

10/20/1992

PORTSMOUTH NAVAL SHIPYARD
INSTALLATION RESTORATION CORRECTIVE ACTION

PUBLIC WORKSHOP SUMMARY

A public workshop was held on Tuesday October 20, 1992, at the Traip Academy in Kittery, Maine at 7:30 pm. The workshop was held to provide the public information and gain their input regarding the on-going hazardous waste investigations at the Portsmouth Naval Shipyard. This summary presents information provided to the public and briefly reviews the questions and issues raised at the workshop.

Acting as the moderator, David Foster (Principal at the Horace Mitchell School) opened the workshop welcoming everyone. David explained that the purpose of the workshop was to present the draft Resource Conservation and Recovery Act (RCRA) Facility Investigation Report (RFIR), also called the onshore report. The onshore report has been developed for the Portsmouth Naval Shipyard in cooperation with the Naval Facilities Engineering Command (NAVFAC), the Environmental Protection Agency (EPA), and the Maine Department of Environmental Protection (MEDEP). Ground rules for the meeting were established prior to introducing the speakers.

Rear Admiral Select Felton, the Portsmouth Naval Shipyard Base Commander, reiterated the purpose of the workshop and stated that the Shipyard is continuing to provide open communication with the community, and to be proactive in the environmental community.

The second speaker, Ernest Waterman, EPA Region I Project Manager, has been involved with the Shipyard's investigations for the past two years. He explained that the role of EPA is to provide oversight and approval of the Navy's work throughout the RCRA investigation. His presentation provided an overview of the RCRA Corrective Action permit and identified where the Portsmouth Naval Shipyard is in the process. Currently the onshore report and Human Health Risk Assessment are under review at EPA and MDEP. Upon approval of the onshore report, the process will continue with the Corrective Measures Study. Mr. Waterman closed his presentation with a brief overview of the roles of all the agencies involved in the process as well as the role of the Technical Review Committee.

The third speaker, Mark Hyland (Federal Facilities Division Director from the MEDEP), explained the state's role in the investigation as follows:

- Assist in developing work plans and selecting cleanup remedies
- Review all documents and data, and perform independent sample testing to confirm the Shipyard's results
- Advise EPA and the Shipyard of the compliance requirements of state laws and regulations

- Conduct inspections throughout the investigation
- Enforce cleanup standards and deadlines

The fourth speaker, Mike Pedersen of the Shipyard's Environmental Division, provided a brief history on the completed RCRA investigations and the sites under investigation. In June 1983, an Initial Assessment Study (IAS) was completed. The IAS identified 28 sites that could potentially pose a threat to human health and the environment from past waste management practices. These sites are called Solid Waste Management Units (SWMUs).

After further investigation, EPA concluded that only 13 of the original 28 SWMUs required further studies. In 1989 EPA issued a Corrective Action Permit which outlined the requirements of the Shipyard's continuing investigation.

Along with the onshore study, the Navy proposed an off-shore study which was much more comprehensive than what EPA originally requested. This study is considered necessary to characterize the delicate estuary and how the estuary is interrelated with the Shipyard.

The presentation then described each of the Solid Waste Management Units (or SWMUs) under investigation, listed below:

- SWMU #5- Outfalls discharged storm water and industrial wastes to the Piscataqua River before installation of the Industrial Wastewater Treatment Plant in 1975.
- SWMU #6- The Defense Reutilization and Marketing Office Storage Yard (DRMO) was used to store batteries and other scrap materials. Operations at the storage yard have been changed to control releases of contaminants to the soil, air and river. The storage yard is partially vegetated and fenced.
- SWMU #8- The Jamaica Island landfill (JILF), now closed, contains primarily general refuse and construction debris along with some wastes that would now be classified as hazardous.
- SWMU #9- The Mercury Burial Sites are two locations of buried concrete blocks within the JILF that contain mercury contaminated waste. One of the areas (the oldest) has been excavated and sampled and the blocks are known to be intact.
- SWMU #10,11,12,13,16,21,23-
The tank units consist of underground waste oil storage tanks, a battery acid tank, a water blowdown tank and a collection of rinsewater tanks. Only the water blowdown

tank remains in service. The other nine tanks have been removed as interim corrective measures undertaken primarily at the Navy's initiative.

SWMU #26- Portable oil/water tanks stationed at berths and dry docks used to temporarily store bilge water and oily wastes.

SWMU #27- Underground piping associated with the Shipyard's fuel tank farm and distribution system leaked #6 Bunker "C" oil through a ruptured pipe. The pipeline was immediately removed, and soil remaining in the trench area has been investigated. A comprehensive study of fuel farm geology and groundwater will be done in 1993.

The main speaker, Jim Tayon of the Shipyard's Environmental Division, provided the presentation of the onshore report (RFIR). The three key messages from the onshore report were presented as follows:

Key Message #1: THE ONSHORE STUDY IDENTIFIES AREAS TO BE CLEANED-UP

The Navy's conclusions from the onshore report are that contaminants are generally staying within the Shipyard boundaries. The Navy has not identified any immediate health threats resulting from the contamination.

Analytical results of the onshore investigation show that chemicals detected included heavy metals, organic compounds (volatile and semi-volatile), pesticides and PCBs and the SWMUs where the chemicals were detected are the JILF (SWMU #8), the DRMO Storage Yard (SWMU #6) and the Fuel Oil Spillage Area (SWMU #27).

The studies that were performed for the investigation included:

- Water background samples were taken, and 54 monitoring wells were installed for sampling groundwater to identify contaminants and understand groundwater flow. The Navy is currently finding groundwater upwelling (water flowing up), which generally inhibits the groundwater contaminants from migrating down.
- Deep soil borings (21) were dug to sample the soil.
- Shallow groundwater samples were also taken.
- Geophysical studies that have been conducted include magnetometry, metal detection and seismic studies to determine depth of the bedrock and the nature of landfilled materials.

- A comprehensive air monitoring program is also being conducted, and soil gasses were profiled.

The results of these studies were evaluated and provide the basis for identifying which sites may require further remediation.

Key Message #2: THE NAVY IS PURSUING AN AGGRESSIVE CORRECTIVE MEASURE SCHEDULE

What has been done already?

- A total of 9 tanks were removed from service and pulled out of the ground.
- The Navy completed an interim risk assessment at the Child Development Center and Quarters S, N, and 68 because of their close proximity to the DRMO storage yard. There were no undo risks found.

Future activities for 1993 were identified and discussed. These are:

- A cap (clay barrier) will be constructed at the DRMO storage yard, SWMU 6, in Spring, 1993. This will prevent rain infiltration, reduce soil runoff to the nearby river, and reduce airborne contaminants.
- Other areas targeted by the Navy for priority corrective measures in 1993 include: 1) The western tip of the JILF, SWMU 8, where petroleum was found in a monitoring well, 2) The location at SWMU 27 where the pipeline was pulled out of the ground. 3) and an area near SWMU 11 where some soil contamination exists.

The Shipyard will be performing an additional investigation in 1993 of the geology and groundwater under the tank farm near SWMU 27 for both the licensing process of the fuel farm with the State and for the RCRA permit.

Long range activities beyond 1993 were also discussed, including:

- Phase II of the off-shore study will be completed in 1993.
- The onshore Public Health Evaluation Risk Assessment is currently being reviewed by EPA and MDEP.
- A Media Protection Standards document has been prepared and proposes to set standards to protect the air, sediment, groundwater, and soils. The proposal is currently under review

by EPA and MDEP.

