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PORTSMOUTH NAVAL SHIPYARD
RCRA CORRECTIVE ACTION PROJECT
MINUTES OF MEETING

SUBJECTS: Results from the Interim Risk Assessment at the Child Development Center (Dr. Lawrence Kaufmann)
Scope of Work for the On-Shore Ecological Risk Assessment (Charles Harmon)

PURPOSE: To discuss findings of the Interim Risk Assessment and to present the objectives of the On-Shore Ecological Risk Assessment

LOCATION: Portsmouth Naval Shipyard
Admiralty Village
Kittery, Maine

DATE: December 5, 1991

PREPARED BY: June Wiley, Project Management Specialist
McLaren/Hart Environmental Engineering Corporation
Albany, New York

REVIEWED BY: Stephen J. Myers, Managing Principal
Project Director
1/6/92

ATTENDEES:

- **Portsmouth Naval Shipyard**

  Jim Tayon, Portsmouth Naval Shipyard
  Perry Barnard, Portsmouth Naval Shipyard
  Mike Pedersen, Portsmouth Naval Shipyard
  Nancy Utiger, Portsmouth Naval Shipyard, CDC

- **Philadelphia Naval Base**

  Linda Dietz, Northern Division Project Manager
  Jim Szykman, Northern Division Chemical Engineer
  Kristen Wall, Northern Division

- **McLaren/Hart Environmental Engineering Corp.**

  Stephen Urschel, Project Manager
  Dr. Lawrence Kaufmann, Principal Toxicologist
  Charles Harmon, Senior Scientist
  June Wiley, Project Management Specialist

- **Maine Department of Environmental Protection**

  Pam Parker

- **Town of Kittery, Maine**

  Onil A. Roy
  Cecil Abels

- **U.S. EPA - Region I**

  Ernest Waterman

BACKGROUND:

Linda Dietz indicated that the fact sheet for the upcoming EPA public meeting was being finalized. The Navy was deciding whether to put the date of the public meeting in the fact sheet or not. If not, a notice would be placed in the newspaper of the date and location of the public meeting. It was open for discussion whether to send out a mass mailing announcing the public meeting or to put notices in local grocery stores, laundromats, etc.

The TRC meeting opened with individual introductions and then continued with discussion of the notice for the upcoming public meeting. The agenda for the public meeting was discussed. EPA will moderate the meeting. Ernest Waterman will open the meeting discussing RCRA, then the Navy will have approximately 45 minutes and will discuss the history and status of the SWMU's being investigated and the off-shore program. The meeting will then be open to questions from the audience, with the question period being limited to one hour, or a maximum of 1½ hours before taking a short break, then returning to answer questions until there are no more questions.

It was decided that notices of the public meeting should be mailed to certain people including State Representatives. Consideration was given to including an ad in the Portsmouth Press newspaper. A tentative date of January 7th in Boston with the EPA was set to have a dry run of the public meeting.

DISCUSSION:

The meeting agenda for December 5, 1991 included two presentations; one by Dr. Lawrence Kaufmann of McLaren/Hart to review the findings for the Interim Risk Assessment at the Child Development Center (CDC) and the second by Charles Harmon of McLaren/Hart to discuss the scope of work and objectives of the On-Shore Ecological Risk Assessment for the DRMO and JILF.

Dr. Kaufmann opened his presentation noting that the Final Risk Assessment or Public Health and Environmental Risk Evaluation (PHERE) was due in June 1992. McLaren/Hart was contracted by the Navy to determine if a risk exists to the children at the Child Development Center. The study by the Navy was proactive, and not required by the USEPA. Larry stated that the draft report was based on USEPA Region I Guidelines. The objective of the report was to estimate health risks to persons who work at or receive care at the Child Development Center and to determine whether interim corrective measures are needed to protect health. Larry determined that there is no need for immediate measures.

The Child Development Center is not in the proximity of any identified SWMU. There was a gas station previously located near the existing CDC. The gas station is southwest of the JILF approximately 1/10th of a mile and 1/4 mile northeast of the DRMO.

The procedures/methodology were then discussed. EPA methods are required for Human Health Risk Assessments. The four basic components used were:

1) Hazard Identification - Identify the chemicals of concern.

2) Toxicity Assessment - Establish what health effects there may be for people exposed.

3) Exposure Assessment - Determine the quantity of contamination was present, define exposure pathways and quantify exposure using EPA guideline.

4) Risk Characterization - Quantify the associated risk.

A map showing the sample locations was presented. A discussion of the exposure pathways which were evaluated as well as the EPA guidelines used in developing the risk assessment of the CDC followed. The assessment considered both carcinogenic and non-carcinogenic risks for exposed populations at the CDC. The exposed populations were considered to be the children attending the CDC and adults working at the CDC. The adult population exposure was considered to be that of gardeners who work with the soil most often as a worse case evaluation. A comparison was made between risks inside and outside the fenced boundary of the CDC. A separate discussion was also presented concerning lead since, by EPA guidelines, it is handled somewhat differently from other contaminants. A lead biokinetic model was evaluated and this model predicted the percentage of children with safe blood lead levels based on established EPA guidelines.

The presentation concluded with a summary of the findings including the conclusions that the soil contamination within the fenced area at the CDC does not pose any imminent threat to the human health of the exposed populations. It was reported that the results indicated that essentially all children within the fenced area would have safe blood lead

levels and that the average cumulative carcinogenic risk falls within the EPA acceptable range of between 10^{-6} and 10^{-4} for all exposure scenarios. The most elevated risk was posed by arsenic and polynuclear aromatic hydrocarbons (PAHs) which were found at concentrations which were within the normal ranges for background soils for urban communities. It was pointed out that additional soil and air data would be available for use during preparation of the Public Health and Environmental Risk Evaluation (PHERE).

Following Dr. Kaufmann's presentation, there was some discussion about the findings of the Navy's (PNS) independent sampling at the CDC. Data from Tom Devane's (PNS) study also suggested limited risk with the consensus being that the CDC did not pose an unacceptable risk to exposed populations.

Following Dr. Kaufmann's presentation, Mr. Charles Harmon presented his work on the on-shore ecological assessment. Chuck began his presentation by outlining the procedures for this assessment. He indicated that data were currently being evaluated and that some analytical data had not yet been received from the laboratory. Chuck indicated that the on-shore ecological assessment was distinct and separate from the off-shore ecological assessment being performed by NOSC.

Chuck went on to describe the objectives of the on-shore work which includes characterization of the plants and animals native to the PNS and an assessment of potential impacts from hazardous waste on on-shore biota.

The presentation continued with a discussion of the approach and methodologies employed in the study.

Direct Impacts

1) Visual assessment -- any direct signs? Stress vegetation? Abnormalities on animals?

