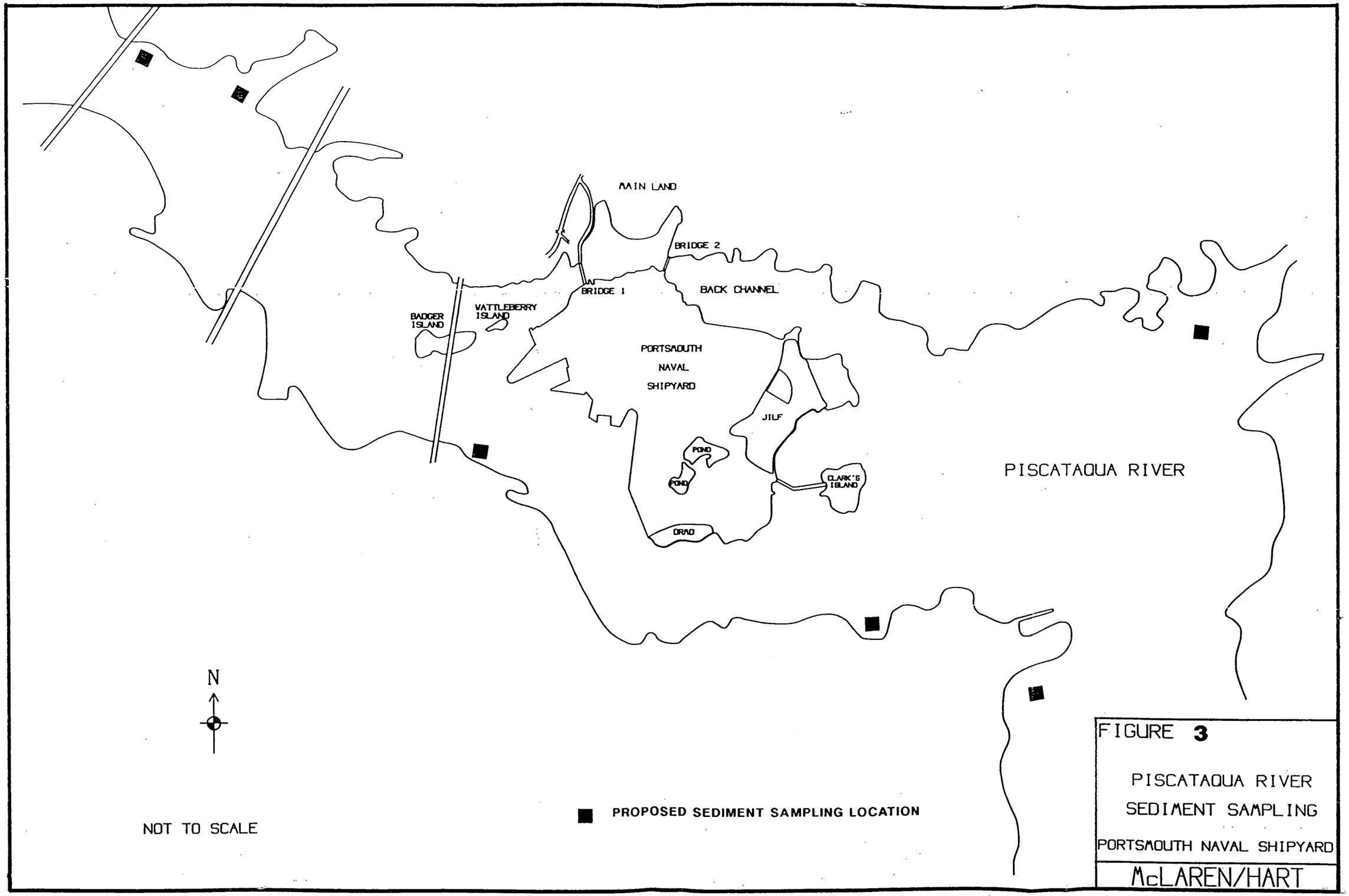


FIGURE 3

PISCATAQUA RIVER SEDIMENT SAMPLING

PORTSMOUTH NAVAL SHIPYARD

McLAREN/HART

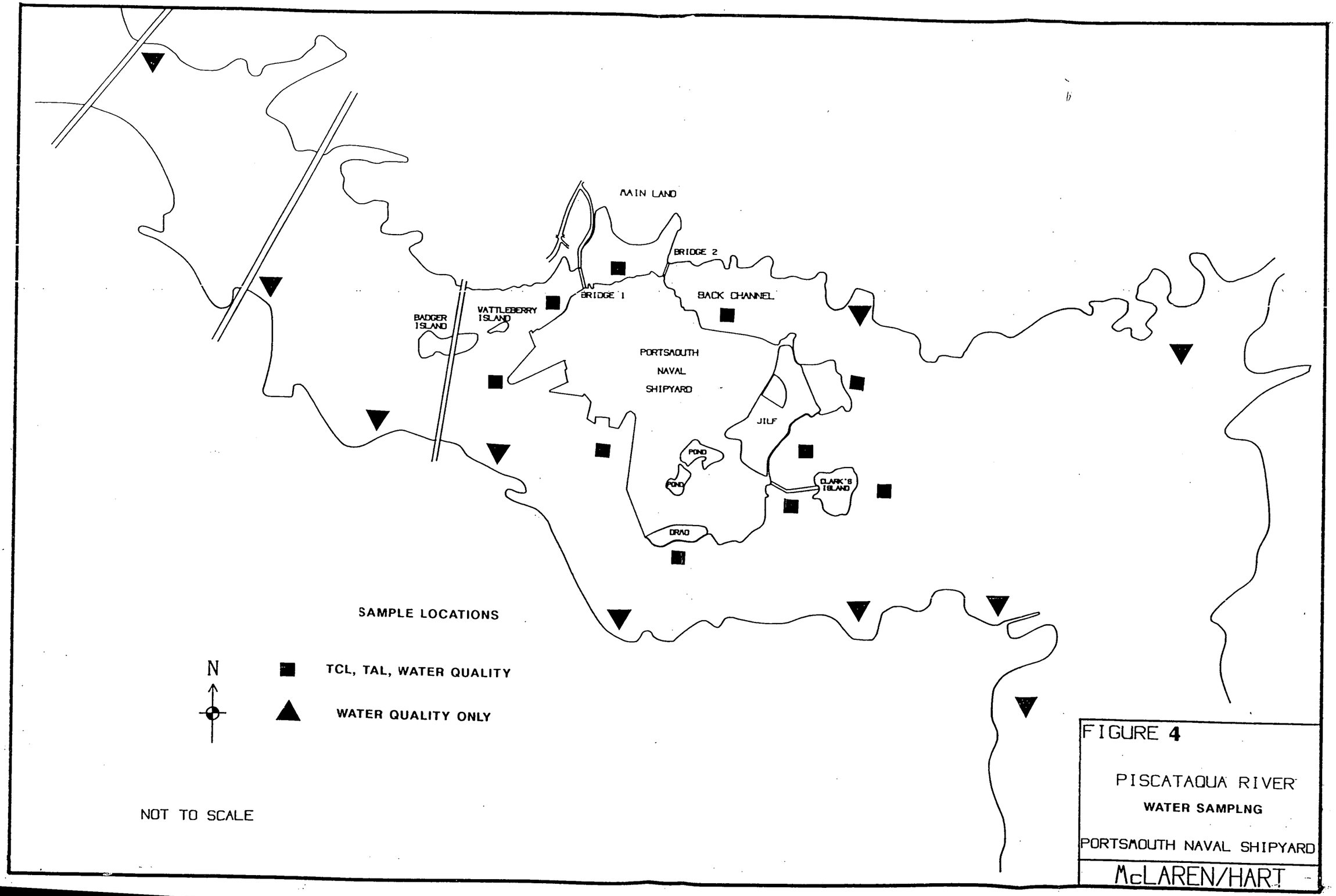


FIGURE 4

PISCATAQUA RIVER

WATER SAMPLNG

PORTSMOUTH NAVAL SHIPYARD

McLAREN/HART

rounds at low tide. This will provide a comparison of water quality at high and low tide levels. In addition, one set of high tide/low tide sampling rounds will be conducted with approximately a one week hiatus before the second set of high tide/low tide samples are collected. This will provide some information concerning water quality fluctuation within the estuary over a period of time.

All water samples will be collected with a caliwassa type sampler at a depth of approximately five (5) feet below the surface. The sampling depth was chosen to avoid potential interference from the surface or the river bottom.

5) Biota Study

Purpose: To describe the distribution and abundance of estuarine species in the vicinity of PNS and to identify contaminant concentrations within select species.

Approach: The Biota Study proposal is now in preparation and will be submitted by mid April, 1991.

SECTION 9.0 TANK INVESTIGATION

Comment 1.*

The EPA has requested that the location, number and collection method for sampling soil and sediment around the Portable Oil/Water tanks (SWMU 26) be identified.

Numerous portable dockside dumpsters are used at the submarine berths for the cleanout of submarine bilges and various tanks. The areas in which these tanks are used are very close to the edge of the submarine berths and numerous discharges to the coastal waters have been documented due to the overflow of these aboveground tanks. Reportedly, soil under these tanks is protected by concrete or asphalt pavement. Spillage of waste oils from these tanks would enter the adjacent river. Contamination under the pavement or concrete surrounding the portable oil tanks is not anticipated and no soil sampling under these tanks is proposed. However, the Off-shore Investigation Proposal attached, addresses sediment sampling in the river and in the vicinity of the berths where these portable tanks are located.

Comment 2.*

The EPA has requested that the first paragraph on page 9-3 be removed and replaced with a paragraph that reads:

A full investigation of SWMU 12 shall be performed as proposed in Sections 9.2, 9.3, and 9.4 unless it is determined by EPA and ME DEP that SWMU 12 is not a SWMU. Historical information will be provided to EPA and ME DEP within 30 days of the initiation of the RFI investigation to allow them to review SWMU 12's status as a SWMU or draft a new paragraph which conveys the equivalent information.

The paragraph that was replaced read:

"The historical information indicates that SWMU 12 has operated as a Power Plant Boiler Blowdown consisting of the following water aditivites: Disodium phosphate, Sodium sulfite, and Betz Balanaced Polymer BP5205. These are consider non-hazardous. Therefore, SWMU #12 should does not contain a hazardous waste and should be removed as a SWMU, tightness testing or soil investigation will not be proposed for SWMU 12. If during the RFI it is determined that this is not accurate, a full investigation of this tank will be performed as proposed in Sections 9.2, 9.3, and 9.4".

Comment 3.*

Information will be provided with Addendum submittal in March 1991.

Comment 4.*

The EPA has requested that the sentence on the bottom of page 9-3 that reads, "During the excavation--in a scheme acceptable to DEP and EPA--sampling of soil will be performed", be replaced with, "A scheme for the excavation and removal of underground storage tank SWMUs shall be developed and submitted to EPA and MEDEP. During excavation soil sampling will be conducted".

The Navy has adopted this change.

Comment 5.*

The EPA requested that specific methods of soil sampling and analysis be provided for tank related SWMUs number 13, 16, 21 and 23.

These four tank SWMUs are scheduled for removal. After the tanks have been removed from the excavation, a visual inspection of the tank and the excavation will be made to attempt to determine if the tank may have leaked, or if it has to determine which area of the excavation may be most affected.

Soil samples will be collected from the bottom and side walls of the excavation for laboratory analysis. The soil samples will be analyzed for Appendix IX compounds, or a subset of Appendix IX if there is sufficient evidence that the subset will detect any releases of hazardous waste and/or hazardous constituents from the SWMU of concern. If a subset of Appendix IX is recommended, this subset will be analyzed only after approval of EPA and MEDEP.

In order to adequately assess the presence or absence of contaminated soil in the excavations, a total of four soil samples will be collected for analysis from each excavation. Two composite soil samples will be collected from the floor of the excavation, one composite soil sample will be collected from the north and west wall of the excavation and one composite soil sample will be collected from the south and east wall of the excavation. This sampling technique will provide good coverage of the soils in the excavation and will provide a means of focusing future sampling or remedial efforts within the excavation to the areas of concern.