- The Corrective Measures Study is being prepared to evaluate potential corrective measures for the SWMUs that require remediation.
- A decision document will be developed to incorporate all of the above documents and provide a comprehensive overview of the study findings.

Key Message #3: THE ONSHORE REPORT PLUS THE OFF-SHORE STUDIES TOGETHER PROVIDE A COMPLETE ENVIRONMENTAL PICTURE.

1) The onshore and the off-shore report, when considered together, will be used to identify the most appropriate and best corrective action(s); 2) The draft onshore report is completed and is being reviewed by EPA and the State; 3) There is no indication of large migration offsite; and 4) No immediate hazards have been identified by the Shipyard.

The last speaker, Bob Johnston (from the Naval Command Control and Ocean Surveillance Center), presented information on the status and findings to date of the off-shore study.

Bob Johnston explained that the team effort to complete this study included: The University of New Hampshire (UNH), UNH Jackson Estuarine Laboratory, the Naval Command, Control and Ocean Surveillance Center, San Diego, CA; and the US Environmental Research Laboratory, Narragansett, RI.

This off-shore study has been broken down into two phases to assess the potential environmental effects from past, present and future releases from the Shipyard to the estuary. Phase I began in September 1991 and is 90% complete. Phase I will determine if there is evidence that the Shipyard contaminants are currently impacting the estuary. Phase II which began in July 1992 and will be completed by January 1994, serves to verify and evaluate any evidence of past releases and to predict any future impacts.

Samples are being collected in the Great Bay and Little Bay, Piscataqua River, Spruce Creek and other tributaries. Preliminary results show that chemical contamination levels in Portsmouth Harbor are relatively low, and that lobsters and flounder contain only low amounts of chemical contamination. The estuary's water quality is very good compared to other waterbodies associated with urban and industrial areas. However, indications of ecological stress have been measured at various locations in the lower estuary. These results, and how they will be applied to determine appropriate corrective actions for the Shipyard, are being evaluated.

Bob stated that The Ecology of the Great Bay Estuary, New Hampshire and Maine: An Estuarine Profile and Bibliography has been prepared

by UNH. This report provides a historical overview of the ecology of the Great Bay Estuary, and will be available in the information repositories.

In summary, the off-shore study provides information on:

- 1) The fate of chemical contaminants released
- 2) The effects of chemical contaminants that are present
- 3) Potential accumulation in the food chain, and
- 4) The overall impact of contamination on the ecology of the estuary

QUESTIONS AND ANSWERS

The following section summarizes the questions asked by members of the public relating to hazardous waste and the Installation Restoration Program and the responses provided by the speakers previously mentioned as well as Steve Urschel, Project Manager of McLaren Hart, and Dr. Eileen Mahoney, Senior Toxicologist of Mahoney Associates.

The question and answers have been rephrased or condensed into broad categories for ease of reading:

- 1) **The presentation identified the analysis of lobster and flounder but what about the analysis and results of mussels and clams?**

Answer: A combination of mussels, lobsters, oysters and fish have been sampled. To date no major differences have been found between the sampling stations and only low amounts of contaminants have been found. Clams have not been sampled yet; they will be sampled in the next phase of the off-shore investigation.

- 2) **Is the migration of the contaminants going offsite. If so, where are the contaminants going? To what extent are the contaminants becoming airborne?**

Answer: It was reiterated that no wide scale migration of contaminants are going offsite. Air monitoring is showing little or no releases of air borne contaminants.

- 4) **What is the direction of the groundwater flow?**

Answer: The Shipyard is finding the groundwater is upwelling instead of going downward. This provides a natural resistance to downward movement of the contaminants. The flow is toward the river as is seen in the constant outflow from the 2 interconnected fresh water ponds.

- 5) **Why was the risk assessment conducted at the Child Development Center (CDC), how was it performed, and what were the results? Is the report in the repository?**

Answer: The risk assessment was voluntarily conducted by the Navy because of the Center's proximity to the JILF landfill. It was performed by following the EPA guidance/modeling procedures for risk assessments, using the worse case scenario of children eating the soil. The results from the risk assessment showed that there were no risks to the children or workers at the CDC. The report is not in the repository, but can be reviewed upon request from Jim Tayon.

6) What type of cleanup is being proposed and on what schedule?

Answer: The type of cleanup method is unknown now but will be specific. Preliminarily sites could possibly be contained by capping, using a pump and treat system for the groundwater, employing bioremediation (bacteria that eat the contaminants) or other innovative techniques. While interim corrective actions are being considered, these cleanup alternatives will not be formally looked at until the end of 1993.

7) How is the credibility of the independent certified laboratory used to analyze environmental samples?

Answer: It was explained that the samples taken for this investigation are sent for analyses to a certified laboratory. In addition, samples are split with the MDEP and EPA for periodic independent analysis and verification. This as well as other means provide a "check and balance" on the Navy's certified laboratory.

8) Are there any plans to establish stations further up in the Great Bay Estuary? Do we feel that contaminants are being carried away from the Shipyard? What other types of analysis are being done to determine other sources that could be contaminating the estuary?

Answer: There are 22 sampling stations throughout the Great Bay Estuary, up the Piscataqua River, and the Little Bay. If contaminants are being carried away from the Shipyard they are being diluted. To determine other possible sources, "chemical markers" are searched for throughout the investigation process. These chemicals tend to be very persistent in the environment, and can help to identify the specific source of the chemical. Examples of chemical markers include markers for sewage, or a certain chemical produced by tire wear which indicates an urban environment.

9) Members of the public expressed concerns about sweeping generalizations that there is no migration off the Shipyard, no immediate health risk or air release?

Answer: The reports that have been completed support the statement

that, currently, the Navy is not finding wide scale migration of contaminants or air releases from the Shipyard. The risk assessment document identifies no immediate health concerns. This is the Navy's conclusion, and EPA and MEDEP cannot support nor disapprove this conclusion because they are currently reviewing the reports.

10) How is radioactive waste addressed in this investigation?

Answer: This investigation, being conducted under the Resource Conservation Recovery Act (RCRA), which specifically excludes source, special nuclear and byproduct radioactive materials from its regulation. Radioactive wastes are not part of this current investigation. Radioactive wastes are highly controlled by the Naval Nuclear Propulsion Program, and the Shipyard follows those requirements. Since nuclear operations began in 1958, there has been no radioactive waste buried on the Shipyard. Even though radioactive waste is not part of the RCRA investigation, contractors, the EPA and the MEDEP did (and still do) screen for potential radioactive contamination. No increase of radioactivity above normal background levels has been detected.

11) What is the difference between cleanup vs. containment and how is the determination made which sites get cleaned up vs. contained? and will there be any future building on the JILF?

Answer: Sometimes the best corrective measure is to contain the area, to keep chemical contamination from spreading. Areas such as the JILF will probably be contained. Even though some soil might be removed, overall the site will be contained to prevent any migration now or in the future. The MEDEP stated that no buildings are allowed to be placed on landfills.

13) There is concern that the Navy is pursuing quick fixes by capping the DRMO.

Answer: Capping the DRMO is an interim cleanup measure to mitigate any releases from the DRMO. The final cleanup measure is unknown.

