United States
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Agency

Oil and Special Materials
Control Division
Marine Protection Branch
Washington DC 20460

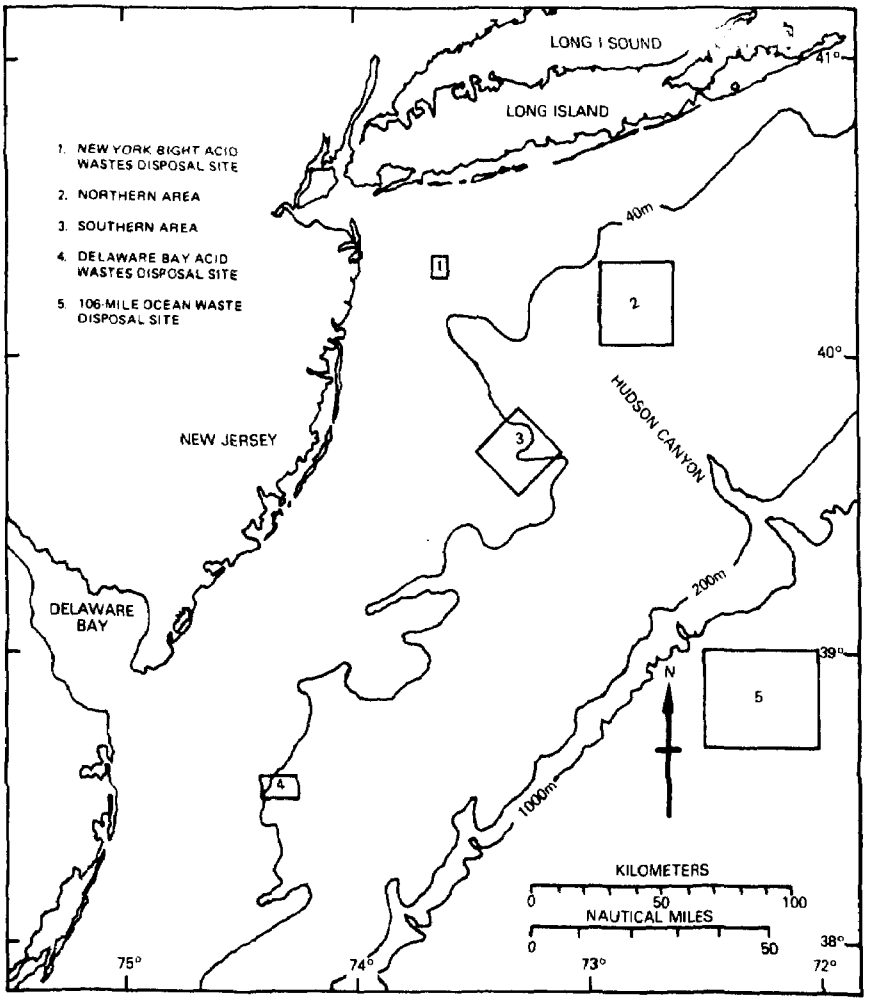
September 1980

Water

EPA

Environmental Impact Statement (EIS) for New York Bight Acid Waste Disposal Site Designation

Final



METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measure

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.54	centimeters	cm
ft	feet	30.	centimeters	cm
yd	yards	0.9	meters	m
fm	fathoms	1.8	meters	m
mi	statute miles	1.6	kilometers	km
nmi	nautical miles*	1.9	kilometers	km

*1 nautical mile = 6.076 feet = 1.15 statute miles

		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
nmi^2	square nautical miles	3.4	square kilometers	km^2
		MASS (weight)		
oz	ounces	28.	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2,000 lbs)	0.9	tonnes†	t

†1 tonne = 1,000 kg = 1 metric ton

		VOLUME		
fl oz	fluid ounces	30.	milliliters	ml
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	0.55(°F) - 32	Celsius temperature	°C
		VELOCITY		
in/sec	inches per second	2.5	centimeters per second	cm/sec
ft/sec	feet per second	30.	centimeters per second	cm/sec
ft/min	feet per minute	0.5	centimeters per second	cm/sec
mph	miles per hour	1.6	kilometers per hour	kph
kn	knots**	51.	centimeters per second	cm/sec
kn	knots (nautical miles per hour)	1.9	kilometers per hour	kph

**1 knot = 1.15 mph

Approximate Conversions from Metric Measure

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
m	meters	0.6	fathoms	fm
km	kilometers	0.6	statute miles	mi
km	kilometers	0.5	nautical miles*	nmi

*1 nautical mile = 6.076 feet = 1.15 statute miles

		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	11.	square feet	ft^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
km^2	square kilometers	0.3	square nautical miles	nmi^2
		MASS (weight)		
g	grams	0.4	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes†	1.1	short tons (2,000 lb)	

†1 tonne = 1,000 kg = 1 metric ton

		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.1	quarts	qt
l	liters	0.3	gallons	gal
m^3	cubic meters	35.	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8(°C) +32	Fahrenheit temperature	°F
		VELOCITY		
cm/sec	centimeters per second	0.4	inches per second	in/sec
cm/sec	centimeters per second	0.03	feet per second	ft/sec
cm/sec	centimeters per second	2.0	feet per minute	ft/min
cm/sec	centimeters per second	0.02	knots (nautical miles per hr)**	kn
kph	kilometers per hour	0.6	miles per hour	mph
kph	kilometers per hour	0.5	knots	kn

**1 knot = 1.15 mph

FINAL

ENVIRONMENTAL IMPACT STATEMENT (EIS)
for
NEW YORK BIGHT ACID WASTE DISPOSAL SITE DESIGNATION

August 1980

EPA

Prepared Under Contract 68-01-4610
T. A. Wastler, Project Officer
for
U.S. ENVIRONMENTAL PROTECTION AGENCY
Oil and Special Materials Control Division
Marine Protection Branch
Washington, D.C. 20460

ENVIRONMENTAL PROTECTION AGENCY

FINAL
ENVIRONMENTAL IMPACT STATEMENT ON THE NEW YORK BIGHT ACID WASTE DISPOSAL SITE DESIGNATION

Prepared by: U.S. Environmental Protection Agency
Oil and Special Materials Control Division
Marine Protection Branch
Washington, D.C. 20460

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER PROGRAM OPERATIONS
MARINE PROTECTION BRANCH

(X) Administrative/Regulatory action

( ) Legislative action

The review period for comments on the Draft EIS ended on 12 February 1980; however, the review period was extended until 6 March 1980 in order to incorporate all public comments.

The 30-day review period for comments on the Final EIS ends on

December 5, 1980

Comments should be addressed to:

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Environmental Protection Agency
Region II (2 SA-MWP)
Marine and Wetlands Protection Branch
26 Federal Plaza
New York, N.Y. 10007

The Final Statement may be reviewed at the following locations:

Environmental Protection Agency
Public Information Reference Unit, Room 2404 (Rear)
401 M Street, SW
Washington, D.C. 20460

Environmental Protection Agency
Region II
Library, Room 1002
26 Federal Plaza
New York, N.Y. 10007

Environmental Protection Agency
Region II
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Approved by: _____ _____
T.A. Wastler **Date**
Project Officer

SUMMARY

This Environmental Impact Statement (EIS) provides the public information required for the decisionmaking process about formal designation of the New York Bight Acid Waste Disposal Site (Acid Site) for continued use as an ocean disposal site. It recommends the types of wastes that could be released at the site, summarizes the history of waste disposal at the site, and provides guidance for the U.S. Environmental Protection Agency (EPA) to manage the site under the ocean dumping permit program.

ORGANIZATION OF THE ENVIRONMENTAL IMPACT STATEMENT

The EIS has three levels of detail. This summary emphasizes significant points of the chapters, permitting readers to understand major points without reading the entire text. The main text contains additional technical information, with full discussions of the alternatives and choices. The Appendices contain supplemental technical data and information which amplify and support the preferred alternative. It is not necessary to read the appendices to understand the rest of the document.

Six Chapters comprise the main body of the EIS:

- Chapter 1 specifies the purpose of and need for the proposed action and presents background information relevant to ocean waste disposal. The legal framework by which EPA selects, designates, and manages ocean waste disposal sites, is described.

- Chapter 2 presents alternatives to designating the Acid Site, outlines the procedures by which alternatives were chosen and evaluated, and summarizes the relevant comparisons of all alternatives.

- Chapter 3 describes the environmental features of the Acid Site and the alternative sites. The history of waste disposal and other activities in the site vicinities is fully described.

- Chapter 4 discusses the environmental consequences of waste disposal at the alternative sites and at the proposed site.

- Chapter 5 lists the preparers of the EIS and those who commented on the DEIS.

- Chapter 6 contains a glossary and the references.

Seven Appendices are included to support the text:

- Appendix A specifies the environmental characteristics of the New York Bight* and describes the oceanographic processes occurring at the Acid Site.

- Appendix B discusses the Acid Site in detail, specific studies already performed at the site, and unique features.

- Appendix C describes the waste inputs to the Bight from all contaminant sources.

- Appendix D discusses the previous waste disposal at the Acid Site and compares the inputs to the total waste loading.

- Appendix E summarizes the existing monitoring plan at the site and defines general criteria for future site monitoring.

- Appendix F contains the letters received during the public comment period and the responses to these comments.

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*Hereinafter - "the Bight;" mid-Atlantic Bight will be in full.

- Appendix G presents the Federal Register May 29, 1980 announcement of the Proposed Site Designation and Criteria for Management of the New York Bight Acid Waste Disposal Site.

BACKGROUND

The Council on Environmental Quality (CEQ) identified ocean waste disposal as a potentially serious environmental problem (CEQ, 1970). As a result of the CEQ's report and increasing public awareness of the dangers of unregulated waste disposal in the oceans, Congress passed the Marine Protection, Research, and Sanctuaries Act (MPRSA) in 1972. This law placed the ocean disposal of barged wastes under the authority of EPA, which published the Final Ocean Dumping Regulations and Criteria in 1977 (superseding regulations published in 1973). These were designed to regulate waste disposal, evaluate environmental effects of various waste types, and designate and manage all ocean disposal sites for continued use. The regulations identified 14 interim municipal and industrial waste disposal sites for use until waste disposal operations were terminated, or until sites were designated for use, in accordance with the criteria. The interim designation of the sites was extended pending completion of in-depth studies of various dumpsites. (See 40 CFR 228.12 as amended 16 January 1980; 45 FR 3053.) The subject of this EIS is the designation of the Acid Site for continued use.

PROPOSED ACTION

EPA proposes to designate the Acid Site for continued use for liquid acid waste disposal. This action will satisfy the need for a suitable location off the Middle Atlantic States for disposal of certain wastes which comply with the criteria for ocean disposal, under EPA's ocean dumping permit program. The criteria are based on a demonstrated need for ocean disposal in preference to land-based alternatives, and an evaluation of the potential impact on the marine environment.

The Acid Site was first used in 1948. Only two industrial waste generators, NL Industries, Inc. and Allied Chemical Corp., are presently (1980) using the site for disposal of highly acidic waste. Acids in the waste are rapidly neutralized by seawater. Other waste constituents, present in minute quantities, have no apparent impact on the marine environment. NL Industries and Allied Chemical have each submitted reports to EPA, which demonstrate that their respective wastes comply with the environmental impact criteria of the Ocean Dumping Regulations. Land-based alternative disposal methods are considered before granting a permit for ocean disposal. EPA requires the permittees to investigate the most promising alternatives with the objective of eliminating ocean dumping. At this time, however, ocean disposal of these acid wastes is the environmentally preferable disposal solution.

Continued use of the existing interim site in the New York Bight Apex (Apex) is the preferred alternative for several reasons. More than 30 years of studies have not documented any long-term adverse effects from acid waste disposal at this site. The amount of pollution introduced by acid waste is slight, thus the transference of waste disposal activities to a more distant site would not environmentally counterbalance increased economic costs (to the waste generators and the Federal Government) and logistic difficulties of using a new site.

MAJOR ALTERNATIVES

The major alternatives to designation of the Acid Site are:

(1) No action - The site would continue under the interim designation. No action is not a viable alternative since the EPA is required to decide the fate of this site, i.e., final designation or end of dumping at the site.

(2) Use of alternative ocean disposal sites.

Three other locations, the Northern and Southern Areas in the Bight, and the 106-Mile Ocean Waste Disposal Site (106-Mile Site) off the Continental Shelf, were considered as possible alternatives to the existing site. The following listing shows the category of each alternative site:

Site	Category
Acid Site	Existing site on the Continental Shelf
106-Mile Site	Existing site off the Continental Shelf
Northern Area	New site on the Continental Shelf offshore Long Island
Southern Area	New site on the Continental Shelf offshore New Jersey

Nine municipal and industrial waste disposal sites (excluding dredged material disposal sites) exist in the mid-Atlantic region. (See Figure 2-2, Chapter 2). Sites used for other types of wastes (cellar dirt, wood incineration, wrecks, and sewage sludge) were not considered as candidates for acid waste disposal. Combinations of different waste types at a single site are generally undesirable because synergistic interactions may occur between the wastes. The Delaware Bay Acid Waste Site was not considered because of its inactive status and distance from New York Harbor.

The 106-Mile Site was considered as a viable alternative since it is presently used for disposal of aqueous industrial wastes (including acids), and is located beyond the Continental Shelf. The Northern and Southern Areas were considered as alternative sewage sludge disposal sites, and site-specific information is available for both areas. The Alternate Sewage Sludge Site, (Figure 2-2 in Chapter 2) has been designated in the northeast corner of the Northern Area. These areas are representative of the mid-shelf region offshore New Jersey and Long Island. If another specific location on the shelf were selected, the same reasoning would apply. Table S-1 summarizes the favorable and unfavorable features of each alternative considered in this EIS.

TABLE S-1
SUMMARY EVALUATION OF PROPOSED ACTION AND ALTERNATIVES

Alternative	Favorable Factors	Unfavorable Factors
No Action		
Continue interim site designation	None	(i) Interim designation expires December 1982. (ii) Less environmentally sound alternative disposal method would be implemented or the plant would be shut down.
Proposed Action		
Designate existing Acid Site	(i) Commercial resources (lobster, whiting, bluefish) not harmed by waste disposal. (ii) Site has been used over 30 years without apparent environmental damage. (iii) Nearshore location simplifies monitoring effects of disposal and surveillance of disposal operations; cost of these programs is low. (iv) Documented loss of biotic or mineral resources have not occurred due to acid waste disposal. (v) Hauling costs are low for all permittees.	(i) Although a small amount (<1% of the total input), acid wastes are additional sources of contaminants to the Apex, a highly stressed area. (ii) Acid-iron wastes form a visible plume of ferric hydroxide (rust) which is persistent (48 hr max), aesthetically displeasing and may interfere with some pelagic sport fisheries.
Alternative Sites		
Off-the-Continental Shelf		
106-Mile Site	(i) No adverse effects on fisheries, aesthetics, or benthos due to distance from shore and depth. (ii) Short-term adverse effects on the water same as at existing site. (iii) Site has been used for 14 years for aqueous industrial wastes without apparent environmental damage.	(i) Detecting adverse changes difficul due to environmental complexity. (ii) Distance from shore increases hauling costs 5-8 times. Primary waste generator probably could not use site and could shut down plant. (iii) Surveillance and monitoring costs increased. (iv) Slightly increased navigational hazard and risk.
On-the-Continental Shelf		
(1) Northern Area	(i) Area does not have large numbers of commercially exploitable species. (ii) Water movement usually carries contaminants along or off-Shelf and away from shore. (iii) Short-term adverse effects on the water same as at existing site.	(i) Distance from shore increases hauling costs 3-4 times. Primary waste generator probably could not use site and may shut down plant. (ii) Surveillance and monitoring costs increased. (iii) Would contaminate an area where wastes have never been dumped. Possible accumulations in the sediments.
(2) Southern Area	(i) Short-term adverse effects on the water same as at existing site.	(i) Area has potentially exploitable biotic and mineral resources. (ii) Would contaminate an area where wastes have never been dumped. Possible accumulations in the sediments. (iii) Economically, same adverse effects as in Northern Area; (iv) Shoreward movement of the wastes more probable than at one of the alternative sites.

AFFECTED ENVIRONMENT

The Acid Site is in the Apex. The Apex is adjacent to one of the most industrialized and populated regions of the country, and receives wastes from more than 20 million people. Large quantities of acid wastes are released annually at the site, but adverse effects last only a few minutes following disposal. When compared with waste inputs from all sources, the contaminants in acid wastes are insignificant. The existing site is 15 nmi from shore, abuts the Hudson Shelf Valley, has a sandy bottom, and is in 26 m of water.

The Northern and Southern Areas are further offshore (30 nmi), with sandy bottoms in deeper water (31 to 53 m). The Hudson Shelf Valley and Canyon, an important geological feature and a migration route for some animals, lies between the two named areas. Potentially exploitable shellfish resources and mineral resources exist near the Southern Area. The Northern Area is neither unique nor especially productive.

The 106-Mile Site is just beyond the edge of the Continental Shelf, 90 nmi from shore, in over 1,500 m of water. The site is oceanic with the water characteristics and biological features resembling more the open ocean to the east than coastal areas to the west. Chemical wastes were released there, beginning in 1961; munitions and low-level radioactive wastes have also been dumped in or near this area. Long-term adverse effects caused by such wastes have not been demonstrated. There are no known exploitable mineral or biological resources in the area.

ENVIRONMENTAL CONSEQUENCES

Since acid-waste liquids do not have a toxic solid phase, before or after release, the short-term effects after release will be similar at all alternative sites. Acid-iron waste does form a ferric hydroxide (rust) floc after release which, according to the Ocean Dumping Regulations, is part of

the suspended particulate phase. Four characteristics of these liquid acid wastes are important in considering possible effects at the alternative sites:

(1) Aqueous wastes will not measurably affect benthos at deep sites, but some waste constituents may accumulate in sediment at shallow sites.

(2) Aqueous wastes have short-term (minutes to hours) effects on the water when released at rates that allow adequate dispersion, preventing accumulation of waste constituents in the water mass.

(3) Bioaccumulation of waste constituents in organisms that inhabit the water column (plankton or fish) is unlikely.

(4) Solid fraction will slowly settle to the bottom after being dispersed over a wide area.

Acid waste disposal has had minimal adverse impacts on the environment of the Acid Site. Assessments of over 30 years of documentation from investigations by Federal, university, and private groups, show that there are no long-term adverse effects from the wastes. Accumulations of waste constituents in sediments are possible, but acid wastes represent less than 1% of total contaminant inputs to the Bight. Consequently, transferring waste disposals to other locations probably would not measurably improve either water quality or ecosystem health in the Bight.

The effects of acid waste disposal in the Southern Area could be more severe than at the existing site. Since wastes have never been released in the area, detectable accumulations in the sediments may occur and adversely affect the ecosystem. It should be noted that potentially exploitable biological (shellfish) and mineral (sand, oil, and gas) resources exist in the area, and waste disposal operations could interfere with such profitable ocean usage.

If wastes were released in the Northern Area, effects on the ecosystem would parallel those in the Southern Area. Such effects are potentially more severe than those resulting from continued use of the existing site. The adverse effects on public health and water quality would be negligible since exploitable resources are not found near the site.

If the 106-Mile Site were designated for the disposal of acid wastes, the effects would be similar to those at the existing nearshore site. Should adverse environmental effects occur, however, they would be more difficult to detect because of the inherent complex oceanographic characteristics at the site. The risk of emergency (short) dumping is further increased because of the much longer transit time to the site from New York Harbor.

CONCLUSIONS

After carefully evaluating all reasonable alternatives, EPA proposes that the New York Bight Acid Waste Disposal Site receive final designation for continuing acid industrial waste disposal in compliance with the EPA Ocean Dumping Regulations and Criteria. However, under the MPRSA, evaluation of alternative disposal methods should continue. Relevant research and development will continue to be a condition imposed by EPA on waste generators obtaining ocean disposal permits. After the publication of the DEIS, EPA, the Department of Justice, and NL Industries entered into a consent decree which will phase out the ocean disposal of NL Industries waste by 31 December 1989. Details are provided at the end of Chapter 2.

Wastes permitted for disposal at the site should have the following characteristics:

- Aqueous acidic wastes with low concentrations of suspended solids.
- Neutrally to negatively buoyant in seawater.
- Contain no materials in concentrations prohibited by the MPRSA.

- Demonstrate low toxicity to representative planktonic and nektonic marine organisms after allowance for initial mixing and dispersion.

The disposal operations should have the following characteristics:

- Wastes should be discharged from a vessel under way to facilitate rapid and immediate dilution.

- Limiting permissible concentration (LPC) for waste constituents will not be exceeded outside the disposal site during initial mixing nor will it be exceeded anywhere in the environment after initial mixing.

- Each barge load should be sufficiently small to permit adequate dispersal of the waste constituents before disposal of the next load so that accumulation of waste materials would not occur due to successive dumps.

- Except in emergency situations, only one barge should be permitted within the site for disposal operations within the 4-hour initial mixing period.

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Chapter 1
PURPOSE OF AND NEED FOR ACTION

An ocean disposal site is needed since land-based disposal methods for some acid wastes cannot be implemented using existing technology. To fulfill this need, EPA proposes to designate the New York Bight Acid Waste Disposal Site in accordance with the January 11, 1977 EPA Ocean Dumping Regulations and Criteria. This chapter defines the action to be taken, discusses the history of the regulation of ocean disposal, and summarizes the legal regime for identifying and establishing viable options.

Ocean disposal of waste materials has been practiced for generations on an international scale. In the early 1970's, U.S. legislation and international agreements were enacted to control the disposal of waste in the marine environment. This legislation greatly decreased the number of industries and municipalities using the ocean for waste disposal and forced the development of land-based alternatives. However, some industrial processes produce wastes which cannot (using current technology) be treated or disposed of safely or economically on land, but can be disposed of in the ocean without seriously degrading the marine environment. Most of this waste-generating activity is centered around the heavily populated and industrialized East Coast. To accommodate this need for ocean waste disposal, the U.S. Environmental Protection Agency (EPA) proposes to designate the New York Bight Acid Waste Disposal Site (referred to as the Acid Site) for continued use.

The Acid Site is in the New York Bight Apex (hereinafter called the Apex). Figure 1-1 shows the location of the site and the geographical positions of several features. The New York Bight (or Bight) stretches from Montauk, Long Island to Cape May, New Jersey and seaward to the edge of the Continental Shelf. The Apex is bounded by the coast and latitude 40°10'N and longitude 73°30'W. The Hudson Shelf Valley begins in the Apex and reaches to the Hudson Canyon at the edge of the Shelf. The term mid-Atlantic Bight refers to the Continental Shelf from Cape Cod, Massachusetts to Cape Hatteras, North Carolina.

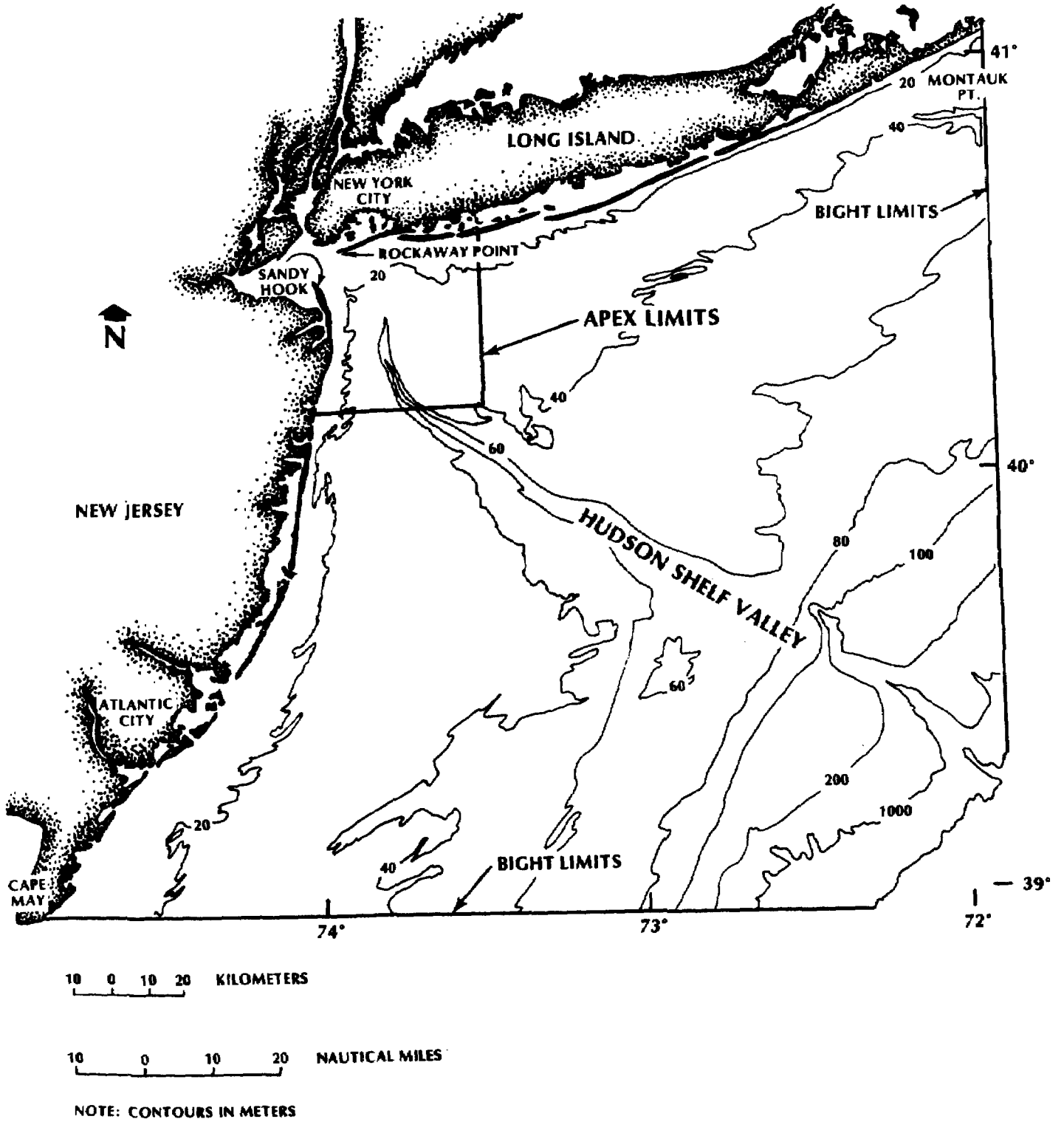

Figure 1-1. New York Bight Acid Waste Disposal Site Location in the New York Bight Apex

The Acid Site has been used for waste disposal since 1948. In 1973 EPA designated this site for use on an interim basis, for disposal of acid wastes. Only three companies have used the site for waste disposal: (1) NL Industries, Inc., Sayreville, New Jersey; (2) Allied Chemical Corporation, Elizabeth, New Jersey; and (3) the E.I. du Pont de Nemours and Company, Grasselli Plant, Linden, New Jersey. Since December 1975, only NL Industries and Allied Chemical have used the site. The projected use of the site (1.4 million tonnes* annually until April 1981) is well below the long-term average (2.3 million tonnes annually from 1958 to 1978). Almost all of the wastes released at the site have been highly acidic (pH below 1.0); some caustic wastes (pH above 12) were released by DuPont-Grasselli before 1976, when their waste disposal operations were moved by EPA to the 106-Mile Ocean Waste Disposal Site (hereinafter, simply the 106-Mile Site).

Studies of the effects of waste disposal at the Acid Site have been conducted since 1948. Until 1972 most of the work was conducted by university scientists and sponsored by NL Industries, the main user of the site. In 1973, the National Oceanographic and Atmospheric Administration - Marine EcoSystem Analysis (NOAA-MESA) - New York Bight Project began assessing the environmental health of the Bight and man's influence on the area. This work, and all other work performed at the site or in the general area, has not uncovered significant adverse effects caused by acid waste disposal.

By January 1, 1982 ocean disposal of industrial wastes will be permitted only for wastes which comply with EPA's environmental impact criteria and cannot be treated on land for environmental or economic reasons. NL Industries and Allied Chemical have demonstrated that their wastes comply with EPA's environmental impact criteria and that, at present, technically feasible alternative disposal methods are environmentally less preferable than continued use of the site; therefore, a present and future need exists for the designation of an ocean dump site. The reason for this continuing need is

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* One metric ton equals 2,205 lb. Throughout this EIS, the word tonne will be used to designate a metric ton and to distinguish it from an English ton.

twofold: (1) NL Industries and Allied Chemical each produce wastes that can be released safely at the Acid Site without unreasonable degradation of the marine environment, and (2) ocean waste disposal may be required for other wastes that do not comply with environmental regulations for land disposal, but can be released into the marine environment without causing irreversible adverse effects.

As part of the decision-making process, EPA has investigated all reasonable alternatives to the continued use of the Acid Site. Two broad categories of alternatives exist: (1) take no action, which would leave the existing site with an interim designation, or (2) designate and use another ocean location for disposing of these wastes.