Comment 6.*

The EPA has requested that Section 9.3, Waste Characterization, be revised to include methods for insuring that the limits of excavations made during tank removals will be clearly delineated and that clean fill will remain separated from in-situ materials. EPA is concerned that positive soil sampling results may require the re-excavations of soils that once surrounded the underground SWMU. The EPA has proposed that polyethylene sheeting be used to separate clean fill from in-situ materials while soil samples are being analyzed.

The Navy concurs, polyethylene sheeting will be used to ring the excavation prior to backfilling with clean fill. Stakes will also be used to delineate the limits of the original excavation.

Comment 7.*

The comment was deleted by the EPA.

Comment 8.*

The EPA has requested that the first sentence under Section 9.4, Release Detection, page 27, which reads:

"In conjunction with the document review and waste sampling tank tightness tests will be performed on USTs in compliance with EPA technical standards as outlined in 40 CFR 280, Subpart D, and appropriate State of Maine regulations", be revised to read:

"In conjunction with the document review and waste sampling, that tightness tests will be performed on SWMUs 12, 13, 16, 21 and 23 in compliance with EPA technical standards as outlined in 40 CFR 280, Subpart J, and appropriate State of maine regulations".

The first sentence under Section 9.4 will be revised as specified by the EPA.

SECTION 10.0 BIOTA CHARACTERIZATION

Comment 1.*

The EPA requested the removal of the sentence on page 10-3 which reads "The marine environment will include the portion of the Clark's Island cove adjacent to the Jamaica Island landfill; and the intertidal and subtidal area immediately adjacent to the DRMO" and that it be replaced with sentences which read "The marine environment will include all of the Piscataqua River in the vicinity of PNS. The upstream and downstream limits of biota characterization work will be determined from the sediment characterization study and will cover all areas where contaminated sediments from PNS have come to be located".

Comment 2.*

The EPA requested the addition of a sentence to the end of the third paragraph on page 10-3 which reads "Direct comparison of analytical results from previous studies and analytical results of the current RFI will only be possible if analytical methods used in the different studies are comparable".

Insert the following paragraph at the end of Section 10.2

Information derived by the biotic characterization will be used to develop an assessment of the risks posed by potential PNS generated contamination to the ecosystem of the estuary. The ecological risk assessment protocol is described in Section 15.

SECTION 11.0 QUALITY ASSURANCE PROJECT PLAN

Comment 1.*, 2.*

The comments need clarification from the EPA on what detection limits are needed to support the PHERE for beryllium, hexachlorobenzene, 1,1,2-trichloroethane and vinyl chloride.

Comment 3.*

Table 3-1 of the QAPP will be revised to reflect the EPA comments.

Comment 4.*

A sentence will be added to the QAPP as per the EPAs comment.

Comment 5.*

Section 4.0 of the QAPP will be revised to include sludge free liquid and sludge sampling and analytical procedures.

Comment 6.*

Section 4.0 of the QAPP will be revised to reflect EPAs changes.

Comment 7.*

Section 5.0 of the QAPP will be revised to contain a statement as per EPAs request.

Comment 8.*

The sentence on page 1 of 5 in Section 5.0 of the QAPP will be revised to reflect EPAs changes.

Comment 9.*

The sentence on page 3 of 5 in Section 5.0 of the QAPP will be revised to reflect EPAs changes.

Comment 10.*

The reference on page 2 of 2 in Section 6.0 of the QAPP will be changed to the reference as stated by the EPA.

Comment 11.*

Table 7-2 of the QAPP will be changed to comply with SW-846, 3rd edition.

Comment 12.*

References will be provided for Tables 7-3, 7-4, and 7-5 of the QAPP.

Comment 13.*

Quantitation limits for 4-Nitrophenol in Table 7-4 of the QAPP will be changed.

Comment 14.*

The reference for Table 7-6 of the QAPP will be provided.

Comment 15.*

The contract required detection limit for lead in Table 7-6 of the QAPP will be changed to reflect EPAs comments.

Comment 16.*

Analytical methods will be provided for the detection limits in Table 7-7 of the QAPP.

Comment 17.*

The detection limit for total phenols will be changed in Table 7-7 of the QAPP.

Comment 18.*

Table 7-6 of the QAPP applies to both RCRA and Priority Pollutant metals and will be revised to state this.

Comment 19.*

References on page 2 of 3 in Section 8.0 of the QAPP will be revised to reflect Region I references.

Comment 20.*

A table in the QAPP will be provided to summarize QA/QC samples for SWMU 10, 11, 12, 13, 16, 21, 23, 26, and 27.

Comment 21.*

Discrepancies between Section 12.0 and 8.0 of the QAPP will be corrected.

Comment 22.*

The reference for the methods found in Appendix D of the QAPP is stated on page 1 of 11 in Section 7.0. The source of the methods is Resources Analysts, Inc., Standard Operating Procedures.

Comment 23.*a,b

The QAPP will be corrected to reflect the RFI Proposal.

Comment 23.*c

c) The EPA noted a discrepancy between the RFI Proposal which states that grain size analyses will follow ASTM methods while the QAPP states Resource Analyst Inc. Standard Operating Procedure QA-120 will be used for grain size. The RFI should state that Resource Analyst Inc. Standard Operating Procedure (SOP) QA-120 will be used for grain size analyses.

SECTION 12.0 DATA MANAGEMENT PLAN

Comment 1.*

The EPA approved this section without conditions.

SECTION 13.0 HEALTH AND SAFETY PLAN

Comment 1.*

The EPA had no comments on the Health and Safety Plan (Attachment B).

SECTION 14.0 PROJECT MANAGEMENT PLAN

Comment 1.*

The EPA requested that the Project Management Plan be revised to show when each of the phases discussed in the RFI Proposal shall occur.

This schedule was submitted 2/13/91.

Comment 2.*

The EPA requests the removal of the sentence on Figure 14-2 which reads "The biota and surface water characterization will be submitted within eighteen months of the approved RFI".

This has been revised and submitted with the revised project schedule submitted 2/13/91.

Comment 3.*

The EPA requested the revision of Figure 14-2 to show the project implementation schedule in calendar days not working days.

This has been revised and submitted on 2/13/91.

SECTION 15.0 ECOLOGICAL RISK ASSESSMENT (PHERE)

Comment 1.*

The EPA has requested a revision of the sentence on page 15-2 which reads "Data summary tables will be presented for each media within each SWMU and will include average, maximum and range of values measured in each medium, number of samples taken and frequency of detection" to read "Data summary tables will be presented for each media within each SWMU and will include average, maximum and range of values measured in each medium, the location of maximum value, number of samples taken, frequency of detection, and detection limits and range of detection limits, if detection limits were variable for any particular analyte or media".

Comment 2.*

The EPA requested a revision of the sentence on page 15-6 which reads "An analysis of uncertainties inherent in the exposure assessment will discuss exposure factor values, likelihood of current and future land use conditions, exposure pathways, and data sampling and analysis" to read "An analysis of uncertainties inherent in the exposure assessment will discuss exposure factor values, likelihood of current and future land use conditions, exposure pathways, different methods of calculating of RME, and data sampling and analysis".

Comment 3.*

The EPA requested that a sentence be added to the end of Section 15.1.6 which reads "References and date of IRIS access will be included for all summary table data".

Comment 4.*

The EPA requested that a plan for an Environmental Risk Evaluation be prepared.

The plan described below should be inserted following Section 15 Public Health and Environmental Risk Evaluation.

15.2.1 Objectives

The purpose of the Ecological Risk Assessment (EA) Work Plan is to describe the methodology and rationale which McLaren/Hart will use to evaluate the risks posed to plants and animals other than people and domesticated species by chemicals of concern at the Portsmouth Naval Shipyard, Kittery, Maine.

The goal of this process is to provide a scientific framework necessary to evaluate pertinent ecological aspects of the site including those living resources at or near the site, the effects of chemicals of concern from the site on those resources and the effects of remedial actions on those resources. The predominant goal of the EA is to assess whether ecological effects have any relevance to the choice of remedial action or other pertinent decisions as part of the RCRA corrective action process.

The ecological risk assessment will assess the possibility of adverse effects on the ecosystem defined by the site boundaries, including the adjacent areas of the Great Bay estuary. The study will provide an analysis of the baseline ecological risks associated with the site and determine the need for future response actions, if any.

15.2.2 Scope

The ecological risk assessment is intended to quantify the ecological risks posed by the Site. Specifically, this involves an investigation of the extent of the release of contaminants from SWMUs #5, 6, 8, 9, 10, 11, 12, 13, 16, 21, 23, 26 and 27 (identified in the HSWA permit issued to Portsmouth Naval Shipyard) into the surrounding environmental receptor media, and a determination of current and potential exposure pathways as defined in Section 2.1 of the USEPA Region 1 Guidance For Ecological Risk Assessments (Draft Final). Additional guidance documents used in the development of the EA include:

> Risk Assessment Guidance For Superfund Volume II Environmental Evaluation Manual. (EPA/540/1-89/001).
>
> Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference. (EPA/600/3-89/013).

15.2.3 Site Characterization and Potential Receptors

An ecological description of the terrestrial and aquatic habitats and their associated flora and fauna will be presented. The description will include potential areas and levels of contamination, specific habitat types, and profiles of characteristic species found in the habitats. The site characterization will draw heavily upon past biotic descriptions of the area, local scientific research and the results of the Biotic Characterization (Section 10.0).

15.2.4 Selection of Chemicals, Species, and Endpoints for Risk Assessment

The effects of contamination from the PNS will be judged based on the selection and evaluation of certain indicator chemicals. The results of the off-shore analysis of sediments and surface waters as well as on-shore results from the RFI will provide a base for selecting those chemicals considered of most potential concern to the environment. Those chemicals will be assessed based on criteria of persistence, high bioaccumulation potential, toxicity, and elevation above naturally occurring levels. The chemicals that are chosen will be considered of greatest potential concern with regards to potential impacts to the ecosystem and, via the biotic pathway, to human health.

The health of the ecosystem will be based on the evaluation of indicator species with regards to certain endpoints such as population, contaminant levels in tissue, growth and physiological impacts. The elected indicator species (both aquatic and terrestrial) will serve as an indication of the potential effects of contamination from the PNS on the ecosystem. The indicator species will be chosen based on their importance to the ecological system, sensitivity, relevance to human beneficial uses, availability of practical methods for prediction and measurements and on the applicability as a trustee species or Regulatory endpoint.

15.2.5 Exposure Assessment

An exposure assessment will be conducted in an attempt to quantify the duration and magnitude of the exposure of indicator species as indicator chemicals. Potential pathways for this exposure will be presented through a physical description of the environmental setting, based on on-shore and off-shore RFI results. This will allow for a characterization of sources, with respect to the SWMUs. Transport and fate analysis of contaminants of concern will allow for further assessment of the spatial and temporal trends in contaminant distribution. Where possible, models will be utilized in the analysis of contaminant transport and fate.

Exposure scenarios will be evaluated using the results of the biotic characterization study. Tissue samples collected from biota will provide an important complement to the results generated by analysis of the abiotic matrices of the ecosystem (soil, water, sediment). Data developed from the exposure analysis, together with life history data of the indicator species, will be utilized to prepare an integrated exposure assessment of the ecosystem.

An analysis of uncertainties inherent in the exposure assessment will discuss exposure factor values, exposure pathways and the impact of life history characteristics on exposure.

15.2.6 Toxicity Assessment

The toxicity assessment will attempt to evaluate the potential toxic effects of the indicator chemicals on the indicator species chosen for this study. This will include a description of the physical, chemical and metabolic properties of the chemicals and an assessment of the dose-response relationship.

The toxicity assessment will initially be based on a hazard identification. Data collected in the biotic characterization and off-shore and on-shore sampling program will be compared to literature values to evaluate the hazards presented by the chemicals of concern to the indicator species. Comparison will be to data developed in studies such

as the National Status and Trends Program under NOAA. Data from previous studies in the area will be collected and compiled. That data will compliment field observations made during the biotic characterization of selected endpoints such as growth, distribution and gross abnormalities. This data will also be used to evaluate the hazards presented by indicator chemicals.