2) Tissue samples were taken from three groups:

- Animals - rodents
- Vegetation
- Fish from freshwater ponds

Sample results will be compared to literature values from other corresponding data. Tissue samples were analyzed for metals arsenic, chromium, lead from TAL list and TCL semi-volatile organic compounds such as DDT, DDE, chlorodane etc. and volatile organic compounds (VOC's) such as benzene, tetrachloroethylene, etc.

Terrestrial macrophyte samples were taken from the Jamaica Island Landfill. Five aboveground and five below ground samples were taken to see whether there is movement of any chemicals. Samples taken included Aster, red top, salt meadow cord grass and soft rush. At the DRMO five aboveground, one below ground and one edible tissue sample were collected. Samples were taken from salt meadow cord grass, black cherry, Forsythia and apples from an apple tree adjacent to the DRMO.

Aquatic Plants

- Five submerged/emergent samples
- Five below ground samples
- Two submerged samples

Samples taken were from water lilies, cat tails, soft rush and Elodia canadensis.

Animals

-- Five samples from the JILF

Samples were whole body basis samples were a meadow vole which is a common rodent.

-- Four samples were taken from the DRMO

Samples were whole body basis samples were Deer Mice.

Fish

-- Three fish samples included examination of internal organs, edible tissue and whole body. (Whole body was used because sea gulls can eat the whole fish.)

There was a interest in the freshwater pond because it seemed that certain parts of the ecosystem were missing -- e.g., there were no little minnows for the fish to feed on.

ERLN analysis was to compare results of the off-shore to the freshwater ponds inland. Particular organisms were chosen because of availability -- samples were taken from particular rodents, plants and fish because they are likely to supply ample samples. They are major points in the ecosystem.

Questions were raised regarding the fact that no samples were taken from groundhogs around the landfill area. Chuck stated that there were not many gophers and that family.

There was a question about the ponds appearing sterile. Chuck indicated that usually there are numerous different levels in ponds. But the ponds only had two levels with nothing in between. Invertebrates and small mouth bass.

A question was raised as to what scenarios were being evalutaed to cause only two levels. Chuck said it may be historical but he is not sure. He would like to approach Maine Fish and Game about seeing what was stocked. Just trout stocked as far as he knows.

Linda Dietz adjourned the meeting at 2:45 pm. The next TRC meeting was set for February 5th at 10:30 am on the subject of the Phase IV fieldwork. The Navy is looking for new location for TRC meetings because the number of attendees is increasing. Linda Dietz would also like to finalize the public meeting at that time.

TECHNICAL REVIEW COMMITTEE MEETING

DECEMBER 5, 1991

PORTSMOUTH NAVAL SHIPYARD

AGENDA FOR TRC MEETING

- Interim Health Risk Assessment at Child Development Center
- On-Shore Ecological Assessment

INTERIM HUMAN HEALTH RISK ASSESSMENT FOR CHILD DEVELOPMENT CENTER PORTSMOUTH NAVAL SHIPYARD

TRC MEETING, DECEMBER 5, 1991

I. INTRODUCTION

II. OBJECTIVES

III. PROCEDURES/METHODOLOGY

IV. EXPOSURE PATHWAYS EVALUATED

V. RISKS CALCULATED

VI. CONCLUSIONS

I. INTRODUCTION

- FINAL RISK ASSESSMENT (PHERE) DUE 6/92
- INTERIM, NOT FINAL
- DRAFT REPORT BASED ON USEPA REGION I GUIDELINES
- PROACTIVE STUDY - NOT REQUIRED BY USEPA

II. OBJECTIVES

- **ESTIMATE HEALTH RISKS TO PERSONS WHO WORK AT OR RECEIVE CARE AT CHILD DEVELOPMENT CENTER**

- **DETERMINE WHETHER INTERIM CORRECTIVE MEASURES ARE NEEDED TO PROTECT HEALTH**
  (IN OUR JUDGMENT, NO IMMEDIATE MEASURES NEEDED)

CHILD DEVELOPMENT CENTER

- Not In Immediate Proximity of Any Identified SWMU
- Interim Risk Assessment Was Undertaken by the Navy to be Protective of Persons, particularly Children at the Development Center, Not Required by EPA
- Gas Station was Previously Located Near Existing Child Development Center
- SW of JILF (0.1 Mile)
- NE of DRMO (0.25 Mile)