After a careful review of the alternatives, EPA has determined that designation of the New York Bight Acid Waste Disposal Site for continued use is the most favorable course of action. Continued use of the site will allow approved dumping of the wastes at the site under current ocean dumping permits, and will provide for the disposal of new wastes which the EPA deems acceptable for ocean disposal. EPA Region II will manage the site, regulate times, rates, methods of disposal, and quantities and types of materials disposed, develop and maintain effective monitoring programs for the site, conduct disposal site evaluation studies, and recommend modifications in site use or designation as necessary.

FEDERAL LEGISLATION AND CONTROL PROGRAMS

Before the early 1970's, there was little regulation of ocean waste disposal. Limited regulation was provided primarily by the New York Harbor Act of 1888, which empowered the Secretary of the Army to prohibit disposal of wastes, except from streets and sewers, into the harbors of New York, Hampton Roads, and Baltimore. The Refuse Act of 1899 prohibited the disposal of materials into navigable waters when disposal impeded safe navigation. Under these acts, selection of disposal locations by the U.S. Army Corps of

Engineers (CE) and the issuance of permits for ocean disposal were based primarily upon transportation and navigation factors rather than upon environmental concerns.

Public interest in adverse effects of ocean disposal was aroused in 1969 and 1970 by incidents resulting from disposal of warfare agents in the ocean. Simultaneous studies by the National Oceanic and Atmospheric Administration (NOAA) and several universities identified potential adverse effects of sewage sludge and industrial waste disposal in the New York Bight (e.g., Buelow et al., 1968; Gross, 1970; Pearce, 1972). The Council on Environmental Quality (CEQ) 1970 report to the President identified poorly regulated ocean waste disposal as a potential environmental danger.

The CEQ report, and the increasing public awareness of the potentially undesirable effects of poorly regulated ocean waste disposal, were mainly responsible for the enactment of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (PL 92-532, as amended), the primary U.S. legislation now regulating barged ocean waste disposal. Seeking advice and counsel from EPA marine scientists and from marine specialists in universities, industries, environmental groups, and other Federal and State agencies, EPA developed criteria which would provide effective technical bases for the regulatory program required by the Act. The criteria were published in May 1973, finalized in October 1973, and revised in January 1977. The criteria are used to evaluate the need for ocean waste disposal and the potential impact of disposal on the marine environment.

The Clean Water Act (CWA) of 1977 (PL 95-217) amended and replaced earlier legislation and established a comprehensive regulatory program for controlling discharge of pollutants from outfalls into navigable waters of the United States, including ocean waters. The primary objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. CWA regulates discharges by the promulgation of criteria to prevent degradation of the marine environment (Section 403), and the application of the criteria in the issuance of permits (Section 402). Thus, CWA and MPRSA are the primary Federal statutes which are used to control waste disposal via ocean outfalls or by dumping at offshore disposal sites.

MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT (MPRSA)

The MPRSA regulates the transportation and ultimate dumping of waste materials in ocean waters. The Act is divided into three parts: Title I - Ocean Dumping, Title II - Comprehensive Research on Ocean Dumping, and Title III - Marine Sanctuaries. This EIS concentrates on Title I, specifically Section 102(c), which charges EPA with the responsibility for designating sites and times for dumping.

Title I, the primary regulatory section of the Act, establishes the permit program for the disposal of dredged and non-dredged materials, mandates determination of impacts, and provides for enforcement of permit conditions. Through Title I, the Act provides a procedure for regulating the transportation and ocean disposal of waste materials into ocean waters under the jurisdiction or control of the United States. Title I requires that a permit be obtained by any person of any nationality wishing to transport waste material from any U.S. port, or under a U.S. flag, to be dumped anywhere in the oceans of the world.

Title I prohibits the dumping in ocean waters of certain wastes, among them biological, radiological, and chemical warfare agents, and all high-level radioactive wastes. Title I was amended in November 1977 (PL 95-153) to prohibit dumping of harmful sewage sludge* after December 31, 1981. The provisions of Title I include a maximum criminal fine of $50,000 and jail sentence of up to one year for every unauthorized dump or violation of permit requirement, or a maximum civil fine of $50,000. Any individual may seek an injunction against an unauthorized dumper with possible recovery of all costs of litigation.

Title II of MPRSA provides for comprehensive research and monitoring of ocean dumping effects on the marine environment. Under Title II, NOAA's ocean

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* Harmful sewage sludge is defined by PL 95-153 as sewage sludge that "may significantly degrade or endanger human health, welfare and amenities, the marine environment and ecological systems, or economic potential."

dumping program has conducted extensive survey and laboratory investigations over the past several years at ocean waste disposal sites in the North Atlantic Ocean. This work aids EPA in site management by providing data for site-use decisions.

Several Federal departments and agencies share responsibilities under the Act (Table 1-1). The major responsibilities are mandated to EPA to review, grant, and enforce dumping permits for all wastes except dredged materials, and to designate and manage all disposal sites. In October 1973, EPA implemented its responsibility for regulating ocean dumping under MPRSA by issuing Final Ocean Dumping Regulations and Criteria (hereinafter the "Ocean Dumping Regulations") which were revised in January 1977 (40 CFR, Parts 220 to 229). These regulations established procedures and criteria for designating and managing ocean disposal sites (Part 228), reviewing ocean disposal permit applications (Part 222), assessing impacts of ocean disposal (Part 227), and enforcing permits (Part 226). Interim disposal sites were authorized pending final designation for continuing use or a decision to terminate use. The Acid Site was one of 14 municipal and industrial sites approved for interim use.

The CE issues permits for disposal of dredged material after determining compliance of the material with EPA environmental impact criteria (40 CFR 227). Compliance with the criteria is subject to EPA concurrence. The CE is responsible for evaluating disposal applications and granting permits to dumpers of dredged materials, whereas dredged material disposal sites are designated and managed by EPA.

Under MPRSA, the Commandant of the U.S. Coast Guard (USCG) is assigned responsibility by the Secretary of Transportation for conducting surveillance of disposal operations to ensure compliance with the permit conditions and to discourage unauthorized disposal. Violations are referred to EPA for enforcement. Surveillance is accomplished by means of spot checks of disposal vessels for valid permits, interception or escorting of dump vessels, use of shipriders, aircraft overflights during dumping, and random surveillance missions at land facilities.

TABLE 1-1
RESPONSIBILITIES OF FEDERAL DEPARTMENTS AND AGENCIES
FOR REGULATING OCEAN WASTE DISPOSAL UNDER MPRSA

Department/Agency	Responsibility
U.S. Environmental Protection Agency	Issuance of waste disposal permits, other than for dredged material Establishment of criteria for regulating waste disposal Enforcement actions Site designation and management Overall ocean disposal program management
U.S. Department of the Army Corps of Engineers	Issuance of dredged material disposal permits Recommending disposal site locations
U.S. Department of Transportation Coast Guard	Surveillance Enforcement support Issuance of regulations for disposal vessels Review of permit applications
U.S. Department of Commerce National Oceanic and Atmospheric Administration	Research on alternative ocean disposal techniques Long-term monitoring and research Comprehensive ocean dumping impact and short-term effect studies Marine Sanctuary designation
U.S. Department of Justice	Court actions
U.S. Department of State	International agreements

All of these methods are used for surveillance at the Acid Site, and interception and escort by USCG vessels or aircraft are the most common methods. In addition, the USCG has tested the feasibility and accuracy of an automatic Ocean Dumping Surveillance System (ODSS), which is based on electronic navigation. The system has been field-tested and evaluated by the USCG for future use in routine surveillance. Proposed regulations (33 CFR 158) requiring installation and use of an ODSS were issued in the Federal Register on 13 December 1979. Systems would have to be approved and installed within six months of the date of publication of the final rules.

Under Title II of MPRSA, NOAA conducts comprehensive monitoring and research programs on the effects of ocean dumping on the marine environment, including short-term effects and potential long-term effects of pollution, over-fishing, and other man-induced changes in oceanic ecosystems. Title III of MPRSA authorizes NOAA to designate coastal Marine Sanctuaries, after consultation with other affected Federal agencies, and to regulate all activities within the sanctuaries.

The Department of Justice initiates relief actions in court, at EPA's request, in response to violations of the terms of MPRSA. When necessary, injunctions to cease ocean dumping are sought. Fines and civil penalties may be levied administratively by EPA after a favorable court decision. Jail sentences may be imposed, based on the magnitude of the violation.

The Department of State seeks effective international action and cooperation in protection of the marine environment by negotiating international agreements furthering the goals of MPRSA. The most significant international negotiation with respect to ocean dumping is the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (hereinafter the "London Dumping Convention").

The MPRSA has been amended several times since its enactment in 1972. Most amendments provide for annual appropriations for administration of MPRSA. However, two of the amendments are noteworthy: first, passage of an amendment in March 1974 (PL 93-254) brought the Act into full compliance with the

Convention. Second, an amendment (PL 95-153) passed in November 1977, prohibits disposal of harmful sewage sludge in ocean waters after December 31, 1981.

OCEAN DISPOSAL SITE DESIGNATION

Under Section 102(c) of the MPRSA, the EPA Administrator is authorized to designate sites and times for ocean disposal, provided that the waste does not contain prohibited materials, and will not significantly degrade, or endanger, human health, welfare, and amenities, the marine environment and ecological systems, or economic potential.

Land-based methods of disposal as alternatives to ocean dumping are thoroughly evaluated during the permit application process. Through this evaluation, the applicant must prove a need for ocean disposal, and evaluate alternative disposal means before a permit for ocean dumping is granted. Since potential alternative disposal methods will vary, based on the type of waste, the issue is best resolved during the permit application stage.

Part 227 Subpart (C) of the Ocean Dumping Regulations specify the factors considered and the basis for determining that the need for ocean dumping exists. Even if a permit is granted, EPA may require the permittee to

> "...terminate all ocean dumping by a specified date, to phase out all ocean dumping over a specified period or periods, to continue research and development of alternative methods of disposal and make periodic reports of such research and development in order to provide additional information for periodic review of the need for and alternatives to ocean dumping..."

The conditions hold even when the permittee has demonstrated that the wastes comply with the requirements of Part 227 Subparts (B), (D), and (E) to prevent environmental impact; damage to aesthetic, recreational, or economic values, or interference with other uses of the ocean.

EPA has established criteria for designating sites in Part 228 of the Ocean Dumping Regulations. Included are criteria for site selection and procedures for designating the sites for disposal. Through this and other EIS's, EPA is

conducting in-depth studies of various dump sites to determine their acceptability in keeping with the criteria. The agency has designated a number of existing dump sites on an interim basis for use pending completion of the studies and formal designation or termination of the sites. (See 40 CFR 228.12, as amended 16 January 1980; 45 FR 3053.) The Acid Site is included in these interim designations.

General criteria for selection of sites, as provided in the Ocean Dumping Regulations, are:

> (a) The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.
>
> (b) Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.
>
> (c) If, at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis do not meet the criteria for site selection set forth in [Section] 228.5 to 228.6, the use of such sites will be terminated as soon as suitable alternate disposal sites can be designated.
>
> (d) The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-term impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study.
>
> (e) EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf, and other such sites that have been historically used. [Section 228.5]

Factors considered under the specific criteria for site selection relate more closely to conditions at the proposed sites by treating the general criteria in additional detail. A proposed site which satisfies the specific

criteria for site selection conforms to the broader, general criteria. The factors to be considered are:

- Geographical position, depth of water, bottom topography and distance from coast.
- Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.
- Location in relation to beaches and other amenity areas.
- Types and quantities of wastes proposed to be disposed of and proposed methods of release, including methods of packing the waste, if any.
- Feasibility of surveillance and monitoring.
- Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.
- Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).
- Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.
- The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.
- Potentiality for the development or recruitment of nuisance species in the disposal site.
- Existence at, or in close proximity to the site of any significant natural or cultural features of historical importance. [Section 228.6a]

These factors are addressed relative to the Acid Site in Chapter 2.

Once designated, the site must be monitored to determine if adverse impacts are occurring as a result of waste disposal. EPA monitors the following types

of effects to determine the extent of marine environmental impacts due to material released at the site:

- Movement of materials into estuaries or marine sanctuaries, or onto oceanfront beaches or shorelines.
- Movement of materials toward productive fishery or shellfishery areas.
- Absence from the disposal site of pollution-sensitive biota characteristic of the general area.
- Progressive nonseasonal changes in water quality or sediment composition at the disposal site when these changes are attributable to materials disposed of at the site.
- Progressive, nonseasonal, changes in composition or numbers of pelagic, demersal, or benthic biota at or near the disposal site, when these changes can be attributed to the effects of materials disposed of at the site.
- Accumulation of material constituents (including, without limitation, human pathogens) in marine biota at or near the site. [Section 228.10b]

EPA has established impact categories in the Ocean Dumping Regulations which specify impacts, detected by means of site monitoring, which require modifications in disposal site usage:

> (1) Impact Category I: The effects of activities at the disposal site shall be categorized in Impact Category I when one or more of the following conditions is present and can reasonably be attributed to ocean dumping activities:
>
> (i) There is identifiable progressive movement or accumulation, in detectable concentrations above normal ambient values, of any waste or waste constituent from the disposal site within 12 nautical miles of any shoreline, marine sanctuary designated under Title III of the Act, or critical area designated under Section 102 (c) of the Act; or
>
> (ii) The biota, sediments, or water column of the disposal site, or any area outside the disposal site where any waste or waste constituent from the disposal site is present in detectable concentrations above normal ambient values, are adversely affected by the toxicity of such waste or waste constituent to the extent that there are statistically significant decreases in the populations of valuable commercial or recreational species, or of specific species of biota essential to the propagation of such species, within the disposal site and such other area as compared to populations of the same organisms in comparable locations outside such site and area; or

(iii) Solid waste material disposed of at the site has accumulated at the site or in areas adjacent to it, to such an extent that major uses of the site or of the adjacent areas are significantly impaired and the Federal or State agency responsible for regulating such uses certifies that such significant impairment has occurred and states in its certificate the basis for its determination of such impairment; or

(iv) There are adverse effects on the taste or odor of valuable commercial or recreational species as a result of disposal activities; or

(v) When any toxic waste, toxic waste constituent, or toxic byproduct of waste interaction, is consistently identified in toxic concentrations above normal ambient values outside the disposal site more than four hours after disposal.

(2) Impact Category II: The effects of activities at the disposal site which are not categorized in Impact Category I shall be categorized in Impact Category II. (Section 228.10.)

On May 29, 1980 EPA published the announcement of a proposed rulemaking in the Federal Register establishing the New York Bight Acid Waste Disposal Site as an EPA-Approved Ocean Dumping Site. The closing date for receipt of comments was set at July 28, 1980. The announcement appears in Appendix G of this report.

OCEAN DUMPING PERMIT PROGRAM

EPA's Ocean Dumping Regulations establish a program for the application, evaluation, and issuance of ocean dumping permits. When a site is selected and duly designated, permits for the use of the site can be issued by CE for dredged material dumping and by EPA for other dumping. The Ocean Dumping Regulations are specific about the procedures used to evaluate permit applications, and the granting or denying of such applications. EPA and the CE (when appropriate) evaluate permit applications principally to determine whether there is (1) a demonstrated need for ocean disposal, and proof that no other reasonable alternatives exist (40 CFR 227 Subpart C), and (2) compliance with the environmental impact criteria (40 CFR 227 Subparts B, D, and E).

Compliance with EPA's environmental impact criteria ensures that the proposed waste disposal will not "unduly degrade or endanger the marine environment," and will not cause unacceptable adverse effects on human health,

the marine ecosystem, or other uses of the ocean. The criteria are too lengthy to include here; however, the relevant points are briefly summarized below:

- Prohibited Materials: High-level radioactive wastes; materials produced for radiological, chemical, or biological warfare; unknown materials; persistent floatable materials which interfere with other uses of the ocean.

- Materials present as trace contaminants only: Organohalogens; mercury and mercury compounds; cadmium and cadmium compounds; oil; known or suspected carcinogens, mutagens, or teratogens.

- Trace contaminants in the liquid fraction must neither exceed the marine water quality criteria (EPA, 1976) nor exist in toxic and bioaccumulative forms after initial mixing.

- Bioassays on the suspended particulate or solid fractions must not indicate occurrence of significant mortality or significant adverse sublethal effects, including bioaccumulation due to waste dumping.

- When bioassay methods are unavailable: Maximum concentrations of mercury and cadmium apply; organohalogen concentrations must be less than is known to be toxic to organisms; oils in the waste must not produce a visible sheen on the water.

- Trace contaminants must neither render edible marine organisms unpalatable nor endanger health of humans, domestic animals, shellfish, or wildlife.

Six types of ocean dumping permits may be issued: Interim, Special, General, Emergency, Research, and Incineration-at-Sea. With few exceptions, EPA has issued only Interim Permits. These permits are valid for one year maximum. They are issued when the permittee cannot demonstrate compliance of the waste with the environmental impact criteria, but can demonstrate that the need for ocean disposal is of greater significance to the public interest than possible adverse environmental impacts. However, Interim Permits cannot be issued to applicants who were not issued dumping permits before April 23, 1978. Holders of present Interim Permits must have a compliance schedule which will ensure either the complete phaseout of ocean dumping or compliance with the environmental impact criteria by December 31, 1981. After that date, EPA will not issue Interim Permits and ocean disposal of harmful wastes will cease. No present permittees at the Acid Site hold Interim Permits.

Special Permits, which are issued when the applicant can adequately demonstrate compliance of the wastes with the environmental impact criteria and can demonstrate a need for ocean disposal, may be issued for a maximum of three years. Holders of Special Permits are not subject to the 1981 deadline for cessation of the ocean disposal of harmful wastes. Some industrial permittees have been granted Special Permits. NL Industries and Allied Chemical each hold Special Permits for use of the Acid Site.

General Permits may be issued for ocean disposal of small amounts of materials which will have minimal adverse effects upon the environment. Examples of materials which warrant a General Permit include human remains or ashes for burial at sea, target vessels for ordnance testing, and derelict vessels transported for scuttling.

Emergency Permits may be issued for ocean disposal of materials which pose unacceptable risks to human health, and for which there are no other reasonable disposal techniques. Emergency Permit requests are considered case-by-case by EPA on the basis of the waste characteristics and the safest means for its disposal.

Research Permits may be issued for dumping material into the ocean as part of a research project, when the scientific merit of the project outweighs the potential adverse impacts of the dumping. EPA designates the disposal site to be used by Research Permit holders on the basis of the nature of the study project.

Incineration-at-Sea Permits are either Research, Interim, or Special permits. Current Incineration-at-Sea Permits are Special Permits, issued for disposal at the New York Bight Wood Incineration Site. As Special Permits, they are issued for a maximum period of three years. Burning is conducted under controlled weather conditions; the ash is transported back to shore and used as landfill. Research and Interim Permits have been issued by EPA in the past for the incineration of organochlorine wastes.

INTERNATIONAL CONSIDERATIONS

The principal international agreement governing ocean dumping is the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention), which became effective in August 1975, upon ratification by 15 contracting countries. Designed to control dumping of wastes in the oceans, the Convention specifies that contracting nations will regulate disposal in the marine environment within their jurisdiction, disallowing all disposal without permits. Certain other hazardous materials are prohibited, such as biological, radiological, and chemical warfare agents and high-level radioactive matter. Certain other materials (e.g., cadmium, mercury, organohalogens and their compounds, oil, and persistent synthetic materials which float) are prohibited, except when present as trace contaminants. Other materials - arsenic, lead, copper, zinc, cyanide, fluoride, organosilicon, and pesticides - while not prohibited from ocean disposal, require special care. Permits are required for at-sea disposal of materials not specifically prohibited. The nature and quantities of all waste material, and the circumstances of disposal, must be periodically reported to the Intergovernmental Maritime Consultative Organization (IMCO), which is responsible for administration of the Convention. Effective in March 1979, the Convention was amended to incorporate regulations for control of incineration of wastes at sea to be enforced nationally.

Chapter 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The proposed action is to designate the New York Bight Acid Waste Disposal Site for continued use. Thirty-two years of studies on the effects of acid wastes disposed at the site have not produced evidence of any adverse, long-term effects on the site environment. Alternative sites (Figure 2-1) were considered but rejected because there would be no environmental benefits, and barging costs to the waste generators and monitoring costs to the Federal Government would increase. The quality of the marine environment in the Apex would not improve if the ocean disposal of acid wastes were moved to another site. The No-Action alternative was rejected because a decision -- either final designation or an end to dumping at the interim site -- is needed for this site.

After reviewing the alternatives, EPA proposes that the interim Acid Site be designated for continued use. The alternatives considered were:

- No-Action Alternative: The existing Acid Site would retain its interim designation until December 31, 1982.

- Proposed Action: Designate the existing Acid Site.

- Use of Other Sites: Designate another, existing or new, disposal site.

The environmental consequences of each alternative, and the economic burdens, implications and effects of each alternative have been predicted from analyses of available data and are discussed below. Evaluations and comparisons of the alternatives are based upon three major considerations:

- Public Health and Safety.
- Ecosystem Effects.
- Economic Costs.

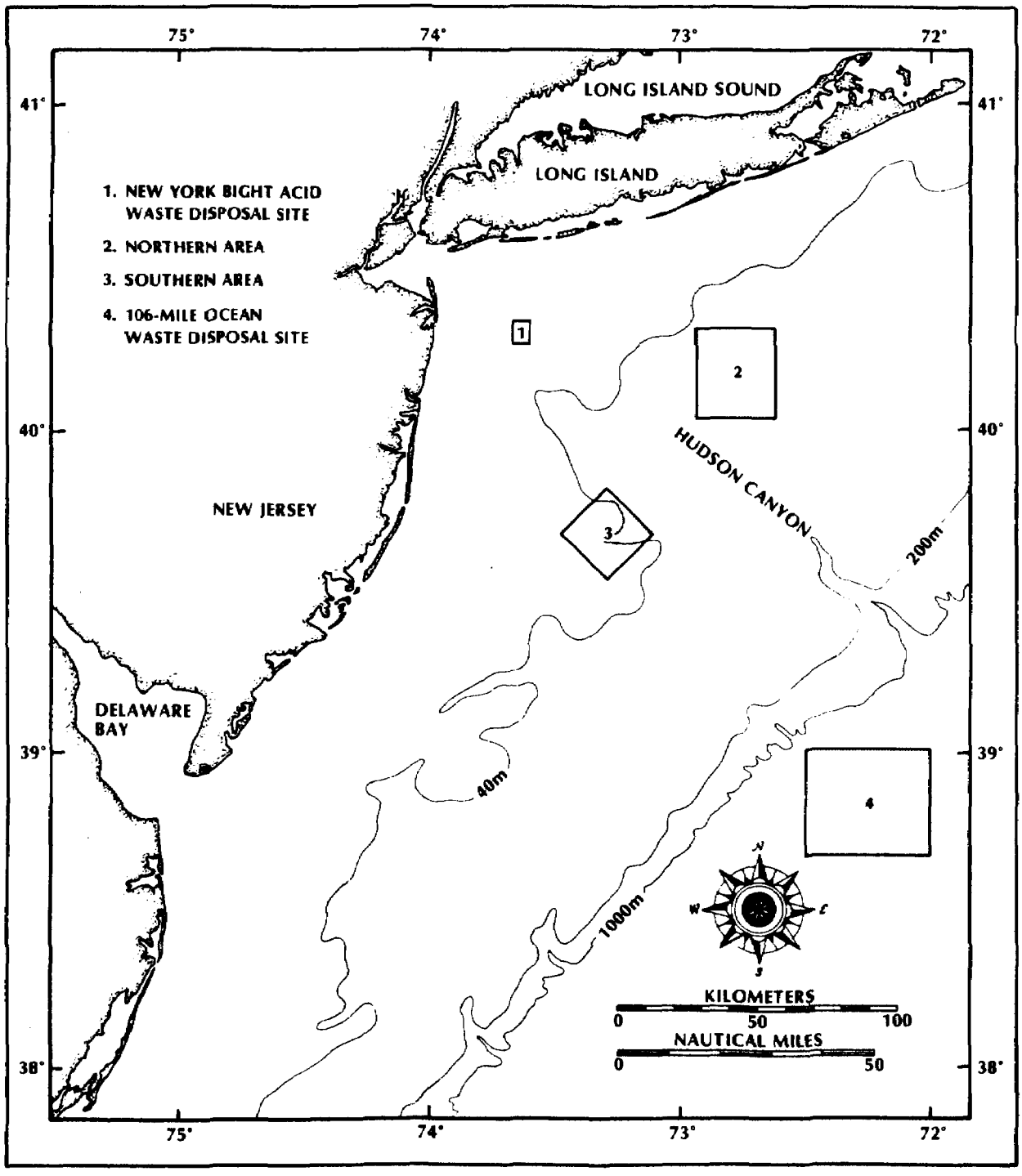

Figure 2-1. Proposed Site and Alternative Sites

As stated in Chapter 1, land-based alternatives are considered for each individual applicant during the application for a permit. They are not considered in this EIS because:

- Different wastes will have different manufacturing processes and, hence, different alternative methods of disposal.

- The EPA Region, as the site management authority, can best evaluate the environmental impacts of each alternative and determine the most acceptable solution.

- If a site is designated and there is a new applicant for ocean dumping, it would be evaluated by the EPA Region under the criteria in Part 227 of the Ocean Dumping Regulations.

Once the site management authority determines that ocean disposal is required for waste, the EIS provides information to determine the best location for the ocean dumpsite.

The EPA has required the waste generators to evaluate several land-based alternatives in previous permit requirements. To date, these alternative disposal methods have not been found to be more environmentally acceptable than continued ocean dumping. Recycling or upgrading and selling the wastes is done to the maximum possible extent. Listed below are the alternatives to ocean disposal considered by the permittees and the more important adverse impacts associated with each alternative:

- NL Industries:

  (1) Neutralize the acid waste with lime or caustic soda, landfill sludge solids, and discharge effluent into the Raritan River. Consequences: Increased air pollution and energy consumption with possible adverse effects on Raritan River or Raritan Bay. Large landfill areas are required.

(2) Neutralize the acid waste producing usable by-products and landfill sludge solids. Consequences: Increased air pollution and energy consumption, and not all by-products can be sold. Large landfill areas are required.

(3) Change to the chloride process to produce less waste. Company has not developed an effective manufacturing process.

(4) Neutralize the acid waste before ocean disposal. Consequences: Increased energy consumption and amounts of suspended solids.

- Allied Chemical:

(1) Neutralize the acid waste, landfill sludge solids, and discharge clarified effluent to Newark Bay. Consequences: Adverse effects on Newark Bay, increased air pollution and energy consumption.

(2) Upgrade and sell a portion of the acid waste, and neutralize the excess acid, thereby producing sludge for landfill and a clarified effluent. Consequences: Similar effects as alternative (1), but less severe. Oversupply of higher grade acid severely limits market.

(3) Convert by-product hydrochloric acid to chlorine using the Kel-chlor process, which produces a less toxic waste. Consequences: Remaining acid still requires disposal. Requires other companies to develop need for chlorine.

(4) Neutralize the acid waste before ocean disposal. Consequences: Unreasonable capital/operating costs for essentially no environmental benefit with increased energy consumption.

As outlined above, the permittees have evaluated, and are continuing to evaluate, various alternatives to the current disposal practices. Their reports are public information and are on file at Region II. The reports are part of the company's permit application and have been summarized in public hearings held prior to issuing permits.

Recently (May 1980), EPA, the Department of Justice, and NL Industries entered into a consent decree concerning the ocean disposal of NL Industries waste. The major features of the agreement are, by 31 December 1981, NL Industries will:

- Reduce the free sulfuric acid portion of its waste to 1.2 tons per ton of titanium dioxide produced (about 50%).

- Cease all ocean dumping of its gangue solids slurry.

Further information about the agreement is provided at the end of this chapter.

NO-ACTION ALTERNATIVE

The No-Action Alternative would result in leaving the existing Acid Site with an interim designation. The Ocean Dumping Regulations (Section 228.12[a]) state that the site was "...approved for dumping the indicated materials on an interim basis pending completion of baseline or trend assessment surveys and designation for continuing use or termination of use ... The sizes and use specifications are based on historical usage and do not necessarily meet the criteria [for site designation] stated in this Part."

Taking no action toward a final determination of the site status -- either continued use or termination of use -- would violate the intent of Section 102(a) of the MPRSA since the interim sites may not comply with the site selection criteria mandated by the MPRSA and outlined in the Ocean Dumping

Regulations. Therefore, the No-Action Alternative has been rejected because of the need for a decision on the fate of this site -- final designation or termination of dumping at the site.

CONTINUED USE OF THE PROPOSED SITE

This section presents a detailed summary of the projected impacts of the proposed action, which forms the basis for comparison with the other alternative sites considered.

The Acid Site was established in 1948 for the disposal of acid wastes generated from industries in New Jersey. The site is 14.5 nmi (27 km) from the New Jersey and Long Island coasts, covers 12 nmi^2 (41 km^2) and is on the Continental Shelf (Figure 2-1 #1). The boundaries of the site are latitudes 40°16' to 40°20'N and longitudes 73°36' to 73°40'W. Topographically, the bottom is relatively flat, with an average depth of 25.6 m (84 ft), ranging from 22.6 m (74 ft) to 28.3 m (93 ft). Sediments are predominantly medium to fine grained sands.