If the data derived from the hazard identification process indicates that levels of contamination in the abiotic matrices and in the tissue samples present a hazard, then a program of long-term toxicological studies will be conducted. These types of analyses could include laboratory toxicity tests such as bioassays or monitoring programs of indigenous fauna.

An uncertainties analysis will be conducted to assess the impacts of such issues as interspecies extrapolation, quantitative structure-activity relationships and acute to chronic extrapolation on the toxicity assessment process.

15.2.7 Risk Characterization

A risk characterization of the contaminants of concern will be made. The risk characterization will attempt to address the probability that adverse effects to receptors of concern in the aquatic ecosystems will occur. To that end, data will be quantitatively assessed to calculate the risk of exceeding background or No Observed Adverse Effects

Level (NOAEL) or Lowest Observed Effects Level (LOEL) or similar comparison standards. An estimation of risk on a single species/single chemical standpoint, as well as an attempt to evaluate multiple species and multiple chemicals will be made. Comparison standards will be drawn from data on specific organisms, or from assumptions made based on similar organisms or from other information bases. The risk characterization will attempt to quantify both the effects on specific organisms and on community characteristics such as population. Uncertainties in the risk characterization will be summarized in this section. Uncertainties will include exposure assessments and toxicity assessments; the unknown interaction of such items as age, sex, behavioral characteristics and metabolic processes of the organism; and uniformity and availability of the contaminant.

APPENDICES

Comment 1.*

The data presented in Appendix C was presented to McLaren/Hart in its semi-illegible form by the Navy and will be resubmitted in a legible format.

APPENDIX I

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

CERTIFIED MAIL: RETURN RECEIPT REQUESTED

January 15, 1991

Captain Thomas M. Hagge, CEC, USN
Public Works Officer
Portsmouth Naval Shipyard
Portsmouth, NH 03084

Re: U.S. Environmental Protection Agency Approval with Conditions of the RCRA Facility Investigation (RFI) Proposal for Portsmouth Naval Shipyard (PNS).

Dear Captain Hagge:

Please find enclosed our comments on the subject document. This document is, as provided, acceptable with conditions. Pursuant to Part II.B of the HSWA Permit issued to PNS each of the enclosed comments should be construed as a condition which must be fully met in the manner specified in each comment. An asterisk highlights those conditions which affect the text of the RFI Proposal. Highlighted conditions are to be fulfilled with a submittal to EPA by February 28, 1991. These highlighted conditions may be addressed by preparation of a revised RFI Proposal or revised portions of the RFI Proposal.

As provided in Part II.C of the HSWA Permit the deadline for delivery of the RFI Report, Public Health and Environmental Risk Evaluation, and Media Protection Standards Proposal is now set for eighteen (18) months after the Navy's receipt of this letter.

As a general observation regarding this RFI Proposal, I note with disappointment several instances where the Navy has not addressed the intent of EPA's previous comments. As you know, this Navy submittal is the second version of the RFI Proposal. The first RFI Proposal was submitted August 7, 1989. That version was found by EPA to be incomplete and was supplemented by the Navy with various submissions of information between November 7, 1989 and February 7, 1990. EPA then reviewed the document and issued a lengthy comment letter on March 13, 1990. At the Navy's request EPA reviewed a response to these comments submitted to EPA on April 30, 1990 and then issued comments on this response package in a July 27, 1990 letter. At several meetings between July 27, 1990 and the Navy's November 9, 1990 submittal of a revised RFI Proposal EPA further clarified comments made in the March 13th and July 27th letters. I am concerned that after this lengthy interaction that some of EPA's comments are still not adequately addressed. Consequently, in several instances in the attached conditions EPA has specified work to be performed in lieu of the Navy submitting an acceptable proposal. I am

hopeful and optimistic that this situation might be due to communication or review problems rather than a reflection of unwillingness on the part of the Navy to perform the necessary level of investigation and corrective action at PNS.

I also note with disappointment the Navy's insistence that no release has occurred from PNS to the sediments of the Piscataqua River. It is evident that releases have occurred. The Navy's failure to acknowledge this fact has effectively delayed progress towards a comprehensive and systematic investigation of the environmental media surrounding PNS.

I am aware that over the past several months the Navy has initiated some field work that is described in the RFIP. As EPA has indicated on several occasions this work was undertaken without EPA review, approval or endorsement, and therefore at some risk to the Navy. EPA does not necessarily accept all of the work performed prior to this approval of the RFIP as fulfilling Part II.B of the HSWA Permit issued to PNS which requires RFI performance in accordance with the approved RFIP. Specifically, by comparing the methods used to date by the Navy with certain of the attached conditions, EPA may be requiring repeat data acquisition activities at certain sample locations, this time using methods which EPA believes are necessary to achieve the goals of the permit provisions. If the Navy wishes to use the results of sampling performed to date in lieu of sampling called for in the approved RFIP or in the attached conditions, the Navy must clearly document in the RFI that the data was acquired in accordance with this conditional approval.

EPA and the Navy should be resolved in our mutual goal of taking meaningful corrective action to protect public health and the environment in and around PNS which has been affected by contaminant releases from PNS. Clearly our efforts should be directed towards this goal. We look forward to working cooperatively with the Navy in the clean-up of Portsmouth Naval Shipyard.

If there are any questions on this letter or the enclosed conditions please do not hesitate to call me or Ernest Waterman of my staff at (617) 223-5511. Thank you for your attention in this matter.

Sincerely,

David Webster, Chief
ME, NH & VT Waste Regulation Section

Enclosure

cc: Pamela Parker, ME DEP
Linda Resta, USN NAVFAC Northern Division

ATTACHMENT A
Comments on the
RCRA Facility Investigation Proposal
for the Portsmouth Naval Shipyard
Kittery, Maine

General Comments

1.* Prepare a plan for screening of all samples collected at the site with a geiger counter; inclusion of a geiger counter in the monitoring of field activities; radiation monitoring of field personnel; a radiation survey of SWMU 6 and 8 (DRMO and JILF); and an in-situ gamma survey at SWMU 8.

On p. B-19 of the Health and Safety Plan a statement is made which appears to raise the concern that radioactive materials, radioactive waste or mixed waste might be encountered during site investigations.

2. Conduct a professional survey, if not already performed, to establish a uniform three dimensional coordinate system that can be used to locate all sampling and measurement points used or referred to in the RFI and all anticipated points to be referenced in the Corrective Measures Study, Corrective measures design, and corrective measures. Use this surveyed coordinate system to locate data on all maps and appropriate data tables. The Navy should also consider linking this data to a Geographic Information System. This must be done as part of the RFI.

The extensive work to be done at PNS creates a need for a system to keep accurate track of where all data is generated.

Section 1.0 Initial Facility Characterization Report

1. Identify what data, if any besides salinity data from Larsen (1979), exists to support the conclusion on p. 1-13 that the Great Bay Estuary is a type B, slightly stratified estuary. The Navy shall also identify how this classification or other data supports the statement on p. 1-15 that the Great Bay Estuary can be expected to be well mixed in the vicinity of PNS. This information must be included in the RFI Report.

2.* Revise the sentence on p. 1-25 which reads "HART will study whether the water flow in the portion of the estuary near the shipyard may be successfully modelled if information from the RFI indicates that contaminants have been released from the shipyard to the estuary," to read "The Navy will study whether the water flow in the portion of the estuary near the shipyard may be successfully modelled" or draft a new sentence which conveys the equivalent information.

   Given the nature of SWMU 5 (Industrial Waste Water Outfalls) which pumped contaminant laden wastewater into the Piscataqua River and SWMUs 6 & 8 (DRMO & JILF) which allowed contact between the waters of the Piscataqua River and contaminant sources there is sufficient evidence that PNS has released contaminants to the Great Bay Estuary. The Navy stated this in their 1978 application to the State of Maine for a Wetlands Alteration Permit and Water Quality Certification for the disposal of dredge spoils where the Navy says that SWMU 8 "which is currently used for the disposal industrial waste is exposed to seawater with each tide thereby allowing contaminants to leach to the Piscataqua River".

3.* Remove the statement on p. 1-29 that till will be found only above the high tide line.

   There is no evidence to suggest till deposits are not present below tidal sediments in intertidal and subtidal areas.

4.* Revise the sentence on p. 1-38 which reads "HART will address contaminant affects on species within the food chain if it is determined that contaminants are being released from the shipyard to the estuary and that these contaminants have the potential to affect estuary species," to read "HART will address contaminant effects on species within the food chain" or draft a new sentence which conveys the equivalent information.

Given the nature of SWMUs 5, 6, & 8 there is sufficient evidence that PNS has released contaminants to the Great Bay Estuary.

5.* Remove the sentence on p. 1-40 which reads "While the discharges of Shipyard industrial wastes prior to the construction of the Industrial Waste Water Treatment Plant in 1974, conceivably may have contributed to the contamination in some form, it is not feasible to isolate the various sources up and down the Piscataqua River and delineate the proportional shares."

It is clear from the nature of SWMU 5 and existing test data that the industrial waste outfalls have contributed contaminants to the Piscataqua River. It is one of the objectives of this RFI to determine the extent and effect of this contamination. It is the Navy's responsibility to determine a method to fulfill this objective such as a proposed allocation of pollution loading. It should not be assumed at this stage that a means of determining the extent and effect of contamination from SWMU 5 or any other SWMU cannot be found. If the Navy fails to find a method for fulfilling this objective then EPA will determine a method for fulfilling this objective as a requirement for completion of the RFI using conservative assumptions.

6.* Revise the discussion on p. 1-40 to 1-43 of potential releases of contaminants from the SWMUs to include identification of potential releases to soil and sediment in addition to air, ground water, surface water, and subsurface gas.

Fulfillment of Part II.A of the HSWA Permit requires that potential releases to all media be evaluated for the SWMUs at PNS.

7.* Revise the statements on p. 1-41 that SWMUs 10 and 11 have no current potential for release of contaminants to ground water or surface water to read that these SWMUs do have a potential for release of contaminants to ground or surface water.

Contaminated soil at these SWMUs could be acting as contaminant sources for ground and surface water even though the original tanks have been removed.

8.* Prepare plans for the collection of air monitoring and SWMU-specific meteorological data at SWMU 8 (JILF) sufficient to meet the objectives of the RFI. The air monitoring plan should be designed to provide data on the release of [illegible] Volatiles (plus any Appendix IX Volatiles detected in sampling of other media) to the air space above [illegible]

outside the boundaries of SWMU 8. The data obtained must be capable of supporting the PHERE. The Air/Superfund National Technical Guidance Study Series EPA 450/1-89-001 to 004 should be followed in designing air monitoring for SWMU 8.

The second paragraph of p. 1-47 states "If it is apparent that a particular SWMU might contribute to airborne contaminants, future studies would be undertaken to ascertain the off-SWMU distribution of these contaminants and would entail air monitoring and the collection of SWMU-specific meteorological data. It is apparent from statements made on p. 1-40 that SWMU 8 may be a source of airborne contaminants. Air should be identified as a media of concern for SWMU 8 pursuant to Part I.A.1.g of the HSWA Permit issued to PNS.

9. Identify, if known, the length of time nickel-cadmium batteries were stored at SWMU 6. This information must be included in the RFI Report.

10.* Submit a report detailing any and all records relating to the placement of acetylene and chlorine gas cylinders in SWMU 8. Information to include, if available, is the nature of the cylinders in which the gas was contained, their location within the landfill, and their probable present condition. Provide copies of records, if any exist. If any of these data are not available or cannot be estimated, provide an explanation.

The exact location and condition of the chlorine and acetylene gas cylinders is a critical factor in determining RFI and Corrective Measures strategies. A detailed knowledge of all available information on these cylinders is important for all parties involved in the Corrective Action.