The workshop was adjourned by stating that if anyone had any further questions or comments to please call Jim Tayon at (207) 438-3832, or Mike Pedersen at extension 5140. Also if anyone would like to read the draft onshore report, or any other reports from the investigation, they are available in the informational repositories in the Kittery and Portsmouth Public Libraries. The material is categorized in hanging file folders and table of contents makes the material user friendly.

WORKSHIOP AGENDA

Traip Academy, Kittery, Maine

October 20, 1992

Meeting Opening	David Foster, Moderator
Introduction	Admiral Felton, Portsmouth Naval Shipyard
EPA's Role and Permit Status	Ernest Waterman, EPA
Maine DEP's Role	Mark Hyland, MDEP
History of Shipyard Operations	Mike Pedersen, Portsmouth Naval Shipyard
Recognition of Guests, Status of Onshore Investigation	Jim Tayon, Portsmouth Naval Shipyard
Status and Findings of Offshore Investigation	Robert Johnston, NCCOSC
Open Question/Answer Period	

**Key Message #1:
Onshore Study Identifies
Areas to be Cleaned Up**

- **Contaminants generally contained under island**
- **Chemical migration offsite is minimal**
- **Documents under review by EPA and DEP**
- **No immediate health concerns**

Method of Investigation

- **Background samples**
- **Groundwater (54 Monitoring Wells Sampled)**
 - **Evaluate ability to pass water through soils to groundwater**
 - **Assess groundwater quality**
 - **Identify contaminants**
 - **Determine flow direction (upward, toward river)**
- **Soil (21 Deep Borings)**
- **Soil Gases**

Method of Investigation (Cont.)

- **Surface samples to identify contaminants**
- **Subsurface investigations to characterize geology and nature of landfilled material**
 - **Magnetic**
 - **Metallic**
 - **Ground penetrating radar**
 - **Seismic refraction studies**
- **Air**
 - **Comprehensive air monitoring program**
- **Offshore**
 - **Limited sampling of seeps/sediments**

Following Chemicals Were Detected:

- **Heavy Metals (Examples: lead, arsenic)**
 - Generally not mobile; found primarily in soils
- **Organic Compounds (Examples: gas, oil, solvents, acetone)**
 - Both volatile and semi-volatile
- **Pesticides (Examples: DDT)**
 - Widespread, very low concentrations
 - Probably resulting from past application practices
- **PCBs**
 - Very low concentrations
 - May have been in oils mixed with pesticides

Common Contaminants Found at the Main SWMUs

SWMU	VOC	SVOC	Pesti- cides	PCBs	Metals	TPH	Visual Contam.
Jamaica Island Landfill							
Soil	●	●		●	●		
Ground Water	●	●		●	●		●
Surface Water/Sediment							
Air	●				●		
DRMO Storage Yard							
Soil		●	●	●	●	●	
Ground Water				●	●		
Surface Water/Sediment				●	●		
Air					●		
Fuel Oil Spillage Area							
Soil						●	●
Groundwater					●		●
Surface Water/Sediment							
Air							
PORTSMOUTH NAVAL SHIPYARD							

JAMAICA ISLAND LANDFILL

(Contaminants by Media)

SOILS

METALS (Lead)

PCBs

VOCs (Volatile Organic Compounds)

GROUNDWATER

METALS (Arsenic, Beryllium, Cadmium, Chromium, Lead, Mercury, Nickel)

PCBs

Semi-Volatile Organic Compounds

VOCs (Benzene, Perchloroethylene (PCE), Trichloroethylene (TCE), and Vinyl Chloride)

AIR

METALS (Arsenic, Cadmium, Chromium VI, Nickel)

VOCs (Low concentrations of Trichloroethylene (TCE), and Benzene)

DRMO STORAGE YARD

(Contaminants by Media)

SOIL

METALS (Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Zinc)

PCBs

Pesticides

Semi-Volatile Organic Compounds

Total Petroleum Hydrocarbons

GROUNDWATER

METALS (Arsenic, Beryllium, Cadmium, Chromium, Lead, Mercury)

PCBs

AIR

METALS (Arsenic, Cadmium)

FUEL OIL SPILLAGE AREA

(Contaminants by Media)

SOIL

Total Petroleum Hydrocarbons (#2 and #6 Fuel Oil and Transmission Fluid)

GROUNDWATER

METALS (Arsenic, Beryllium, Cadmium, Chromium, Lead, Mercury, Nickel)

VOCs (Low concentrations of Trichloroethylene (TCE))

Key Message #2:
**We Are Pursuing an Aggressive
Approach to Corrective Measures**

- **Some corrective measures already completed**
- **Near-term plans identified (1993)**
- **Long-range activities being developed**

What Have We Done Already?

- **Pulled nine tanks and sampled areas around tanks; no immediate action needed**
- **Performed risk assessment at CDC, Quarters S, N, and 68 revealing no excessive risks to human health**
- **Phase I data collected for off shore risk assessment; Phase II proceeding**

In 1993

- **Cap DRMO storage yard**
 - **Clay/gravel barrier being designed**
 - **Will limit soil erosion to river, air-borne particles, infiltration to groundwater**
 - **Interim measure, other measures may be considered in the future**
- **Address petroleum at fuel oil spill area**
- **Address petroleum at west end of JILF**