The principal user of the site, since it was first established, has been NL Industries, Inc., which contributes about 95% of the total annual volume of waste disposed therein. The only other currently active permittee is Allied Chemical Corporation. Du Pont-Grasselli Plant released part of its caustic wastes at this site until 1975, when their entire waste disposal operations were moved by EPA to the 106-Mile Site.

The effects of all wastes released into the Apex, including those at the Acid Site, have been extensively investigated by the NOAA-MESA New York Bight Project; the NOAA-National Marine Fisheries Service (NMFS) Sandy Hook Laboratory; and the permittees (Appendix B, Table B-1). The site environment, history of ocean disposal, and the important waste constituents are described in Chapter 3. Chapter 4 includes a description of the environmental consequences of acid waste disposal at this site.

PUBLIC HEALTH AND WATER QUALITY

A winter whiting fishery and some lobster fishing are conducted near the site. During some seasons, bluefish appear to be attracted to the area, so there is concern that disposal of acid wastes may adversely affect these resources; however, there has been no evidence of undesirable effects. The wastes rapidly disperse through the water column and are neutralized within minutes by the tremendous buffering action of sea water. Bioassays have demonstrated that the acidity of the waste is the toxic component; neutralized wastes have low toxicity.

There is a visible impact of one waste type; when acid-iron wastes are released, the ferrous sulfate turns the water a distinctive green color. As the ferrous iron oxidizes to ferric hydroxide (rust), the color turns red-brown. The waste plume is distinguishable usually for less than 24 hours, but it may persist for several days after a disposal operation; however, there are no apparent long-term adverse effects on the water quality. This visual impact may be responsible for attracting bluefish to the area. When the site was originally chosen in 1948, it was an unproductive fishing area. Westman (1958) reported that the area had become popular and, in the early part of the season, bluefish were abundant at the site. Recently (1978) charter boatmen stated that the overall effect on fishing was extremely harmful due to the waste plume drifting outside of the site. If the plume drifted into an active fishing area, the fish stopped biting and the boats had to move. Concern that the floc interferes with normal migration patterns and reduces the abundance of near-shore fish has also been expressed. The net effects of the waste plume (beneficial or adverse) have not been determined.

ECOSYSTEM

Long-term effects of acid waste on the ecosystem are undetectable. The first investigation of the area was made in 1948, immediately before waste disposal operations began. Since then, studies have been periodically conducted and no adverse long-term effects attributed to the wastes have been detected or documented (Appendix D). The major reports for the site are by Redfield and Walford (1951), Ketchum et al. (1958a,b), Westman (1958), and

Vaccaro et al. (1972). NL Industries (1977b) has summarized these and other studies made of the site in a document included as part of their permit application.

Investigators have examined several environmental features of the Acid Site which may have been affected by the waste. With respect to the impacts of the waste on the biota, the water quality, and the sediment quality, some of the conclusions are:

- Vaccaro et al., 1972:
  - "There is no indication of an increase in iron (the most abundant waste constituent) in sediments of the acid grounds over the past 14 years.
  - "Although the standing crop of zooplankton and numbers of benthic animals were less on the acid grounds than the control area, we have been unable to attribute these differences to acid waste.
  - "A phytoplankton toxicity experiment carried out in a culture containing a 10^{-4} concentration of acid waste in seawater, a concentration four times greater than that observed in the field, has no effect on phytoplankton growth."

- Grice et al., 1973:
  "..laboratory experiments ... [indicate] the mortality of zooplankton caused by the release of acid waste is negligible on adult copepod populations because of the very few minutes in which lethal concentrations of low pH occur immediately behind the barge. The iron floc which persists in the acid grounds at great dilutions does not affect adult copepods and probably does not affect their developmental stages."

- Wiebe et al., 1973:
  "... In the laboratory tests, the principal cause of copepod mortality appeared to be the acidity of the waste product rather than some toxic component in the material. Thus the laboratory experiments suggest that the mortality of zooplankton resulting from acid waste discharge is negligible because potentially lethal concentrations of low pH do not persist for sufficient time to produce a noticeable effect in the field. The field observations support this conclusion... acid-waste discharges do not appear to have a systematic effect on zooplankton numbers or biomass which is detectable...Longer term effects on developmental stages of copepods also appear negligible since concentrations of acid waste required to inhibit development do not occur for sufficient time in the receiving waters."

The purpose of monitoring is to ensure that long-term adverse impacts do not develop undetected, especially adverse impacts which are irreversible.

Monitoring at this site is simplified since the area is nearshore and shallow, yet difficult because there are so many contaminant inputs to the region (Appendix C, Tables C-1 to C-9). However, the NOAA-MESA New York Bight Project has coordinated and generated many investigations in the Bight, and this area is one of the best understood oceanic regions in the world. Effects of acid waste disposal have not been demonstrated; however, the long history of site-specific and general-area studies provides an excellent base from which any changes could be detected.

EPA and NASA have cooperated in programs to develop remote-sensing techniques (aircraft and satellite flights) for monitoring. Recent dumpings of acid-iron can be located to within <185 m (0.1 nmi) and EPA can determine if the operations conform to permit restrictions (Anderson and Mugler, 1978). Other work on remote sensing of acid wastes revealed that iron concentrations in seawater can be estimated by means of these techniques (Lewis, 1977).

Emergency or "short" dumping occurs when the vessel releases its load before reaching the designated disposal area. The Acid Site is close to shore, thus the probability of a short dump is minimal.

ECONOMICS

The cost, to the waste generators and the Federal Government, of waste disposal at the Acid Site is not great. This section examines the costs of transportation, monitoring, surveillance, and the loss of other resources.

In October 1977, NL Industries, the primary user of the site, reported that the estimated cost, for barging to the existing site, was $1.84 million per year, equal to $2,900 per trip (estimated 640 trips). Allied Chemical has estimated costs at about five times NL Industries cost per trip. For 12 trips per year, the cost is about $170,000; therefore, the estimated costs for hauling wastes to the site (including tugs, fuel, maintenance and associated shore facilities) are about $2 million per year for the two permittees. The effects of inflation and increased fuel costs have not been estimated; however, NL Industries now barges less frequently to the site. This estimate

does not include other costs associated with permit analytical requirements, reporting, and alternative studies required by current permit conditions. Site monitoring costs are discussed below.

Rodman (1977a) reported (for NL Industries) that a round trip takes 12 hours. Timing is important: there are two drawbridges between the waste loading dock and the mouth of the harbor, and the barge can only pass at certain times and under certain tidal conditions. If barging operations have to be postponed, NL Industries has adequate storage facilities for temporarily holding the wastes until barging can resume.

Monitoring costs are difficult to estimate for this site; however, the cost to the Federal Government is low, since monitoring programs are required for the other ocean disposal sites in the Apex. Monitoring costs are spread over all the sites. The Acid Site is within the NOAA-MESA sampling grid for trend assessment surveys, and this grid would not change if use of the site were discontinued. The permittees are required to conduct a summer survey each year to evaluate the short-term effects of the waste. These surveys cost approximately $45,000 to $50,000 each. The cost is lower for this nearshore, shallow site than it would be for a site further offshore in deeper water.

The program goal for USCG surveillance at this industrial waste site is 10% of all dumping operations. Surveillance at the Acid Site is effective and costs are relatively low. The site is within the normal cruising range of Coast Guard ships and helicopters, and routine surveillance can be conducted with only infrequent use of shipriders. Vessels assigned to surveillance missions remain available for other, higher priority missions (e.g., search and rescue).

There are no documented losses of biological or mineral resources in the Apex due to acid waste discharges. Potential mineral resources, e.g., sand and gravel, may be contaminated by other waste sources (dredged material, sewage sludge) but are unaffected by acid waste. Table 2-1 lists the economically important fish and shellfish landed from the Bight. Except for whiting, important species are either absent at the site, not affected by acid

wastes, or become contaminated by other sources, such as sewage sludge. A whiting fishery exists near the site in the winter. The whiting are apparently unaffected by the waste.

TABLE 2-1
FISH AND SHELLFISH LANDINGS BY STATES - 1974

Landings	New York		New Jersey		Total	
	000 lb	$000	000 lb	$000	000 lb	$000
Fish						
Fluke	2,487	846	3,499	1,153	5,986	1,999
Menhaden	576	18	107,307	2,735	107,883	2,753
Scup	3,635	852	6,040	880	9,675	1,732
Whiting	1,955	250	7,022	587	8,977	837
Shellfish						
Lobsters	731	1,396	1,191	1,916	1,922	3,312
Surf Clams	3,951	719	22,657	2,948	26,608	3,667
Scallops	884	1,158	344	531	1,228	1,689

Note: Landings are shown in round (live) weight except for clams, lobsters (total meat), and scallops (edible meat).

Source: Adapted from NOAA-NMFS, 1977(?)

USE OF ALTERNATIVE EXISTING SITES

INTRODUCTION

Eight municipal and industrial waste disposal sites (aside from dredged material sites and the proposed site) presently exist in the mid-Atlantic area (Figure 2-2), six in the New York Bight and two near Delaware Bay. Only the 106-Mile Site is a viable alternative.

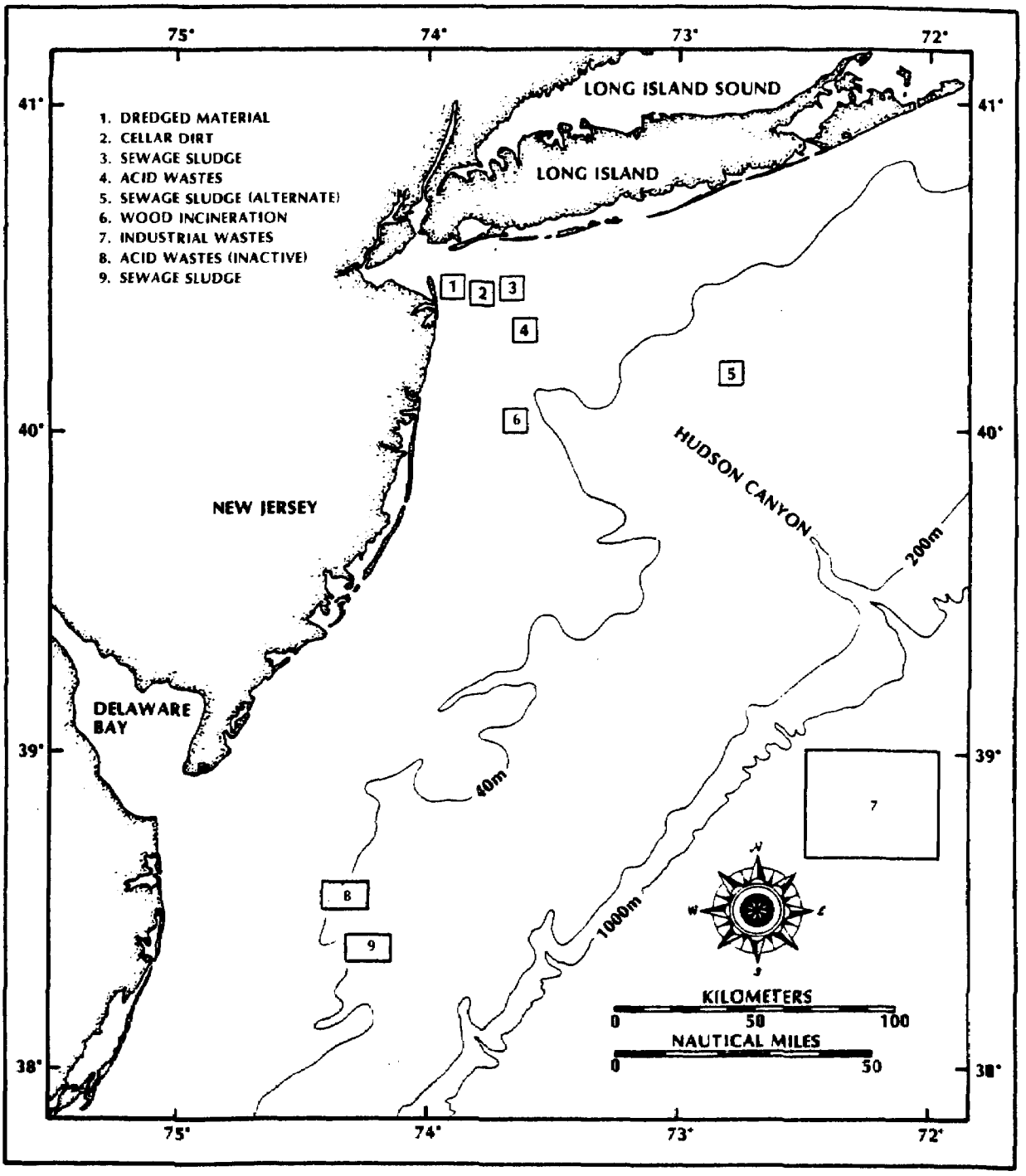

Figure 2-2. Categories of Existing Disposal Sites in the Mid-Atlantic

The other interim sites were not considered as possible alternatives for several reasons. Only the Delaware Bay Acid Site (Figure 2-2, #8), which has been inactive since March 1977, has been used for acid waste disposal. The other sites are for the disposal of construction debris (cellar dirt), wrecks, sewage sludge, or the incineration of wood. Combining acid wastes with other materials violates the tenet of segregating generic wastes by disposal site. Disposal of different types of wastes at the same site could cause problems such as:

- Synergistic interactions at sites where the wastes are not chemically inert. The effects of the combined wastes might be worse than the sum effects of individual materials. In 1974, EPA-Region II required that all industrial wastes dumped at the New York Sewage Sludge Site be transported to the 106-Mile Site.

- Monitoring would be more difficult since the effects of the individual wastes would be extremely difficult to differentiate.

- Some of these interim sites have already experienced adverse impacts due to waste disposal operations (e.g., New York Bight Sewage Sludge Site [Figure 2-2, #3] and Delaware Bay Sewage Sludge Site [Figure 2-2, #10]); the situation could be aggravated by increasing the load or changing the character of part of the waste load.

- Increased traffic to the nearshore sites would increase navigational hazards and could cause logistic difficulties in coordinating disposal operations.

The Delaware Bay Acid Site was not considered as an alternate site for several reasons: (1) it has been inactive since March 1977 and, when sewage sludge disposal ends at a nearby site, there will be no anthropogenic inputs to the area, (2) the site is further from New York Harbor than the 106-Mile Site, which would add to transportation costs, logistics difficulties, and fuel requirements, (3) if acid waste disposal should adversely affect the benthos at a shallow site, moving the disposal operations to another shallow

another shallow, coastal site would not be logical, especially when a very deep site (106-Mile Site) could be used, and (4) the interim designation of this site was terminated in January 1980 (EPA, 1980). Consequently, the other disposal sites in the mid-Atlantic region were not considered as acceptable alternatives for acid waste disposal. Only the 106-Mile Site is considered here, and is compared with the Acid Site.

106-MILE OCEAN WASTE DISPOSAL SITE

The 106-Mile Site, established in 1961 for the disposal of industrial wastes unsuitable for land disposal, is approximately 106 nmi (196 km) southeast of Ambrose Light, New York, and approximately 126 nmi (233 km) east of Cape May, New Jersey. The site covers 480 nmi^2 (1,646 km^2) on the Continental Slope and Continental Rise, and its latitudes and longitudes are 38°40'N to 39°00'N, and 72°00'W to 72°30'W, respectively. Water depths at the site range from 1,440 m (in the topographically rugged northwest corner) to 2,750 m (in the relatively flat southeast corner). An inactive munitions waste disposal site is within the site boundaries, and an inactive low-level radioactive waste disposal area is 10 nmi (18.5 km) due south.

NOAA, assisted by other government agencies and academic institutions, has been studying this site for several years, and has published survey results in two summary reports (NOAA, 1975; 1977), several memoranda, public hearing testimony, and in its annual report to Congress (NOAA, 1978). A private contractor, acting on behalf of the permittees, has been monitoring the site for two years. The permittees have submitted the results of these monitoring cruises to EPA-Region II (e.g., Hydroscience, 1978). A Draft Environmental Impact Statement on designation of the 106-Mile Site has been issued (EPA, 1979b).

PUBLIC HEALTH AND WATER QUALITY

Waste disposal at the 106-Mile Site will not directly endanger human health. This site is not in a commercially or recreationally important fishing or shellfishing area. NOAA resource assessment surveys do not extend out to the site, but it is known that the densities of fish eggs and larvae

are low beyond the edge of the Continental Shelf. Foreign fishermen may be near the site from late winter to early spring, but they usually catch highly migratory fish. The probability of migratory fish remaining in the site and accumulating toxic levels of contaminants from the waste is extremely unlikely.

Navigational hazards due to the use of the site are minimal. Barges can use the Ambrose-Hudson Canyon Traffic Lane for most of the journey. The greatest danger of collision is in the Precautionary Zone through which all the vessel traffic for New York Harbor must pass (Figure 3-10). All waste barges will pass through this area, irrespective of any designated disposal site.

ECOSYSTEM

The short-term effects of acidic waste will be similar to those observed at the Acid Site. Long-term adverse effects are improbable at the 106-Mile Site, since these have not been demonstrated for the Acid Site. The potential for adverse effects on the indigenous biota and existing water and sediment quality, although remote, is even less at this site because the organism density is much lower and the site is larger and in deeper water. The natural variability of the water at the site, caused by the interactions of three different water masses, causes greater changes in the biotic assemblages of the site than acid waste disposal. Consequently, only immediate, short-term (minutes) changes can be related to the wastes (Chapter 3).

Monitoring at a site off the Continental Shelf is much more difficult than at a shallower, inshore site. NOAA (1977) observed:

> **"In the case of the 106-Mile Site, this situation [the difficulty of measuring and predicting the effects of waste disposal] is further complicated by the interactions of major water masses, Shelf Water, Slope Water, and Gulf Stream eddies. The [site] is a complex oceanographic area in which to assess natural environmental conditions and the impact of man's activities upon those conditions."**

Long-term impacts would be nearly impossible to document, since potentially affected animals will probably have moved out of the area, either carried by currents (plankton) or actively swimming (nekton).

The use of a distant offshore site causes increased risks of emergencies and short dumping. The effects of a short dump of waste materials would depend upon the location of the dump, and particularly water depth. Acid wastes are liquid and dilute rapidly after discharge, thus a single cargo of dumped waste would cause local, immediate acute effects, but no long-term adverse effects. If emergency disposal is necessary, during inclement weather, the effects would be mitigated by the rapid dilution caused by storm turbulence.

ECONOMICS

NL Industries estimated operating costs to barge to the 106-Mile Site at $9.25 million per year. This is about $14,500 per trip, or about five times more expensive than present costs. Assuming that Allied Chemical's costs also increase five times, their annual expense would be $850,000, and the total cost would be about $10.1 million. This estimate may be low. EPA (1978a) estimated that the cost of hauling sewage sludge to the 106-Mile Site would be from 6.4 to 8 times more expensive than hauling to the New York Sewage Sludge Site. Assuming that a similar relationship exists for acid wastes, the cost of hauling acid wastes to the 106-Mile Site would be from $12.8 to $16.0 million annually.

Logistically, the use of this site would be extremely difficult for the primary waste generator. NL Industries submitted a report (Rodman, 1977a) to EPA-Region II concerning the problems of moving out to the 106-Mile Site. The barge round trip transit-time would increase from 12 to 38 hours. Barging from the present loading dock would be infeasible due to increased travel time, higher probability of weather delays, the requirement to pass through two drawbridges during certain tidal conditions, and a need for increased temporary land storage facilities. NL Industries investigated the possibility of building new loading facilities below the drawbridges, and did not believe

that the required construction permits could be obtained, especially since the facility would be located in a wetlands area. If the permits were granted, the estimated capital costs would be $30 million.

The cost of monitoring the 106-Mile Site is high compared to other areas, due to the complexity of the environment and distance from shore. NOAA is responsible for assessing long-term changes by biological monitoring. A cost of $1 million per year has been estimated for conducting baseline surveys, two of which have been completed (Breidenbach, 1977). The NOAA - National Ocean Survey (NOS) is continuing earlier work at the site. The cost to permittees for a monitoring program is high, due to the site's distant location. These costs would be moderately increased if acid wastes were released at the site; however, the bulk of the monitoring costs are due to ship time and crew costs.

Surveillance Costs

The current U.S. Coast Guard Instruction regarding enforcement of regulations and surveillance of dumping at ocean sites (Commandant Instruction 16470.2B, dated 29 September 1976) establishes a goal of observing 75% of all industrial waste disposal operations. Surveillance activities include stationing a shiprider aboard the vessel to observe the disposal operation, to conduct random spot checks before the barge leaves port, and to check the vessel log for departure and arrival times. The USCG assigns several full-time personnel to the surveillance of disposal activities in the Bight, including the 106-Mile Site.

Shipriders at the 106-Mile Site are the most efficient means of surveillance. In 1978, the Coast Guard expended 7,247 man-hours on shiprider surveillance, excluding the time that shipriders awaited departure due to delays caused by mechanical failures or weather and tidal conditions (Schubert, 1979). The Acid Site is in the Apex and within the normal range of Coast Guard ships and aircraft, thus shipriders are not normally used.

Surveillance of acid waste disposal activities at the 106-Mile Site would represent a significant, additional requirement for personnel, particularly since NL Industries barges wastes at least daily. Assuming 400 trips annually, surveillance of approximately 300 disposal operations would be required, or approximately 11,200 man-hours.

Loss of Biotic or Mineral Resources

Only fluke and lobster may be present at or near the site, where they may be affected by the waste materials. (Table 2-1 lists the most economically important finfish and shellfish in the mid-Atlantic Bight.) Liquid wastes would be diluted and dispersed in the water column and not reach the bottom at this deepwater site, therefore stocks would not be adversely affected by disposal operations. Almost all U.S. fishing activities are over the Continental Shelf and would not be directly affected by the wastes. Foreign ships fish along the edge of the Continental Shelf from Georges Bank to Cape Hatteras, especially during the late winter and early spring. However, the site is not a unique location for foreign fishing, nor does it obstruct migration routes of commercially valuable species. Therefore, the probability of foreign fishing operations being affected by disposal operations at the site is extremely remote.

Future oil and gas development is possible near the site (see Chapter 3, Figure 3-9). Waste disposal would not interfere with petroleum exploration or production activities. The only potential navigational hazard would be due to the barge traffic to and from the site. To date, there has been no known lost income resulting from existing disposal operations at the 106-Mile Site, and if acid wastes were also released there, it does not appear that income or resources would be adversely affected.

OVERALL COMPARISON WITH THE ACID SITE

There would not be significant adverse environmental effects from acid waste disposal at the 106-Mile Site. Effects on public health and water quality are minimal and effects on the ecosystem would be limited to

short-term changes. However, an increase in monitoring activities would be required, and the probability of short dumping is greater, because the site is so distant from New York Harbor.

The economic impact of moving waste disposal to 106-Mile Site would be severe. Barging costs would increase five to eight times over present levels and barging may be infeasible for the dominant waste generator. Surveillance requirements by the Coast Guard would increase substantially, since surveillance would be required for approximately 480 barge trips annually. Shipriders would be required frequently, whereas they are used infrequently at the Acid Site. If acid wastes are released at this site, the probability of biological or mineral resource losses is low.

The effects on public health, the ecosystem, and other uses of the ocean would be low at the 106-Mile Site, as they are at the Acid Site. The wastes have minimal or no environmental impacts at the present site. Thus, moving the disposal operations to the 106-Mile Site would not have any additional important environmental benefit. Therefore, the increased costs and difficulty of barging to the 106-Mile Site reduce the value of this action.

USE OF NEW SITES

In addition to the use of an existing disposal site, new sites on or off the Continental Shelf are alternatives to disposal at the Acid Site. The areas under consideration are the Bight and the Continental Slope along the eastern edge of the Bight. A feasible alternative site for ocean disposal must meet the criteria for "selection of ocean disposal sites" (Sections 228.5 and 228.6 of the Ocean Dumping Regulations). The criteria require that the site must not: (1) conflict with other uses of the area, e.g., resource development or commercial fisheries, or (2) endanger human health or amenities. If possible, the site should be within the range of the present fleet of waste disposal vessels, in order to make ocean disposal economically feasible.

LOCATIONS ON THE CONTINENTAL SHELF

The Bight is one of the busiest oceanic regions in the world; uses include extensive commercial shipping, fishing, shellfishing, recreation, resource development, and waste disposal. In selecting a site within the Bight for ocean waste disposal, other conflicting activities in the area must be evaluated for potential adverse effects on disposal operations and vice versa. Adequate background environmental information on the area must presently exist to provide firm bases for projecting impacts of waste disposal.

Most of the survey work in the Bight has centered around existing disposal sites. However, two candidate areas for sewage sludge disposal, the so-called Northern and Southern Areas, have been studied. These areas were selected for study by NOAA, in part to avoid conflict with living marine resources (NOAA-MESA, 1976) and, therefore, were concluded to be the most reasonable alternative locations for acid waste disposal. Within the larger areas suggested by NOAA for consideration, two smaller areas were studied in detail, the Northern and Southern Areas discussed below.

The Northern and Southern Areas are representative of the marine environment on the Continental Shelf off New Jersey (Southern Area) and Long Island (Northern Area). If other locations were evaluated as alternatives, the same considerations discussed below would be valid. The advantages in considering these particular areas are that surveys have been completed and site-specific data are available. If another location were chosen for acid waste disposal, predisposal surveys would be required.

SOUTHERN AREA

Public Health and Water Quality

The Southern Area is adjacent to commercially exploitable shellfish resources. Surf clams and ocean quahogs are numerous in and shoreward of this area, and sea scallops are present, but abundance estimates were not made (EPA, 1978a).

Other contaminant inputs do not exist in this area, thus there is a risk (although low) that the bivalves may concentrate contaminants from the acid wastes. Preliminary work by Pesch et al. (1977) indicated that the tissues of sea scallops accumulated vanadium from acid wastes released by Du Pont-Edge Moor at the Delaware Bay Acid Site. However, other metals present in high concentrations in the waste (e.g., iron, manganese, and titanium) were not accumulated by the animals. Simpson (1979), working with other bivalves (mussels), found that the uptake and loss of trace metals varied with the body weight of the animal and the phase of its reproductive cycle. Additional work is needed to establish if benthic organisms can accumulate contaminants from these liquid wastes.

The site is not visited by sport fishermen due to distance from shore, so that undesirable visual effects of temporarily discolored water resulting from the release of acid-iron wastes would not be noticed at this site; however, if bluefish are attracted to the waste plume, the sportfishing value might be lost. In addition, if other pelagic fish avoid the waste plume, pelagic fisheries could be adversely affected for a short time.

Ecosystem

The short-term effects of acid waste on the water column biota would be similar to changes already documented for the Acid Site (i.e., minor effects on the plankton, but no irreversible changes). As noted above, there is a slight possibility of changes in benthic populations due to waste constituents. These changes would be simple to detect, since the site is outside the Apex where multiple contaminant inputs exist.

Monitoring would require an additional program since none of the existing surveys concentrate on the area. Due to the existence of the NOAA data based on predisposal conditions in the Southern Area, monitoring is feasible. This site is outside the heavily contaminated Apex, and there are no contaminants from other sources. Thus detecting changes caused by waste disposal at the site would be simplified.

Economics

The economic consequences of moving acid waste disposal to this area are important. Neither permittee has estimated the costs of using this area. However, EPA (1978a) estimated that the cost of hauling sewage sludge to this area would be 3.2 to 4 times more expensive than the cost of hauling to the existing New York Sewage Sludge Site. Assuming that the same relationship is valid for acid wastes, the cost for hauling acid wastes to the Southern Area would range from $6.4 to $8 million per year. For NL Industries, logistic difficulties due to using a more distant site (as for the 106-Mile Site), are increased. If ocean disposal is not feasible, the company would have to find alternative treatment methods. According to reports submitted to EPA-Region II, in compliance with previous Interim Permits, land-based alternatives are less environmentally preferable and economically infeasible for the large volumes of waste liquid generated by NL Industries (NL Industries 1975a, 1975b, 1975c, 1977a; Ryckman/Edgerly/Tomlinson and Associates, 1977).

Monitoring costs would increase at this site. The costs to the waste generators would probably be about the same as existing costs, since the short-term effects of the waste would be similar. NOAA, however, would be required to establish additional surveys in the site, to evaluate the long-term biological effects of waste disposal.

Surveillance costs and difficulties would increase in the Southern Area. It is located beyond the normal operating range of Coast Guard 82-foot and 95-foot patrol boats, and helicopters normally used for surveillance, so multiple missions are not possible. As for the 106-Mile Site, the much higher number of barge trips would require shipriders. The overall time would be less than at the 106-Mile Site since the transit time is less to this site. However, the use of shipriders for acid waste would be a new requirement for the Coast Guard.

The possible loss of biotic resources is probably the most important cost of using this site. As shown in Table 2-1, economically important finfish (scup and whiting) and shellfish (lobsters, surf clams, and scallops) are found in the area. The site region contains an important and established

fishery resource. Ocean quahogs, shellfish which may be exploited in the future, are abundant in the area (EPA, 1978a). The area is shallow, so that wastes may reach the bottom and shellfish may take up waste constituents. Finfish may avoid the area; consequently, use of this site could cause a significant adverse economic impact on such living resources. The potential economic impact cannot be quantified, because the actual amounts of fish and shellfish taken from the area are unknown.