11. Prepare a summary, in a consistent tabular format similar to Table 1-5 of all sampling which has been conducted at PNS during previous investigations. Provide a column of location information using the uniform 3-dimensional coordinate system required in General Comment #2. This summary must be presented in the RFI Report.

A clear knowledge of all sampling work which has occurred at PNS is essential for EPA and ME DEP.

12. Prepare tables which present all of the raw data collected in each of the previous investigations which have occurred at or in the waters around PNS. These tables must specify methods of analyses used and detection limits of the analytical methods. QA/QC information on the data must also be included. The locations from which the samples were taken must be shown on accompanying maps and shall

identified on the tables using the uniform 3-dimensional coordinate system required in General Comment #2. The data must be presented in a consistent format on a computer disk compatible with EPA software. The data should also be presented in a format which may be expanded as new data is generated. These tables must be presented in the RFI Report.

As stated above, a clear knowledge of all sampling work which has occurred at PNS is essential for EPA and ME DEP.

13.* Submit information for SWMUs 10, 11, 12, 13, 16, 21, 23, 26, and 27 at the same level of detail as is done for SWMUs 5, 6, 8, and 9 in Section 1.4 of the RFI Proposal.

The information on SWMUs 10, 11, 12, 13, 16, 21, 23, 26, and 27 presented is less detailed than that presented for SWMUs 5, 6, 8, and 9.

14.* Revise Table 1-6 to note that tank content information is based on only two years of information and is insufficient to properly characterize tank contents.

The limited information upon which tank content information in Table 1-6 is based should not be considered to fully characterize the historical contents of these tanks.

15.* Replace the trivalent chromium permissible concentration of 170 ug/l and hexavalent chromium permissible concentration of 50 ug/l presented on p. 1-68 with the National Interim Primary Drinking Water Regulation (NIPDW) of 50 ug/l for total chromium. Replace the lead permissible concentration of 50 ug/l presented on page 1-69 with the proposed MCL for lead of 5 ug/l.

16.* Provide information that demonstrates that State of Maine information that SWMU 8 was receiving waste through 1982 is incorrect or revise p. 1-72 of the RFI Proposal to indicate that landfilling operations at SWMU 8 continued through at least 1982.

There are discrepancies between statements on the duration of landfilling operations made in the RFI Proposal and State of Maine information based on aerial photography of PNS.

EPA requested a confirmation or refutation of State of Maine information in our March 13, 1990 comment letter.

Section 2.0 Preliminary Investigation of Corrective Measures

1. Prepare a section for the RFI Report for PNS which covers the subject areas which Section 2.0 of the RFI Proposal was intended to cover and which demonstrates that the RFI Report contains all field information needed to evaluate Corrective Measures.

   In Part II.A.2 of the HSWA Permit requires that "The RFI Proposal shall identify the potential corrective measures technologies that may be used on-site or off-site to contain, treat, remedy and/or dispose of the contamination resulting from the releases of hazardous waste and/or hazardous constituents from the SWMUs listed in Attachment I. This preliminary investigation shall summarize all prior investigations and identify field data that needs to be collected during implementation of the RFI to facilitate the technical evaluation and selection of the final corrective measure or measures (e.g. compatibility of waste and construction materials, information to evaluate effectiveness, treatability of wastes, etc.)."

   Section 2.0 of the RFI Proposal fails to present a detailed discussion of the data needed to develop and evaluate technologies and combinations of technologies considered for site remediation. Nor does this section of the RFI Proposal discuss the data quality objectives of the data to be collected.

2.* Revise the sentence on p. 2-12 which reads "Current USEPA policies and guidance, including the Superfund Exposure Assessment Manual (September 1987) and the Superfund Public Health Evaluation Manual (October, 1986)" to read "Current USEPA policies and guidance, including the Superfund Exposure Assessment Manual (September 1987) and the Risk Assessment Guidance for Superfund, Human Health Evaluation (EPA, December 1989)" or draft a new sentence which conveys the equivalent information.

   The Risk Assessment Guidance for Superfund, Human Health Evaluation (EPA, December 1989) has superseded the Superfund Public Health Evaluation Manual (October, 1986)

3. Address SWMU 26 in the section of the RFI Report which shall cover the subject areas which section 2.0 of the RFI Proposal was intended to cover.

   The RFI proposal does not contain an analysis of potential corrective measures for SWMU 26. Although the Navy believes it has proper controls on future releases from this SWMU they must identify corrective measures for past releases.

Such an analysis is a requirement of Part II.A.2 of the HSWA Permit.

Section 3.0 Surface Geophysical Investigation

1.* Identify what specific information the Navy must collect to decide whether or not seismic refraction work will be conducted in SWMU 8 (JILF) and set a schedule for the collection of this information. Specify what information the Navy will collect to replace seismic refraction surveys if they are not conducted.

It is not clear from the RFI Proposal why an analysis of the feasibility of seismic work at SWMU 8 cannot be performed at this time.

2.* Specify that Seismic lines will be keyed into soil borings to allow correlation of seismic data with stratigraphic data from soil borings.

It is unclear whether or not seismic lines will be positioned such that they will intersect soil borings. The need for seismic lines to intersect soil borings was identified in EPA's March 13, 1990 comment letter.

3.* Prepare a schedule which clarifies the timing of surface geophysical investigations.

The current RFI Proposal is unclear as to when certain tasks will occur. On p. 3-3 it is stated that GPR will be used over areas of large magnetometry anomalies if such anomalies are found during a phase II geophysical investigation but earlier in the RFI Proposal it is stated that magnetometry work will occur in phase I. It is also unclear how these phases fit into the overall timing of the RFI.

Section 4.0 Soils Investigation

1.* Revise Section 4.0 to specify that all soil samples, except for underground storage tank related soil samples, will, at a minimum, be analyzed for TCL Organics, TAL Inorganics, compounds found during Appendix IX Sampling, pH, Total Organic Carbon, Grain Size, Atterberg Limits, and Water Content.

Consistency in sample results and the need to insure that comprehensive sampling occurs is an important facet of the RFI.

The need for more uniform soil sampling parameters was cited in EPA's March 13, 1990 comment letter.

Analysis parameters for underground storage tank related SWMUs are presented in EPA's comments on Section 9.0 (Tank Investigations).

2.* Revise Section 4.0 to specify that all exploratory borings will be continuously split spoon sampled.

EPA's March 13, 1990 comment letter called for continuous split spoon sampling of all borings.

3.* Identify why the variability in the elevation of the water table at SWMU 6 (DRMO) is attributed to the wide variety of fill material encountered at SWMU 6.

It appears from the information presented in the RFIP that water table measurements at SWMU 6 wells were made at the time of boring installation with no time allowed for water levels in the well to reach equilibrium. The location of the DRMO also makes it likely that the variability is due to tidal effects.

4.* Specify how the "most highly contaminated sample" will be selected for Appendix IX analysis in areas where non-volatile contaminants predominate.

The field screening methods proposed will only detect contamination by volatiles. Visual inspection of contaminants cannot be relied upon to determine which sample is the most highly contaminated. The Navy should also consider X-ray fluorescence as a screening tool.

5.* Revise Section 4.0 to specify that HNu/OVA used in screening soil samples will use an 11.7 eV lamp.

Use of an 11.7 eV lamp will maximize the number of compounds the HNu/OVA is capable of detecting. The Navy should also consider using X-ray fluorescence as a screening tool for soil sample selection.

6.* Revise Section 4.0 to specify that all surface soil samples will include the top 12 inches of the soil.

A surface soil sample depth of 12 inches is desirable to support the Public Health and Environmental Risk Assessment.

7.* Identify locations for the collection of background surface and subsurface soil samples and provide a rationale for locations chosen.

Background soil samples were called for in EPA's March 13, 1990 comment letter and are needed to support performance of Part II.F of the HSWA Permit.

8.* Revise Section 4.0 to specify that soil samples for the full range of chemical and physical parameters listed in the RFI Proposal will be collected below the water table in each boring as well as above the water table.

Soil samples need to be collected below the water table to completely understand the volume of contaminated soil and the degree of contaminant sorption to saturated soils.

9.* Revise Section 4.1 to include collection of at least one surface soil sample from within SWMU 6 (DRMO) for Appendix IX analysis.

The existing surface soil samples from inside of SWMU 6 appear to have looked at only chromium, cadmium, lead, and nickel.

10.* Revise Section 4.1 to include surface sampling of soil inside SWMU 6 (DRMO) at no fewer than 20 locations.

The existing surface soil sampling data from within SWMU 6 looked only at chromium, cadmium, lead and nickel. This set of parameters is too limited to characterize SWMU 6.

11.* Revise the sentence on p. 4-22 which reads "If visible contamination extends to the water table a groundwater investigation may be necessary" to read "If contamination extends to the water table or if contaminants found at SWMU 27 are likely to have leached to ground water a groundwater investigation will be necessary" or draft a new sentence which conveys the equivalent information.

The meaning of the term "visible contamination" is unclear. The presence of contaminants at the level of the water table or the presence of contaminants which could have been leached and introduced to ground water should both be triggering conditions for ground water investigations at SWMU 27.

12.* Revise Section 4.2.2 to include the installation and sampling of at least three soil borings at SWMU 27 (Fuel Oil Pipeline).

The wastes released at SWMU 27 (Fuel Oil Pipeline) might tend to act as a dense non-aqueous phase liquid. This possible behavior suggests that soil borings should be conducted to guarantee that all areas of probable contamination at SWMU 27 are sampled. Borings should be sited to underlie and bracket the area in which release of contaminants occurred and should be finished to bedrock and sampled in the same manner as borings at SWMUs 6, 8, & 9 (DRMO, JILF, Mercury Burial Sites).

13.* Specify the location of the three proposed test pits at SWMU 27 (Fuel Oil Pipeline) relative to the location of the fuel oil spill and document why three test pits are believed to be adequate to characterize the release at SWMU 27 and to determine the volume of contaminated soils.

14.* Remove the sentence on p. 4-27 which reads "Because the spatial distribution of the six continuously sampled borings includes both upgradient and downgradient perimeters of the JILF, the borings will be indicative of both SWMU related and non-SWMU related conditions.

There is insufficient information at this point to be sure that the wells assumed to be upgradient are upgradient and/or in an area free of contamination.

15.* Revise the sentence on p. 4-29 which reads "Samples which are representative of the subsurface stratigraphy, particularly those which may form a confining layer, will be selected for analysis" to read "Samples which are representative of the subsurface stratigraphy, particularly those which may form a confining layer or high conductance zone, will be selected for analysis" or draft a new sentence which conveys the equivalent information.

High conductance zones may provide contaminant pathways and should receive the same attention as potential confining layers.

16.* Remove the sentence on p. 4-31 which reads "Bedrock characteristics in borings which are not cored will be easily extrapolated from nearby cored holes."

Extrapolations of this type are usually not very accurate due to the often rapid lateral variations in geology that are typical of Maine. Furthermore a five foot core will not yield a detailed profile of the underlying bedrock characteristics. Shallow cores of this type produce a snapshot of a limited geological regime.

Section 5.0 Ground Water Hydraulics

1.* Identify the variables needed to characterize ground water flow and contaminant migration in each aquifer system at PNS. At a minimum the variables to be collected through field and/or laboratory testing for each aquifer should include porosity, 2-D hydraulic conductivity, 3-D extent of the aquifer, heterogeneity of aquifer materials and properties, organic carbon content of ground water, pH of ground water, and other chemical information to describe contaminant migration.

On p. 5-1 of the RFI Proposal the Navy states a need to have a thorough understanding of the variables which define each aquifer system without identifying what these variables are. The variables listed above comprise a minimal list of data which would have to be collected in understanding and remediating contaminant migration in ground water at PNS.

The Navy should consider collecting as much of this information as is possible at this time rather than waiting for the Corrective Measures Study phase of the Corrective Action process to collect this data.

2.* Revise Section 5.0 to include the installation and monitoring of tide gauges at SWMUs 6 and 8 (DRMO and JILF).

These tide gauges must be monitored and tide height data recorded during the 48 hour monitoring of wells in SWMUs 6 and 8 to determine head differences caused by tidal influence.