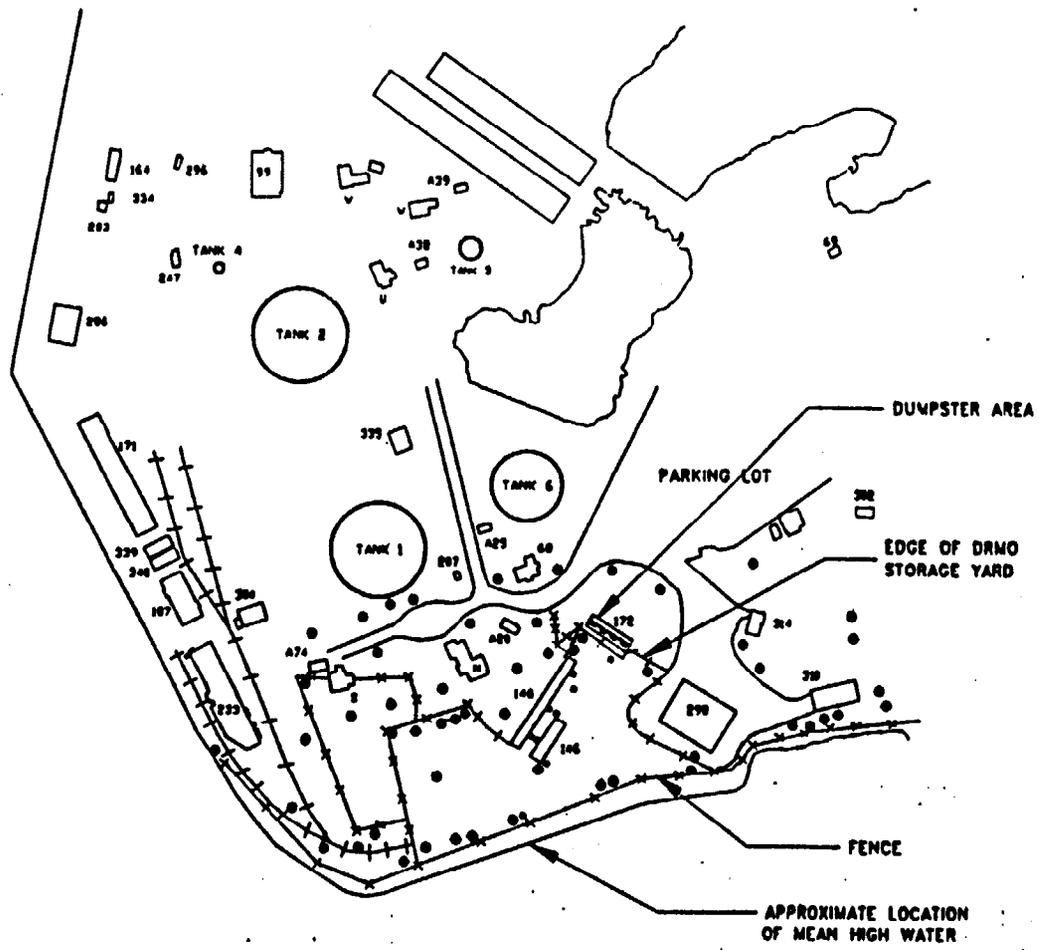
Future Activities

Future Activities	Status
Phase II off shore study	Underway
Public Health and Environmental Risk Evaluation (onshore portion)	EPA/DEP Review
Corrective measures study	Coordinating with EPA/DEP
Media protection standards (onshore portion)	EPA/DEP Review
Decision document	To Be Developed

Key Message #3:

Onshore Studies Plus Estuary Studies Together Make a Complete Report

- **Land:**
 - **Draft report in hand, results presented this evening**
 - **Contaminants are generally staying in place**
 - **No immediate hazard**
- **River:**
 - **Study well underway**
 - **Preliminary results completed**
 - **River is relatively clean**
 - **Continuing to look at impact of tidal flushing**
- **Both studies will be used to determine most appropriate long-term actions**



PISCATAQUA RIVER



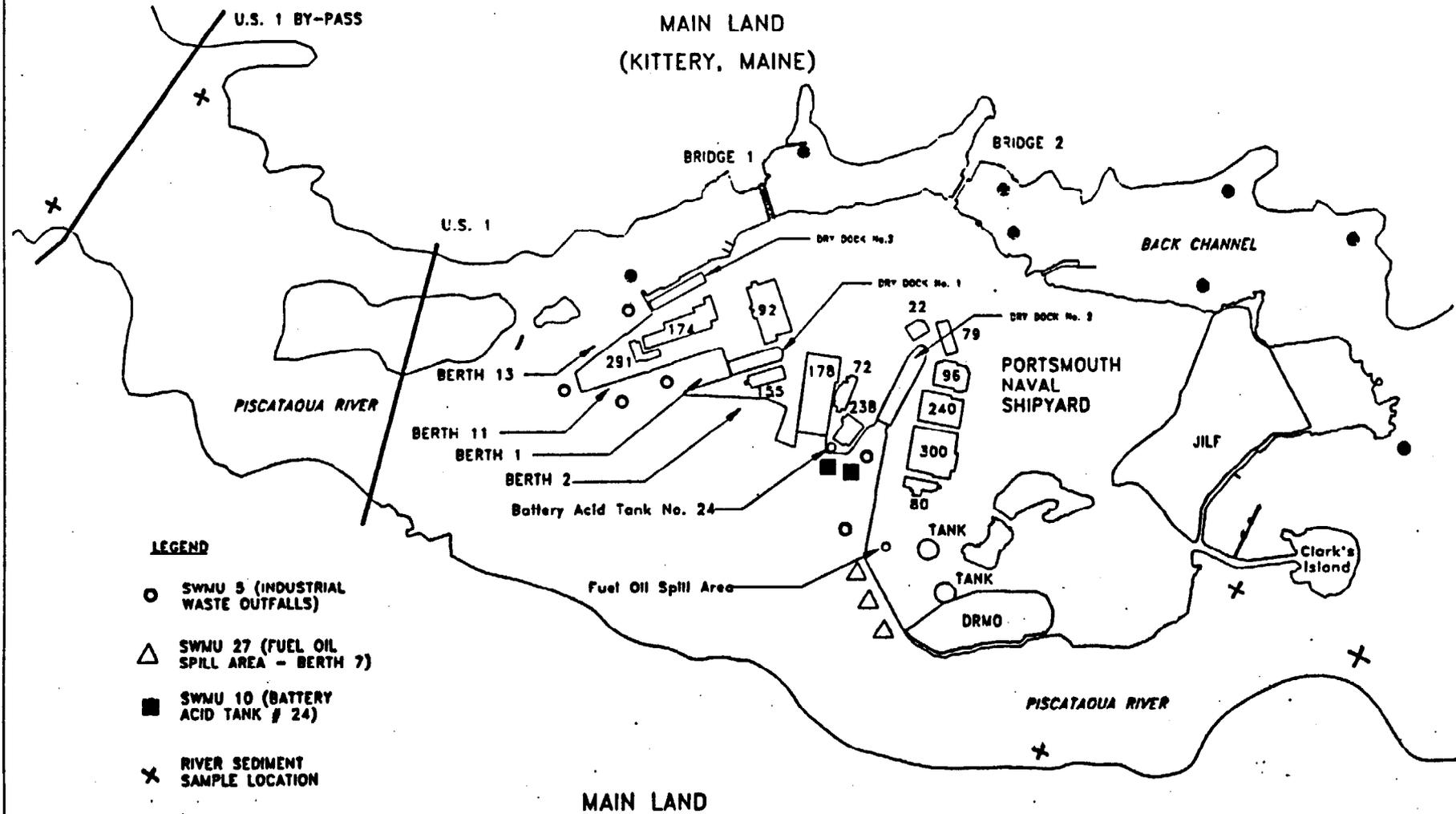
- ◆ TEST BORING/MONITORING WELL LOCATIONS
- ▣ CATCH BASIN LOCATIONS
- ⊙ SURFACE SOIL SAMPLE LOCATIONS



DRMO (SWMU #6)
 SAMPLING LOCATIONS
 ALONG THE
 300 FOOT ARC

Portsmouth Naval Shipyard

MAIN LAND
(KITTERY, MAINE)