Use of the Southern Area would not affect sand and gravel deposits which could be mined in the site vicinity, since the wastes are not sufficiently toxic to require decontamination of the mined materials. Barging operations should not interfere with exploration and development of oil and gas resources.

Overall Comparison with the Acid Site

The possible effects on the areas of public health and water quality and on the ecosystem are much higher at a site in the Southern Area. There are no other contaminant inputs to the area, thus existing resources are not adversely affected. The possibility of acid waste constituents contaminating economically important resources does exist. Use of this area is less economically desirable. The transportation costs to the waste generators would increase 3.2 to 4 times, as would monitoring and surveillance costs to the Federal Government.

NORTHERN AREA

Public Health and Water Quality

Minimal or no effects on public health and water quality would be expected as a result of acid waste disposal at this site. Surf clams, sea scallops, and ocean quahogs are present in the vicinity, but commercial possibilities are probably less than in the Southern Area (EPA 1978a). Aesthetically, the effects of waste disposal should be minimal, the same as in the Southern Area.

Ecosystem

The oceanographic features of the two areas are similar, therefore effects on the ecosystem would be similar to those in the Southern Area, i.e., short-term effects on the water with the possibility of waste constituents accumulating in the sediments or benthic organisms. NOAA would be required to initiate a new long-term monitoring program to supplement those already planned for other sites. If sewage sludge were released at the Alternative Sewage Sludge Site (Figure 2-2, #5) it would be difficult to differentiate between the effects of acid waste and sludge contaminants.

Economics

The Northern Area is almost the same as the Southern Area as to transportation costs, logistics difficulties related to a more distant site, monitoring, and surveillance costs. These costs would be higher for the permittees and the Federal Government. The Northern Area is within the normal distribution of surf clams, but they are not abundant at the site. The density of sea scallops is not known, but ocean quahogs are abundant, and acid waste disposal could possibly interfere with the development of these potentially valuable marine resources. This adverse effect would be mitigated because the net dispersive flow appears to be offshore, away from the Continental Shelf (EPA, 1978a).

Ocean disposal at a site in the Northern Area would not interfere with development of mineral resources in the Southern Area. The area is approximately 60 nmi (110 km) northeast of the oil and gas lease tracts identified on the mid-Atlantic Shelf (OCS Sales No. 40 and 49; Figure 3-9); however, future sales may include tracts near the Northern Area (OCS Sale No. 59). Acid waste disposal could possibly interfere with this petroleum exploration or development.

Overall Comparison with the Acid Site

There are few economic resources in the Northern Area, thus it is preferable to the Southern Area. The effects on the ecosystem would be

similar to those predicted for the Southern Area and potentially more severe than the documented effects at the Acid Site.

Economic considerations make use of the Southern Area much less desirable than continued use of the Acid Site. Hauling costs for the permittees would increase 3.2 to 4 times, thus ocean disposal may not be possible for NL Industries, which generates the largest volume of wastes requiring ocean disposal. Monitoring and surveillance costs to the Federal Government would increase.

LOCATIONS OFF THE CONTINENTAL SHELF

Information on the mid-Atlantic Continental Slope and Continental Rise is sparse (TRIGOM, 1976). The 106-Mile Site is at the closest point to New York Harbor beyond the Continental Shelf (Figure 2-1). Due north of the site is the Hudson Canyon, a major migratory route for fish entering the New York Bight. (See Chapter 3.) Waste disposal nearer the Canyon would be environmentally unacceptable, primarily because migrating organisms could accumulate toxic constituents of the waste, and become a potential health hazard to humans consuming the animals.

Little background environmental information exists for the Slope beyond the 106-Mile Site. The environment immediately southwest of the 106-Mile Site along the Continental Slope is also unknown. Designating a site for waste disposal in that area would require extensive baseline survey work.

There are no data indicating that the 106-Mile Site is on or near an especially unique portion of the Slope. The same physical processes affect this entire region and the benthos is fairly uniform over great horizontal distances at these depths. Other localities, further northeast or south of the 106-Mile Site, would add considerably to the round trip time and distance without any clear environmental benefit. The longer travel time increases the probabilities of emergencies and short dumps.

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The 106-Mile Site is the best off-shelf alternative for acid waste disposal for a number of reasons: Unlike other areas off the mid-Atlantic Shelf, the 106-Mile Site has been studied extensively, thus adequate information exists for projecting effects of disposal activities. Use of any other Continental Slope site would require extensive new survey work to produce as much data as are presently available for the 106-Mile Site. The site is on the portion of the Continental Slope closest to New York Harbor, and highly accessible to potential users of the site. No environmental advantage would be gained by choosing another off-Shelf location instead of the 106-Mile Site.

SUMMARY

Several alternative sites on and off the Continental Shelf were evaluated as potential dump sites. A number of features of the Acid Site make it the best choice among all alternatives examined:

- It conforms to the Ocean Dumping Regulations recommendation to use either historical sites, or sites off the Continental Shelf whenever feasible.

- It has been studied repeatedly for more than 30 years.

- Only minor, short-term, adverse environmental changes and no long-term effects caused by acid waste disposal have been demonstrated at the site.

- Movement of acid waste disposal from the Apex would not create a measurable environmental benefit, nor would nearby areas closed to shellfishing be reopened.

- The site is convenient to New York Harbor.

Thus, in considering all reasonable alternatives to the proposed action, the proposal of designating the Acid Site for continued use is the preferred alternative for the foreseeable future. Although there are risks involved in

this action, the environmental risk of waste disposal at this site is considered to be less serious than the risk of disposing of wastes at other locations on or off the Continental Shelf (Chapter 4). If subsequent monitoring at the site shows that adverse effects resulting from waste disposal are greater than anticipated, EPA may discontinue or modify use of the site, in accordance with Section 228.11 of the Ocean Dumping Regulations.

Table 2-2 presents the comparative evaluation of the possible effects of acid wastes at the alternate sites discussed in this chapter. The effects on three major components are summarized: (1) public health and water quality, (2) ecosystem, and (3) economics.

DETAILED BASES FOR SELECTION OF THE PROPOSED SITE

Part 228 of the Ocean Dumping Regulations and Criteria describes general and specific criteria for selection of sites to be used for ocean waste disposal. In brief, the general criteria state that site locations will be chosen:

- "...to minimize the interference of disposal activities with other activities in the marine environment..."
- "...[so] temporary perturbations in water quality or other environmental conditions during initial mixing...can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery."
- "[site sizes] will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts."
- "EPA will, whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used."

The Acid Site complies with all of the above criteria.

TABLE 2-2
SUMMARY EVALUATION OF ALTERNATIVE DISPOSAL SITES FOR ACID WASTES

Affected Component	Northern Area Site	New York Bight Acid Waste Disposal Site	Southern Area Site	106-Mile Ocean Waste Disposal Site
PUBLIC HEALTH & WATER QUALITY	None to very slight short-term potential effects.	None to very slight short-term potential effects.	Slight potential effects.	None to very slight short-term potential effects.
Commercial Fishing	No effects as commercial stocks either do not exist (shellfish) or are not unique (finfish) to the area.	No effects documented after 32 years of disposal activities.	Slight potential for contamination of exploitable resouces.	No effects as exploitable resources are not found in this area.
Recreational Fishing	No effects as the site is beyond the normal range of most fishermen.	Slight effects.	No effects as the site is beyond the range of most fishermen.	No effects as the site is well beyond the range of fishermen.
Navigational Hazards	Very slight potential effects as site is further from shore.	Very slight potential effects as site is located over part of a traffic lane. No increased hazard over present practice.	Slight potential effects as site is further from shore and potential resource development in area.	Moderate potential effects as site is much further from shore.
Aesthetics	No effects as area is not frequented.	Very slight effects when waste is released. Discolored water does not reach shore.	No effects as area is not frequented.	No effects as area is not frequented.
ECOSYSTEM	Slight potential effects	Very slight effects.	Slight potential effects.	Very slight potential effects.
Biota				
• Plankton	Slight toxic effects when waste released. None to very slight potential for modifying the population structure.	Slight toxic effects when waste released. None to very slight potential for modifying the population structure.	Slight toxic effects when waste released. None to very slight potential for modifying the population structure.	Slight toxic effects when waste released. None to very slight potential for modifying the population structure.
• Nekton	Slight potential for uptake of waste contaminants.	Slight potential for uptake of waste contaminants.	Slight potential for uptake of waste contaminants.	Slight potential for uptake of waste contaminants.
• Benthos	Moderate potential for modifying the population structure or contaminant uptake.	Very slight potential for further changes.	Moderate potential for modifying the population structure or contaminant uptake.	No potential for bottom effects.
Water Quality				
• Trace Metals	Slight short-term increase of concentrations.	Slight short-term increase of concentrations.	Slight short-term increase of concentrations.	Slight short-term increase of concentrations.

TABLE 2-2. (Continued)

Affected Component	Northern Area Site	New York Bight Acid Waste Disposal Site	Southern Area Site	Ocean Waste Disposal Site
Sediment Quality				
• Trace Metals	Slight potential for detectable accumulation.	Very slight potential detectable accumulation. Cannot distinguish from other waste sources.	Slight potential for detectable accumulation.	Slight short-term increase of concentrations.
Monitoring	No difficulty in following short-term changes.	No difficulty in following short-term changes.	No difficulty in following short-term changes.	Slight difficulty in following short-term changes.
Short Dumping	Slight short-term effects along the Nantucket Navigational Lane.	Slight short-term effects in the Precautionary Zone.	Slight short-term effects along the Hudson Canyon Navigational Lane.	Slight short-term effects. More probable occurrence as site is so far from shore.
ECONOMICS	Slight to moderate increase in effects over present practice.	Present practice. Very slight effects.	Moderate increase in effects over present practice.	Moderate to severe increase in effects over present practice.
Transportation Costs	Moderate increase over present practice.	No increase in costs.	Moderate increase over present practice.	Large increase over present practice.
• Logistics	Moderate difficulty due to increased barging distance and location of loading facilities.	No difficulty over current practices.	Moderate difficulty due to increased barging distance and location of loading facilities.	Severe difficulty due to much increased barging distance and location of loading facilities.
• Energy Requirements	Moderate increase over current requirements.	No increase over current requirements.	Moderate increase over current requirements.	Large increase over current requirements.
Monitoring	Increased effort as site is further from shore.	No increased effort over current requirements.	Increased effort as site is further from shore.	Substantially increased effort as site is much further from shore.
Surveillance	Moderate difficulty as site is outside range of normal Coast Guard activities.	No difficulties as site is well within range of normal Coast Guard activities.	Moderate difficulty as site is outside range of normal Coast Guard activities.	Moderate difficulty as site is well outside range of normal Coast Guard activities.
Loss of Resources				
• Fisheries	No loss of non-commercial resources.	Slight effects on recreation fishing. No loss of commercial resources.	Slight potential loss of commercial resources.	No loss of commercial or recreational resources.
• Mineral Resources	No potential resources identified.	Resources contaminated by other waste sources.	Very slight change of loss of potential resources.	No potential resources identified.

Eleven specific site selection criteria are presented in Section 228.6 of the Ocean Dumping Regulations. The following eleven subsections consolidate the information for the Acid Site, and show that the site complies with the eleven site selection criteria. Additional information is in Chapter 3 (Affected Environment) and Chapter 4 (Environmental Consequences).

GEOGRAPHICAL POSITION, DEPTH OF WATER, BOTTOM TOPOGRAPHY AND DISTANCE FROM COAST

The Acid Site is on the Continental Shelf at the Apex (Figure 2-1). The coordinates are latitudes 40°16'N to 40°20'N and longitudes 73°36'W to 73°40'W. The water depth averages 25.6 m (84 ft) and ranges from 22.6 to 28.3 m (74 to 93 ft). The site is approximately 15 nmi south of Long Beach, Long Island and 15 nmi east of Long Branch, New Jersey.

LOCATION IN RELATION TO BREEDING, SPAWNING, NURSERY, FEEDING, OR PASSAGE AREAS OF LIVING RESOURCES IN ADULT OR JUVENILE PHASES

All of the above activities occur throughout the entire coastal area of the mid-Atlantic Bight. The site is not uniquely important for any species, and no stage in the life history of valuable organisms occurs primarily at or near the Acid Site. The site is just north of the Hudson Shelf Valley, which is an important migratory route for some animals. However, studies have not shown that aqueous acid wastes affect the benthos; conditions in the Valley are primarily affected by ocean disposal activities at other sites and contaminant inputs from shore and harbor outflow.

LOCATION IN RELATION TO BEACHES AND OTHER AMENITY AREAS

The distance from the site to the shore precludes the possibility of danger to beaches or other amenity areas. Swanson (1977), Manager of the NOAA-MESA - New York Bight Project, stated that, "...we have no evidence to suggest that waste materials from the Apex Acid Waste Dumpsite have reached shore".

TYPES AND QUANTITIES OF WASTES PROPOSED TO BE DISPOSED OF, AND PROPOSED METHODS OF RELEASE, INCLUDING METHODS OF PACKING THE WASTE, IF ANY

Wastes released at the site must meet the EPA environmental impact criteria specified in the Ocean Dumping Regulations and Criteria, Part 227, Subparts B, D, and E. In all cases, in accordance with Part 227, Subpart C, a need for ocean disposal must be demonstrated before issuance of a permit. At this time (1980), permit applications from companies not presently barging and dumping wastes in the ocean are not anticipated.

All wastes expected to be released after final site designation will be aqueous acid wastes transported by vessels. The wastes will be discharged below the surface into the wake. None of the wastes are proposed to be containerized or packaged in any way.

FEASIBILITY OF SURVEILLANCE AND MONITORING

Surveillance and monitoring activities are quite simple at the site. The site is close to shore, and well within the areas regularly patrolled by Coast Guard 82- and 95-ft patrol boats. The site is within the patrol range (25 miles from shore) of the Coast Guard HH-52A helicopter.

The Apex has been extensively studied by researchers from the EPA, NOAA, universities, industries, and others. One goal of the NOAA-MESA project is to develop waste management plans and monitoring strategies for the Bight (NOAA-MESA, 1977). The existing monitoring plan for the Acid Site is presented in Appendix E.

DISPERSAL, HORIZONTAL TRANSPORT AND VERTICAL MIXING CHARACTERISTICS OF THE AREA, INCLUDING PREVAILING CURRENT DIRECTION AND VELOCITY

The physical oceanographic features of the Acid Site are described in detail in Appendices A and B. The waste behavior immediately after release is discussed in Appendix D.

Wastes from both permittees are diluted and dispersed within the permissible 4-hour mixing period. Even if an ocean current traveled directly from the site to the shore, the concentration of the most abundant waste constituent would be far less than ambient levels. One waste type forms an iron hydroxide (rust) floc which usually persists for less than 24 hours, although a colored waste plume may be detectable up to 48 hours after a disposal operation.

Surface currents in the Apex often move in an anticyclonic (clockwise) eddy around the Bight. At the site, surface and bottom currents tend to move in northerly and westerly directions. These directions, however, are neither constant nor predictable, and details of the circulation within the Apex have not been resolved.

EXISTENCE AND EFFECTS OF CURRENT AND PREVIOUS DISCHARGES AND DUMPING IN THE AREA (INCLUDING CUMULATIVE EFFECTS)

Numerous studies have failed to detect significant, long-term, adverse effects caused by the acid wastes at this site. Redfield and Walford's (1951) conclusion is still valid:

> "Consideration of the general rate of exchange of water between the New York Bight and the adjacent parts of the ocean make it extremely unlikely that the quantity of waste discharged during more than a few days could be found in the region at any one time. No evidence has appeared which indicates that undesirable effects of any sort have arisen from these waste disposal operations."

INTERFERENCE WITH SHIPPING, FISHING, RECREATION, MINERAL EXTRACTION, DESALINATION, FISH AND SHELLFISH CULTURE, AREAS OF SPECIAL SCIENTIFIC IMPORTANCE, AND OTHER LEGITIMATE USES OF THE OCEAN:

Mineral extraction, desalination, and fish and shellfish culture do not occur at or near the site. The site is not located in a unique area of the Bight, and is not an area of special scientific significance other than the evaluation of acid waste disposal. The site is in one of the outbound traffic

lanes from New York Harbor, yet disposal operations have not interfered with shipping. When in the traffic lanes, barges move parallel with them, otherwise they move at right angles to the traffic. In the 32 years of operations at the site, there has never been a collision of a waste-discharging barge and another vessel, although a collision did occur in 1976 between a freighter and a barge bound for the 106-Mile Site (P. Anderson, personal communication*). Use of the site does, however, increase the traffic density in the approaches to New York Harbor.

When the site was originally chosen in 1948, it was an unproductive fishing area. Ironically, the site has become a sportfishing area because the iron floc apparently attracts bluefish. Recreational fishermen in private and charter boats use the site.

Numerous studies on the effects of acid waste disposal on finfish of the area have failed to document any health problems associated with finfish caught at the site or in the plume. Fishermen claim that the industry is being destroyed by the dumping; yet the conclusions of Ketchum et al. (1958b), that the waste is nontoxic and rapidly diluted, are apparently still valid.

THE EXISTING WATER QUALITY AND ECOLOGY OF THE SITE AS DETERMINED BY AVAILABLE DATA, BY TREND ASSESSMENT, OR BASELINE SURVEYS

The large numbers of surveys made at or near the site have been summarized above, in Chapter 4, and in Appendix B. Adverse effects resulting from acid waste disposal have not been documented.

Both NL Industries and Allied Chemical have evaluated the influences of their respective wastes on the existing water quality of the site (Energy Resources Company, 1978a,b). The wastes of both industries comply with the

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* P. Anderson, Chief, Marine and Wetlands Protection Branch, EPA-Region II, New York, NY.

marine water quality criteria for all constituent materials. Concerning the ecology of the site, Swanson (1977) stated:

> "Hydrated, iron oxide precipitates from acid wastes coat suspended particles, including biota. It might be suspected that coatings could adversely affect some membrane transport functions. No observational evidence can be found to indicate any effects on biota from such coatings. Surveys of benthic populations in the immediate vicinity of the Apex Acid Waste Dumpsite have not demonstrated an observable impact of waste acid. Such an observation at the site would not be expected for two reasons: first, the acid waste materials do not accumulate in the sediments at the site; and second, any impacts would be the sum of all activities affecting the site, and could not be attributed to acid wastes alone. Long-term, sublethal, toxic effects on organisms at and near the Apex site have not been investigated."

Swanson's last statement refers to comprehensive, in situ studies. Vaccaro's group (Vaccaro et al., 1972; Grice et al., 1973; Wiebe et al., 1973) did investigate chronic effects of acid waste in the laboratory and concluded that biologically significant effects did not occur. If adverse effects due to waste disposal are detected, the Ocean Dumping Regulations state that appropriate mitigating measures must be taken, ranging from reducing the discnarge rate, frequency of dumping, or annual volumes to relocating the disposal operations, or prohibiting ocean disposal (40 CFR 228.11).

POTENTIAL FOR THE DEVELOPMENT OR RECRUITMENT OF NUISANCE SPECIES IN THE DISPOSAL SITE

After 32 years of disposal, acid waste has not promoted or attracted nuisance species to the area. Extensive phytoplankton blooms in the Bight, which cause adverse effects, usually result from an excess of nutrients combined with anomalous physical conditions (Sharp, 1976). Acid wastes do not contain constituents which promote phytoplankton growth.

EXISTENCE AT, OR IN CLOSE PROXIMITY TO, THE SITE OF ANY SIGNIFICANT NATURAL OR CULTURAL FEATURES OF HISTORICAL IMPORTANCE

No such features are known to exist at or near the site. The site is sufficiently distant from shore so that wastes do not affect state or national parks or beaches.

CONCLUSIONS AND PROPOSED ACTIONS

EPA has determined that the Acid Site should be placed in Impact Category I but designated for continuing use. The site was placed in this category because iron, a nontoxic constituent of NL Industries waste, is present in detectable concentrations above normal ambient values within 12 nmi of shore. NL Industries and EPA have entered into a consent decree which provides for the reduction of iron levels. The site remains the most preferred location for disposal of some acid wastes generated in the New Jersey region.

All future use of the Acid Site for acid waste disposal must comply with the EPA Ocean Dumping Regulations and Criteria -- a requirement which brings prospective dumping into compliance with the MPRSA and the London Dumping Convention. EPA determines compliance with the Ocean Dumping Regulations on a case-by-case basis as applications for disposal permits are evaluated. General guidelines for determining acceptability of applicant wastes proposed for release at the Acid Site are outlined below.

TYPES OF WASTES

Waste materials similar to those presently dumped at the site are acceptable since no significant adverse environmental effects from these wastes have been demonstrated. If adverse effects are observed in later monitoring, dumping must be altered (reduced or stopped) until such effects

cease (Ocean Dumping Regulations, Section 228.11). For the present, however, industrial wastes with the following characteristics may be released at the site:

- Aqueous acid wastes with low solid phase content.
- Neutrally buoyant or slightly denser than seawater.
- Low toxicity (after neutralizing and initial mixing) to representative marine organisms.
- Contain no materials in concentrations prohibited by the MPRSA.
- Be released at a rate such that the limiting permissible concentration for all waste constituents will not be exceeded outside the disposal site during initial mixing (4 hours) nor will it be exceeded anywhere in the environment after initial mixing.

The foregoing are liquid wastes which comply with the Ocean Dumping Regulations with respect to environmental impact, need for ocean disposal, and impacts on aesthetic, recreational, economic, or other uses of the ocean.

WASTE LOADINGS

Cumulative effects of past waste loading have not been demonstrated at the site, thus no upper limit can be defined beyond which undesirable effects could occur. The maximum historical input, roughly 5.45 million tonnes of acid wastes in 1963, did not cause observable adverse effects. It is certain that historical average volumes are acceptable (about 2.3 million tonnes per year). Existing (1980) permits allow a maximum of 2.2 million tonnes annually to be released at the site. However, the total annual input is not the critical element in evaluating the effects of waste loading at the site; rather, an individual barge load is important because the waste constituents do not accumulate, but are dispersed below toxic or bioaccumulative levels by currents. The rate of release of each waste load must not be greater than the ability of the water to dilute it to acceptable levels within a short time. Compliance with Section 227.8 of the Ocean Dumping Regulations (limiting permissible concentration) should ensure that the marine environment will not be adversely or irreversibly affected.

The total assimilative capacity of the site or area is unknown for these wastes since long-term adverse effects have not been demonstrated. The current patterns in the Apex are highly complex and have large, unpredictable variations, thus the short-term (days) transport of the waste cannot be predicted. The most prevalent direction of transport is to the south-southwest. However, estimating maximum seasonal or annual waste loadings is not possible at this time. Each waste proposed to be dumped must be evaluated individually and in relation to other wastes being dumped, for dispersion characteristics and input of toxic elements to the Apex environment. In the absence of more accurate information, waste loadings increased above the present level may be permitted as long as the site is carefully monitored for adverse effects. However, the amount of material dumped in each barge load must not be greater than that amount which can be reduced to acceptable levels by dispersal and dilution at the site. EPA establishes the size of barge loads and rates of release of materials at the site to meet this objective.

DISPOSAL METHODS

Present disposal techniques are acceptable and will be required for future permittees. The wastes are transported to the site in specially constructed rubber lined barges. Wastes are discharged from 30-cm diameter underwater ports at a specified rate while the barge is under way (5 to 7 kn). The turbulence created by the wake of the barge causes immediate dilution of the waste (from 1:250 to 1:1,800). The acid is neutralized by the buffering action of seawater; pH changes are detected only occasionally behind the barge and rarely exceed 0.2 pH units below ambient conditions after initial mixing. This method (or another method that maximizes initial dilution upon discharge) will be required for all future disposal.

DISPOSAL SCHEDULES

Only two companies are using the site; thus there have not been any scheduling problems. Allied Chemical makes 12 to 18 trips per year to the site, whereas NL Industries barges at most twice (usually once) a day. Only

one barge will be allowed in the site during a 4-hour period, to prevent additional hazards from shipping, and preclude the condition within the site of still showing the influences of the previous dump.

SPECIAL CONDITIONS

Current permits have ten special conditions, which will remain part of future permits issued for waste disposal at the Acid Site. Special Conditions Numbers 1, 2, 7, and 9 of NL Industries permit have been modified by a consent decree between the EPA, the Department of Justice, and NL Industries. Details are provided at the end of this section:

- Special Condition 1 is the time period the permit is in force. Current permittees are:

  - NL Industries, April 10, 1979 to April 9, 1981.

  - Allied Chemical, January 15, 1979 to January 14, 1982.

- Special Condition 2 is a description of the material to be transported for ocean dumping. Separate quarterly reports from the waste generator and waste transporter on volumes of waste delivered or transported are required. Allowable volumes (1980) are:

  - NL Industries - not to exceed 2,147,000 tonnes per year (2,370,000 wet tons) or 2,721,000 tonnes (3,000,000 wet tons) of liquid sulfuric acid and gangue slurry during the term of the permit.

  - Allied Chemical - 51,700 tonnes (57,000 wet tons) per year of by-product hydrochloric acid generated in the manufacture of fluorocarbons.

- Special Condition 3 specifies the disposal site. Each present permittee releases wastes at the Acid Site.

- Special Condition 4 lists the barges to be used and requires that navigational overlays of the dump vessel trackline during any disposal operation be submitted to the Coast Guard. The waste transporter must notify the Captain of the Port, USCG, of his departure time from the port and the time of actual discharge. Discharge rates are also indicated. Current barges used are:

  - NL Industries: MORAN 102 (633,000 gal capacity).
    MORAN 108 (990,000 gal capacity).

  - Allied Chemical: AC-5 (456,000 gal capacity).

  Discharge rates are presently (1980):

  - NL Industries: 100,000 gal/nmi
    (378,500 l/nmi).

  - Allied Chemical: 12,000 gal/nmi
    (45,425 l/nmi).

- Special Condition 5 specifies the waste constituents to be monitored, the approved analytical procedures, and some requirements for laboratory quality control practices. Samples for analyses are taken monthly by NL Industries and quarterly by Allied Chemical.

- Special Condition 6 requires the continuation of the EPA-approved monitoring program to determine the short-term environmental impacts of the ocean disposal of acid waste. Details of the monitoring program are in Appendix E.

- Special Condition 7 pertains to the implementation of alternative disposal methods. Each current permittee has submitted reports to demonstrate that their respective wastes are in compliance with 40 CFR, Part 227. This condition requires further research and evaluation of alternative disposal methods with the objective of ending ocean disposal. The conditions in the current permits are:

  - NL Industries:

    (1) After publication of the proposed national effluent guidelines for the titanium dioxide industry, the company will submit a plan committing it to cease ocean dumping within 18 months of promulgation of final guidelines.

    (2) Evaluate the feasibility of three process changes:
        (a) Chloride process.
        (b) Ishihara process (neutralizing of ammonia).
        (c) Malazsian Titanium Corp. process.

    (3) Report amounts of acid waste produced, amounts discharged to municipal treatment plants, amount recycled, and amounts sold.

    (4) Plan and implement a land-based disposal method for insoluble gangue and ore slurry. Anticipated cessation of the ocean dumping of this material is June 30, 1981.

    (5) Continue research and development on alternative land-based disposal techniques for the acid phase of the waste.

  - Allied Chemical:

    (1) Submit a detailed report prepared by an independent consultant evaluating economic and environmental effects of several alternative technologies recently studied (1977-1978) by the company.

(2) Report amounts of by-product acid produced and amounts sold.

(3) Continue research and development in alternative land-based disposal techniques.

- Special Condition 8 details procedures for notifying the USCG that dumping is to occur. This notification is required to facilitate USCG surveillance of disposal operations.

- Special Condition 9 details information relative to correspondence and reports required by the special and general conditions of the permit.

- Special Condition 10 specifies the liabilities for compliance related to the special conditions of the permit as applicable to the waste generator, waste transporter, or both.

The special conditions will continue to be part of all permits authorized for wastes to be released at the Acid Site.

EPA and NL Industries have entered into a consent decree which has changed several of the special conditions of the ocean dumping permit issued to NL Industries. The action was taken between the time of publication of the Draft EIS and this Final EIS. At the time of publication of this EIS, EPA, the Department of Justice, and NL Industries are reviewing comments received on the consent decree.

- Expiration date of the current permit is extended to 9 April 1982.

- Allowable volumes of waste to be dumped are:

Year	Volume (tonnes)	Material
1980	196,800,000	Sulfuric acid/gangue solids
1981	214,500,000	Sulfuric acid/gangue solids
1982 (to 9 April 1982)	407,000	Sulfuric acid

- Implementation plan and schedule is changed to:

  - Gangue will not be dumped in the ocean after 31 December 1981.

  - The free sulfuric acid portion of the waste will be reduced to less than 1.2 tons of free sulfuric acid per ton of titanium dioxide produced by 31 December 1981 (about 50% reduction).

  - The free sulfuric acid portion of the waste will be reduced to less than 0.6 tons of free sulfuric acid per ton of titanium dioxide produced by 9 April 1985 (about 75% reduction).

  - The free sulfuric acid portion of the waste will be reduced to less than 0.2 tons of free sulfuric acid per ton of titanium dioxide produced by 9 April 1988 (about 90% reduction).