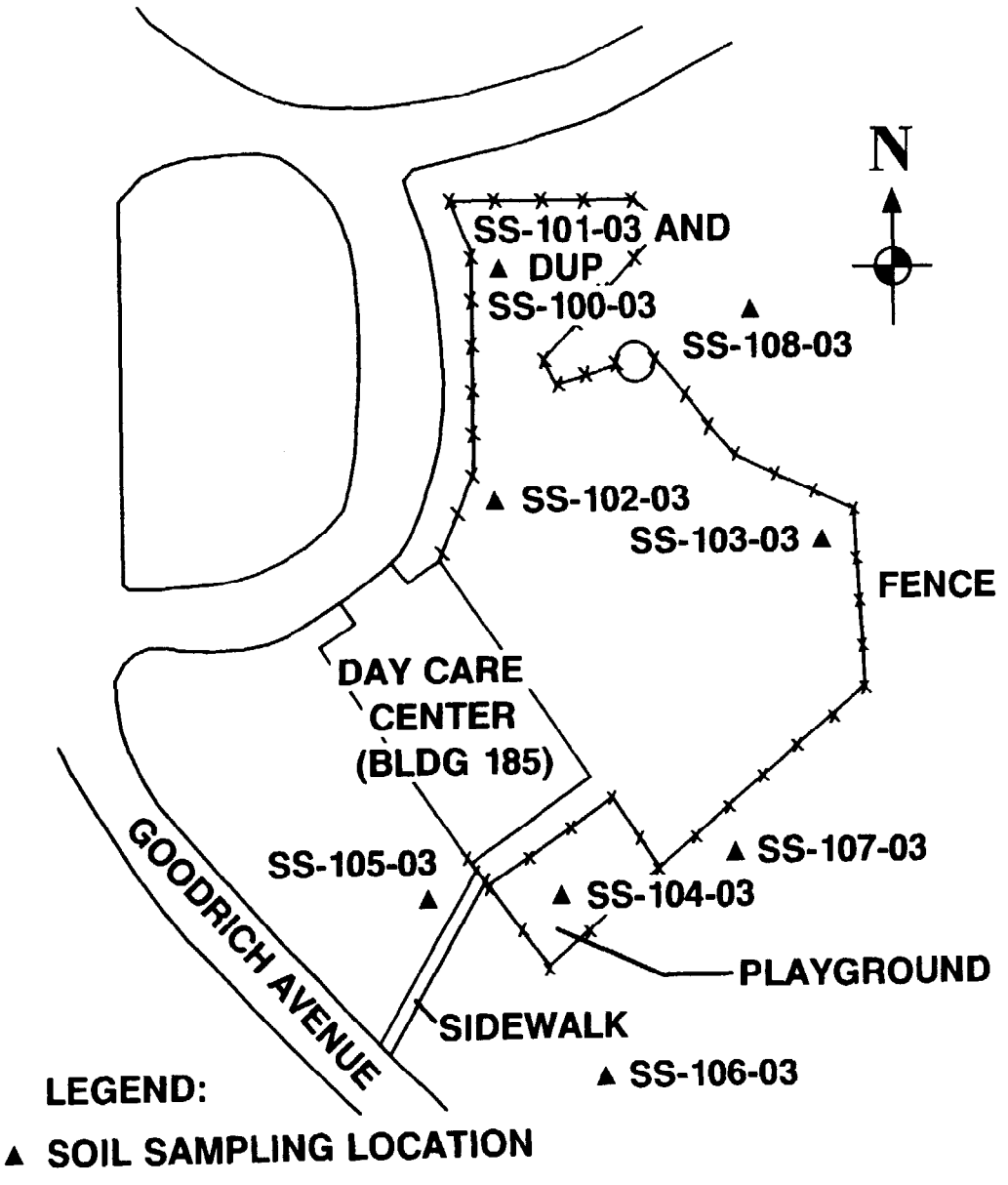
III. PROCEDURES/METHODOLOGY

- EPA METHODS ARE REQUIRED FOR HUMAN HEALTH RISK ASSESSMENTS

  1. HAZARD IDENTIFICATION
  2. TOXICITY ASSESSMENT
  3. EXPOSURE ASSESSMENT
  4. RISK CHARACTERIZATION

III. PROCEDURES/METHODOLOGY (Continued)

- RISK ASSESSMENT GUIDANCE FOR SUPERFUND USEPA (1989)
- SUPPLEMENTAL RISK ASSESSMENT GUIDANCE FOR THE SUPERFUND PROGRAM USEPA REGION I
- MAP OF SOIL SAMPLING LOCATIONS FOR PHASE III



NOT TO SCALE

SURFACE SOIL SAMPLING FOR THE DAY CARE CENTER

McLAREN/HART

IV. PATHWAYS EVALUATED

SOIL INGESTION

- CHILDREN 6 YEARS; SCHOOL EXPOSURE
- ADULTS AS GARDENERS; 30-YEAR OCCUPATION EXPOSURE

DERMAL ABSORPTION

- CHILDREN 6 YEARS; SCHOOL EXPOSURE
- ADULTS AS GARDENERS; 30-YEAR OCCUPATIONAL EXPOSURE

ASSUMPTIONS

- GENERALLY CONSERVATIVE ASSUMPTIONS ARE USED (E.G., SOIL INGESTION RATE, ABSORPTION FACTORS)
- STUDENTS ATTEND SCHOOL
  8 HR/DAY - 5 DAYS/WK - 50 WK/YR
- STUDENTS PLAY OUTDOORS 107 DAYS/YR BASED ON WINTER CONDITIONS, FROM USEPA REGION I GUIDANCE
- CHILDREN ARE THE MOST SENSITIVE POPULATION

V. RISK CHARACTERIZATION

- RISK IS A FUNCTION OF <u>BOTH</u> EXPOSURE AND CHEMICAL TOXICITY

- NON- CARCINOGENIC AND CARCINOGENIC RISKS ARE COMPARED TO EPA GUIDELINES ESTABLISHED IN THE NATIONAL CONTINGENCY PLAN (NCP)

- NON-CARCINOGENIC RISKS ARE MEASURED USING HAZARD INDEX. IF HAZARD INDEX IS <1, CHEMICAL IS NOT A HEALTH CONCERN BASED ON EPA GUIDELINES

V. RISK CHARACTERIZATION (Continued)

- CARCINOGENIC RISKS ARE CALCULATED AND COMPARED TO NCP-ESTABLISHED ACCEPTABLE RISK RANGE OF 10^{-6} (ONE IN ONE MILLION) TO 10^{-4} (ONE IN TEN THOUSAND)

- SINCE EPA'S RISK GOAL IS 10^{-6}, WE HAVE SUMMARIZED ALL RISKS EXCEEDING ONE IN A MILLION. BASED ON AVERAGE AND MAXIMUM SOIL CONCENTRATIONS.

SUMMARY OF POTENTIAL CUMULATIVE RISKS FOR CARCINOGENS

Exposure Scenarios	Soil Ingestion		Dermal Absorption	
	Average	Maximum	Average	Maximum
Children - inside fence	5.8×10^{-5}	1.9×10^{-4}	6.4×10^{-6}	2.2×10^{-5}
Adults - inside fence	2.2×10^{-5}	7.4×10^{-5}	9.9×10^{-6}	3.5×10^{-5}
Children - outside fence	1.6×10^{-5}	2.4×10^{-5}	6.0×10^{-6}	8.5×10^{-6}
Adults - outside fence	6.2×10^{-6}	9.1×10^{-6}	4.3×10^{-6}	1.3×10^{-5}

Risk Levels

10^{-6} = one in a million

10^{-5} = one in 100,000

10^{-4} = one in 10,000

SOIL CONCENTRATIONS[1] OF CHEMICALS AT CHILD DEVELOPMENT CENTER

Parameter [2]	Average [3]	Maximum[4]	Urban Soil[5]	Rural Soil[5]
Arsenic	12.3	18.5	1.0 - 50.0[7]	----[8]
Benzo(a)anthracene	2.3	8.2	0.17 - 59.0	0.005 - 0.02
Benzo(a)pyrene[6]	2.2	7.7	0.17 - 0.22	0.002 - 1.3
Benzo(b)fluoranthene	2.5	9.0	15.0 - 62.0	0.02 - 0.03
Benzo(k)fluoranthene	3.5	13.0	0.3 - 26.0	0.01 - 0.11
Chrysene[6]	2.4	8.3	0.25 - 0.64	0.038
Dibenzo(a,h)anthracene	0.2	0.3	-----	-----
Indeno(1,2,3 cd)pyrene	1.1	4.0	8.0 - 61.0	0.01 - 0.015

[1] mg/kg
[2] parameters with risks exceeding 1 in a million
[3] average of soil concentrations inside fence
[4] maximum soil concentration inside fence
[5] typical range reported for urban and rural soils (Toxicological Profile for PAHs U.S. Public Health Service; Agency for Toxic Substances and Disease Registry)
[6] exceeds background range
[7] Hazardous Waste Land Treatment USEPA 1983 (SW874)
[8] no data available