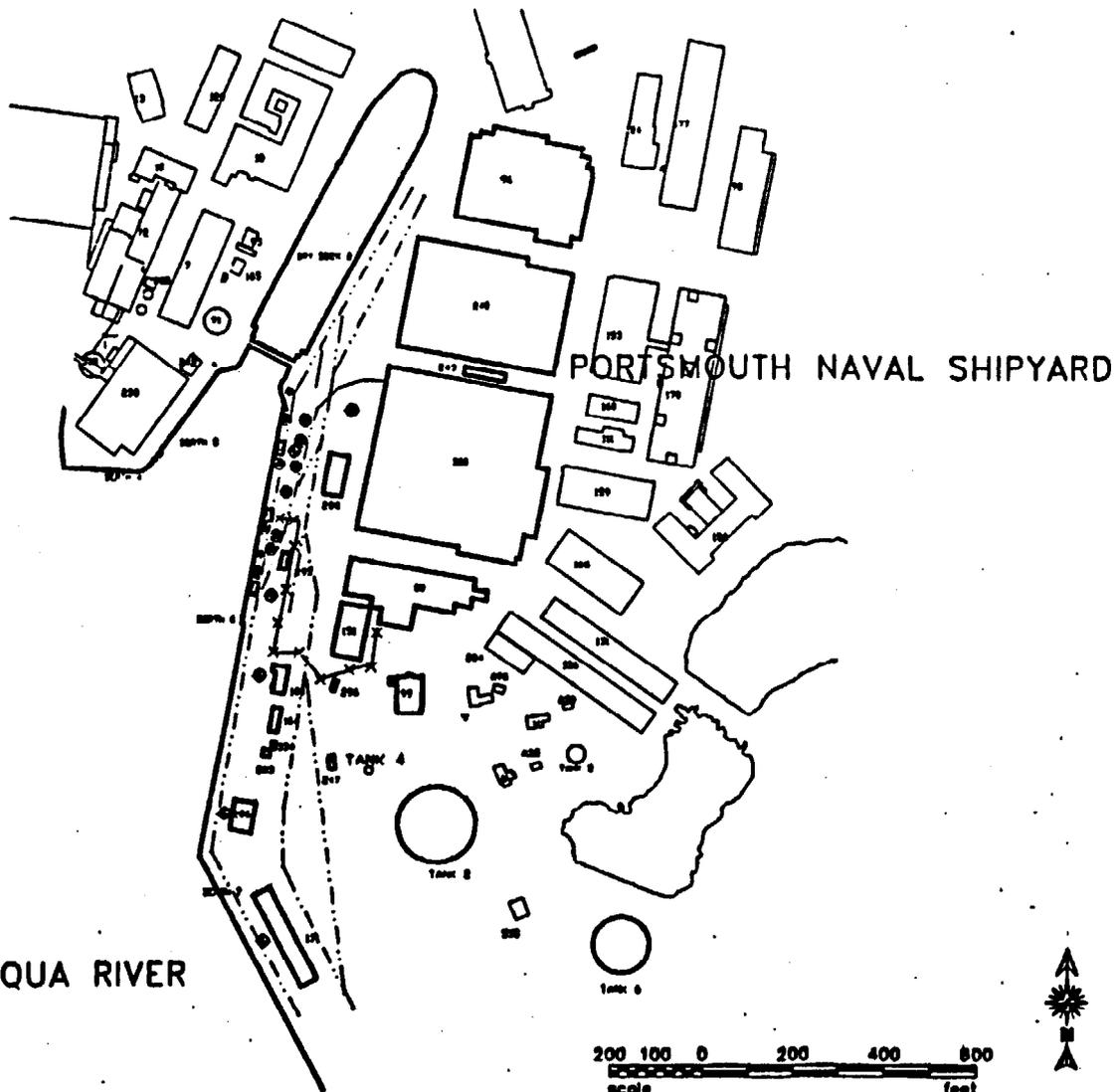
LEGEND

- SWMU 9 (INDUSTRIAL WASTE OUTFALLS)
- △ SWMU 27 (FUEL OIL SPILL AREA - BERTH 7)
- SWMU 10 (BATTERY ACID TANK # 24)
- ✕ RIVER SEDIMENT SAMPLE LOCATION
- BACK CHANNEL SEDIMENT SAMPLE LOCATION