  - Ocean dumping of all waste will cease by 31 December 1989.

  - The reporting requirements have been modified, so that after 1 January 1982, NL Industries will report (monthly) the total volume of waste and the total volume of free sulfuric acid transported for ocean dumping.

The initial reduction in free sulfuric acid wastes will be accomplished through the conversion to a Liquid Phase Digestion Process. Subsequent reductions will involve recycling of the acid wastes to the maximum extent possible.

Chapter 3
AFFECTED ENVIRONMENT

The environmental characteristics of the proposed Acid Site and three alternative sites (106-Mile Site, Northern Area, and Southern Area) were assessed in terms of oceanographic features (physical, geological, chemical, and biological), the history of waste disposal at the sites, the effects of wastes at the sites, and other activities near the sites which may be affected by waste disposal. The proposed site, located nearshore at the Apex, has been used since 1948 with no adverse effects on the environment or on activities in the area. The 106-Mile Site, located beyond the Continental Shelf in deep water, has been used since 1961 primarily for aqueous chemical waste disposal with no detected adverse effects. The Northern and Southern Areas, located in shallow water near Hudson Canyon with oceanographic features similar to the proposed site, have never been used for waste disposal. The Acid Site is preferred for designation because of (1) the greater distance to the 106-Mile Site and the difficulty of detecting effects in deep water, (2) the absence of other contaminant inputs and the additional expense of surveillance and monitoring at the Northern and Southern Areas, and (3) the lack of adverse effects at the proposed Acid Site.

PROPOSED SITE - NEW YORK BIGHT ACID WASTE DISPOSAL SITE

ACID SITE ENVIRONMENT

The Acid Site (Figure 3-1) is not unique when compared with the rest of the Apex. Physical processes operate over broad areas, the chemical and biological features of the water being nearly uniform over the entire Apex. The sediments and associated biota in the Apex and at the site are typical of the sandy bottom assemblages found throughout the mid-Atlantic Bight. Anthropogenic inputs (dredged material, sewage sludge, and cellar dirt) have extensively modified the sediments in some areas; acid waste, which is liquid, does not appear to affect the bottom. (See Appendix B for details.)

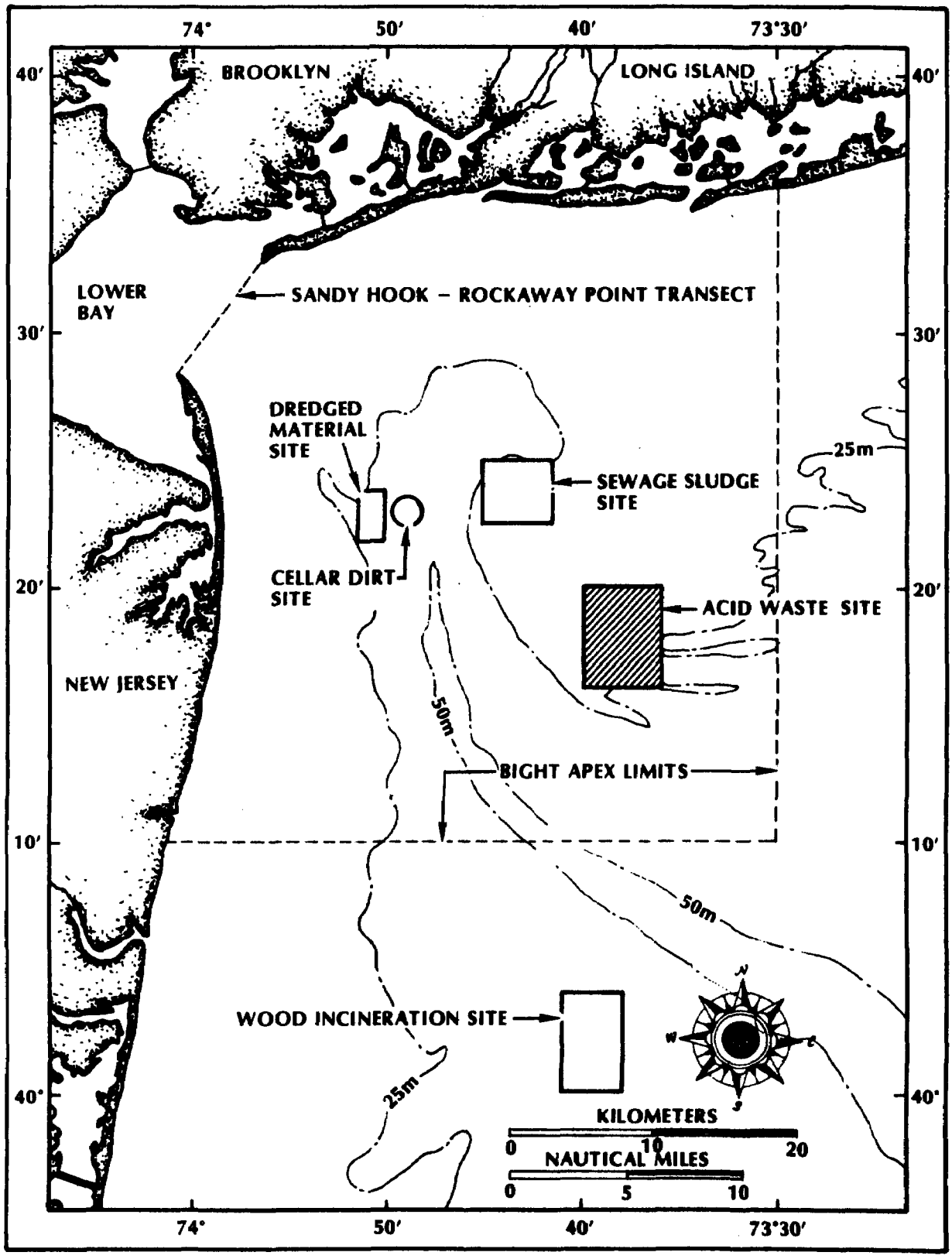


Figure 3-1. Location of New York Bight Acid Waste Disposal Site

PHYSICAL CONDITIONS

The physical characteristics of the Bight are complex. Seasonal patterns of temperature, salinity, insolation, and river runoff are complicated by strong meteorological events and intrusions of Slope Water into the outer Bight (Bowman and Wunderlich, 1977). The hydrography of the Bight exhibits clear seasonal cycles in temperature, salinity, and density structures. Two distinct oceanographic regimes, with short transition periods between them, prevail during an annual cycle. Early winter storm mixing, and rapid cooling at the surface create well-mixed, unstratified water. A moderate stratification develops in the early spring, and intensifies through the summer (Charnell and Hansen, 1974). The rapid formation of the seasonal thermocline divides the water into upper and lower layers. Bottom waters retain their characteristics with little modification until storms and cooling trends break up the thermocline in late autumn.

The major feature of Bight circulation is a slow flow to the southwest over most of the Continental Shelf; an anticyclonic (clockwise) eddy is often present in the inner Bight. Exchange circulation, characterized by seaward surface flow of estuarine waters and landward flow of bottom waters, occurs through the Sandy Hook-Rockaway Point Transect. All of these features can be masked by stronger but variable wind-driven currents on a day-to-day basis, and may be drastically altered for periods of several weeks. Alterations are more common during the summer, when there may be sustained periods of strong southerly winds (Hansen, 1977).

GEOLOGICAL CONDITIONS

The Continental Shelf surface of the Bight is a vast, sandy plain, underlain by clay (Emery and Schlee, 1963; Milliman et al., 1972). Whereas sand is the most abundant textural component on the Shelf, significant deposits of gravel and mud exist. Sediments at the Acid Site are 96% to 98% sand and gravel, the remainder being silt. The site is at the edge of the Hudson Canyon where the predominant sediments are silts and clays.

Suspended particulate matter (SPM) includes fine material from natural and man-made sources. SPM may be transported for some distance by waves and currents before sinking to the bottom, and may be resuspended by bottom currents and transported to another area. SPM can cause several adverse environmental effects: higher levels of this material can increase turbidity, in turn decreasing the depth of light penetration in water, thereby limiting the depth at which plants can photosynthesize -- which limits the amount of primary production in the area. Suspended particulates can be toxic, or can bind or adsorb toxic materials which are eventually carried to the bottom. While suspended in water or lying on the bottom, the toxic material can be consumed by marine organisms.

The Acid Site has concentrations of SPM typical of other Apex areas, but higher than areas further offshore. Acid-iron waste does contribute to the elevated levels of SPM in the Apex; the ferric hydroxide floc which forms after waste release remains in suspension for many hours. Additional significant sources of SPM to the Apex are material from other ocean disposal sites (Dredged Material, Cellar Dirt, and Sewage Sludge Sites), atmospheric fallout, coastal shelf currents, and outflow from New York Harbor through the Sandy Hook-Rockaway Point Transect. SPM, however, is not a major environmental problem in the Bight. After considering the effects from all sources, Pararas-Carayannis (1973) concluded that, "turbidity associated with ocean dumping does not appear to have an adverse lasting effect on the sediment and water quality of the Bight."

CHEMICAL CONDITIONS

The coastal metropolitan area is the primary source of heavy metals entering the Bight (Benninger et al., 1975; Carmody et al., 1973). The concentrations of dissolved heavy metals in the water of the Bight vary seasonally. Background (natural) concentrations however, are generally higher than those reported for the open ocean (Bewers et al., 1975). Heavy metal concentrations in bottom sediments are not uniformly distributed throughout the Apex; elevated levels of metals in the sediments of the Bight are

associated with the Hudson Shelf Valley, and the Dredged Material and Sewage Sludge Sites. Levels of iron (the most abundant waste constituent) were similar at the Acid Site and a control area, but were half the level of metals in samples from the Hudson Shelf Valley (Vaccaro et at., 1972). Some material may reach the bottom during unstratified (winter) conditions, but there is no indication of a buildup of contaminants from acid waste in the sediments.

Surface values of dissolved oxygen are usually at or near saturation levels. Below the seasonal thermocline, saturation may fall to 30% in the vicinity of the Sewage Sludge Site (O'Connor et al., 1977). There are no indications of abnormally depressed oxygen levels near the Acid Site. Levels of trace metals in the water are higher than in samples from the outer Bight, but there are no indications of consistently higher levels near the ocean disposal sites (Segar and Contillo, 1976). Acid waste disposal only causes short-term perturbations in the water. The flushing time for the entire Apex is 6 to 14 days, thus waste is being continually diluted and transported from the region. The overall direction of transport is to the south-southwest.

Particulate organic carbon, which may act as a transport agent for toxic substances, has the highest concentrations near areas of wastewater discharge (outfalls) and the Sewage Sludge and Dredged Material Sites. No comprehensive studies of chlorinated hydrocarbons in the New York Bight have been made, but dredged material and sewage sludge disposal are probably the major sources of these materials (EPA, 1975; Raytheon, 1975a, 1975b; West et al., 1976).

BIOLOGICAL CONDITIONS

The total annual phytoplankton production is higher in coastal waters than in the outer Bight. Productivity is uniformly low (0.5 $g/m^2/day$) over the entire Bight during the summer. The outer Bight approaches these levels throughout the year; values in the inner Bight rise throughout the winter (1.0 g $C/m^2/day$) to a spring maximum (2.0 g $C/m^2/day$; Yentsch, 1977).

In the Hudson River estuary and Apex, phytoplankton populations are dominated by diatoms in cold months, and by chlorophytes during warm months, and by diatoms year-round in the outer Bight. Zooplankton populations are

dominated by copepods and larvae of vertebrates and invertebrates (summer only) in the estuary, and by copepods in the outer Bight. However, the high degree of spatial and temporal variation inherent in plankton populations makes studies of their abundance, composition, and distribution extremely difficult. Even though plankton have been studied for about 75 years, the data are insufficient to assess the effects of man's activities on plankton populations in the Bight (Malone, 1977).

Many finfish of commercial and recreational importance are found in the Bight. Their diversity and abundance are due to the geographical location of the Bight, which is the northern limit of tropical and subtropical migrants, and the southern limit of boreal migrants (Grosslein, 1976). Some species are found inshore, others offshore, and some migrate from inshore to offshore. However, because of wide seasonal fluctuations in the Bight (especially temperature, which ranges from 2°C in the winter to 25°C in the summer), the important fish species are migratory, and not unique to the Apex.

There is a rich mixture of species in the Bight -- each species occupying wide areas over the Shelf. Eggs, larval stages, and immature forms can be found all year round throughout the area. Spawning and larval growth usually occur over a broad geographic area, thus it is difficult to assess man's effects on the stock. Grosslein indicated that there are no Shelf areas free from potential changes induced by waste disposal activities.

Commercial fishing activities are minor around the Acid Site. A seasonal whiting fishery exists north of the site along the edge of the Hudson Shelf Valley during the winter, and lobster are taken inshore of the site. Most of the Apex is closed to shellfishing because of bacterial contamination. Some species of commercially important shellfish are evenly distributed over the Bight, while others (e.g., sea scallops) have a more patchy distribution (Figure 3-2).

The inshore benthic fauna are dominated by organisms characteristic of a high-energy coastal marine environment: bivalves (*Tellina agilis* and *Spisula solidissima*) and the sand dollar (*Echinarachnius parma*; Pearce, 1972).

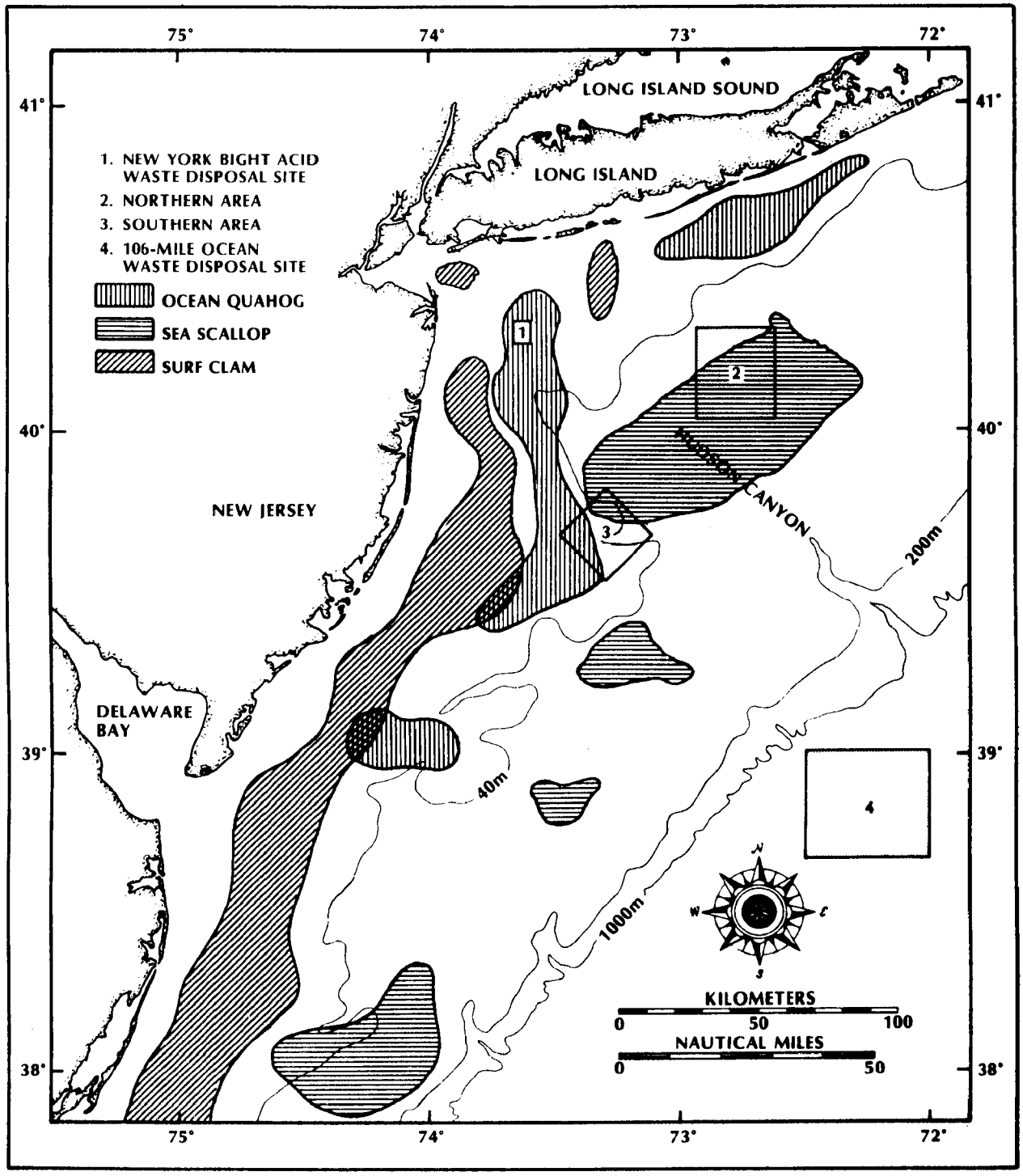


Figure 3-2. Distribution of Surf Clams, Ocean Quahogs, and Sea Scallops in the New York Bight
Source: Adapted from NOAA-NMFS, 1974, 1975

Benthic populations in the Bight are not static and substantial annual changes occur due to natural causes. The benthic fauna change from a sand bottom assemblage to silty-sand, and then silty-clay fauna further offshore in the Bight (Figure 3-3).

WASTE DISPOSAL AT THE ACID SITE

The Acid Site was established in 1948 for disposal of aqueous waste produced by industries in New Jersey. Waste disposal at the site is discussed in detail in Appendix D.

RECENT WASTE DISPOSAL ACTIVITIES

Two permittees -- NL Industries and Allied Chemical -- are now (1980) using the Acid Site. NL Industries liquid waste materials consist of approximately 8.5% (by weight) sulfuric acid (H_2SO_4) and 10% (by weight) ferrous sulfate ($FeSO_4$) dissolved in fresh water. Insoluble materials (e.g., silica and unrecovered titanium dioxide) are present in the waste. When the waste is discharged, the ferrous sulfate colors the water light green. The barge wake then turns brown as the ferrous iron is oxidized, to form ferric hydroxide (rust). NL Industries waste represented 97% of the total amount discharged at the site between 1975 and 1978.

Allied Chemical waste materials consist of approximately 30% by weight hydrochloric acid (HCl), 2% by weight hydrofluoric acid (HF), and trace constituents in aqueous solution. Allied Chemical wastes represented 3% of the total material released at the Acid Site between 1975 and 1978.

WASTE CHARACTERISTICS

Several studies have shown that the acid wastes do not remain together as a cohesive mass but are diluted rapidly after discharge. Redfield and Walford (1951) reported that the maximum volume of water having an acid reaction was 162,000 m^3 (640 m long, 23 m wide, and 11 m deep); the acid was neutralized less than 3.5 minutes after discharge. It was calculated that, at discharge,

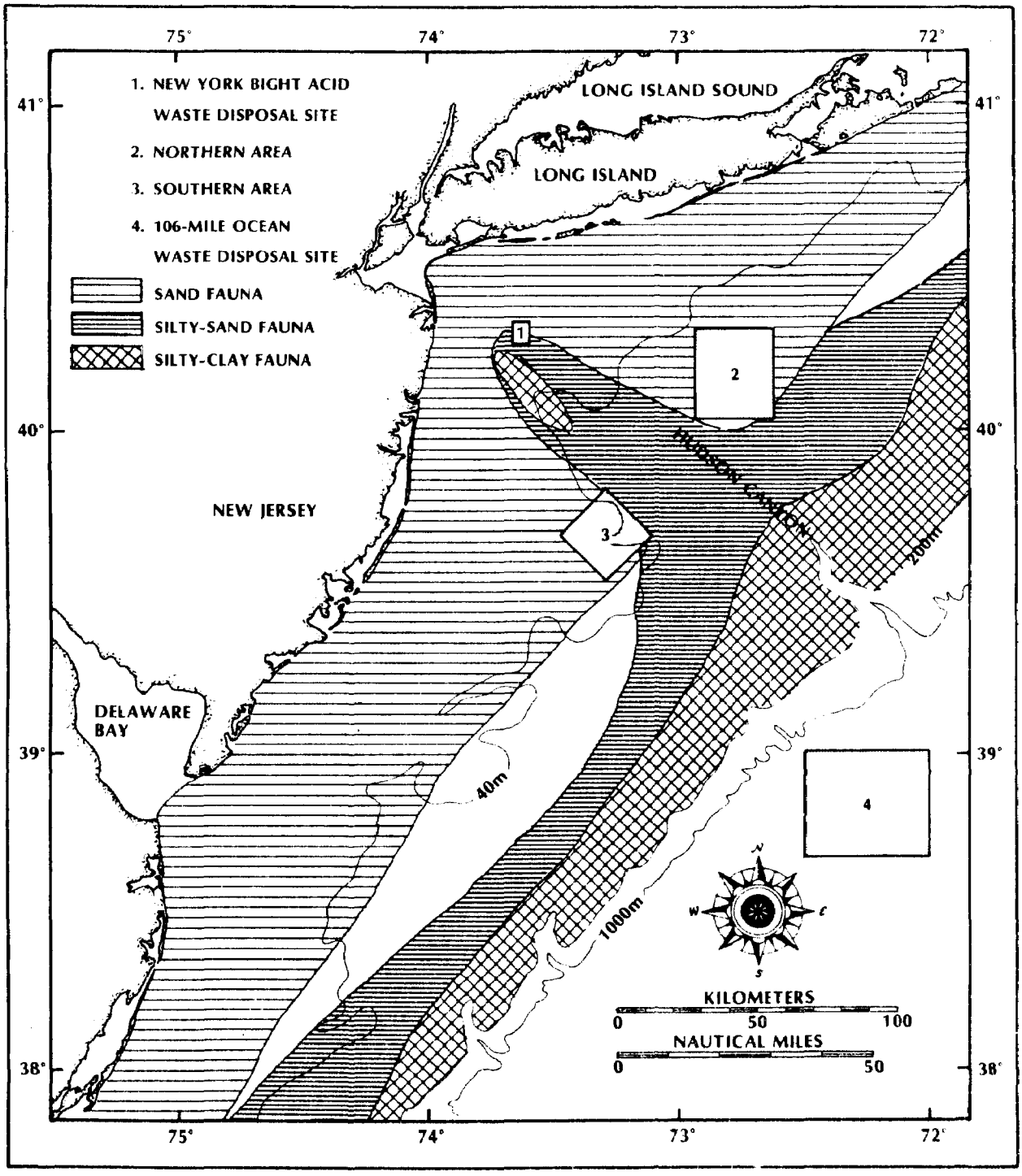


Figure 3-3. Benthic Faunal Types in the Mid-Atlantic Bight
Source: Adapted from Pratt, 1973

the sulfuric acid would be diluted immediately to 0.02 μg/l and the seawater pH would not fall below 4.5. The actual pH depression observed 2 minutes after discharge was only 1.3 pH units (from 8.2 to 6.9).

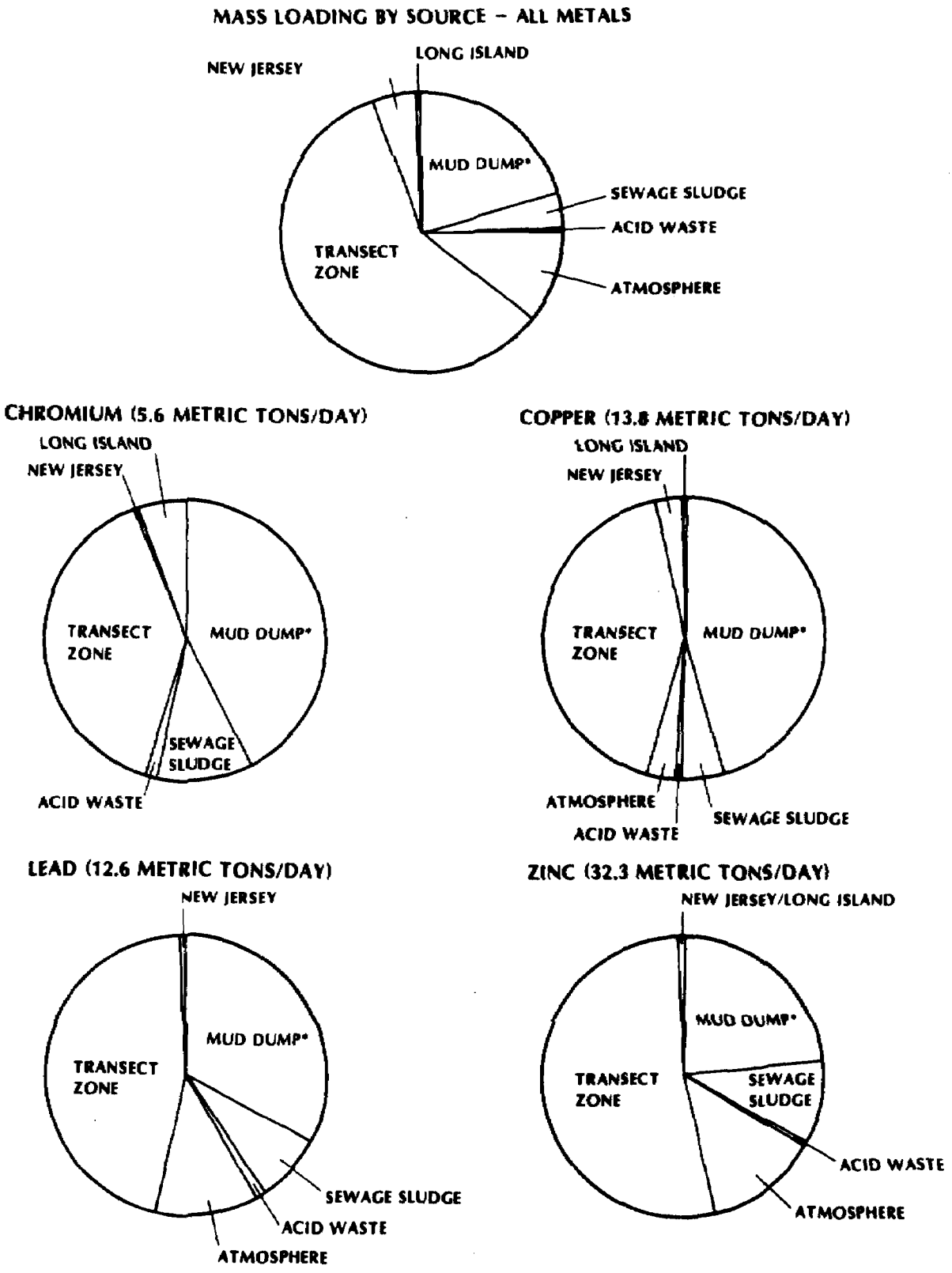
Trace metals in acid wastes are insignificant sources of contaminants to the Apex. In all cases, the acid wastes contribute less than 1% of the total input, and usually much less than the input from atmospheric fallout (Figure 3-4).

EFFECT ON ORGANISMS

Before ocean dumping was regulated by the EPA, numerous laboratory and field toxicity studies had been performed on the wastes dumped at the Acid Site. Observations of minor effects were reported by Redfield and Walford (1951), Public Health Service Sanitary Engineering Center (1960), Ketchum et al. (1958a,b), Vaccaro et al. (1972), Wiebe et al. (1973), Grice et al. (1973), and Gibson (1973). In contrast, the Sandy Hook Laboratory (SHL) (1972) reported more severe effects due to acid waste disposal; however, the SHL method and conclusions were criticized by Buzas et al. (1972).

A variety of phytoplankters and zooplankters have been collected in the wake of an acid waste discharge. Animals may be immobilized immediately after disposal, but recover quickly when the waste is diluted with an equal volume of seawater. The gastrointestinal tracts of copepods and ctenophores collected at the site after a discharge were filled with iron particles from the waste, but the animals did not appear to show ill effects.

Laboratory work indicated that phytoplankton were unaffected by a concentration of acid waste four times higher than concentrations observed in the field. Zooplankton were chronically affected by concentrations of one part waste in 10,000 parts seawater. Reproduction was impaired and development slowed over an 18-day period. These results, however, are not biologically important, because this concentration of waste only persists for a few minutes after disposal. When the toxicity of neutralized acid waste and the toxicity of the pH change were determined, the pH change appeared to cause lethal effects rather than the toxic elements in the waste. Neutralized acid waste was not toxic to test organisms.



*MUD DUMP – NEW YORK BIGHT DREDGED MATERIAL DISPOSAL SITE (FIGURE 3-11, NO. 1).

Figure 3-4. Inputs of Metals to the New York Bight (Adapted from Mueller et al., 1976)

When the site was first established (1948), there was controversy over possible effects on migratory fish in the Bight. NL Industries sponsored the first comprehensive studies of the effects of acid-iron waste, which concluded (Redfield and Walford, 1951) that there was no conflict between the waste disposal operations and sportfishing activities in the Apex. After that, Westman has periodically surveyed the site and other fishing areas in the Bight (Westman, 1958, 1967, 1969; Westman et al., 1961), and concluded that bluefish and yellowfin tuna were attracted to the site, and that an active pelagic fishery had begun in the area. He did not observe adverse effects caused by the waste disposal.