3.* Revise the statement on p. 5-1 of the RFI Proposal that slug tests will be performed on each "critical stratigraphic unit" to provide that slug tests will be performed on "each lithologic unit identified in the soils investigation" rather than on each "critical stratigraphic unit".

Part II.A.5.c of the HSWA Permit requires that the Navy determine the hydraulic conductivity of each lithologic unit identified in the Soils Investigation.

4.* Specify that wells will be screened in each unit which is to undergo slug tests.

The RFI Proposal states that slug tests will be performed on critical stratigraphic units without establishing that wells for this work will be screened in these units.

5.* Select either rising or falling head measurements as a primary means of conducting slug testing.

While evaluation of hydraulic conductivity by both rising and falling head methods where possible is desirable (and should be retained as a feature of the RFI) it is important that all wells also be tested by one, consistent method to allow for meaningful comparisons between wells.

6.* Specify the methods of hydraulic conductivity calculation which will be applied to slug test data and submit documentation on these methods to EPA.

The RFI Proposal states that solutions developed by Cooper, Bredehoeft, Papadoupulos, Rice and others will be used in analyzing slug test data but does not present the equations themselves, the conditions under which they may be validly applied, or the assumptions made in their development.

7.* Specify how hydraulic conductivity calculations based on slug test data will be applied to bedrock wells.

The bedrock at PNS is a fractured media. It is important to document whether the bedrock will be assumed to be a porous media when slug test data is analyzed or if some other assumptions will be made in calculating hydraulic conductivity values for the bedrock aquifer.

8.* Specify the technique which will be followed in correcting slug test data for tidal influences and provide hypothetical examples of its application.

9.* Remove the sentence on p. 5-3 which reads "No water will be generated during aquifer hydraulic conductivity testing," and replace with a sentence which reads "Rinse water from aquifer hydraulic testing will be contained in suitable DOT approved 55 gallon drums, tested and evaluated as to whether the water meets the definition of a hazardous waste under 40 CFR Part 261. The containers will be properly identified, marked, and labelled per 40 CFR Part 262.31 and 49 CFR Part 172. Any rinse water meeting the definition of a hazardous waste under 40 CFR Part 261 will be handled and managed in accordance with applicable Federal and State of Maine regulations" or draft a new sentence which conveys the equivalent information.

Section 6.0 Hydrogeologic Monitoring Plan

1.* Revise Section 6.0 to specify that all ground water samples will, at a minimum be analyzed for TCL Organics, TAL Inorganics, other compounds found during Appendix IX Sampling, and field parameters (pH, Temperature, Specific Conductance, Salinity, Turbidity).

Consistency in sample results and the need to make sure comprehensive sampling occurs is an important facet of the RFI.

2.* Revise Section 6.0 to include provisions for the installation of additional wells and discuss the triggering criteria for the placement of new wells as the RFI progresses.

The existing well network appears to be generally sufficient to identify the release of contaminants to ground water from SWMUs 6, 8, & 9 (DRMO, JILF, Mercury Burial Sites). Full characterization of the extent and fate of contaminant releases may require additional wells. Triggering conditions for the installation of new wells should include, but is not necessarily limited to, the need to define the extent of identified plumes, the need to screen wells in specific stratigraphic layers, and the need to investigate potential contaminant pathways.

3. Prepare a site specific geologic study of PNS and use the results of this study to site bedrock wells at the facility. The geologic study of the facility must include a review of the latest literature and interpretations of the geology of the region in which PNS is located; a new fracture trace study using low altitude aerial photographs (1:10000 scale); preparation of a site specific geologic map based on field work; and a study of jointing patterns at PNS based on field work. Based on these studies bedrock wells should be sited in fracture trace zones found at PNS and in bedrock lows associated with SWMUs at PNS. The results of these studies must be presented in the RFI Report.

The bedrock wells proposed in the RFI Proposal are inadequate to characterize the bedrock aquifer at PNS. The RFI Proposal assumes that data collected from wells in the uppermost portion of the bedrock will characterize any and all bedrock aquifer contamination at PNS. It is true that jointing in bedrock tends to close up with depth making the shallow bedrock more highly permeable and a likely zone for detecting contamination. It is also true (as was discussed in Section 1.2.2.1 of the RFI Proposal) that fracture zones may exist at PNS and may provide a pathway for contaminant

migration and that bedrock topography might also influence the migration of contaminants.

4.* Remove those portions of Section 6.0 which state that bedrock wells will not be placed where confining layers are encountered or where confining layers and contamination are encountered.

Bedrock or overburden wells may need to be placed through confining layers or potential confining layers to investigate whether or not contamination has spread through the confining layer. Wells placed through confining layers must be installed in a manner which insures that the well will not allow contaminants through the confining layer. An acceptable method for achieving this would be to place the well with a hollow stem auger and use this auger as a temporary casing during well installation. A casing which extends from the ground surface through and 1 to 2 feet below the confining layer should be placed inside the hollow stem and the annular space outside the casing tremie grouted with bentonite as the hollow stem auger is retracted. If other drilling methods are employed then a temporary outer casing will have to be driven to and through the confining layer. This casing could be withdrawn when the well was completed and grouted in the same manner as followed using a hollow stem auger.

5.* Revise Section 6.0 to remove all references to specific wells as being upgradient or downgradient of SWMUs 6, 8, & 9 (DRMO, JILF, Mercury Burial Sites).

The possible influences of tidal action in the Piscataqua River and the possibility of radial flow patterns in SWMU 8 make it impossible, at this time, to identify any wells as being continuously up or downgradient of these SWMUs.

6.* Identify locations or provide for the future identification of locations for the installation of background (or reference) wells for use in comparing data from SWMUs 6, 8, & (DRMO, JILF and Mercury Burial Sites).

Wells which can provide information about background water quality information are needed to support performance of Part II.F of the HSWA Permit.

7.* Revise Section 6.0 to include sampling for (and as necessary sampling of) immiscible layers in all well sampling.

Appropriate methods for the detection of immiscible layers may be found on p. 100-102 of the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (OSWER-9950.1

8.* Revise Section 6.1 to include ground water flow velocity and ground water contaminant fate as objectives of the Hydrogeologic Monitoring Plan.

9.* Remove the sentence on p. 6-4 which reads "This fine slot size will restrict the migration of silt sized material into the wells."

The 0.01 inch screen slot size selected for use in wells at PNS is much larger than the 0.003 inch maximum median diameter of silt.

EPA's March 13, 1990 comment letter to the Navy requested that the Navy provide a rationale for using 0.01 inch screen slot size in wells at PNS. The letter also stated that grain size analyses from soil studies should be considered in determining appropriate screen slot size. the rationale provided in the RFI Proposal is inadequate. Determination of screen slot size for wells at PNS shall be made based upon grain size analyses. Slot sizes chosen should be small enough to retain at least 40% of the aquifer material surrounding the screen.

10.* Revise the discussion of general well construction presented in Section 6.1.1 of the RFI Proposal to include a discussion of how filling and sealing of the annular space around wells will be modified if the top of the well screen is too close to the ground surface.

Such a discussion was called for in EPA's March 13, 1990 comment letter. EPA suggested at that time that a 6 inch sand choker collar might be adequate in wells with limited room between the well screen and the ground surface.

11.* Modify the design of wells in high traffic areas (presented on p. 6-5) to prevent contamination by surface runoff.

The use of curb boxes rather than stick ups in high traffic areas may make wells in these areas susceptible to contamination from surface runoff. An acceptable compromise may be to set curb boxes approximately 6 inches above the surrounding ground level and build up a skirt of concrete around the well to prevent its becoming a traffic hazard.

12.* Revise the well development criteria presented on p. 6-5 to include at least 3 complete well purgings before stabilization of turbidity is accepted as proof of successful well development. Also revise the criteria to use 5% or less variation in turbidity as a criteria rather than 10% or less variation.

13.* Add a sentence before the last sentence on p. 6-5 which reads "Stabilization of turbidity will be used as a test of well development only for wells containing brackish (>1000 mg/l total dissolved solids) or saline (>35000 mg/l total dissolved solids) water" or draft new a sentence which conveys the equivalent information.

During a meeting held on August 8, 1990 EPA indicated that the Navy could develop a test of well development based on stabilization of turbidity for use in wells containing brackish water. EPA requested at that time that the Navy also conduct a literature search to determine typical turbidity values in brackish wells to support this approach. This has not been done.

14.* Identify why eighteen to twenty four monitoring wells will be drilled around SWMU 8 (JILF). Identify what rationale supports these numbers and why a range of wells has been presented.

Well siting in the RFI Proposal is presumably being based on some underlying rationale and it is important for this rationale to be identified. If twenty four wells is considered to be the absolute maximum that will be needed to characterize SWMU 8 then the basis for this assumption also needs to be presented.

In general the number and placement of wells at SWMU 8 appears appropriate for identifying contaminated ground water releases though it appears a well should be placed approximately 110 feet east of JW-14s,d on a line running between JW-14s,d and the southeast corner of the salt and sand storage shed. Full characterization of the extent of any contaminant releases found may require the installation of more wells during the RFI.

15.* Revise Section 6.3.1 to include provisions for locating wells in potential contaminant pathways (such as bedrock lows and high hydraulic conductivity zones) in addition to siting wells downgradient of potential contaminant source areas and within contaminant plumes on the basis of borings, subsurface gas monitoring, and geophysical surveys.

Potential contaminant pathways are an important factor in choosing well locations.

16.* Specify how tidal channel deposits will be located for the installation of ground water monitoring wells.

The RFI Proposal states that wells will be positioned to intersect tidal channel deposits whose presence were indicated by the IFCR without stating how these deposits

will be located. If their location is already known it is not clear how they will be precisely located during well installation.

17.* Revise Section 6.5.1 to reference the correct Tables in the QAPP.

There are no Tables A-3 and A-4 in the QAPP. The correct tables are Tables 9-2 and 9-3.

18.* Revise the sentence on p. 6-15 which reads "All sampling procedures will conform to EPA protocols (RCRA Groundwater Monitoring TEGD, 1986 and EPA SW-846" to read "All sampling procedures will conform to EPA protocols (RCRA Groundwater Monitoring TEGD, 1986 and EPA SW-846 3rd Edition with updates" or draft a new sentence which conveys the equivalent information.

19.* Revise the sentence on p. 6-15 which reads "Water level measurements will be obtained with a factory calibrated electronic water level indicator (Model 3000 T-L-C meter) or a steel measuring tape to the nearest 0.01 of a foot and converted to common datum" to read "Water level measurements will be obtained with a factory calibrated electronic water level indicator (Model 3000 T-L-C meter) to the nearest 0.01 of a foot and converted to Mean Sea Level from a known benchmark" or draft a new sentence which conveys the equivalent information. The benchmark for water level measurements should be the same as that used as the basis for the 3-dimensional coordinate system required in General Comment #2.

Use of a chalked steel tape might affect water chemistry in the wells being sampled.

The location of PNS in Great Bay Estuary suggests that Mean Sea Level should be used as a datum to set all ground water level measurements against.

20.* Add a sentence to the end of the 1st paragraph on p. 6-16 which reads " Bailers will also be decontaminated before and after each use" or draft a new sentence which conveys the equivalent information.

21.* Specify where bailers will be stored at PNS and what practices will be employed to insure these bailers remain clean and unexposed to contaminants between uses.

The RFI Proposal states that bailers for each well will be stored on site but does not specify what will be the storage conditions for these bailers.

22.* Revise the sentence on p. 6-17 which reads "Field parameters will be measured immediately upon completion of sampling" to read "Field parameters will be measured immediately before and upon completion of sampling with VOC samples being collected before the initial set of field parameters are measured" or draft a new sentence which conveys the equivalent information.

Measurement of field parameters before and after sampling provides an indication of whether or not conditions in the well were stable during sampling.

23.* Remove the sentence on p. 6-17 which reads "No samples will be subjected to field measurements before or after being placed in sample bottles" and replace with a sentence which reads "Field parameters will be measured on samples separate from those collected for laboratory analysis" or draft a new sentence which conveys the equivalent information.