OFF SHORE SAMPLING
RIVER AND BACK
CHANNEL SEDIMENT
SAMPLING LOCATIONS

Portsmouth Naval Shipyard





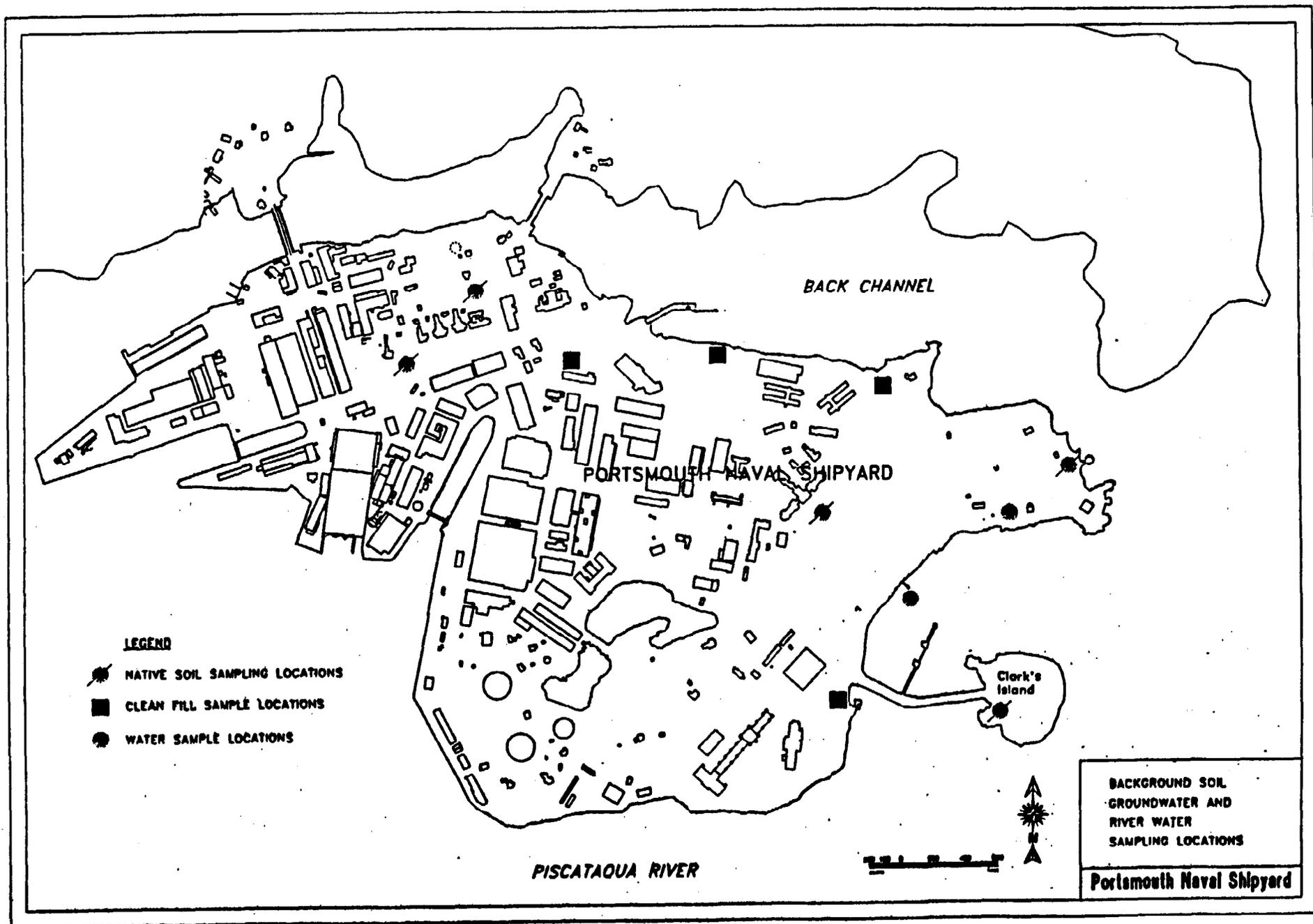
PISCATAQUA RIVER

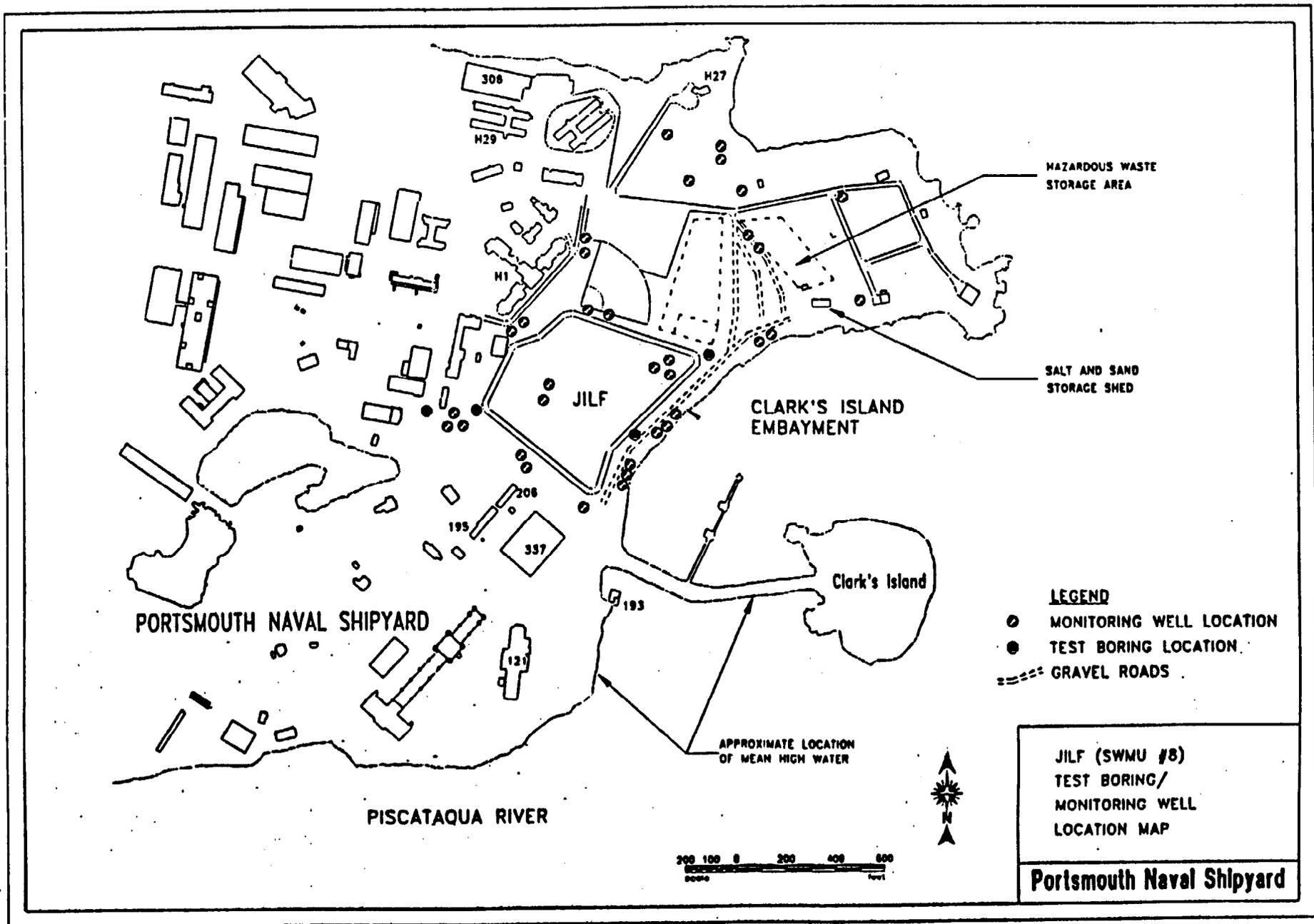
PORTSMOUTH NAVAL SHIPYARD

- LEGEND**
- TEST BORING LOCATION
 - TEST PIT LOCATION
 - OUTFALL SAMPLE LOCATION
 - ◆ MONITORING WELL LOCATION

FUEL OIL
 SPILLAGE AREA
 (SWMU # 27)
 MONITORING WELL
 LOCATION MAP

Portsmouth Naval Shipyard





OFFSHORE INVESTIGATION

ESTUARINE ECOLOGICAL RISK ASSESSMENT FOR PORTSMOUTH NAVAL SHIPYARD

Status Report of Work In Progress

**Presented by:
Robert K. Johnston
Naval Command, Control and Ocean
Surveillance Center**

October 20, 1992

Introduction

Why Conduct Offshore Study?

Status and Progress

Some Preliminary Results

Summary

PARTICIPANTS

**Naval Command, Control & Ocean
Surveillance Center, San Diego, CA**
**US EPA Environmental Research Laboratory
Narragansett, RI**
University of New Hampshire, Durham, NH
Jackson Estuarine Laboratory
Ocean Engineering Program
Woods Hole Oceanographic Institution
URI Graduate School of Oceanography
Narmandeau Associates
MacLaren/Hart
Ceimic Corporation

WHY CONDUCT OFFSHORE STUDY?

**Assess the Potential
Environmental Effect From Past,
Present, and Future Releases
from the Shipyard to the Estuary**

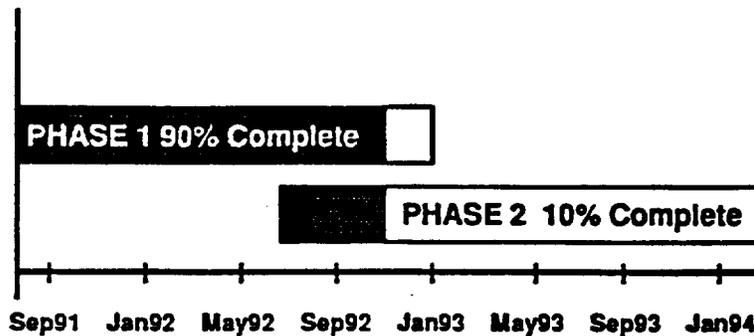
DETERMINE:

Where would it go?
Is it there?
Is it affecting organisms?

STATUS AND PROGRESS

PHASE 1: Is there Evidence that Shipyard Contaminants are Impacting the Estuary RIGHT NOW?

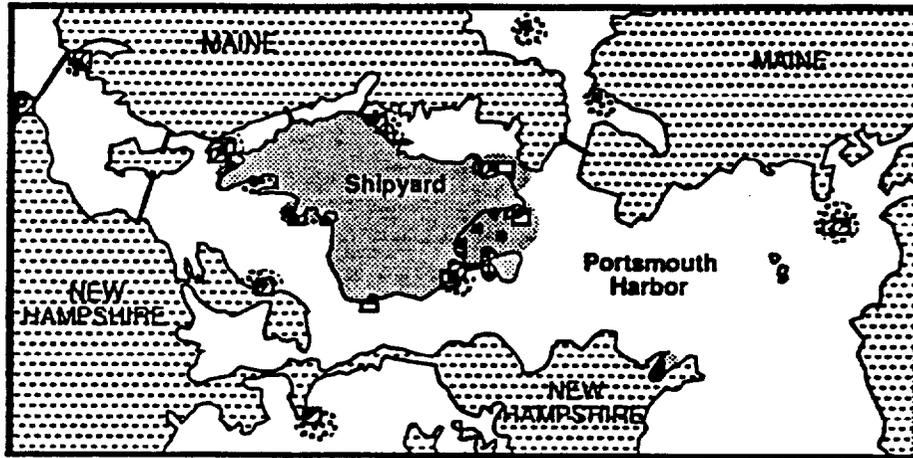
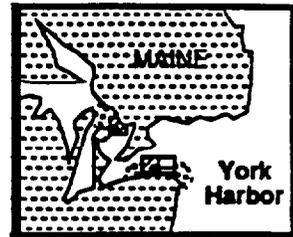
PHASE 2: Verify and Evaluate Any Evidence of PAST Releases and Predict Any FUTURE Impact.