The waste does not appear to be toxic to the bottom-dwelling animals (benthos). The site supports a typical sand-bottom community; the biomass and species diversity are comparable to a control area (Vaccaro et al., 1972), although the number of animals is significantly less. Other investigators (Westman, 1967, 1969; SHL, 1972) have reported anomalous benthic conditions at the site. Recent samples (Pearce et al., 1976a,b, 1977) showed that there were wide natural variations at stations in and around the site. Such variability is common for sand-bottom assemblages of animals.

CURRENT AND FUTURE STUDIES

Scientific Investigations of the Area

The NOAA-MESA program is responsible for identifying and measuring the impact of man on the marine environment of the Bight and its resources. This program began in 1973 and is scheduled to end in 1981. After that date, a smaller monitoring program will be maintained to provide the data necessary for management decisions about use of the resources in the Bight. The MESA project has sponsored and conducted numerous investigations of all the oceanographic features of the Bight; these data provided much of the information used in this EIS.

Sandy Hook Laboratory Ocean Pulse Program of the NOAA-NMFS conducts continuous studies of the area, primarily with respect to man's impact on commercial fish and shellfish resources. The Ocean Pulse Program is designed to monitor and assess the health of the ocean's living resources on the Continental Shelf of the northwest Atlantic Ocean. This program includes the study of effects of pollutants on important marine species.

Area-Wide Planning

The Interstate Sanitation Commission (ISC) conducts research, monitoring, and regulation activities in the New York-New Jersey area. ISC is primarily concerned with monitoring water quality and verifying compliance with existing interstate regulations by sanitary waste dischargers. The ISC is developing a combined management plan for municipal wastes and have begun to monitor air quality in the Bight. The work is not directly pertinent to the Acid Site, but is close enough to the site to produce important information for evaluating effects of acid wastes on the marine environment.

Monitoring

EPA-Region II requires permittees to monitor the respective sites to determine if disposal operations have a short-term adverse impact. Monitoring surveys are made at the Acid Site once a year and at the Sewage Sludge Site daily during the summer. A monitoring plan has been developed for the Cellar Dirt Site and one is being developed for the Dredged Material Site.

OTHER ACTIVITIES IN THE SITE VICINITY

COMMERCIAL FISHERIES

Extensive finfishing and shellfishing activities are conducted in the Bight. Most of the finfish grounds lie over the inner Continental Shelf or near the edge of the Shelf. Most species of shellfish are found throughout the Bight, while others (e.g., lobster) are most abundant nearshore in the Hudson Shelf Valley or at the edge of the Continental Shelf.

DOMESTIC FISHERIES

Table 3-1 shows the 1974 total yield and dollar value for the five major species of commercial finfish in the Bight. The stock of most commercial species is still substantial, but there has been an overall decrease in annual yields of finfish over the last two decades (Figure 3-5), with commercial landings of certain over-fished species (e.g., menhaden) declining. The yield of the domestic shellfishery has increased greatly since 1960 (Figure 3-6). The once-important surf clam is becoming increasingly scarce, and other shellfish species have recently begun to be exploited (e.g., red crab and ocean quahog). Table 3-2 shows the total annual values in 1974 and 1976 for the more important shellfish species. The American lobster is the most important species fished along the Continental Shelf/Slope break, and is becoming the most important fishery resource of the Bight (Chenoweth et al., 1976).

FOREIGN FISHERIES

Nearly all foreign fishing in the north and mid-Atlantic regions of the United States is conducted on the Continental Shelf area, with the majority of foreign vessels trawling in the outer Shelf region (Figure 3-7). Peak foreign fishing activity in the Bight occurs during spring and early summer, when the fleet moves south from its winter fishing grounds on the Georges Bank. The foreign fleet greatly increases in size during this period in order to harvest the greater numbers of fish which congregate at spawning grounds. An average of 1,000 foreign vessels fish along the mid-Atlantic coast annually (Ginter, 1978). Foreign fishing in the Bight is dominated by the Soviet Union, followed by East Germany, Spain, and Japan. Major foreign fisheries are herring, silver and red hake, and mackerel. The seasonal migrations of these species account for the north-to-south movement of the foreign fleet throughout the year. Recently, fishing efforts have been directed towards squid, butterfish, tuna, and saury.

TABLE 3-1
TOTAL LANDINGS IN 1974 OF FIVE MAJOR COMMERCIAL FINFISHES IN THE NEW YORK BIGHT

	New York		New Jersey		Total	
Species	000 lb	$000	000 lb	$000	000 lb	$000
Fluke	2,487	846	3,499	1,153	5,986	1,999
Menhaden	576	18	107,307	2,735	107,883	2,753
Scup	3,635	832	6,040	880	9,675	1,712
Striped Bass	1,409	533	714	177	2,123	710
Whiting	1,955	250	7,022	587	8,977	837

Source: Adapted from NOAA-NMFS, 1977(?)

Table 3-2
TOTAL NEW YORK-NEW JERSEY COMMERCIAL LANDINGS IN 1974 AND 1976 OF IMPORTANT SHELLFISH SPECIES IN THE NEW YORK BIGHT

	1974		1976	
Species	000 lb	$000	000 lb	$000
American Lobster	1,922	3,312	1,117	2,368
Hard Clam	9,769	15,164	10,072	19,396
Surf Clam	26,608	3,667	9,493	3,299
Oyster	2,563	4,778	2,256	5,642
Sea Scallop	1,228	1,689	1,953	3,170
Blue Crab	2,864	725	407	123

Source: From NOAA-NMFS, 1977a, 1977b

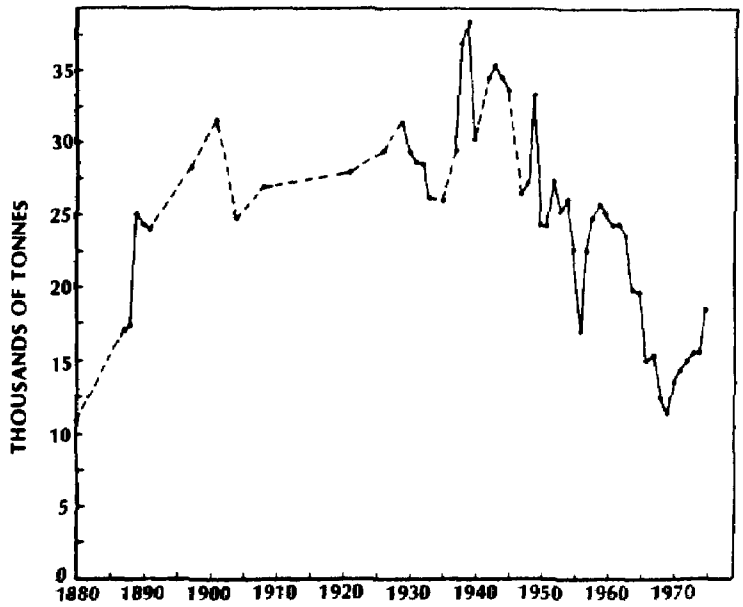


Figure 3-5. Total Landings of Commercial Marine Food Finfishes in the New York Bight Area, 1880-1975
Source: From McHugh and Ginter, 1978

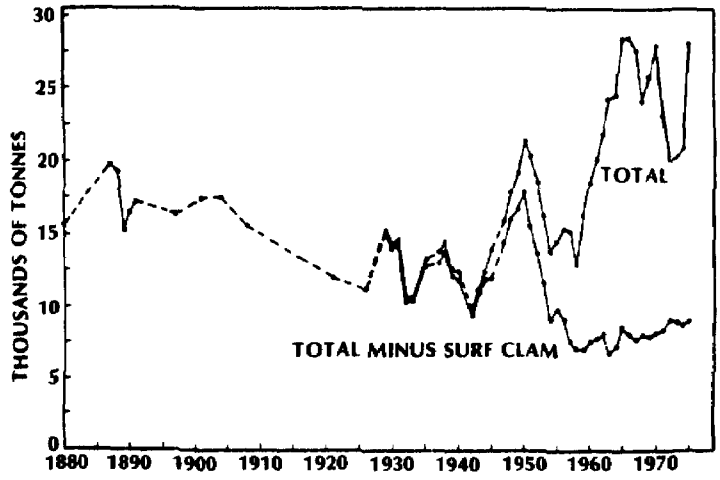


Figure 3-6. Total Commercial Landings of Marine Food Shellfishes in the New York Bight Area, 1880-1975
Source: From McHugh and Ginter, 1978

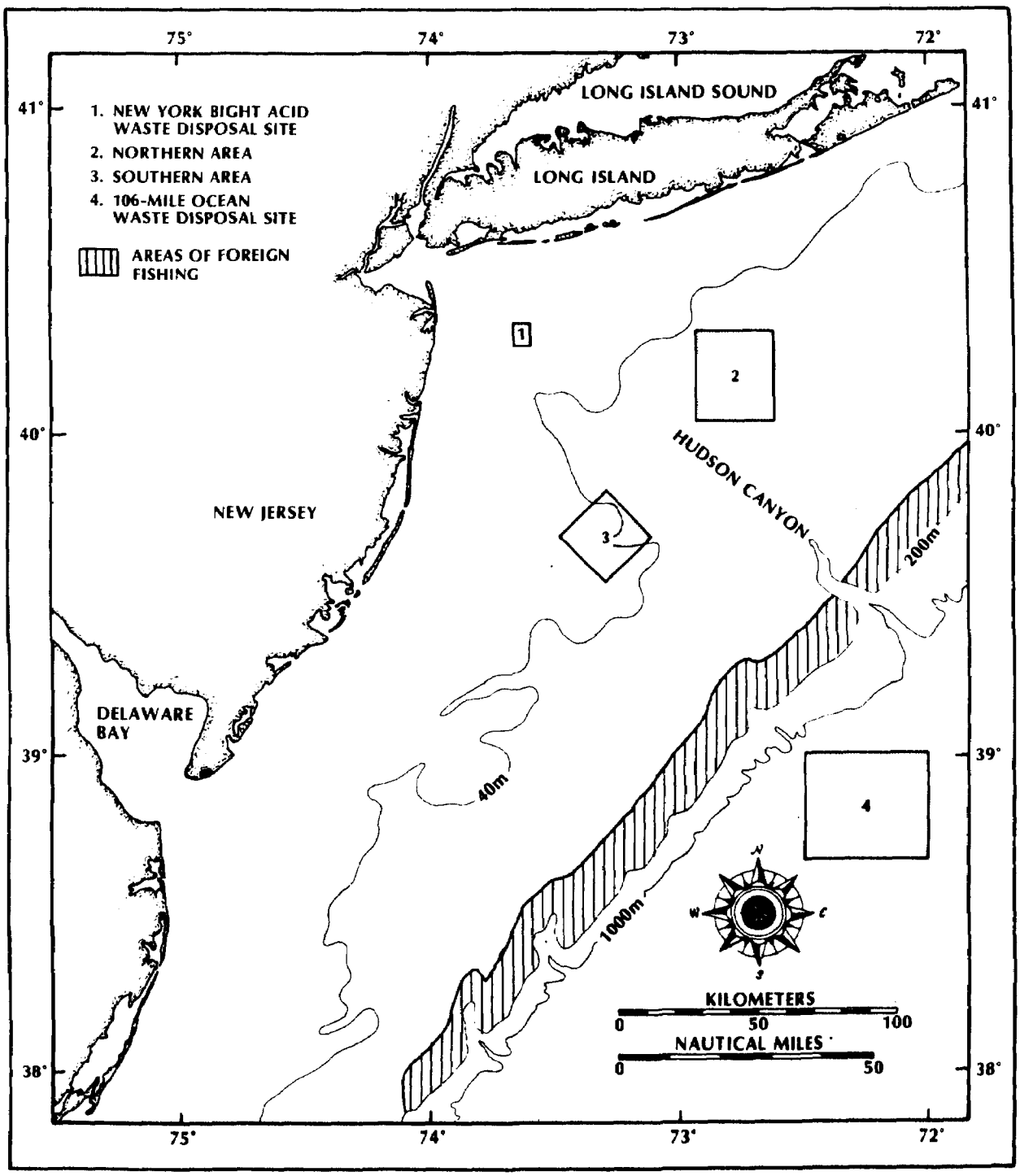


Figure 3-7. Location of Foreign Fishing off the U.S. East Coast
Source: Adapted from McHugh and Ginter, 1978

RECREATIONAL FISHERIES

Most recreational fishing in the Bight is confined to the inner Shelf waters, which are most accessible to the public, and more sport species are found there than in the outer Bight (Chenoweth et al., 1976). The important species are striped bass, weakfish, bluefish, and mackerel. Recreational species fished further offshore are bluefin tuna, marlin, and swordfish. The sport catch often equals or surpasses the commercial landings of certain species (e.g., striped bass), and significantly contributes to the economics of several coastal areas. In 1970, 1.7 million anglers caught 1.3 million kilograms (2.7 million pounds) of fish from the North Atlantic coast.

SAND AND GRAVEL MINING

Sanko (1975) states that "sand deposits in the Lower Bay of New York Harbor have been the largest single source of commercial sand for the New York City metropolitan area since 1963." This is the only marine environment in the Bight where sand is presently mined; however, recent geological surveys show that sand could be mined nearly anywhere in the Bight, with current technology limiting the outer boundary to the 50-m (165-ft) isobath.

There is an estimated area of over 781.4 nmi^2 (2,680 km^2) suitable for sand mining between the 50 m isobath and the Long Island shoreline (Schlee, 1975). Most of the sand is of uniform grain-size and contains a low percentage of fine particles. Gravel deposits in the Bight are much more limited than sand. Potential mining areas for gravel are few, mainly off the northern coast of New Jersey (Figure 3-8).

OIL AND GAS DEVELOPMENT

No existing or planned oil and gas lease tracts are located in any interim or designated ocean disposal site. Figure 3-9 is an EPA (1978a) summary of oil and gas development in the Bight.

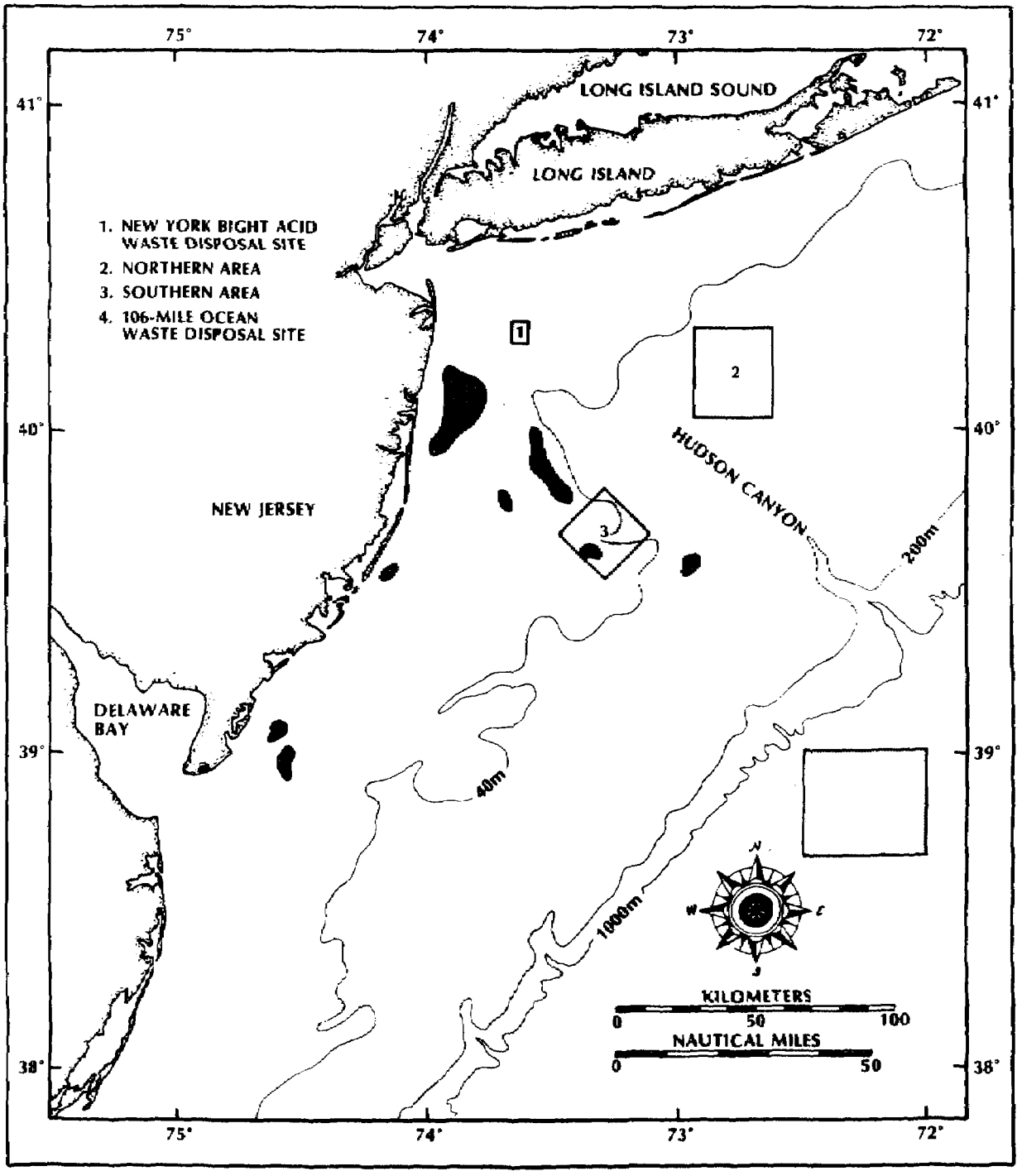


Figure 3-8. Gravel Distribution in the New York Bight
Source: Adapted from Schlee, 1975

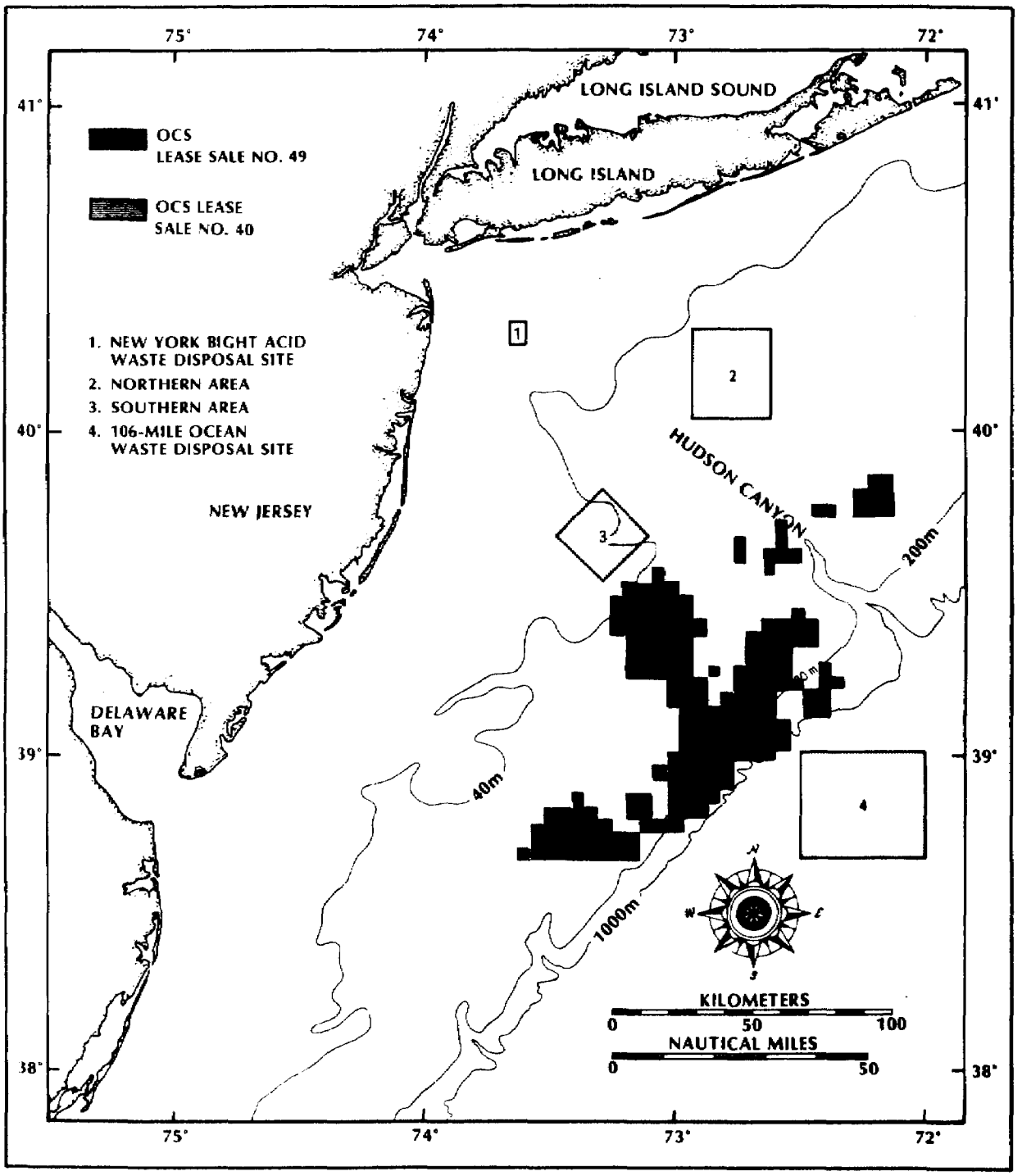


Figure 3-9. Oil and Gas Leases in the Mid-Atlantic Bight
(Adapted from EPA, 1978a)

The U.S. Department of the Interior, Bureau of Land Management (BLM) completed the first sale of oil and gas leases in the mid-Atlantic Baltimore Canyon trough in August 1976 (Outer Continental Shelf [OCS] Sale No. 40). Exploratory drilling at 6 of the 93 tracts leased in OCS Sale No. 40 began in spring and summer of 1978. On May 19, 1978, BLM published a draft EIS on the OCS Sale No. 49, including most of the Baltimore Canyon trough. Sale No. 49 was held in May 1979. A third sale (No. 59) is under consideration and is tentatively scheduled for August 1981 (BLM, 1978).

SHIPPING

The major trade routes identified by NOAA (TRIGOM, 1976) to serve the New York-New Jersey area coincide with the three traffic lanes into New York Harbor: the Nantucket, Hudson Canyon and Barnegat Traffic Lanes (Figure 3-10). The Hudson Lane lies across the Acid Site, and the other lanes straddle the Northern and Southern Areas.

OCEAN WASTE DISPOSAL

The EPA (in 1980) permitted municipal or industrial waste disposal at six locations in the Bight, and the CE permitted dredged material disposal at other sites (Figure 3-11). The Alternate Sewage Sludge Site has not received any wastes to date (1980). This section briefly describes activities at the six sites, but not the Acid Site (Figure 3-11, #4).

SEWAGE SLUDGE SITE

Sewage sludge is composed of residual municipal sewage solids from primary and secondary treatment plants. The present Sewage Sludge Site was established in 1924 (Figure 3-11, #3). There are 19 permittees currently (1980) disposing of sewage sludge at the site, with the City of New York discharging more than any other permittee. The total volume of sewage sludge discharged in 1979 was 5,330 m^3 and is estimated to be 9,890 m^3 in 1981.

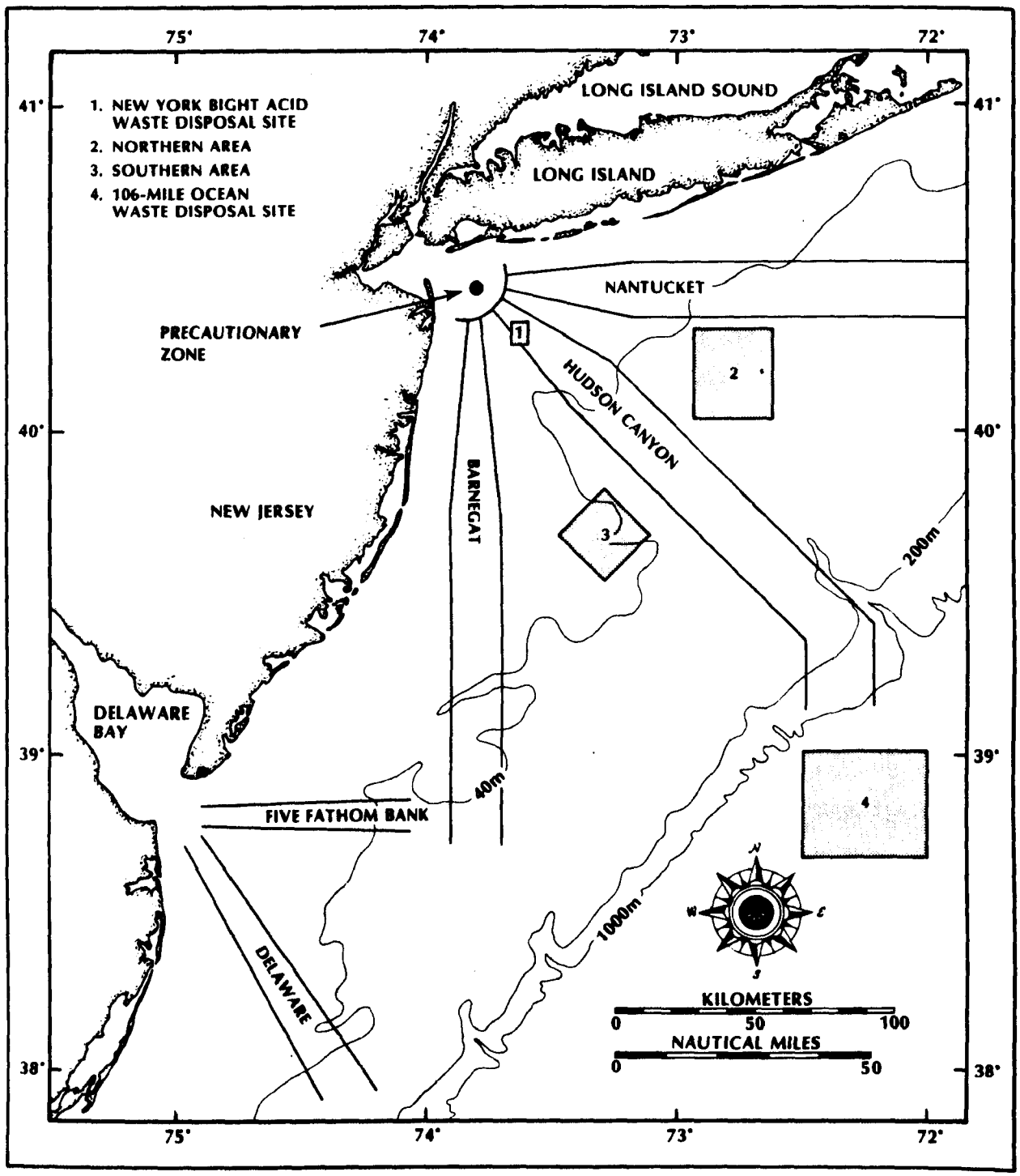


Figure 3-10. Traffic Lanes in the Mid-Atlantic Bight

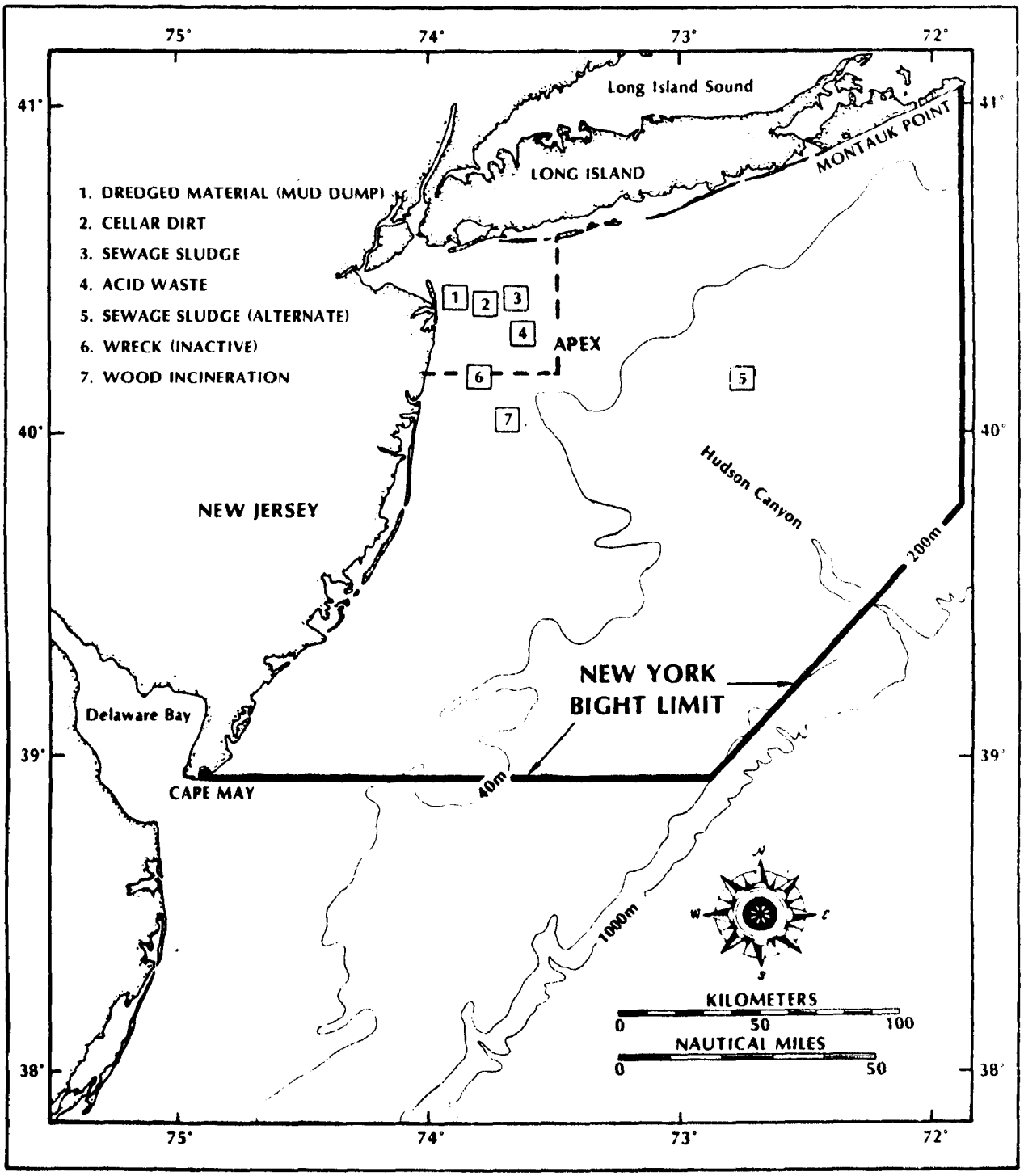


Figure 3-11. Ocean Disposal Sites in the New York Bight

The Alternate Sewage Sludge Site (Figure 3-11, #5) was designated in 1979 for use, if the existing site cannot accommodate the increased volumes of sludge before ocean disposal ends in 1981. No sludge has yet been released at the site.