TYPICAL BACKGROUND SOURCES OF PAHs
(Polycyclic Aromatic Hydrocarbons)

- ENGINE EXHAUST
- WOOD STOVE SMOKE
- CIGARETTE SMOKE
- CHAR-BROILED FOOD
- PETROLEUM RESIDUES

Source: S. Manahan (1988). *Toxicological Chemistry*

SUMMARY OF CUMULATIVE CARCINOGENIC RISKS AT CHILD DEVELOPMENT CENTER (CDC) AS THEY RELATE TO BACKGROUND RISKS

	Soil Ingestion		Dermal Absorption	
Children - Inside Fence	Average	Maximum	Average	Maximum
Risks associated with background levels of chemicals measured at the CDC	4.1×10^{-5}	1.3×10^{-4}	4.3×10^{-6}	1.5×10^{-5}
Risks for levels of chemicals measured above background levels at the CDC	1.7×10^{-5}	5.9×10^{-5}	2.1×10^{-6}	7.4×10^{-6}
TOTAL	5.8×10^{-5}	1.9×10^{-4}	6.4×10^{-6}	2.2×10^{-5}

SUMMARY OF CUMULATIVE CARCINOGENIC RISKS AT CHILD DEVELOPMENT CENTER (CDC) AS THEY RELATE TO BACKGROUND RISKS

	Soil Ingestion		Dermal Absorption	
Adults - Inside Fence	**Average**	**Maximum**	**Average**	**Maximum**
Risks associated with background levels of chemicals measured at the CDC	1.5×10^{-5}	5.0×10^{-5}	6.5×10^{-6}	2.3×10^{-5}
Risks for levels of chemicals measured above background levels at the CDC	6.6×10^{-6}	2.2×10^{-5}	3.4×10^{-6}	1.1×10^{-5}
TOTAL	2.2×10^{-5}	7.2×10^{-5}	9.9×10^{-6}	3.4×10^{-5}

LEAD IN CHILDREN IS OF GREAT CONCERN BUT MUST BE TREATED SEPARATELY USING LEAD BIOKINETIC MODEL.

LEAD BIOKINETIC MODEL

- RELATES LEAD INTAKE FROM MULTIPLE SOURCES TO LEAD LEVELS IN BLOOD
- PREDICTS % OF CHILDREN WITH SAFE BLOOD LEAD LEVELS (ACCORDING TO EPA ESTABLISHED GUIDELINES)
- RESULTS INDICATE ESSENTIALLY ALL CHILDREN PLAYING INSIDE FENCED AREA WOULD HAVE SAFE BLOOD LEAD LEVELS

LEAD BIOKINETIC MODEL (Continued)

- OUTSIDE THE FENCE, ONE HIGH LEAD LEVEL WAS FOUND. HOWEVER, NO EXPOSURE EXISTS TO THIS SAMPLE LOCATION AT THE PRESENT TIME.

- OUR PRELIMINARY STUDY HAS LED TO ADDITIONAL SAMPLING. RESULTS TO DATE INDICATE SAFE LEAD LEVELS.

RISKS POSED BY LEAD EXPOSURES AT CHILD DEVELOPMENT CENTER BASED ON USEPA's LEAD UPTAKE/BIOKINETIC MODEL (VERSION 4)

Exposure Scenarios	Air Lead Concentration ug/m^3 (1)	Groundwater Lead Concentration ppb (2)	Soil Lead Concentration ppm (3)	Indoor Dust Lead Concentration ppm	G.I. Absorption %/Model	% of Children With Predicted Blood Lead Below 10 ug/dL (4)	Geometric Mean Blood Lead Predicted For Children ug/dL (5)
Inside Fence (SS 101-104)	0.2	4.0	132	Multiple Source Analysis	30/Non-linear	99.92	2.30
Inside Fence (10 samples from T. DeVaney)	0.2	4.0	43	Same	Same	100	1.86
Outside Fence (SS 105,106,108)	0.2	4.0	20	Same	Same	100	1.74
Outside Fence (SS 105, 106, 107, 108)	0.2	4.0	8,765	Same	Same	0.08	33.04

VI. CONCLUSIONS

- THERE DOES NOT APPEAR TO BE ANY IMMINENT THREAT TO HUMAN HEALTH AT THE CHILD DEVELOPMENT CENTER.
- LEVELS OF CHEMICALS IN CHILD DEVELOPMENT CENTER SOILS ARE GENERALLY WITHIN NORMAL BACKGROUND SOIL RANGES FOR URBAN COMMUNITIES.
- HAZARD INDICES <1 FOR EACH EXPOSURE SCENARIO (MEANS THAT NON-CARCINOGENS PRESENT IN SOILS ARE NOT A CONCERN).
- AVERAGE CUMULATIVE CARCINOGENIC RISK FALLS BETWEEN 10^{-6} AND 10^{-4} FOR ALL EXPOSURE SCENARIOS.

VI. CONCLUSIONS (Continued)

- MAXIMUM CUMULATIVE CARCINOGENIC RISK BETWEEN 10^{-6} AND 10^{-4} FOR ALL BUT ONE EXPOSURE SCENARIO.
- MOST OF THE RISK IS DUE TO ARSENIC AND PAHs WHICH OCCUR AT CONCENTRATIONS TYPICAL OF URBAN COMMUNITIES.
- SAFE BLOOD LEAD LEVELS (AS PER EPA GUIDELINES) ARE PREDICTED FOR CHILDREN PLAYING INSIDE FENCE.
- ADDITIONAL SOIL SAMPLING & AIR SAMPLING DATA WILL BE USED FOR FINAL HUMAN HEALTH RISK ASSESSMENT.
- INTERIM CORRECTIVE MEASURES NOT NEEDED

Glossary For Health Risk Assessment

Risk Assessment Process (4 steps) including:

1.	**Hazard Identification**	-	First step in Risk Assessment process which identifies those contaminants on site that could cause adverse effects.
2.	**Toxicity Assessment**	-	Identifies both the nature of a chemical's adverse effects (e.g. it may cause liver cancer) and the quantity believed to cause the effects.
3.	**Exposure Assessment**	-	Identifies what exposures are currently experienced or are reasonably expected under different conditions.
4.	**Risk Characterization**	-	Defines the present and potential threats to human health posed by contaminants at the Site.