SOME PRELIMINARY RESULTS

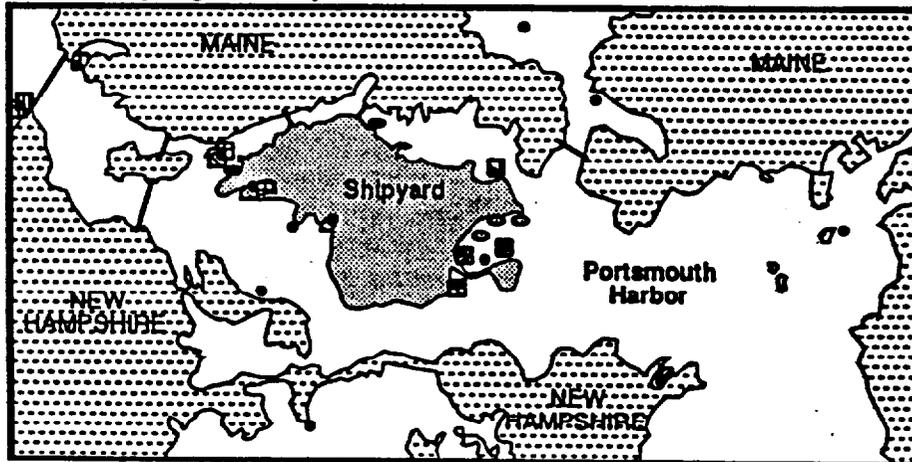
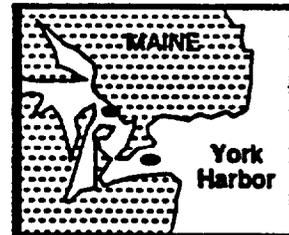
- **Important Ecological Resources Identified**
- **Some Areas Indicated Ecological Stress**
- **Contamination Levels are Relatively Low**
- **Seafood Contains Only Low Amounts of Contaminants**

- HABITAT TYPES**
- Station Location - Mussel Bed
 - ▨ Eelgrass Bed
 - ▧ Fucoid Algae
 - ⊙ Salt Marsh
 - ⊛ Muddy Sand
 - ⊙ Muddy Silt



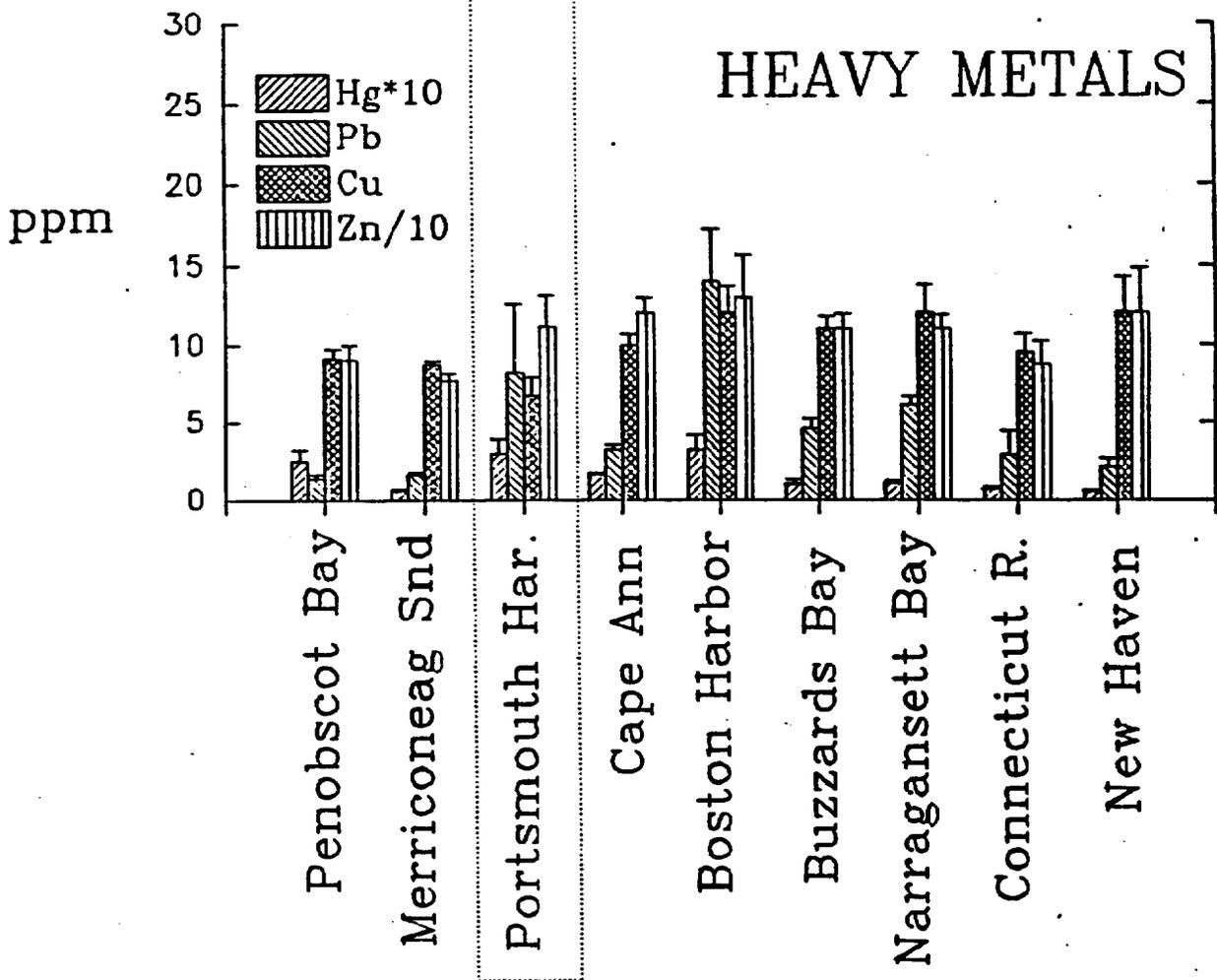
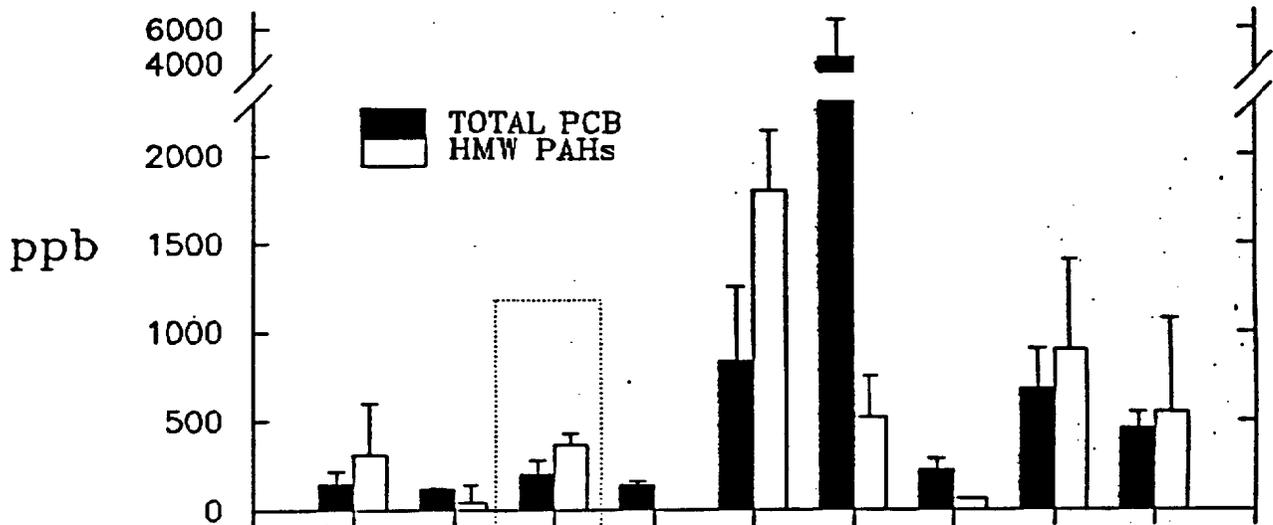
INDICATIONS OF ECOLOGICAL STRESS