DREDGED MATERIAL SITES

Several sites have been used for the disposal of material dredged from navigable waterways in the New York-New Jersey Metropolitan area. Use of the present site (Figure 3-11, #1) began in 1914. Until 1973, fly ash residues *from fossil-fueled power plants were released at the site.*

Each year, the volume of dredged material exceeds that of any other waste. The average annual volume of dredged material for the period 1960 to 1977 was approximately 8 million m^3. Some dredged material is contaminated because particulate solids carried in the Hudson River settle in the harbor.

Other dredged material sites exist just outside the inlets, along the Long Island and New Jersey shoreline (not shown in Figure 3-11). Much lower volumes of sediment are released at the sites, and the material is relatively uncontaminated sand.

CELLAR DIRT SITE

The Cellar Dirt Site (Figure 3-11, #2) has been relocated several times to prevent excessive moundings of the waste. The site has occupied its present location since 1940. Inert materials from land-based construction projects (demolition wastes), including excavated earth, broken concrete, rock, and other nonfloatable materials, are dumped at the site. The average annual volume of cellar dirt released at the site from 1960 to 1977 was 450,000 m^3. The annual volume will fluctuate from year to year according to the activity of the construction industry and the availability of alternate disposal methods.

WRECK SITE

The Wreck Site (Figure 3-11, #6) was designated by the EPA for derelict or wrecked vessels. The site has been used infrequently since 1962, and in 1977 was moved slightly to avoid interference with shipping. In January 1980, designation of the site was terminated. Future use of the Site will be regulated under a General Permit (40 CFR 229.3).

WOOD INCINERATION SITE

The EPA has designated the Wood Incineration Site (Figure 3-11, #7) for burning and disposal of scrap wood from harbor debris, pier pilings, and waterfront construction sites. The site is used as needed and only the combustion products reach the ocean. The remaining ash is sold or dumped on land.

MARINE RECREATION

The shorelines of Long Island and northern New Jersey support an estimated $2-billion per year beach industry (Interstate Electronics Corporation, 1973). The popularity of the low, sandy beaches is due to their quality and accessibility. Beach property in the New York-New Jersey metropolitan area may be publicly or privately owned. In the metropolitan area, the 1976 beach attendance, at state and national parks alone, was over 20 million (Table 3-3).

ALTERNATIVE SITE OFF THE CONTINENTAL SHELF - 106-MILE OCEAN WASTE DISPOSAL SITE

106-MILE SITE ENVIRONMENT

The 106-Mile Site (Figure 3-12) is in an area typical of the Atlantic Continental Slope and upper Continental Rise. The physical and chemical characteristics of the site are highly complex, with large natural

TABLE 3-3
BEACH ATTENDANCE AT STATE AND NATIONAL PARKS IN THE NEW YORK-NEW JERSEY METROPOLITAN AREA 1976

Park	Attendance
Island Beach State Park, N.J.	194,223
Gateway National Recreation Area	
Breezy Point, N.Y. (Jacob Riis State Park)	3,800,000
Sandy Hook, N.J.	2,000,000
Staten Island, N.Y.	1,240,000
Smith Point Co. Park, Fire Island, N.Y.	735,256
Robert Moses State Park, Fire Island, N.Y.	2,122,200
Captree State Park, Long Island, N.Y.	500,000
Fire Island National Seashore, N.Y.	702,194
Fire Island, "Other," N.Y.	2,301,000
Jones Beach State Park, N.Y.	7,000,000
Total	20,594,873

Source: EPA, 1978a

variability. The sediments and benthic biota are typical of deep-water, silty-sand sediments. Disposal of chemical wastes began at the site in 1961, but measurable changes caused by the wastes have not occurred.

PHYSICAL CONDITIONS

The site is just off the Continental Shelf in Slope Water, with intrusions of Shelf Water in the upper 200 m, and intrusions of oceanic water in the form of Gulf Stream eddies. Each water mass has distinctive physical, chemical, and biological characteristics.

Slope Water normally occupies the site; however, when the Shelf/Slope ocean front migrates eastward, Shelf Water of equal or lower salinity and temperature mixes with Slope Water. The differing densities of the water masses causes formation of separate layers. Therefore, the mixing of waters at the site can be quite complex, influenced by highly unpredictable factors and normal seasonal changes (Warsh, 1975).

Occasionally, an eddy of Gulf Stream Water surrounding Sargasso Sea Water is entrained in the Slope Water and migrates through the site. Both are of

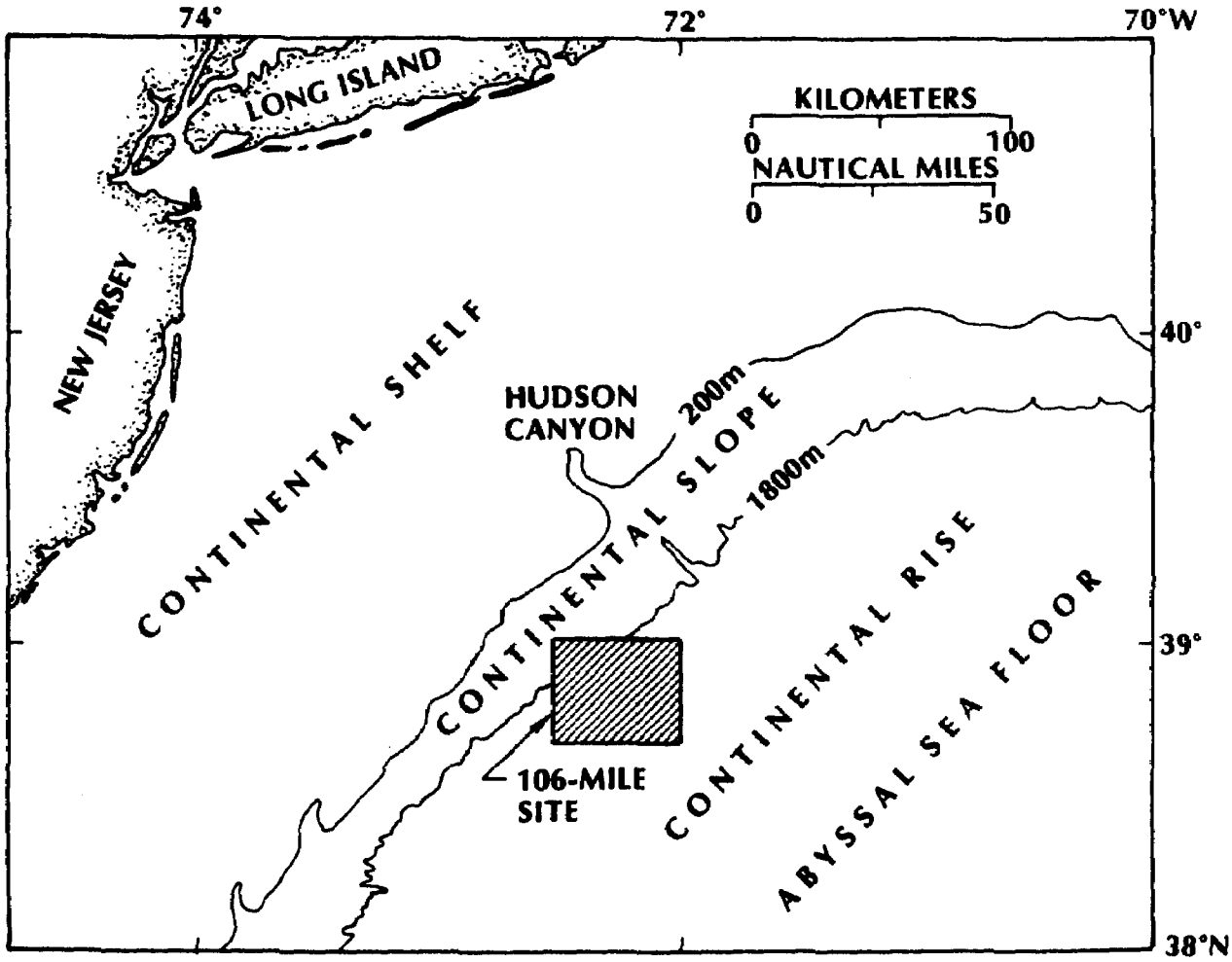


Figure 3-12. Location of the 106-Mile Site

higher temperature and salinity than Slope Water. Eddies do not pass through the site on a seasonal basis; they occupy part or all of the site about 70 days a year (Bisagni, 1976).

As the surface waters of the site warm in late spring, stratification within the top 50 m forms layers of water with differing temperatures, salinities, and densities. This stratification (the thermocline) can occur within one water mass without any mixing with another water mass and persists until September/October, when cooling and storm activity destroy it. From autumn to early spring, the temperature of the water column is the same from

the surface to a depth of approximately 200 m. At 200-m depth, however, a permanent stratification exists. The seasonal changes are important because the changing density gradients greatly influence the ultimate fate of liquid waste discharges.

Few ocean-current measurements exist for the site, yet the literature indicates a general net flow to the southwest along the margins of the Continental Shelf (Warsh, 1975). In addition, the surface flow is generally seaward with a shoreward subsurface flow in the upper 200 m. These flows are usually minor except in spring when there may be a larger influx of Shelf Water over the Continental Slope. In deeper water (below 200 m) the net direction of the currents is also to the southwest. When eddies traverse the area, the flow within the eddy is anticyclonic (clockwise).

The physical and chemical characteristics of the site cause biological complexity because each water mass possesses characteristic associations of plants and animals.

GEOLOGICAL CONDITIONS

The Continental Slope within the disposal area has a gentle (4%) grade, leveling off (1%) outside the site, in the region of the upper Continental Rise. Sediments within the site are principally sand and silt, with silts predominating (Pearce et al., 1975). The sediment composition is an important factor which determines the types of animals found in an area. Generally, greater diversity and abundance of fauna are associated with finer sediments (e.g., silt), although unusual physical conditions will alter the community structure. Fine-grained sediments commonly have higher concentrations of heavy metals. Sand, gravel, and rocky bottoms rarely contain metals in high concentrations.

Continental Slope sediments across the site are subject to different dynamic forces; the upper Continental Rise is an area of tranquil deposition, and the lower Continental Rise is an area of shifting deposition. Erosional areas (caused by bottom currents) lie between these two provinces. The different processes would largely determine the ultimate fate of any waste

products (probably insignificant) which reach bottom. In areas swept by currents, waste products would be carried out of the disposal site, and greatly diluted before being buried. In erosional and shifting depositional areas, the waste material may be temporarily deposited before being moved. In areas of tranquil or slow deposition, waste products would be slowly buried.

CHEMICAL CONDITIONS

Dissolved oxygen concentrations at the 106-Mile Site generally follow the temperature gradients; the permanent stratification level at 200 m divides the water into upper and lower regimes. Water densities of these regimes (due to differences in temperatures and salinities) keep the two layers distinctively different, and no mixing occurs. Dissolved oxygen levels decline from surface levels to a natural minimum between 200 to 300 m, then slowly increase with depth. Figure 3-13 illustrates that summer and winter dissolved oxygen gradients are similar, with slightly higher surface concentrations during winter. Acid wastes, which have not caused oxygen depletion problems in the Apex, would not significantly change the natural conditions.

Chemical surveys and monitoring programs at the 106-Mile Site have analyzed trace metal levels in sediments, water, and selected organisms. Metals in the sediments and water represent contaminants potentially available to site fauna, and may possibly be assimilated (bioaccumulated) and concentrated by them in toxic quantities.

Metals are naturally present in seawater. Only concentrations of metals which exceed natural background levels, and approach known or suspected toxic levels, threaten the marine fauna or man. The most recent studies of the trace metal content in the water of the 106-Mile Site found near-background levels typical of other Shelf-Slope regions (Kester et al., 1977; Hausknecht and Kester, 1976a, 1976b).

Trace metals in sediments all along the Continental Slope and Rise (including the site area) are elevated in comparison to Continental Shelf

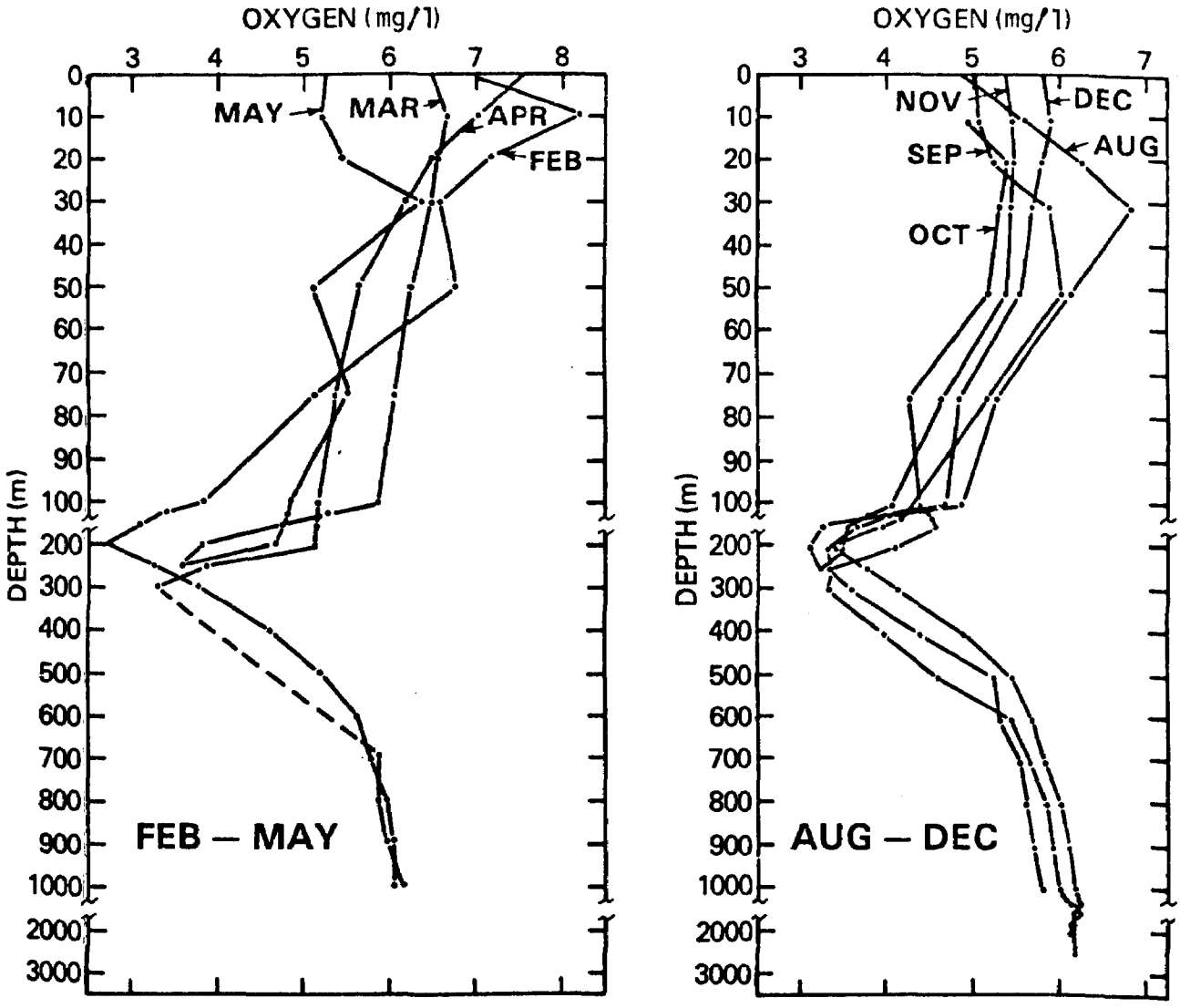


Figure 3-13. Monthly Averages of Oxygen Concentration Versus Depth at the 106-Mile Site
Source: From Warsh, 1975

values (Greig et al., 1976; Pearce et al., 1975). However, these values are widespread and cannot be attributed to waste disposal activities at the site.

Analyses of trace metal concentrations in finfish caught at the site revealed high cadmium levels in three swordfish livers, mercury levels above the Food and Drug Administration (FDA) action level ("unfit for human consumption") in most fish muscle samples, and low to moderate copper and

manganese concentrations, similar to those in Bight finfish (Greig and Wenzloff, 1977; Greig et al., 1976). However, the fish were migratory and transient species, and the levels in benthic organisms were similar over a large area, therefore waste disposal was not suggested as the "cause" of the elevated metal concentrations; other factors, e.g., seaward transport from the Hudson Shelf Valley to the Hudson Canyon, were important (Pearce et al., 1975).

BIOLOGICAL CONDITIONS

Plankton are microscopic plants (phytoplankton) and animals (zooplankton) which drift passively with the current or swim weakly. The plankton are the primary source of all food in the ocean, therefore their health and ability to reproduce are of crucial importance to all life in the ocean, including fish and shellfish of commercial importance.

Plankton populations at the 106-Mile Site are highly diverse due to the influence of the Shelf, Slope, and Gulf Stream Water Masses. Diatoms dominate in Shelf Waters, whereas coccolithophorids, diatoms, dinoflagellates, and other mixed flagellates are important in the low-nutrient Slope Waters (Hulburt and Jones, 1977). Mixed assemblages of zooplankters (common to the different water masses) occupy the site year-round (Sherman et al., 1977; Austin, 1975).

Fish have been surveyed at various depths within the site. The diversity and abundance of near-surface fish are similar inside and outside the disposal site (Haedrich, 1977). Fish occurring primarily at mid-depths (mesopelagic fish), are dominated by Slope Water species with anticyclonic (clockwise) eddies bringing in some north Sargasso Sea species (Kreuger et al., 1977; Haedrich, 1977). At some depths, particularly in the lower water column, the density of mesopelagic fish may be lower at the site when compared with control (natural) areas (Krueger et al., 1977). Several migratory oceanic fish, usually associated with the Gulf Stream, are found in midwater regions of the site. The diversity and abundance of benthic (bottom) fish in the site area are similar to those in other Slope areas (Musick, et al., 1975; Cohen and Pawson, 1977). Fifty-five species have been reported at the site. Numbers of individuals in species and numbers of species decrease with depth.

At the bottom, the abundance and diversity of invertebrates at the 106-Mile Site are similar to other Slope localities of the mid-Atlantic Bight. Invertebrates living on the surface (the epifauna) of the 106-Mile Site bottom are dominated by echinoderms (e.g., starfish and sea urchins), whereas segmented worms (polychaetes) are the dominant burrowing organisms.

WASTE DISPOSAL AT THE 106-MILE SITE

PERMITS AND WASTE VOLUMES - 1973 to 1978

The 106-Mile Site was proposed for use in 1965 by the U.S. Fish and Wildlife Service as an alternative to inland discharge of industrial/ chemical wastes which might contaminate potable water supplies. However, chemical wastes were released in the area during 1961, 1962, and 1963. From 1961 to 1978, approximately 5.1 million tonnes of chemical wastes and 389,000 tonnes of sewage sludge were released at this site, an average of 305,000 tonnes per year.

When ocean waste disposal came under EPA regulation in 1973, there were 66 permittees at the site. Since then, the number of permittees has steadily declined until, as of November 1979, only four permittees remain: American Cyanamid (Linden, N.J.), E.I. du Pont de Nemours and Co., Inc., Edge Moor Plant (Edge Moor, Del.) and Grasselli Plant (Linden, N.J.), and Merck & Co. (Rahway, N.J.). The volume of waste released, however, increased from 341,000 tonnes in 1973 to 797,000 tonnes in 1978. The increase was due to four factors: (1) the relocation of industrial waste generators from the Sewage Sludge Site in 1974, (2) Du Pont-Grasselli's move from the Acid Site in 1975, (3) Du Pont-Edge Moor's move from the Delaware Bay Acid Site in 1977, and (4) the relocation by court order, of waste disposal operations of the City of Camden, New Jersey to the site in 1977. Camden, however, contributed only 48,000 tonnes. Overall, approximately 75% of the waste discharged from 1973 to 1978 was from three industrial sources: Du Pont-Edge Moor, Du Pont-Grasselli, and American Cyanamid. The actual dumping volumes of each permittee appear in Table 3-4. Table 3-5 shows the projected inputs to the site from 1979 to 1981.

TABLE 3-4
WASTE VOLUMES, 1973-1978 AT 106-MILE SITE
(thousands of tonnes)

Permittee	1973	1974	1975	1976	1977	1978	Totals	Average
American Cyanamid Co.	118	137	116	119	130	111	731	122
Camden, N.J.	--	--	--	--	48	54	102	51
Chevron Oil Co.	25	26	22	--	--	--	73	24
Du Pont-Edge Moor	--	--	--	--	380	372	752	376
Du Pont-Grasselli	116	155	264	164	107	172	978	163
Hess Oil Co.	7	--	--	--	--	--	7	7
Mixed Industries*	34	35	78	67	85	72	371	62
Mixed municipalities**	41	93	96	25	16	16	287	48
Totals	341	446	576	375	766	797	3,301	

* Crompton and Knowles, Merck and Co., and Reheis Chemical Co.
** Permittees using New York Bight Sewage Sludge Site (sewage sludge digester cleanout residue).

Source: Data from EPA-Region II permit files

TABLE 3-5
PROJECTED VOLUMES, 1979-1980, AT 106-MILE SITE
(thousands of tonnes)

Permittee	Scheduled Phaseout Date	Year		
		1979	1980	1981
American Cyanamid	April 1981	123	123	30
Du Pont-Edge Moor	November 1980	299	250	0
Du Pont-Grasselli	None	295	295	295
Merck	April 1981	36	36	10
Annual totals:		753	704	335

WASTE TYPES AND CONTAMINANTS

The types of wastes, physical characteristics, authorized discharge rate, and dispersion factors are summarized in Table 3-6. The averages and ranges of concentrations of selected trace metals are presented in Table 3-7. Table 3-6 shows that the different wastes have some common characteristics. The wastes are heavier than seawater, although American Cyanamid wastes are almost neutrally buoyant. Minimal dilution after initial mixing ranges from 20,000 to 25,000:1 up to 75,000:1. The authorized discharge rates have been established by EPA-Region II to prevent long-term adverse effects caused by the waste discharges. Comparing the mean and maximal trace metal concentration (Table 3-7) with the minimal dilution factors (Table 3-6) shows that, with few exceptions, even maximal concentrations of waste constituents are diluted well below the limiting permissible concentration (LPC) within 4 hours after a waste disposal operation.

TOXICITY

Periodic toxicity bioassays are required of each permittee at the 106-Mile Site. Table 3-8 summarizes the results for the remaining waste generators. These results show the variability common to tests of this type and probable

TABLE 3-6
PHYSICAL CHARACTERISTICS FOR THE WASTES AT THE 106-MILE SITE

Company	Waste Produced From the Manufacture of:	Number of Barge Trips Per Month	Mean Specific Gravity (Range)*	pH (Range)**	Authorized Discharge Rate (per nautical mile)	Minimum Dilution and Dispersion 4 Hours After Waste Release
American Cyanamid	Rubber, mining and paper chemicals, nonpersistent organophosphorus pesticides and surfactants	7	1.028 (1.010-1.055)	2.7 to 8.3	113,400 liters (30,000 gallons)	25,000:1
Du Pont-Edge Moor	Titanium dioxide (chloride process) iron chloride and hydrochloric acid	7	1.135 (1.085-1.218)	0.1 to 1.0	140,000 liters (37,000 gallons)	75,000:1
Du Pont-Grasselli	DMHA and Anisole	7-9	1.109 (1.036-1.222)	12.4 to 13.6	197,000 liters (52,000 gallons)	30,000:1 to 55,000:1
Merck & Company	Thiabendazole (pharmaceuticals)	1-2	1.115 (1.022-1.132)	5.2 to 10.3	378,000 liters (100,000 gallons)	20,000:1 to 52,000:1

Sources: Data from EPA-Region II permit files
* Specific gravity of seawater = 1.025 approximately
** pH of seawater = 7.8 to 8.4

TABLE 3-7
AVERAGE METAL CONCENTRATIONS (in $\mu g/l$) FOR THE WASTES AT THE 106-MILE SITE

Metal	Seawater Concentration	Reference	American Cyanamid		Du Pont-Edge Moor		Du Pont-Grasselli		Merck Industries	
			Mean	Range	Mean	Range	Mean	Range	Mean	Range
Arsenic	2-3	Kopp, 1969	620	20-2,600	140	5-525	<6	1-21	30	1-130
Cadmium	0.15	Fleischer et al., 1974	4	1-150	320	20-900	170	3-700	3,200	20-15,600
Chromium	1	EPA, 1976	550	45-4,900	270,200	52,600-900,000	330	10-3,500	21,170	4-170,000
Copper	3.0	Mero, 1964	350	1-4,100	3,250	4-7,400	330	25-1470	10,900	1-115,000
Lead	0.03	Horne, 1969	120	1-1,000	40,540	2,700-76,000	900	10-4,900	8,840	8-62,000
Mercury	0.05-0.19	Robertson et al., 1972	30	1-200	30	1-500	7	1-20	300	21-3,830
Nickel	5-7	NAS, 1974	1,100	145-6,400	29,060	200-65,000	730	30-2,000	4,900	20-31,500
Zinc	10	EPA, 1976	560	7-5,150	100,960	110-530,000	540	30-2,700	163,800	15-1,400,000

Source: Data from EPA-Region II permit files

TABLE 3-8
TOXICITY BIOASSAYS FOR WASTES AT THE 106-MILE SITE
(μl/liter)

Company	*Menidia menidia* (Minnow 96-h TL_{50})		*Skeletonema costatum* (Phytoplankton-diatom)	*Acartia tonsa* (Zooplankton-copepod)
	Aerated	Unaerated	96-h EC_{50}	96-h TL_{50}
American Cyanamid	0.24 to 2,900	0.10 to 2,900	10 to 1900	19.5 to 3,500
Du Pont-Edge Moor	5,000	5,000 to 14,400	712 to 3,450	No data
Du Pont-Grasselli	750 to 6,950	730 to 6,170	160 to 8,600	57 to 238
Mixed Industries (includes wastes other than Merck)	650 to 100,000	150 to 100,000	65 to 12,000	29.7 to 5,300

Source: Data from EPA-Region II permit files

variability in the toxicity of different bargeloads of waste. The EPA established the discharge rates (Table 3-6) based upon the more conservative bioassay results.

In addition to the bioassays, the Du Pont plants have sponsored additional laboratory work on the toxicity of their wastes. For wastes from the Edge Moor Plant, Falk and Phillips (1977) concluded that:

- In 200-day chronic toxicity tests, the "no-effect" level for Mysidopsis bahia (opossum shrimp) and Cyprinidon variegatus (sheepshead minnow) ranged from 25 to 50 ppm.
- pH-neutralized waste (which rapidly occurs in seawater) produces mortalities only at concentrations several orders of magnitude above the unaltered waste.
- Pulsed exposure of Palaemonetes pugio (grass shrimp) to initial wastewater concentrations of 250 ppm (v/v)* followed by dilution slower than that observed in the barge wake produced no mortalities.
- Maximum waste concentrations in the barge wake were calculated to be approximately 150 ppm within 2 hours, and about 5 ppm within 8 hours. The 2-hour calculated wake concentrations is about half the acute LC_{50} value range of 240 to 320 ppm and the 8-hour wake concentration is a fifth of the calculated chronic no-effect level of 25 to 50 ppm for unaltered waste.