Cancer Risk	-	Probability of an individual developing cancer.
Cancer Risk Goal	-	EPA's goal of limiting cancer risks to a one in a million probability; defined in the National Contingency Plan (NCP). Acceptable risk range: 10^{-6} to 10^{-4} is also defined in NCP.
Cancer Risk Numbers	-	10^{-6} (E-06) = One in a million 10^{-5} (E-05) = One in a hundred thousand 10^{-4} (E-04) = One in ten thousand
Exposure Pathway	-	How exposure to contaminants may occur (by eating [ingestion], through the skin [dermal absorption], by breathing [inhalation]). Includes identifying a chemical source, route of exposure, and point of contact.
Hazard Index	-	EPA's method for summarizing non-cancer health risks for all chemicals at a location. If the Hazard Index is <1, there is no health concern.
Lead Biokinetic Model	-	EPA's method for relating the amount of lead taken in by a person from different sources to the amount of lead in the person's blood.
PAHs	-	A group of polyaromatic hydrocarbon compounds produced by partial combustion. Background sources include engine exhaust, wood stove smoke, cigarette smoke, and petroleum residues.
PHERE	-	Public Health and Environmental Risk Evaluation, which will be completed for PNS by June 1992.

ON - SHORE

ECOLOGICAL ASSESSMENT

PORTSMOUTH NAVAL SHIPYARD

KITTERY, MAINE

DECEMBER 5, 1991

GLOSSARY

Agrostis stolinifera - red top, a common grass

Aster - a group of common flowering plants

Biota - flora and fauna of a particular area

Elodia canadensis - common submerged aquatic plant

Fauna - animals

Flora - vegetation

Forsythia viridissima - forsythia, a common landscape plant

Indigenous - native to a particular environment

Juncus effusis - soft rush

Macrophytes - plants large enough to be seen with the naked eye

Micropterus dolomieui - smallmouth bass

Microtis pennsylvanicus - meadow vole, a common rodent

Nymphaea odorata - water lily

GLOSSARY

Peromyscus maniculatus - deer mouse

Prunus serotina - black cherry

Pyrus malus - apple

Spartina patens - salt-meadow cord grass

Typha latifolia - cattails

Viscera - internal organs

OBJECTIVES

1. CHARACTERIZE INDIGENOUS BIOTA

2. ASSESS POTENTIAL IMPACTS FROM HAZARDOUS WASTE TO ON-SHORE BIOTA

CHARACTERIZATION OF INDIGENOUS BIOTA

1. LITERATURE SEARCH
2. ONSITE DESCRIPTION OF VEGETATION
3. DEVELOPMENT OF FAUNAL SPECIES LIST

- Birds
- Mammals
- Fish
- Reptiles and Amphibians

ASSESSMENT OF POTENTIAL IMPACTS FROM HAZARDOUS WASTE TO ON-SHORE BIOTA

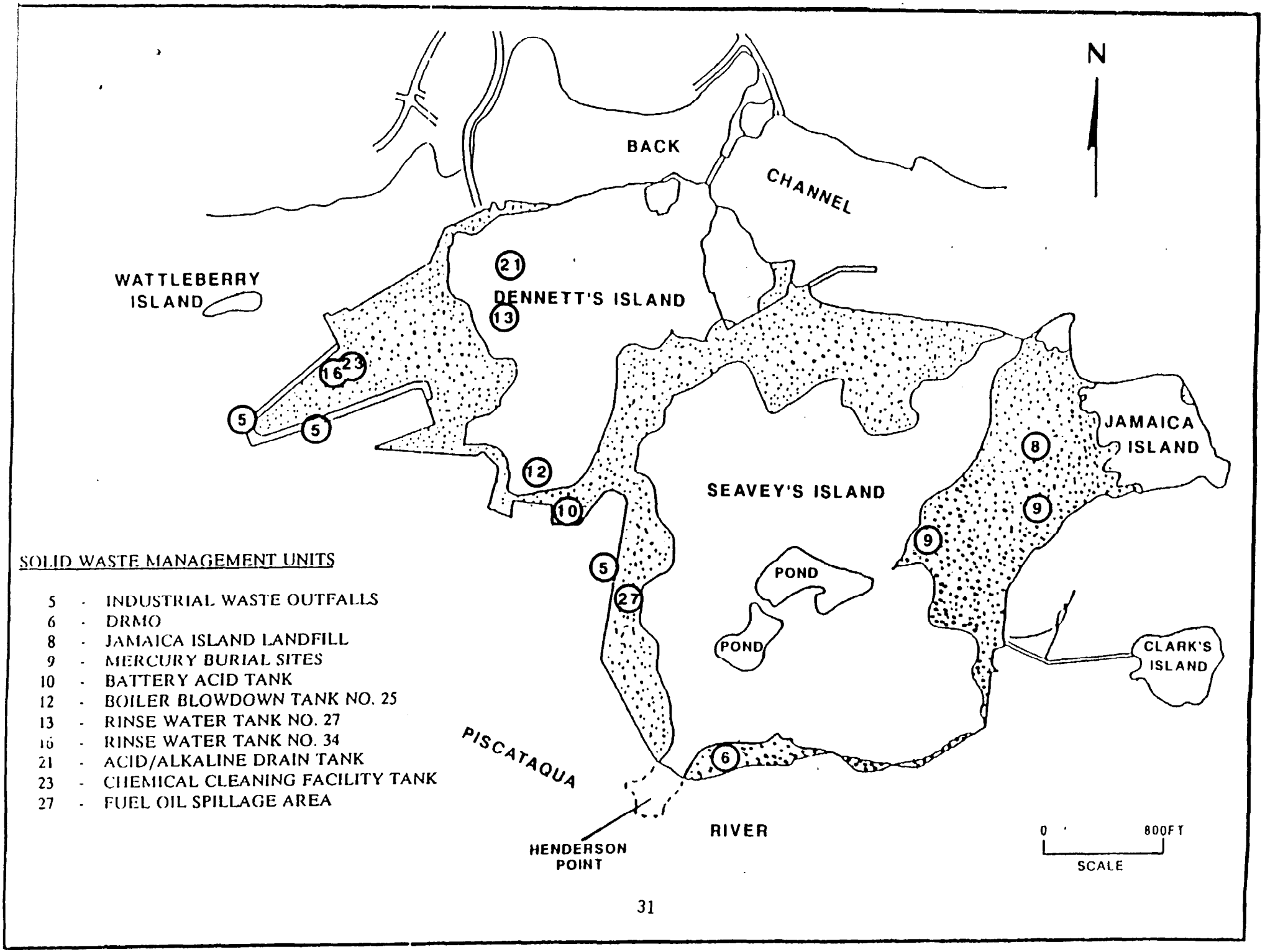
1. In-Direct Impacts
   - Modification to Habitat
   - Community Structure