- Toxicity to Amphipods
- Toxicity to Sea Urchin Sex Cells
- ▨ High Microbial Contamination
- ▧ Stress on Mussel Growth
- ▩ High Density of Worms
- ▩ Very High Density of Worms

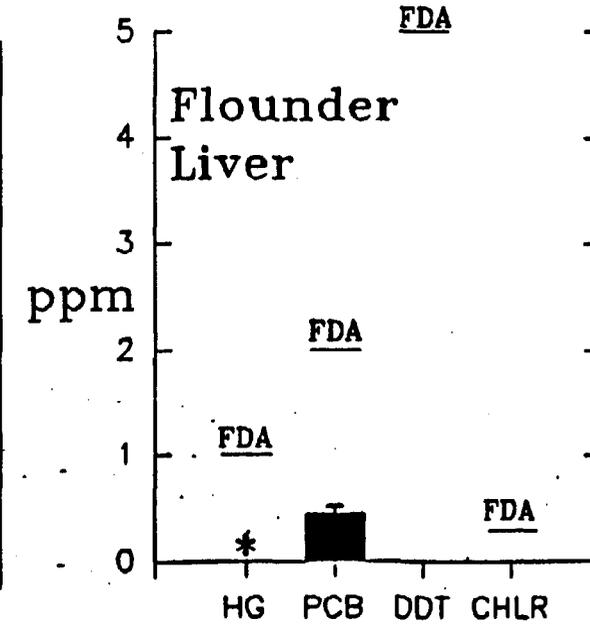
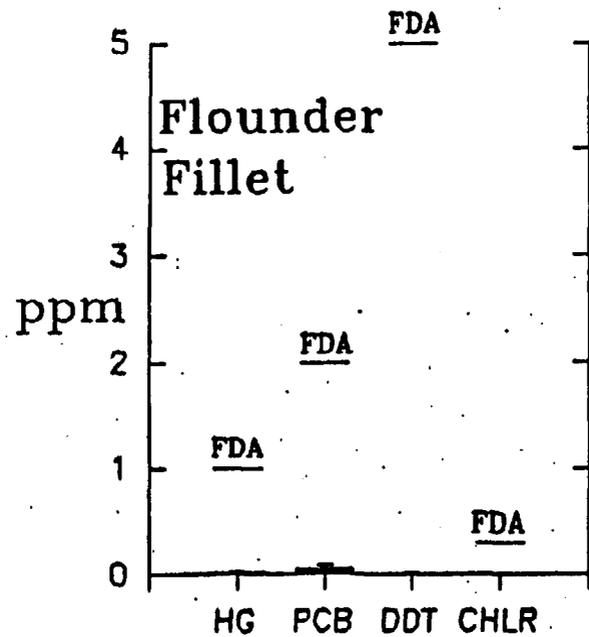
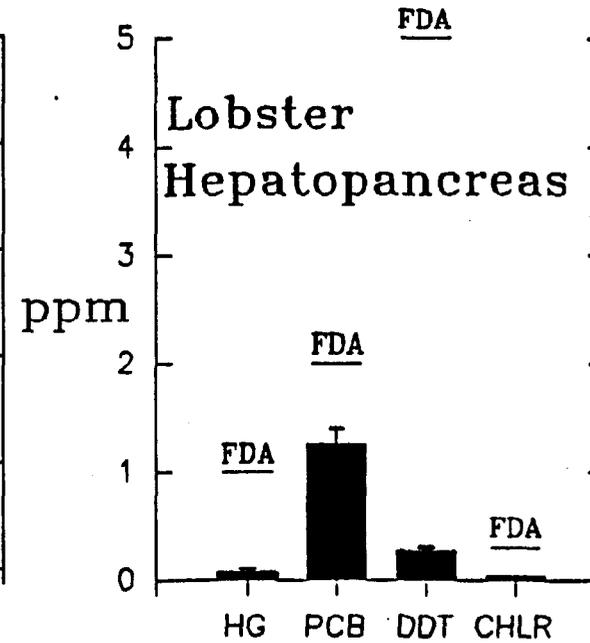
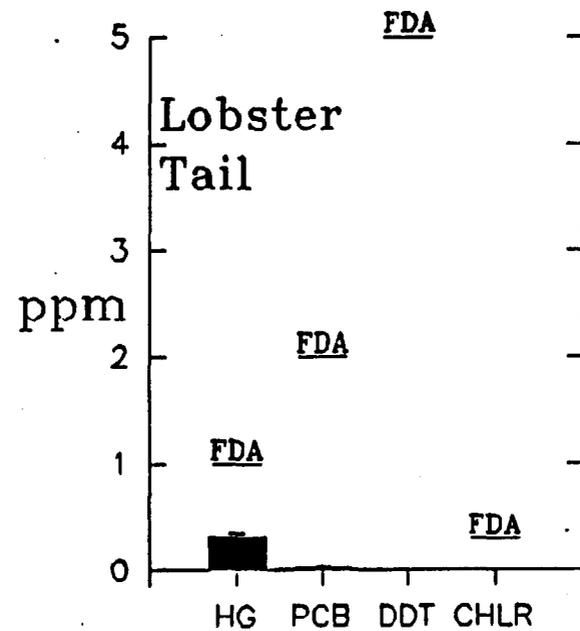


Mussel Tissue Concentrations

ORGANIC CONTAMINANTS



Seafood Concentrations



Wet Weight
 HG = Mercury
 PCB = Total Aroclor
 DDT = All Forms
 CHLR = Chlordane
 FDA = Action Level
 * = Not Measured

SUMMARY

ONSHORE STUDY PROVIDES INFORMATION ON:

- **Source Strength and Types of Contaminants**
- **Routes of Release and Migration**
- **Rates of Loading into the System**
- **Exposure to Inhabitants of the Island (Human and Nonhuman)**

SUMMARY

OFFSHORE STUDY PROVIDES INFORMATION ON:

- **Fate of Contaminants Released**
- **Effect of Contaminants Present**
- **Potential Accumulation in Food Chain**
- **Overall Impact on Ecology of Estuary**

CONCLUSION

***TOGETHER THE
ONSHORE AND OFFSHORE
STUDIES
PROVIDE THE TECHNICAL DATA
AND INFORMATION TO MAKE
INFORMED DECISIONS***