The existing sentence is ambiguous and implies that field parameters may be measured on laboratory samples. Measurement of field parameters using laboratory samples is unacceptable.

24.* Revise the sentence on p. 6-17 which reads "Accurate records will be kept of all sampling activities and will include, at a minimum, the following information: date, time, location, sample identification code, depth to water measurement, method and volume of water evacuation and sampling technique" to read "Accurate records will be kept of all sampling activities and will include, at a minimum, the following information: date, time, location, weather conditions, tidal conditions, air temperature, sample identification code, depth to water measurement, depth to any immiscible layers, depth to bottom of well, method and volume of water evacuation and sampling technique" or draft a new sentence which conveys the equivalent information.

Section 7.0 Subsurface Gas Characterization

1.* Revise Section 7.0 and the Quality Assurance Project Plan to specify that the charcoal absorbent tubes used in the Petrex Soil Gas Sampling Tubes are precleaned and verified to be clean using Curie point desorption mass spectrometry; that trip blanks will be taken and analyzed; that field duplicates being collected and analyzed; and that matrix spikes are being added and analyzed to determine percent recoveries.

These quality control measures are needed to insure the validity of the data collected from Petrex Soil Gas Sampling Tubes.

2. Prepare an analysis of the effects of the clay cap at SWMU 8 (JILF) on the results obtained from the soil gas characterization to EPA and analyze what are the resultant limitations on use of the results. The results of this analysis must be included in the RFI Report.

Soil gas techniques are dependent on the movement of volatile organic species up through the overlying soil. Any limitation of this transport will limit the utility of these techniques. On p. 7-2 of the RFI Proposal it is stated that static soil gas collectors will not penetrate through the clay cap of SWMU 8.

An analysis of the effects of the clay cap was called for inclusion in the RFI Proposal in EPA's March 13, 1990 comment letter.

Based upon the information to be provided by the Navy a soil gas survey which penetrates the clay cap at SWMU 8 may be required or another means of evaluating subsurface gas conditions at SWMU 8 may have to be devised.

Section 8.0 Sediment Characterization

1.* Revise Section 8.0 to specify that all sediment samples will, at a minimum, be analyzed for TCL Organics, TAL Inorganics, other compounds found during Appendix IX Sampling, Total Organic Carbon, Grain Size, and Atterberg Limits.

EPA's March 13, 1990 comment letter cited the need for uniform sampling parameters.

2.* Revise Section 8.0 to specify that all surface water samples will, at a minimum, be analyzed for TCL Organics, TAL Inorganics, other compounds found during Appendix IX Sampling, and Field Parameters (pH, Temperature, Specific Conductance, Salinity, Turbidity).

EPA's March 13, 1990 comment letter cited the need for uniform sampling parameters.

3.* Revise Section 8.0 to specify that the following elements will be part of the surface water sampling plan developed for PNS:
a) At least one surface water sample for Appendix IX analysis will be collected from at least one of the storm drains and other outflows from the shipyard to the Piscataqua River. The location chosen should be one which drains a SWMU or is otherwise suspected of bearing contamination.
b) Surface water samples will be collected from all storm drains and other outflows from the shipyard to the Piscataqua River.
c) Data from storm drain sampling work will be used to calculate rates and amounts of contaminant loading from the shipyard to the Piscataqua River.
d) No fewer than six water samples will be collected from the main channel of the Piscataqua River and four samples from the back channel of the Piscataqua River to support a baseline risk assessment of conditions in the river.

4.* Revise Section 8.0 to specify that sediment samples from surface grabs and the top samples from cores will be withdrawn from the oxygenated layer of the sediment not from 0 to 4 inches.

The oxygenated layer probably represents the depth at which infaunal organisms rework the sediments and become exposed to contaminants. Sediment samples from a thicker section might dilute the contaminant signal in this active layer and might mask contamination of the sediment surface layer.

5. Prepare a map of the Piscataqua River for the RFI Report which covers the area marked on Attachment B and shows areas of sediment occurrence; and contours of sediment thickness in the areas where sediment deposits occur. The map must use the uniform 3-dimensional coordinate system for locational control. The map must be based on subbottom profiling techniques or on physical probing of the river bottom.

The survey limits specified in Attachment B are the limits of predicted concentrated suspended sediment dispersion during the 1978 dredging at PNS. If the results of sampling work show greater dispersion of contaminants from PNS, an expansion of these map limits is required.

6.* Revise Section 8.0 to include sampling of all areas of sediment occurrence within the area shown on Attachment A.

The frequency of sampling locations must be sufficient to enable the Navy to calculate the volume of sediment contaminated in excess of various potential media protection standards. Such volume estimates for key contaminants must be provided in the RFI based on sediment sampling.

Sample locations in areas of sediment occurrence must be spaced no greater than 1000 feet apart which means a minimum of one sample result should be obtained for every 1,000,000 square feet of sediment surface area. At all sample locations surface grabs and cores must be taken. Core samples should have samples for analysis withdrawn from the oxygenated layer and 4"-6" depth as well as the 10"-12" and 16"-18" depth provided for in the RFI Proposal.

The sampling area limits specified in Attachment B are the limits of predicted concentrated suspended sediment dispersion during the 1978 dredging at PNS. If the results of sampling work show greater dispersion of contaminants from PNS, an expansion of the sampling area is required.

The spacing of sample locations is the minimum felt needed to characterize the extent of contamination and the volume of contaminated sediments in the portion of the Piscataqua River near PNS in a preliminary manner. Future work in evaluating and designing corrective measures will likely require even more extensive sediment sampling work. The Navy should consider the potential need to expand the area and density of sampling in designing the execution of the work required above.

In the RFI Report use the data required above to provide a series of contour maps each of which displays known or inferred isocons of a specific contaminant in the sediments

of the waters around PNS. A map must be provided for at each contaminant found in any sediment sample at a value above the acute water quality criteria, and for indicator or total parameters if mapping of such indicator of total parameter depicts a pattern which provides site characterization summary information not evident from the other contaminant-specific contour maps. Each of the contour maps within this series shall:

a) include each data point at the proper map location accompanied with the numeric value associated with that point.

b) use the 3-dimensional coordinate system required in General Comment #2 for locational control.

c) cover at least all area of the open water delineated in Attachment A.

d) use contour intervals no greater than one order of magnitude and which span a range of concentrations from a minimum of the chronic water quality criteria or method detection limit, whichever is lower, to the maximum recorded value.

e) use all available new and historic sediment sampling results.

f) if a value if of questionable data validity , the value must be put on the map with a note explaining the reason for the questioned data validity and the basis for considering or not considering the value when drawing the isocon.

g) For contaminants found at depth prepare separate maps for each tested depth at which contaminants were found.)

In the RFI Report the data must also be used to provide the following information in tables and graphs as calculated from the information plotted on the series of isocon maps described above: (1) The estimated volume of sediment which exceeds each of the isocon values used on the associated contaminant-specific contour map; (2) The estimated area (footprint) of sediment which exceeds each of the isocon values used on the associated contaminant-specific contour map. These tables and graphs must

a) use concentration data intervals no greater than one order of magnitude and which span a range of concentrations from the minimum of the chronic water quality criteria or method detection limit, whichever is lower, to the maximum recorded value.

b) graph concentration vs. volume for each of the contaminants, indicators or total parameters included above.

c) graph concentration vs. area (footprint) for each of the contaminants, indicators or total parameters included above in the volume calculation.

d) explain what assumptions and methods are used in estimating the depth of sediments in the volume calculation.

Section 9.0 Tank Investigation

1.* Identify where and how soil samples and sediment samples for SWMU 26 (Portable Oil/Water Tanks) will be collected and how many soil and sediment samples will be collected.

The RFI Proposal states that soil samples for SWMU 26 will be taken without identifying the locations occupied by these portable tanks, the locations of known spills, or a rationale on how sample locations are being chosen.

Part II.A.8 of the HSWA Permit and EPA's March 13, 1990 comment letter both called for sediment samples to address numerous discharges from SWMU 26 to coastal waters. The current RFI Proposal still does not address SWMU 26.

2.* Remove the first paragraph on p. 9-3 and replace with a paragraph which reads "A full investigation of SWMU 12 shall be performed as proposed in Sections 9.2, 9.3, and 9.4 unless it is determined by EPA and ME DEP that SWMU 12 is not a SWMU. Historical information will be provided to EPA and ME DEP within 30 days of the initiation of the RFI investigation to allow them to review SWMU 12's status as a SWMU" or draft a new paragraph which conveys the equivalent information.

3.* Revise Section 9.3 of the RFI Proposal to specify that Appendix IX analyses will be conducted on the first round of sludge and free liquid samples from within SWMUs 12, 13, 16, 21, 23, and 26 and the first round of soil samples from beneath SWMUs 10, 11, 12, 13, 16, 21, 23, 26, and 27 unless submission to EPA and ME DEP of results from a thorough review of each tank including installation information, contents stored, processes the wastes were received from and tank closure information leads EPA and ME DEP to approve a more limited set of parameters for each of these SWMUs.

Any submissions from the Navy requesting more limited parameter lists for sampling of SWMUs 10, 11, 12, 13, 16, 21, 23, 26, or 27 must be accompanied by a justification of the parameters chosen and present a detailed argument as to why the requested parameter list is sufficiently extensive to detect any releases of hazardous waste and/or hazardous constituents from the SWMU of concern. Broad test parameters such as TPH are not chemical specific enough to support a PHERE and will require resampling of the SWMU if contamination of the SWMU is detected.

EPA will not accept any list of parameters for soil sampling and tank content sampling which does not include at least TCL Organics, TAL Inorganics, pH, Total Organic Carbon,

Grain size analyses, Atterberg limits, and water content for soil samples; and TCL Organics, TAL Inorganics, and Characteristic waste tests for tank contents. More limited parameter lists may be permissible at SWMU 12 (Boiler Blowdown Tank) and SWMU 27 (Fuel Oil Pipeline). Sampling for only TAL Metals, pH, and physical soil characteristics may be appropriate at SWMU 12. Sampling for TCL Organics may be appropriate at SWMU 27. For SWMU 12 the Navy must provide a list of all chemical additives (descalers, defoamers etc.) that have been used in the boiler(s) serviced by SWMU 12.

On p. 9-3 the RFI Proposal states that "A thorough review of each tank including installation information, contents stored, processes the wastes were received from and tank closure information will be performed," Such an analysis should have been performed for the RFI Proposal pursuant to Part II.A.1 of the HSWA Permit and used to justify the analysis parameters proposed in Table 9-1.

Section 4.2 of the RFI Proposal must also be modified to reflect this condition.

4.* Remove the sentence on p. 9-3 which reads "During the excavation--in a scheme acceptable to DEP and EPA--sampling of soil will be performed," and replace with the sentences "A scheme for the excavation and removal of underground storage tank SWMUs shall be developed and submitted to EPA and ME DEP for review within 30 days of the initiation of the RFI. During excavation soil sampling will be conducted" or draft new sentences which convey the equivalent information.

5.* Specify methods of soil sampling and analysis for SWMUs 13, 16, 21, and 23 which are consistent with methods being followed at SWMUs 6, 8, and 9 and provide sufficient representative sampling to confirm that soil remaining at the lateral and vertical limits of the excavation are free from contamination or to confirm that soil contamination remains at certain locations as a result of releases from these SWMUs.

The RFI Proposal does not specify soil sampling procedures for SWMUs 13, 16, 21, and 23. The soil sampling at these SWMUs must provide representative sampling on the bottom and sides of the excavation. Soil sampling at SWMUs 13, 16, 21, and 23 must be consistent with the sampling methods employed elsewhere at PNS to insure data comparability.

6.* Revise Section 9.3 to include methods for insuring that the limits of excavations made during tank removals will be

clearly delineated and that clean fill will remain seperated from in-situ materials.

Positive soil sampling results may require the re-excavation of underground storage tank SWMUs. Some method, such as lining the excavation with polyethelyne before backfilling will help insure that the clean fill will remain clean and will insure that the limits of the original excavation can be reexcavated.