2. Direct Impacts
   - Tissue Samples
   - Visual Assessment

INDIRECT IMPACTS

1. VEGETATIVE COMMUNITY ASSESSMENT
   - JAMAICA ISLAND LANDFILL
   - DRMO

2. BENTHIC MACROINVERTEBRATE ASSESSMENT
   - FRESHWATER PONDS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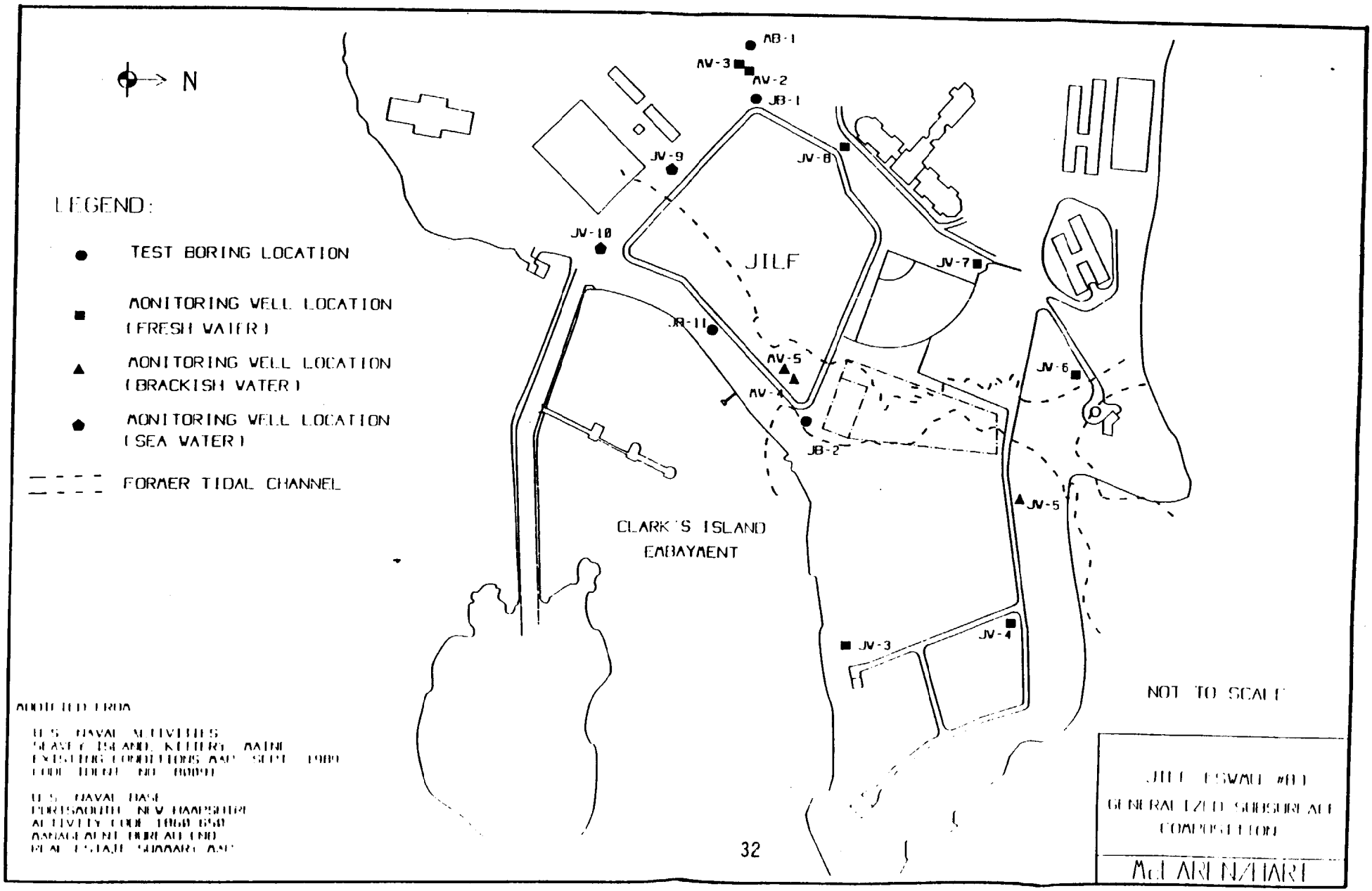
SOLID WASTE MANAGEMENT UNITS
5 - INDUSTRIAL WASTE OUTFALLS
6 - DRMO
8 - JAMAICA ISLAND LANDFILL
9 - MERCURY BURIAL SITES
10 - BATTERY ACID TANK
12 - BOILER BLOWDOWN TANK NO. 25
13 - RINSE WATER TANK NO. 27
16 - RINSE WATER TANK NO. 34
21 - ACID/ALKALINE DRAIN TANK
23 - CHEMICAL CLEANING FACILITY TANK
27 - FUEL OIL SPILLAGE AREA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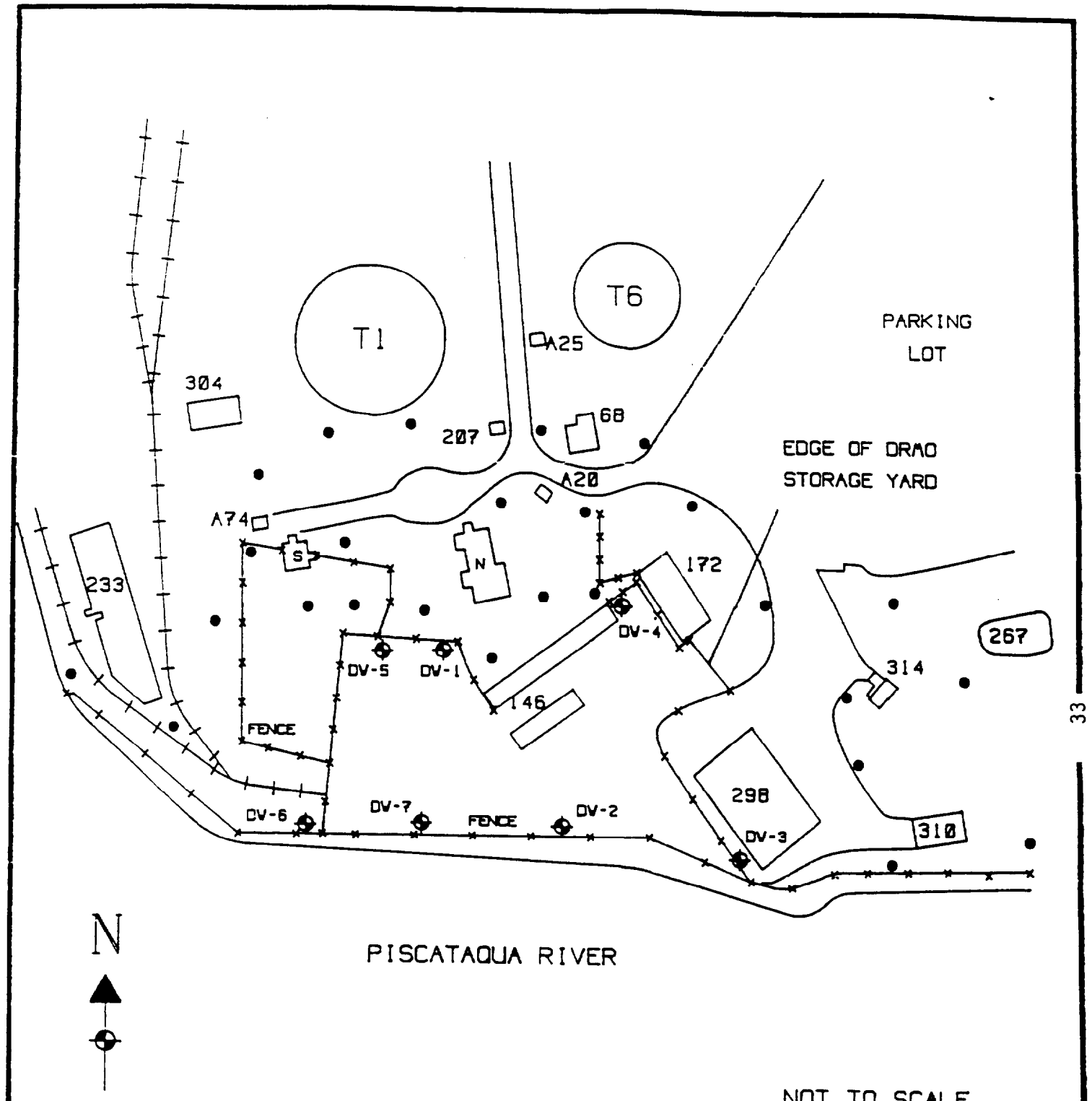
LEGEND:
TEST BORING LOCATION
MONITORING WELL LOCATION (FRESH WATER)
MONITORING WELL LOCATION (BRACKISH WATER)
MONITORING WELL LOCATION (SEA WATER)
FORMER TIDAL CHANNEL
JILF
CLARK'S ISLAND EMBAYMENT
MB-1
MV-3
MV-2
JB-1
JV-9
JV-8
JV-10
JV-7
JB-11
MV-5
MV-4
JB-2
JV-6
JV-5
JV-3
JV-4
NOT TO SCALE
GENERALIZED SUBSURFACE COMPOSITION
McLAREN/HART