7.* Remove the sentence on p. 9-4 which reads "The removal of the tanks and the concurrent sampling of the surrounding soil will preclude any tank testing and augering in advance of the removal of the tanks" and revise the RFI Proposal to include tank tightness tests for underground storage tank SWMUs which are to be removed from the ground.

The removal of an underground storage tank SWMU should not preclude the need to test the underground storage tank for leakage. All underground storage tank SWMUs which are still in the ground as of the date of this letter should undergo tightness testing before they are removed.

8.* Revise the sentence on p 9-5 which reads "In conjunction with the document review and waste sampling, tank tightness tests will be performed on USTs in compliance with EPA technical standards as outlined in 40 CFR 280, Subpart D, and appropriate State of Maine regulations" to read "In conjunction with the document review and waste sampling, tank tightness tests will be performed on SWMUs 12, 13, 16, 21, and 23 in compliance with EPA technical standards as outlined in 40 CFR 280, Subpart J, and appropriate State of Maine regulations" or draft a new sentence which conveys the equivalent information.

Section 10.0 Biota Characterization

1.* Remove the sentence on p. 10-3 which reads "The marine environment will include the portion of the Clark's Island cove adjacent to the Jamaica Island landfill; and the intertidal and subtidal area immediately adjacent to the DRMO" and replace with sentences which read "The marine environment will include all of the Piscataqua River in the vicinity of PNS. The upstream and downstream limits of biota characterization work will be determined from the sediment characterization study and will cover all areas where contaminated sediments from PNS have come to be located" or draft new sentences which convey the equivalent information.

The Navy itself has repeatedly cited their inability to fully design a biota characterization study at this time due to the unknown extent of sediment contamination in the Piscataqua River. The Navy should therefore not limit the area the biota characterization will address before detailed knowledge of the extent of sediment contamination in the Piscataqua River is generated.

Part II.A.10 of the HSWA Permit requires that the Navy design a biota characterization study which addresses the entire Piscataqua River in the vicinity of PNS.

2.* Add a sentence to the end of the 3rd paragraph on p. 10-3 which reads "Direct comparison of analytical results from previous studies and analytical results of the current RFI will only be possible if analytical methods used in the different studies are comparable" or draft a new sentence which conveys the equivalent information.

Direct quantitative comparisons between data sets can only be made when comparable sampling and analytical methods have been used.

Section 11.0 Quality Assurance Project Plan (Attachment A)

1.* Revise the QAPP to specify that all chemical analyses will follow EPA SW-846 3rd Edition with updates except for those analyses which are specified to follow Safe Drinking water Act methods in comment #2 below. Revise all portions of the text and all tables and figures as necessary to reflect this change.

The QAPP must specify analytical methods to be followed to insure comparable data is generated.

2.* Revise the QAPP to specify that resampling will occur for trace detections of Beryllium, Hexachlorobenzene, 1,1,2-trichloroethane, and Vinyl chloride. Specify that the new samples collected will be analyzed using Safe Drinking Water Act (SDWA)methods. Include the appropriate QA/QC information for these SDWA methods in the QAPP.

The detection limits for these substances using EPA SW-846 3rd Edition with updates analytical methods is above the limit needed to support the PHERE.

3.* Revise Table 3-1 of the QAPP to include precision, accuracy and completeness data for Appendix IX and PAH samples in solid and water matrices and Total Phenol samples in a solid matrix and delete precision, accuracy, and completeness information for Total Organic Carbon and Total Petroleum Hydrocarbons in a water matrix or specify what water matrix samples will be analyzed for Total Organic Carbon and Total Petroleum Hydrocarbons.

It is clear from the RFI Proposal and QAPP that samples will be analyzed for Appendix IX and PAH samples in solid and water matrices and Total Phenol samples in a solid matrix. It is also apparent that no Total Organic Carbon or Total Petroleum Hydrocarbon analyses will be performed on water matrix samples.

4.* Add a sentence to the end of the last paragraph on p. 6 of 7 in Section 3.0 which reads "There are limitations to the comparability of data from different studies when different sampling or analytical methods are used" or draft a new sentence which conveys the equivalent information.

Direct quantitative comparisons of data can only be made when the data being compared were generated from comparable sampling and analytical methods.

5.* Revise Section 4.0 of the QAPP to include sludge and free liquid sampling procedures and analytical methods for sludge

and free liquid samples to be taken from SWMUs 12, 13, 16, 21, 23, and 26.

6.* Revise section 4.0 of the QAPP to include aqueous, soil/sediment, sludge, and free liquid sample handling for Appendix IX samples and PAH.

7.* Revise Section 5.0 of the QAPP to include a section which documents that samples from PNS will be packaged, labelled and transported in conformance with all applicable federal, state, and local regulations.

8.* Revise the sentence on p. 1 of 5 in Section 5.0 which reads "Sample labels will be completed in waterproof ink" to read "Sample labels will be completed in indelible ink" or draft a new sentence which conveys the equivalent information.

9.* Revise the sentence on p. 3 of 5 in Section 5.0 which reads "Upon arrival at the laboratory, samples will be checked in by the laboratory representative and pH of samples preserved with acid will be checked and documented" to read "Upon arrival at the laboratory, samples will be checked in by the laboratory representative and cooler temperature and pH of samples preserved with acid will be checked and documented" or draft a new sentence which conveys the equivalent information.

Documentation of sample temperature during transportation is an important aspect of quality control.

10.* Remove the reference on p. 2 of 2 in Section 6.0 to the 17th Edition of Standard Methods for the Examination of Water and Wastewater and replace with a reference to the 16th Edition.

The EPA has not yet approved the 17th Edition of Standard Methods for the Examination of Water and Wastewater.

11.* Change the holding times for TCL Semi-volatiles and TCL Pesticide/PCB presented in Table 7-2.

The correct holding times for these parameters are 7 days from time of sample collection to the time of sample extraction and 40 days from the time of sample extraction to sample analysis in both soil/sediment and water.

12.* Provide references for Tables 7-3, 7-4, and 7-5.

The correct reference is the Contract Laboratory Program (CLP) 2/88 Organic Statement of Work (Organic SOW).

13.* Change the quantitation limit for 4-Nitrophenol presented in Table 7-4 to 50 ug/l.

14.* Provide a reference for Table 7-6.

The correct reference is the Contract Laboratory Program (CLP) 2/88 Inorganic Statement of Work (Inorganic SOW).

15.* Change the Contract Required Quantitation Limit for lead provided in Table 7-6 to 5 ug/l.

16.* Provide the analytical methods to which the detection limits presented in Table 7-7 apply.

17.* Change the detection limit for Total Phenols presented in Table 7-7 to 5 ug/l.

18.* Provide Tables similar to 7-3 through 7-7 for "RCRA Metals" and "Priority Pollutant Metals"

19.* Insert the words Region I in front of each of the Laboratory Data Validation, Functional Guideline references on p. 2 of 3 in Section 8.0.

20.* Provide tables similar to Tables 9-1 through 9-3 which will provide a summary of QA/QC samples for SWMUs 10, 11, 12, 13, 16, 21, 23, 26, and 27.

21.* Remove discrepancies between Section 12.0 and 8.0 regarding the versions of Laboratory Data Validation Functional Guidelines to be used in the RFI.

22.* Provide the source of methods presented in Appendix D of the QAPP. If these methods are not the same as those referenced in the text of the QAPP then remove them from the QAPP and replace with the appropriate material or provide the appropriate reference in the QAPP.

23.* Revise the QAPP and/or RFI Proposal as necessary to remove the following inconsistencies between the two documents: a) The QAPP does not indicate that TOC will be analyzed for SWMU 27 while the RFI Proposal does, b) Table 9-3 of the QAPP states that 17 surface soil samples will be collected at SWMU 6 while the RFI Proposal indicate states that 12 surface soil samples will be collected at this SWMU, c) the RFI Proposal states that grain size analyses will follow ASTM methods while the QAPP says that Resource Analyst Inc. Standard Operating Procedure QA-120.

Section 12.0 Data Management Plan

1. This section is approved without conditions.

Section 13.0 Health and Safety Plan (Attachment B)

1. No comments

Section 14.0 Project Monitoring Plan

1.* Revise the Project Management Plan to show when each of the phases discussed in the RFI Proposal shall occur, when the "Onshore RFI" will be completed, when the work plan for biota characterization, surface water characterization and other interim work plans will be submitted, when the "Offshore RFI" will be completed and when the RFI Report, PHERE and Media Protection Standards Proposal shall be submitted. This schedule must be consistent with the submittal of a RFI Report within eighteen (18) months of the start of the RFI.

The text of the RFI Proposal refers to "phases" which are not discussed in the Project Management Plan or shown in Fig 14-2. The Project Management Plan as currently written does not demonstrate that all portions of the RFI will be completed 18 months of the initiation of the RFI. It also does not provide much detail about when specific tasks will occur. Phasing of the RFI field work is acceptable as long as all conditions of the HSWA Permit, the RFI Proposal and this letter are fulfilled including submittal to EPA of a complete RFI Report within eighteen (18) months of the start of the RFI.

EPA's March 13, 1990 comment letter cited the need for all elements of the RFI to be completed within 18 months of the initiation of the RFI. The current Project Management Plan still does not demonstrate that this will be achieved.

2.* Remove the sentence on Fig. 14-2 which reads "The biota and surface water characterization will be submitted within eighteen months of the approved RFI."

This sentence is unclear in its meaning. The biota and surface water characterization reports are required as part of the RFI Report (see parts II.C.6 and II.C.8 of the HSWA Permit) which is due within eighteen months of approval of the RFI Proposal.

3.* Revise Fig 14-2 to show the project implementation schedule in calendar days not working days.

Compliance with the HSWA Permit schedule is calculated in calendar days not working days.

Appendices

1.* Resubmit the data presented in Appendix C in a form which is legible.

The tables of industrial waste sample results contained in Appendix C are illegible.