NOT TO SCALE

LEGEND:

- ● SURFACE SOIL SAMPLING LOCATIONS (PHASE I AND PHASE II)
- ⊕ GROUNDWATER MONITORING WELL

DRMO (SWMU #6)

SURFACE SOIL SAMPLING AND GROUNDWATER MONITORING WELL LOCATIONS

McLAREN/HART

DIRECT IMPACTS

1. VISUAL ASSESSMENT

2. TISSUE SAMPLES

- Animals
- Vegetation
- Fish

TISSUE SAMPLES

1. ALL SAMPLES ANALYZED FOR TAL METALS AND TCL SEMI-VOLATILE ORGANIC COMPOUNDS

2. ANIMALS

   - Rodents

3. PLANTS

   - Terrestrial Macrophytes
   - Aquatic Macrophytes

4. FISH

Metals - Trace elements

Includes:
- Arsenic
- Chromium
- Lead
- Mercury
- Silver

Analysis: Target Analyte List (TAL)

Volatile Organic Compounds - Organic compounds (oxygen, hydrogen, carbon) that evaporate readily at room temperature

Includes:
- Benzene
- Tetrachloroethylene
- Trichloroethylene
- Chloroform

Analysis: Target Compound List (TCL)

Semi-Volatile Organic Compounds - Organic compounds that can be extracted from water.

Includes:
- Polycyclic Aromatic Hydrocarbons
- Pesticides
- Polychlorinated Biphenyls
- Phthalates

Analysis: Target Compound List (TCL)

TERRESTRIAL MACROPHYTES

1. JAMAICA ISLAND LANDFILL

- 5 Aboveground samples
- 5 Belowground samples
- Spartina patens (1)
- Aster sp. (1)
- Juncus effusis (1)
- Agrostis stolinifera (2)

2. DRMO

- 5 Aboveground samples
- 1 Belowground sample
- 1 Edible tissue sample
- Prunus serotina
- Spartina patens
- Pyrus malus
- Forsythia viridissima

AQUATIC MACROPHYTES

1. 5 submerged/emergent samples
2. 5 belowground samples
3. 2 submerged plants
4. *Nymphaea odorata* (2)
5. *Typha latifolia* (2)
6. *Juncus effusus*
7. *Elodia canadensis* (2)

ANIMALS

1. **JAMAICA ISLAND LANDFILL**

   - **5 samples**
   - **Whole Body Basis**
   - **<u>Microtos</u> <u>pennsylvanicus</u>**

2. **DRMO**

   - **4 samples**
   - **Whole Body Basis**
   - **<u>Peromyscus</u> <u>maniculatus</u>**

FISH

1. 3 Fish
2. Viscera
3. Edible tissue
4. Whole Body
5. ERLN Analysis
   - 6 Fish
   - 1 Whole body
   - Viscera
   - Edible tissue
6. <u>Micropterus</u> <u>dolomieui</u>

RISK TABLES

SUMMARY OF POTENTIAL RISKS EXCEEDING ONE IN MILLION FOR CARCINOGENS

CHILDREN - INSIDE THE FENCE

Parameter	Soil Ingestion		Dermal Absorption	
	Average	Maximum	Average	Maximum
Arsenic	6.78 E-06	1.02 E-05	--	--
Benzo(a)anthracene	8.39 E-06	2.96 E-05	1.05 E-06	3.70 E-06
Benzo(a)pyrene	7.87 E-06	2.78 E-05	9.84 E-07	3.48 E-06
Benzo(b)fluoranthene	9.17 E-06	3.25 E-05	1.15 E-06	4.06 E-06
Benzo(k)fluoranthene	1.26 E-05	4.70 E-05	1.58 E-06	5.87 E-06
Chrysene	8.64 E-06	3.00 E-05	1.08 E-06	3.75 E-06
Dibenzo(a,h)anthracene	8.67 E-07	1.12 E-06	1.08 E-07	1.40 E-07
Indeno(1,2,3 cd)pyrene	3.97 E-06	1.44 E-05	4.96 E-07	1.81 E-06
Cumulative	5.83 E-05	1.93 E-04	6.44 E-06	2.25 E-05

SUMMARY OF POTENTIAL RISKS EXCEEDING ONE IN MILLION FOR CARCINOGENS

GARDENERS - INSIDE THE FENCE

Parameter	Soil Ingestion		Dermal Absorption	
	Average	Maximum	Average	Maximum
Arsenic	2.61 E-06	3.01 E-06	--	--
Benzo(a)anthracene	3.23 E-06	1.14 E-05	1.61 E-06	5.69 E-06
Benzo(a)pyrene	3.03 E-06	1.07 E-05	1.51 E-06	5.35 E-06
Benzo(b)fluoranthene	3.53 E-06	1.25 E-05	1.76 E-06	6.25 E-06
Benzo(k)fluoranthene	4.85 E-06	1.81 E-05	2.42 E-06	9.03 E-06
Chrysene	3.32 E-06	1.15 E-05	1.66 E-06	5.76 E-06
Dibenzo(a,h)anthracene	3.33 E-07	4.31 E-07	1.67 E-07	2.51 E-07
Indeno(1,2,3 cd)pyrene	1.52 E-06	5.56 E-06	7.62 E-07	2.78 E-06
Cumulative	2.24 E-05	7.41 E-05	9.91 E-06	3.51 E-05

SUMMARY OF POTENTIAL RISKS EXCEEDING ONE IN MILLION FOR CARCINOGENS

CHILDREN - OUTSIDE THE FENCE

Parameter	Soil Ingestion		Dermal Absorption	
	Average	Maximum	Average	Maximum
Arsenic	7.15 E-06	9.78 E-06	--	--
Benzo(a)anthracene	1.41 E-06	1.99 E-06	1.76 E-06	2.48 E-06
Benzo(a)pyrene	1.41 E-06	2.17 E-06	1.76 E-07	2.71 E-07
Benzo(b)fluoranthene	1.63 E-06	2.28 E-06	2.03 E-06	2.84 E-06
Benzo(k)fluoranthene	1.34 E-06	1.77 E-06	1.67 E-06	2.21 E-06
Chrysene	1.73 E-06	2.31 E-06	2.17 E-07	2.89 E-07
Dibenzo(a,h)anthracene	--	--	--	--
Indeno(1,2,3 cd)pyrene	1.41 E-06	3.25 E-06	1.76 E-07	4.06 E-07
Cumulative	1.61 E-05	2.36 E-05	6.04 E-06	8.52 E-06

SUMMARY OF POTENTIAL RISKS EXCEEDING ONE IN MILLION FOR CARCINOGENS

GARDENERS - OUTSIDE THE FENCE

Parameter	Soil Ingestion		Dermal Absorption	
	Average	Maximum	Average	Maximum
Arsenic	2.75 E-06	3.76 E-06	--	--
Benzo(a)anthracene	5.42 E-07	7.64 E-07	2.71 E-06	3.82 E-06
Benzo(a)pyrene	5.42 E-07	8.33 E-07	2.71 E-07	4.17 E-07
Benzo(b)fluoranthene	6.24 E-07	8.75 E-07	3.12 E-06	4.37 E-06
Benzo(k)fluoranthene	5.14 E-07	6.81 E-07	2.57 E-06	3.40 E-06
Chrysene	6.67 E-07	8.89 E-07	3.33 E-07	4.44 E-07
Dibenzo(a,h)anthracene	--	--	--	--
Indeno(1,2,3 cd)pyrene	5.42 E-07	1.25 E-06	2.71 E-07	6.25 E-07
Cumulative	6.19 E-06	9.07 E-06	4.29 E-06	1.31 E-05

SUMMARY OF CARCINOGENIC RISK AT CHILD DEVELOPMENT CENTER FOR CHILDREN INSIDE THE FENCE

	Soil Ingestion		Dermal Absorption	
Parameter	Average	Maximum	Average	Maximum
Benzo(a)pyrene	7.9 E-06	2.8 E-05	9.8 E-07	3.5 E-06
Chrysene	8.6 E-06	3.0 E-05	1.1 E-06	3.8 E-06
Dibenzo(a,h)anthracene	8.7 E-07	1.1 E-06	1.1 E-07	1.4 E-07
Cumulative Risk	1.7 E-05	5.9 E-05	2.1 E-06	7.4 E-06

SUMMARY OF CARCINOGENIC RISK AT CHILD DEVELOPMENT CENTER FOR CHILDREN INSIDE THE FENCE

	Soil Ingestion		Dermal Absorption	
Background related	Average	Maximum	Average	Maximum
Arsenic	6.8 E-06	1.0 E-05	--	--
Benzo(a)anthracene	8.4 E-06	3.0 E-05	1.1 E-06	3.7 E-06
Benzo(b)fluoranthene	9.2 E-06	3.2 E-05	1.1 E-06	4.1 E-06
Benzo(k)fluoranthene	1.3 E-05	4.7 E-05	1.6 E-06	5.9 E-06
Indeno(1,2,3-cd)pyrene	4.0 E-06	1.4 E-05	5.0 E-07	1.8 E-06
Cumulative Background Risk	4.1 E-05	1.3 E-04	4.3 E-06	1.5 E-05
TOTAL	5.8 E-05	1.9 E-04	6.4 E-06	2.2 E-05

SUMMARY OF CARCINOGENIC RISK AT CHILD DEVELOPMENT CENTER FOR ADULTS INSIDE THE FENCE

	Soil Ingestion		Dermal Absorption	
Parameter	Average	Maximum	Average	Maximum
Benzo(a)pyrene	3.0 E-06	1.1 E-05	1.5 E-06	5.3 E-06
Chrysene	3.3 E-06	1.1 E-05	1.7 E-06	5.8 E-06
Dibenzo(a,h)anthracene	3.3 E-07	4.3 E-07	1.7 E-07	2.1 E-07
Cumulative Risk	6.6 E-06	2.2 E-05	3.4 E-06	1.1 E-05

SUMMARY OF CARCINOGENIC RISK AT CHILD DEVELOPMENT CENTER FOR ADULTS INSIDE THE FENCE

	Soil Ingestion		Dermal Absorption	
Background related	**Average**	**Maximum**	**Average**	**Maximum**
Arsenic	2.6 E-06	3.0 E-06	--	--
Benzo(a)anthracene	3.2 E-06	1.1 E-05	1.6 E-06	5.7 E-06
Benzo(b)fluoranthene	3.5 E-06	1.2 E-05	1.8 E-06	6.2 E-06
Benzo(k)fluoranthene	4.8 E-06	1.8 E-05	2.4 E-06	9.0 E-06
Indeno(1,2,3-cd)pyrene	1.5 E-06	5.6 E-06	7.6 E-07	2.8 E-06
Cumulative Background Risk	1.5 E-05	5.0 E-05	6.5 E-06	2.3 E-05
TOTAL	2.2 E-05	7.2 E-05	9.9 E-06	3.4 E-05