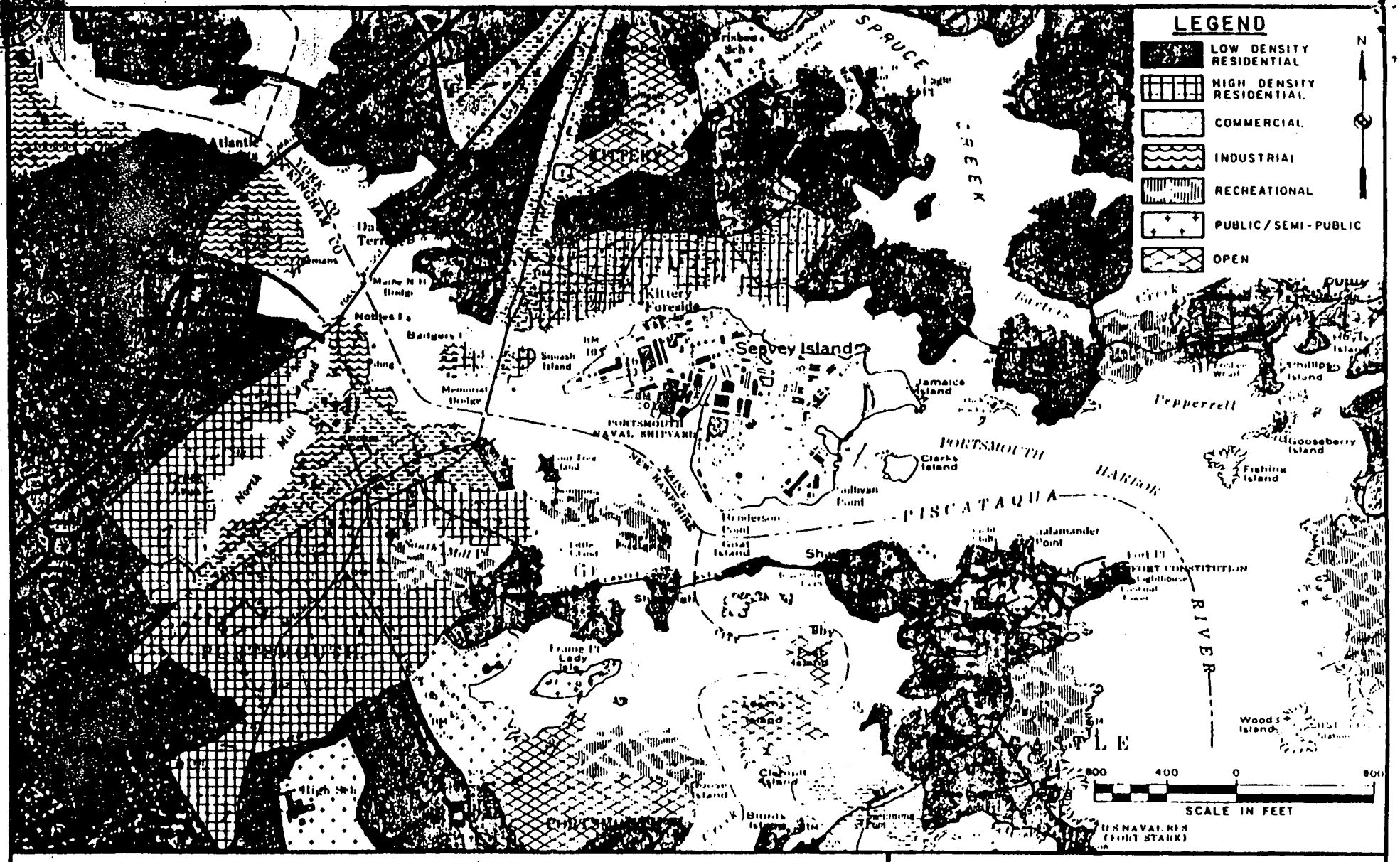


FIGURE 4-5

REGIONAL LAND USE

INITIAL ASSESSMENT STUDY
PORTSMOUTH NAVAL
SHIPYARD

ATTACHMENT B

APPENDIX II

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

February 7, 1991

Captain Thomas M. Hagge, CEC, USN
Public Works Officer
Portsmouth Naval Shipyard
Portsmouth, NH 03084

Re: Clarification and Modification of U.S. Environmental Protection Agency Approval with Conditions of the RCRA Facility Investigation (RFI) Proposal for Portsmouth Naval Shipyard (PNS).

Dear Captain Hagge:

Based upon the results of the January 29, 1991 meeting between representatives of the Navy and the Environmental Protection Agency the purpose of this letter is to provide information for the fulfillment of conditions set in our January 15, 1991 approval of the RFI Proposal and to formally modify several of those conditions.

Supplementary information is provided in Attachment A and modified conditions are provided in Attachment B. If you have any questions on this letter please call me or Ernest Waterman of my staff at (617) 223-5511.

Sincerely,

David Webster, Chief
ME, NH, & VT Waste Regulation Section

Enclosures

cc: Ken Finklestein, NOAA
Pamela Parker, ME DEP
Linda Resta, USN

PRINTED ON RECYCLED PAPER

ATTACHMENT A
Supplem ntary Information

On condition #8 for Section 1.0 EPA agreed to provide the Navy with applicable or relevant and appropriate requirements (ARARs) for setting detection limits for an air monitoring study of SWMU #8 (JILF). Information on ARARs for air monitoring studies is being collected and will be forwarded to the Navy as soon as possible.

On condition #12 for Section 1.0 of the RFI Proposal the spreadsheet software program Oracle is compatible with EPA software provided that the Oracle files are saved in an ASCII format. Submittal of data files stored on Dbase III is pr ferable.

On condition #2 for Section 7.0 of the RFI Proposal the Navy sought guidance on the analysis to be performed on the effects of the clay cap at SWMU #8 (JILF) on the results of the subsurfac gas survey conducted there. Because the meeting ended somewhat arly EPA was unable to respond to this need during the meeting. Our guidance to the Navy at this time is that a qualitative and/or quantitative analysis should be conducted as necessary to demonstrate that the objectives of the permit have been met.

ATTACHMENT B
Modified Conditions

Based on agreements reached at our January 29, 1991 meeting nine of the conditions set on the RFI Proposal are being modified. The modified conditions are presented below with underlining to show where new text has been written into the condition and empty brackets to show where text has been removed from the condition.

1. Condition #12 for Section 1.0 of the RFI Proposal shall now read:

   Prepare tables which present all of the <u>available</u> raw data collected in each of the previous investigations which hav occurred at or in the waters around PNS. These tables must specify methods of analyses used and detection limits of the analytical methods. QA/QC information on the data must also be included. The locations from which the samples were taken must be shown on accompanying maps and should be identified on the tables using the uniform 3-dimensional coordinate system required in General Comment #2. The data must be presented in a consistent format on a computer disk compatible with EPA software. The data should also be presented in a format which may be expanded as new data is generated. These tables must be presented in the RFI Report.

   <u>Also prepare a table which documents which raw data from previous studies is now missing or otherwise unrecoverable. This table must also be presented in the RFI Report.</u>

   As stated above, a clear knowledge of all sampling work which has occurred at PNS is essential for EPA and ME DEP.

2. Condition #15 for Section 1.0 of the RFI Proposal shall now read:

   Replace the trivalent chromium permissible concentration of 170 ug/l and hexavalent chromium permissible concentration of 50 ug/l presented on p. 1-68 [ ] <u>and</u> the lead permissible concentration of 50 ug/l presented on page 1-69 with [ ] <u>current Safe Drinking Water Act Maximum Contaminant Levels and Clean Water Act Ambient Water Quality Criteria. Revise the text of the RFI Proposal to explain the meaning of these criteria.</u>

3. Condition #1 for Section 4.0 of the RFI Proposal shall now read:

Revise Section 4.0 to specify that all soil samples, xc pt for underground storage tank related soil samples, will, at a minimum, be analyzed for TCL Organics, TAL Inorganics, compounds found during Appendix IX Sampling, pH, and Total Organic Carbon [ ]. Specify also that representative Grain Size data will be collected for each critical stratigraphic unit in each SWMU.

Consistency in sample results and the need to insure that comprehensive sampling occurs is an important facet of the RFI.

The need for more uniform soil sampling parameters was cited in EPA's March 13, 1990 comment letter.

Analysis parameters for underground storage tank related SWMUs are presented in EPA's comments on Section 9.0 (Tank Investigations).

4. Condition #6 for Section 4.0 of the RFI Proposal shall now read:

Revise Section 4.0 to specify that all surface soil [ ] sampling locations will include both shallow soil (0-3 inches and deeper soil (at approximately 12 inches deep) if obtainable. An acceptable approach is to obtain for analysis one composite sample taken from 0-3 inches and a second composite sample from 15-18 inches (or the deepest three inch interval less than 15-18 inches which is obtainable) at each surface soil sample location. Specify how the results from these samples will be used in the Public Health and Environmental Risk Assessment (PHERE).

[ ].

5. Condition #19 for Section 6.0 of the RFI Proposal shall now read:

Revise the sentence on p. 6-15 which reads "Water level measurements will be obtained with a factory calibrated electronic water level indicator (Model 3000 T-L-C meter) or a steel measuring tape to the nearest 0.01 of a foot and converted to common datum" to read "Water level measurements will be obtained with a factory calibrated electronic water level indicator (Model 3000 T-L-C meter) or a steel measuring tape to the nearest 0.01 of a foot and converted to Mean Sea Level from a known benchmark" or draft a new sentence which conveys the equivalent information. The benchmark for water level measurements should be the same as

th t used as the basis for the 3-dim nsional coordinate system required in General Comment #2.

[ ].

The location of PNS in Great Bay Estuary suggests that Mean Sea Level should be used as a datum to set all ground water level measurements against.

6. Condition #1 for Section 8.0 of the RFI Proposal shall now read:

Revise Section 8.0 to specify that all sediment samples will, at a minimum, be analyzed for TCL Organics, TAL Inorganics, other compounds found during Appendix IX Sampling, Total Organic Carbon, and Grain Size [ ].

EPA's March 13, 1990 comment letter cited the need for uniform sampling parameters.

(N te; EPA still encourages the collection of Atterberg limit data which may be useful in the design of corrective measures involving dredging.)

7. Condition #3 for Section 8.0 of the RFI Proposal shall now read:

Revise Section 8.0 to specify that the following elements will be part of the surface water sampling plan develop d for PNS:
a) At least one surface water sample for Appendix IX analysis will be collected from at least one of the storm drains and other outflows from the shipyard to the Piscataqua River which receive runoff from any of the SWMUs at the shipyard. [ ].
b) Surface water samples will be collected from all storm drains and other outflows from the shipyard to the Piscataqua River which receive runoff from any of the SWMUs at the shipyard.
c) Data from storm drain sampling work will be used to calculate rates and amounts of contaminant loading from the SWMUs [ ] to the Piscataqua River.
d) No fewer than six water samples will be collected from the main channel of the Piscataqua River and four samples from the back channel of the Piscataqua River to support a baseline risk assessment of conditions in the river.

(Note; EPA encourages the collection of data from all storm drains and other outflows as this data will be useful in obtaining a more global characterization of the shipyard and would be essential in the selection of Alternate Contamination Levels during the setting of Media Protection Standards.)

8. Condition #3 for Section 9.0 of the RFI Proposal shall now read:

Revise Section 9.3 of the RFI Proposal to specify that Appendix IX analyses will be conducted on the first round of sludge and free liquid samples from within SWMUs 12, 13, 16, 21, 23, and 26 and the first round of soil samples from beneath SWMUs 10, 11, 12, 13, 16, 21, 23, 26, and 27 unless submission to EPA and ME DEP of results from a thorough review of each tank including installation information, contents stored, processes the wastes were received from and tank closure information leads EPA and ME DEP to approve a more limited set of parameters for each of these SWMUs. Tank contents from underground storage tank SWMUs which show no evidence of leakage (including visual inspection during removal) may undergo characteristic waste tests instead of Appendix IX analyses.

Any submissions from the Navy requesting more limited parameter lists for sampling of SWMUs 10, 11, 12, 13, 16, 21, 23, 26, or 27 must be accompanied by a justification of the parameters chosen and present a detailed argument as to why the requested parameter list is sufficiently extensiv to detect any releases of hazardous waste and/or hazardous constituents from the SWMU of concern. Broad test parameters such as TPH are not chemical specific enough to support a PHERE and will require resampling of the SWMU if contamination of the SWMU is detected.

EPA will not accept any list of parameters for soil sampling and tank content sampling which does not include at least TCL Organics, TAL Inorganics, pH, Total Organic Carbon, Grain size analyses, Atterberg limits, and water content for soil samples; and TCL Organics, TAL Inorganics, and Characteristic waste tests for tank contents. More limited parameter lists may be permissible at SWMU 12 (Boiler Blowdown Tank) and SWMU 27 (Fuel Oil Pipeline). Sampling for only TAL Metals, pH, and physical soil characteristics may be appropriate at SWMU 12. Sampling for [ ] TPH, PAHs and Petroleum I.D. analyses may be appropriate at SWMU 27 provided that a review of the history of SWMU 27 and the results of petroleum I.D. tests both indicate that only #6 fuel oil is present at SWMU 27. For SWMU 12 the Navy must provide a list of all chemical additives (descalers, defoamers etc.) that have been used in the boiler(s) serviced by SWMU 12.

On p. 9-3 the RFI Proposal states that "A thorough review of each tank including installation information, contents stored, processes the wastes were received from and tank closure information will be performed," Such an analysis should have been performed for the RFI Proposal pursuant t

Part II.A.1 of the HSWA Permit and us d to justify the analysis parameters proposed in Table 9-1.

Section 4.2 of the RFI Proposal must also be modified to reflect this condition.

9. Condition #7 for Section 9.0 of the RFI Proposal stands deleted.

10. Condition #2 for Section 11.0 may be fulfilled by the use of Method 8024 modified to use a 25 ml purge volume instead of a 5 ml purge volume provided that a Method Detection Limit Test shows that the modified method reaches detection limits below the applicable Maximum Contaminant Level for each of the constituents listed in condition #2.