Based on these results, Falk and Phillips (1977) concluded that the Edge Moor wastewaters can be discharged into the marine environment over a 5-hour period, at a barge speed of 6 kn, without adverse impact and without violating the requirements of Section 227.8 of the EPA Ocean Dumping Regulations.

For wastes from the Grasselli plant, Falk and Gibson (1977) concluded:

- Under oceanographic conditions least likely to enhance dispersion, peak wastewater concentration in the barge wake is about 450 ppm (v/v) 1 minute after release.
- Wastewater concentrations decline to a maximum of 80 ppm 4 hours after release, and to about 60 ppm after 12 hours.

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* v/v = volumetric ratio

- In 178-day chronic toxicity tests, the no-effect level for Mysidopsis bahia (opossum shrimp) and Cyprinodon variegatus (sheepshead minnow) was 750 ppm.

- The wastewaters are not selectively toxic to a particular life stage of Cyprinodon or Mysidopsis.

- There is little difference in the toxicity of the wastewater to several species of marine organisms.

The results supported the discharge of Grasselli waste into the site over a 5-hour period, at a barge speed of 5 kn without adverse impact, and without violating the requirements of Section 227.8 of the EPA Ocean Dumping Regulations.

CONCURRENT AND FUTURE STUDIES

NOAA will continue to monitor the 106-Mile Site to detect any long-term changes due to the chemical wastes released. All permittees are required to monitor the short-term effects of their waste discharges. Present permittees have contracted with a private company to conduct continuous monitoring, and twelve reports (as of 1979) have been submitted to EPA-Region II.

OTHER ACTIVITIES IN THE 106-MILE SITE VICINITY

Few activities occur in the site vicinity other than waste disposal operations. A large area immediately south of the Site has been proposed as an Incineration Site; however, there are no other active ocean disposal sites in the vicinity. Oil and gas lease tracts are located west and north of the site, along the outer Continental Shelf (Figure 3-9). The Hudson Canyon Traffic Lane crosses the Continental Slope to the north of the site, but other major traffic lanes are not near the 106-Mile Site.

Limited fisheries resources occur at the 106-Mile Site and vicinity. Due to the abyssal depths at the site, none of the shellfish common to shallower Shelf-Slope areas are found at the site. Lobsters, which constitute a valuable fisheries resource in the Bight, are confined to areas shallower than 500 m. The red crab (a potential fishery resource) is most abundant at depths

between 310 and 914 m; its depth range is to 1,830 m. Small individuals may occur at the site; however, liquid wastes would not affect bottom dwelling animals.

Existing population data show that commercially important species of finfishes in the Bight vicinity are most abundant in Shelf areas and along the Continental Shelf-Slope break (NOAA-MESA, 1975; BLM, 1978; Chenoweth et al., 1976). Consequently, most foreign and domestic fish trawling is conducted at depths shallower than 1,000 m, much shallower than the 106-Mile Site. Nearby waters have been used for the commercial longline fishing of marlin, swordfish, and tuna (Casey and Hoenig, 1977). However, only 1,041 of these fish were taken in 1973 and 1974, in a large area including the 106-Mile Site. In general, catch statistics for Continental Slope areas are unavailable because landing records do not separate Shelf species from Slope species.

ALTERNATIVE SITES ON THE CONTINENTAL SHELF

In addition to existing disposal sites, the so-called Northern and Southern Areas were evaluated as alternative sites for the release of acid wastes. The sites might be considered if disposal operations were moved out of the Apex, but not off the Continental Shelf, due to environmental or economic considerations. The Alternate Sewage Sludge Site is in the northeast corner of the Northern Area, but anthropogenic wastes have never been released in either location.

The main environmental features of the two areas are similar to those discussed earlier in this chapter for the Acid Site, and detailed in Appendix A. This section emphasizes the most significant differences between the areas, and the general oceanography of the Bight. The information is taken from NOAA-MESA (1976).

The flow of waters is generally southwestward, following depth contours, although (as in the Apex) this flow is highly variable and subject to intense meteorological events. Flow in the Hudson Canyon is both up and down the canyon, but the long-term flow is distinctly up-canyon, towards the Apex.

Surface sediments are mostly clean, medium-sized sands. The most prominent feature of the bottom sediment in the Southern Area is a band of coarse, gravelly sand, near the northeast rim of the site, parallel to the Hudson Shelf Valley. The motion in both areas is generally towards the southwest, especially during winter "northeaster" storms.

Dissolved oxygen concentrations in surface, mid-depth, and bottom waters in the Northern and Southern Areas are moderately to highly saturated under winter, spring, and critical summer conditions. The percent saturation of oxygen, at these sampling depths, probably does not fall below 50% at any time of year, and is usually much higher (75% to 110%).

The concentrations of heavy metals in the sediments and waters of the Northern and Southern Areas are low compared to those found in the Apex, but all levels of chemical parameters are typical of the Bight. Concentrations of suspended particulate matter are lower in these areas since they are further removed from shore influence.

The living marine resources are typical of those along the mid-Atlantic and New England Continental Shelf. NOAA-MESA (1976) reported surf clams and sea scallops at each site. Commercial possibilities were not determined. Ocean quahogs were present in both areas. Figure 3-2 shows the distribution of these three species.

Chapter 4

ENVIRONMENTAL CONSEQUENCES

The release of acid waste at any of the alternative sites would produce similar environmental consequences. There will be minor, short-term, adverse effects on the plankton and minimal effects on bottom-living organisms. Effects on the benthos are most probable and would be easiest to demonstrate at the Southern or Northern Areas; effects (if present) at the Acid Site are obscured by the multiple contaminant sources, while no effects are expected at the 106-Mile Site, which is located in water depths of 2,000 m.

Adverse effects from acid waste disposal on the public health and water quality will be minimal except for a site in the Southern Area, where acid waste disposal might interfere with development of exploitable shellfish resources. Demonstrable, adverse effects on the ecosystem are most probable at a new site in the Northern or Southern Areas since wastes have never been released in these regions.

Most importantly, 32 years of study at the existing New York Bight Acid Waste Disposal Site have not demonstrated any adverse effects resulting from the disposal of these wastes.

This chapter details environmental effects of waste disposal at various alternative disposal sites outlined in Chapter 2. Included are unavoidable environmental consequences which will occur if the proposed action takes place. The effects discussed first are environmental changes which directly affect public health, specifically, commercial or recreational fisheries and navigational hazards. Secondly, the environmental consequences of acid waste disposal at each alternative site, are discussed, which cover effects of short dumping in nondesignated areas. Finally, the chapter concludes with descriptions of unavoidable adverse effects and mitigating measures, the relationships between short-term uses of the environment, maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which will occur if the proposed action is implemented.

Much data were examined to evaluate potential effects of acid waste disposal at the sites. The principal data sources for each area are:

- Acid Site: NOAA-MESA studies of the entire Apex beginning in 1973. NMFS/SHL study from 1968 to 1972. Site-specific studies sponsored by NL Industries, Inc., beginning in 1948. Routine monitoring surveys sponsored by the permittees.

- 106-Mile Site: NOAA surveys, starting in 1974. Waste dispersion studies and monitoring of short-term disposal effects sponsored by the permittees. Public hearings concerning relocation of sewage sludge disposal sites and issuing of new permits.

- Southern Area: NOAA survey in 1975. Public hearings concerning the disposal of sewage sludge in the Bight.

- Northern Area: NOAA and Raytheon surveys in 1975. Hearings concerning the disposal of sewage sludge in the Bight.

Information from these and other sources was collected and compiled into an extensive data base entitled Oceanographic Data Environmental Evaluation Program (ODEEP; see Appendix D). The following discussion is based on an evaluation of the available data.

EFFECTS ON PUBLIC HEALTH AND SAFETY

A primary concern in ocean waste disposal is the possible direct or indirect link between contaminants in the waste and man. A direct link may affect man's health and safety. An indirect link may cause changes in the ecosystem which, although not apparently harmful to man, could lead to a decrease in the quality of the human environment.

COMMERCIAL AND RECREATIONAL FISH AND SHELLFISH

The most direct link between man and waste contaminants released into the marine environment is via consumption of contaminated seafood. Shellfishing, for example, is automatically prohibited by the FDA around sewage sludge disposal sites, or other areas where wastes are dumped, which may contain disease-producing (pathogenic) microorganisms. Thus, the possibility of consuming shellfish which may be contaminated by pathogens, is eliminated or minimized. Harmful effects caused by eating fish containing high levels of mercury, lead, or persistent organohalogen pesticides have been documented. Certain compounds (e.g., oil) have made fish flesh and shellfish unhealthy and unpalatable. Therefore, wastes containing heavy metals, organohalogens, oil, or pathogens must be carefully evaluated with respect to possible contamination of commercially or recreationally exploitable marine animals.

Foreign long-line fisheries exist on the Continental Slope, but U.S. fishing in the mid-Atlantic is mostly restricted to waters over the Continental Shelf. Commercial fishing and sportfishing activities on the Shelf are widespread and diverse; finfish and shellfish (mollusks and crustaceans) are taken. The Bight is one of the most productive coastal areas in the North Atlantic, and the region may be capable of even greater production as new fisheries develop.

Important spawning grounds and nursery areas lie within the Bight, but critical assessments of the effects of man-induced contamination on fish and shellfish populations are lacking. Many factors complicate the collection and assessment of these data. For example, normal short-term and long-term population cycles are not well understood, catch data may not be adequate, and the complete life cycle and distribution of the stock may be unknown. Natural population fluctuations, overfishing, and unusual natural phenomena may have greater influences than man-induced contamination on the health and extent of the fisheries' resource. Therefore, assessment of the effects of ocean disposal includes uncertainties due to the weaknesses of existing fisheries information.

NEW YORK BIGHT ACID WASTE DISPOSAL SITE

There is an extremely low potential for endangering public health from continued acid waste disposal at this site. The site location was chosen 32 years ago because it was not a point of concentration for fish or fishing and because the sandy sediments of the site are seldom associated with productive fishing. Ironically, the site has become a sportfishing area because the discoloration of the water caused by acid-iron waste disposal apparently attracts bluefish, a prized sport fish, to the area (Westman, 1958). Fishermen in the New Jersey and Long Island areas claim that the discolored water hurts the fishing for other pelagic sport fish. In winter, a commercial whiting fishery exists near the Acid Site, and lobstering may occur northeast of the site.

Effects of acid waste disposal on these resources are practically nonexistent. No health problems associated with sport fish caught at the site have been reported. No tainting or harmful accumulations of waste components in the flesh of fish taken from the area have been reported. Longwell (1976) observed adverse effects on mackerel eggs taken near the site, but did not suggest that dumping caused these changes, which also appeared at stations halfway to the edge of the Continental Shelf. Long-term damage to the resources by the acid waste disposal have not been documented (EG&G, 1978b; ERCO, 1978a,b). The area nearer shore is closed to shellfishing because of the material released at the Sewage Sludge and Dredged Material Sites.

Acid waste contains only small amounts of tainting substances, e.g., oil and grease. Relative to total inputs of oil and grease to the Bight, acid waste is an insignificant contributor of these contaminants. Waste constituents may reach the bottom and be assimilated by organisms, but other sources of contamination are probably more significant. (The Sewage Sludge Site is only 2.8 nmi from the Acid Site.)

106-MILE SITE

Commercial or recreational fishing is infrequent at this site; consequently, acid waste disposal will not directly endanger human health.

NOAA-NMFS resource assessment surveys do not extend beyond the Shelf, however, densities of fish eggs and larvae are low beyond the edge of the Shelf. Foreign fishermen are near the site in the late winter, but usually catch highly migratory fish. The probability of fish accumulating toxic levels of contaminants from the waste is extremely unlikely.

A small fishery for the deep sea red crab (Geryon quinquedens) exists near the Shelf-Slope break in the mid-Atlantic. Immediately north of the 106-Mile Site, crabs are found in moderate abundance (33 per half hour otter trawl), but the water depth is much shallower than at the site (311 to 732 m). At a station 70 nmi (130 km) northeast of the site, at a comparable depth, no crabs were taken (Wigley et al., 1975). The site is within the range of smaller crabs, yet none of commercial size were taken deeper than 914 m. As with finfish, the probability of liquid wastes affecting a benthic animal is extremely low. Therefore, disposal at this site does not directly endanger human health by contaminating edible organisms.

SOUTHERN AREA

Numerous surf clams, ocean quahogs, and scallops are found in the Southern Area. Most commercial shellfishing is presently to the west, near the New Jersey coast. However, declining harvests may cause the Southern Area to be exploited in the future (EPA, 1978a). Recreational fishing is unlikely at the site due to the distance offshore and the competition from more attractive sportfishing areas closer inshore. If the area were used as a disposal site for wastes, similar to those presently being released at the Acid Site, a real but low potential for an accumulation of waste constituents in the flesh of shellfish would exist.

NORTHERN AREA

Disposal of aqueous acid wastes in the area would probably not directly endanger public health. The site is not in a known commercially or recreationally important fishing or shellfishing area. Resource assessment surveys show that this area has a similar, or lower, density of fish eggs and

larvae compared with other Shelf sites (NOAA, 1975). Shellfish are not abundant in the area. The area supports no commercially or recreationally exploitable finfish or shellfish, thus a health hazard from eating animals contaminated by waste materials is unlikely.

NAVIGATIONAL HAZARDS

Navigational hazards may be separated into two components: (1) hazards resulting from the movement of transport barges to and from a site, and (2) hazards resulting from barge maneuvers within the site.

If an accident occurred involving the release of wastes, the effects from the dumped waste would probably be equivalent to a short dump. The effects from the other ship would depend on the cargo, and could be severe if the barge collided with an oil or liquefied natural gas (LNG) tanker. There is the possibility of loss of life in any collision. Sites further offshore have a longer search and rescue response time than sites closer to shore.

With respect to all sites, barges must pass through the Precautionary Zone centered around Ambrose light (see Chapter 3, Figure 3-10), where traffic is densest and hazards are greatest. Once through the Precautionary Zone, potentials for problems increase with increasing distance from shore. Table 4-1 shows the distance and estimated transit time for the four alternate sites.

ACID SITE

The Acid Site is across the outbound section of the Hudson Canyon Traffic Lane from New York Harbor, but the barging operations are designed to minimize interference with traffic. In 32 years of use at the Acid Site, no collision between a barge discharging waste and a ship has ever occurred. In April 1976, a collision did occur near the Acid Site between a ship and a barge outbound for the 106-Mile Site. The permittees now using the site barge wastes about once a day. Any accident would be close to New Jersey or Long Island beaches.

TABLE 4-1
DISTANCES AND TRANSIT TIMES (ROUND TRIP) TO ALTERNATE SITES

Site	Distance*		Transit Time (hours)**	
	nmi	(km)	5 kn (9 km/hr)	7 kn (13 km/hr)
Acid Site	17	(31)	7	3
106-Mile Site	113	(209)	46	32
Southern Area	53	(98)	22	16
Northern Area	50	(93)	21	16

* Measured from the Rockaway - Sandy Hook Transect
** Does not include time in transit from the loading dock to the Rockaway-Sandy Hook Transect (New York Harbor), nor time spent at the sites.

106-MILE SITE

Barges in transit to the 106-Mile Site from New York Harbor use the Ambrose-Hudson Canyon Traffic Lane for most of the journey. There is a slightly greater possibility for problems during the round-trip transit to the 106-Mile Site than to a site closer inshore.

Hazards resulting from maneuvers within the site are negligible. The site is extremely large, and permittees are required to use different quadrants of the site if there are simultaneous disposal operations. The frequency of existing barging is only two to three times per week. Increased frequency of use would not significantly increase navigational difficulties.

SOUTHERN AREA

The Southern Area lies outside traffic lanes for New York Harbor, thus its use would cause few navigational hazards. Barges could use the Ambrose-Barnegat Traffic Lane for most of the trip. However, increased ship traffic resulting from offshore oil and gas resource development would slightly

increase the hazards. The degree and extent of such hazards would depend on the speed and magnitude of oil and gas development in the area. Any accidents would likely occur in the heavily fished coastal waters off New Jersey.

NORTHERN AREA

The Northern Area lies outside traffic lanes for New York Harbor thus its use would cause few navigational hazards. Barges could use the Ambrose-Nantucket Traffic Lane for most of the trip. Mineral resources have not been found in the area, so there is no possibility of increased hazards from future resource development. Any accidents would be near coastal waters off Long Island.

EFFECTS ON THE ECOSYSTEM

The adverse effects of ocean disposal on the ecosystem (the interacting living and non-living components of the environment) can be subtle, and may not exhibit obvious direct effects on the quality of the human environment. However, subtle adverse impacts can accumulate and combine to cause long-term consequences which are as serious as any readily observed direct impacts. For example, an organism may accumulate waste constituents in its tissues at concentrations which do not cause its death immediately, but instead act at a sublethal or chronic level. Sublethal effects may reduce reproduction, reduce health of eggs and larvae, slow development of juveniles, or affect other facets of the life cycles of individual organisms, followed by adverse changes in the entire population of the organism. The population may eventually be eliminated from an area, not because it was immediately killed by a single waste discharge but because of long accumulations of sublethal effects. If that population were a major human food source or a food source for an organism that was commercially exploited, man could lose the resource. This sequence is vastly simplified, and is not a projection of what is actually resulting from acid waste disposal in the ocean; however, it does illustrate that man, as an integral part of a complex ecosystem, may ultimately feel the results of adverse impacts on other parts of the ecosystem.

The magnitude of the effects of waste disposal on the marine ecosystem depends upon several factors: (1) the types of waste constituents, (2) the concentrations of toxic waste materials in the water and sediments, (3) the length of time that high concentrations are maintained in the water or the sediments, and (4) the length of time that marine organisms are exposed to high concentrations of these materials. Current disposal techniques for aqueous acid wastes maximize the dilution and dispersion of the wastes, and minimize chances for wastes to remain in the water column, or to reach the bottom in high concentrations.

BIOTA

PLANKTON

Plankton consist of plants (phytoplankton) and animals (zooplankton) which spend all or part of their lives floating or weakly swimming in the water. Aqueous wastes primarily affect the water column, thus plankton represent the first level of the ecosystem where the effects of waste disposal are likely to be observed. Accordingly, numerous studies of the effects of wastes on planktonic organisms have been conducted at ocean disposal sites.

Acid Site

The effects of waste disposal on plankton at the Acid Site have been studied extensively. Field studies during waste discharges have shown that acid-iron waste does not harm zooplankton populations (Wiebe et al., 1973; Redfield and Walford, 1951). Evidence of chromosomal damage in mackerel eggs collected in the vicinity of the site has been reported (Longwell, 1976), but the cause of the damage cannot be definitely linked to the disposal of acid wastes since the same abnormalities occurred at stations far from the site. Interpretation of field results from this site is difficult; changes in plankton populations due to acid waste disposal at the Acid Site cannot be reliably distinguished from changes caused by pollutants from other sources introduced into the Apex.

Laboratory studies show that acid wastes released at this site can cause chronic effects in zooplankton after prolonged exposure to waste concentrations which are much greater than those encountered under field conditions (Grice et al., 1973). Sublethal effects (e.g., failure to reproduce and extended developmental times) have been demonstrated in the laboratory, only after 21 days of exposure to waste concentrations which persist for only minutes after actual discharge of wastes at the site (Vaccaro et al., 1972).

Additional release of acid wastes at the Acid Site would not be expected to cause effects different from those presently existing. However, releasing wastes, with characteristics different from wastes previously dispersed, may have unpredictable effects.

106-Mile Site

Numerous field and laboratory studies on the 106-Mile Site have investigated the effects of dumped wastes on the plankton. Some of these wastes are aqueous by-product acids, similiar to those at the Acid Site. Field studies of populations have shown great numerical variations, mainly due to the presence of several water masses, each with different species (Austin, 1975; Sherman et al., 1977; Hulburt and Jones, 1977). NOAA (1977) recognized these factors at the 106-Mile Site:

> Plankton undergo large natural variations with changing water type and for this reason, assessment of the plankton of the region was difficult. Coastal waters are characterized by high nutrient concentrations and populations with wide seasonal variations in abundance and diversity. Oceanic waters have reduced nutrient levels and population densities, but photosynthetic processes extend to much greater depths. Mixing water types will produce a complex combination of these conditions.

Plankton data demonstrate high natural variabilities in populations, hence, changes in species composition, abundance, and distribution data due to waste disposal may never be demonstrated. Variations induced by waste disposal are obscured by variability created by natural events.

The adverse effects of acid waste disposal at this site should be localized and short term.

Southern and Northern Areas

Use of either the Southern or Northern Areas for acid waste disposal would not be expected to have significant long-term effects on plankton. The areas are outside the highly stressed Apex, thus the biota are unlikely to have had the opportunity to adapt to man-induced environmental stresses. However, specific effects would depend upon the nature and volume of wastes and frequencies of disposal. Based upon existing wastes and volumes, any effects would be difficult to demonstrate, because plankton populations are so variable.

NEKTON

The nekton include animals, e.g., fish and mammals, capable of strong swimming and migrating considerable distances.

Acid Site

None of the numerous studies on nekton at the Acid Site have detected long-term effects attributable to acid waste disposal. Many contaminant inputs to the Apex, other than those at the Acid Site, make it unlikely that any deterioration of fish health or populations could ever be proven to be caused by acid waste disposal. Therefore, any effects on fish populations by additional acid waste disposal at this site are difficult to predict, based on information obtained during present disposal operations. However, considering (1) the dilution and dispersion of wastes presently released, (2) the absence of dead fish in the wake of disposal barges, and (3) the ability of fish to move away from temporarily stressed areas, it is unlikely that disposal of acid wastes at the Acid Site would have any demonstrably adverse consequences.

One possible effect under investigation is a relationship between acid waste disposal and mutagenesis in fish eggs (Longwell, 1976). Kinne and

Rosenthal (1967) suggested the possibility, while investigating the effects of sulfuric acid wastes on the larvae of the Atlantic herring (Clupea harengus); however, even this effect would be insignificant. No species spawn only in the vicinity of the site or only in the Apex. Fish eggs and larvae are spread over the entire Bight. Concentrations of acid waste are rapidly diluted to nontoxic levels, and would not affect more than a small number of eggs or larvae.

106-Mile Site

The results of field investigations of effects of chemical waste disposal on fish at the 106-Mile Site have been inconclusive. Field work has usually occurred during the infrequent presence of Gulf Stream eddies. NOAA (1977) reported:

> Total fish catches within and without the dumpsite were not significantly different, although midwater fish were most abundant outside the dumpsite. The highest rate of fishless tows occurred the night after a dump, but whether the tows were still in water affected by the dumped material is not known.

The histopathology of fish collected from the disposal site area (NOAA Pathobiology Division, 1978) has been inconclusive. Lesions were observed in some fish, but the sample size was small. High cadmium levels were found in the livers of three swordfish from the site area, and high mercury levels were observed in muscles of almost all fish analyzed (Greig and Wenzloff, 1977). However, the elevated concentrations were not attributed to disposal operations at the 106-Mile Site, because of the low amounts of metals added to the area by disposal, and the migratory nature of the large swordfish.

Disposal of acid wastes at the site should not significantly affect nekton, other than possibly causing them to avoid the affected area temporarily.

Northern and Southern Areas

Conditions at the Northern and Southern areas are similar to the Acid Site, and the same lack of adverse effects would probably occur. Fish evasion of waste plumes might occur for about an hour or so, until conditions return to preplume ambient levels.

BENTHOS

Benthos consist of animals living on (epifauna) and in (infauna) the sediments. Epifauna are dominated by larger echinoderms and crustaceans while the infauna primarily include small, segmented worms (polychaetes) and mollusks. Benthic organisms are important as indicators of waste-related impacts because many are sedentary and incapable of leaving a stressed environment. They are also important because many are commercially valuable (e.g., shellfish), or are food sources (e.g., worms) for valuable species (demersal fish).

Acid Site

The Bight benthos shows a natural temporal and spatial variability substantially greater than any changes caused by disposal of acid wastes (Pearce et al., 1976d). Any effects from acid waste disposal would probably be overshadowed by effects from the numerous other contaminants introduced to the Bight, particularly the Sewage Sludge and Dredged Material Disposal Sites. This complex interplay between natural variability and contaminants introduced by other sources, makes it extremely difficult to isolate and quantify effects at the site, solely due to the disposal of acid waste. All on-site investigations of the effects of waste disposal have led to similar conclusions.

The first comprehensive study of the site by Redfield and Walford (1951) reported that, "biological observations have failed to produce any direct evidence that the populations of fish or of bottom-living animals are being damaged or excluded from the area by the disposal of waste." Vaccaro et al. (1972) stated that "Our synoptic sampling was planned to detect alterations in

the biota of the acid grounds which could be attributable to discharge of approximately 50 million tons of acid waste over a period of 22 years. We have been unable to detect major effects of acid-iron waste on the sediment and biotas (phytoplankton, zooplankton, and benthos) of the region, although we have indications in our observations of possible minor effects of this waste." More recently, Swanson (1977) concluded that although "observational evidence of the impact of dumping on the biota at the [site] is limited... past studies indicate no reduction of primary productivity or phytoplankton mortality...surveys of benthic populations in the immediate vicinity of the Apex Acid Waste Dumpsite have not demonstrated an observable impact of waste acid....existing scientific evidence indicates so far that ocean dumping [of waste at the Acid Site] has had minor adverse impacts on the ecology."

106-Mile Site

No effects of chemical waste disposal have been observed in the benthos at the 106-Mile Site. The species composition and diversity at the site are similar to those observed in nearby Continental Slope areas (Pearce et al., 1975; Rowe et al., 1977). Analyses of trace metal content in benthic invertebrates have shown values well within the range of background values (Pearce et al., 1975). The results are not surprising since it is unlikely that the low-density liquid waste could reach bottom in measurable concentrations. There is tremendous dilution due to the depth and movement of water at the site. Therefore, readily-dispersed, low-density aqueous wastes should not affect benthic organisms at or near the site.

Southern Area

The Southern Area benthos resembles that of the Delaware Bay Acid Waste Site (Figure 2-2, #9). Preliminary work indicated that disposal of acid wastes at the Delaware Bay Acid Site caused measurable accumulation of vanadium in the tissues of sea scallops (Pesch et al., 1977). Vanadium is not known to be toxic to humans and probably does not have an adverse effect on the sea scallops, yet the possibility of accumulating other, more toxic waste constituents does exist. This would be an adverse long-term impact from acid waste disposal. This effect is observable because of (1) the relative

shallowness of the site (45 m), permitting some solid waste fractions to reach bottom, (2) the lack of other contaminant inputs to obscure the effects of waste disposal, (3) the presence of the shellfish, and (4) the ability of the scallops to concentrate some metals in their tissues at levels much higher than the levels in the surrounding water or sediment. The sites are similar, especially the shallow-water depth factor; therefore similar effects are anticipated at the Southern Area if acid waste disposal is initiated. Accordingly, use of the Southern Area for disposal of acid wastes carries the risk of contaminating commercially valuable shellfish populations, or otherwise changing the benthic community structure.

Northern Area

Acid waste disposal in this area may have the same effects as at the Delaware Bay or Southern Area Sites. Commercially exploitable shellfish resources, however, are not present at or near the site, thus the effects on humans would be neglible. The site could be used for disposal, if the benthos were monitored carefully for changes related to the wastes.

WATER AND SEDIMENT QUALITY

ACID SITE

Investigations of the effects of waste disposal at the Acid Site have continued for more than 30 years, but no changes in the water or sediment chemistry have been positively linked to acid waste disposal. The Apex is a difficult region in which to assess impacts because of the variety of contaminant sources, and the existing high levels of most parameters resulting from the populations, and heavy industrialization of the region.

Most seawater measurements at the Acid Site are well within the background values of the Apex. Vaccaro et al. (1972) reported reduced surface salinity at the site when compared with a control area. Turbidity is usually greater at the site, caused by the iron-floc which forms when acid-iron waste reacts with seawater (NOAA-MESA, 1975).

Trace metal (e.g., mercury, copper, lead, cadmium, and zinc) concentrations in sediments have been reported. High metal concentrations in the Apex occur in the area of the nearby Dredged Material and Sewage Sludge Disposal Sites (Ali et al., 1975). Values at the Acid Site are much lower than at other disposal sites. Some workers have reported higher concentrations of trace metals in Acid Site sediments than in sediments from supposedly uncontaminated areas (Vaccaro et al., 1972; EG&G, 1978c); however, these values have generally been within the range of values from other locations in the Bight (SHL, 1972) described below (Appendix B).

The potential addition of disposal-related metals on the "background" levels at the Acid Site have been estimated (Table 4-2). Only zinc (0.04 tonnes/day) represents a significant input; but, considering the total input of zinc to the Apex (33 tonnes/day), any effects from the acid waste metal content would not be measurable. The 7-day residence for water, used in the calculations, is for the waters near the Acid Site. Water into which waste was released usually moves from the site before the next disposal operation; therefore, the calculations are extremely conservative.

Wastes presently permitted at the site satisfy criteria for evaluating environmental impact (ERCO, 1978a,b), thus no significant changes in the site water quality are anticipated. Ambient concentrations of the waste constituents are not exceeded beyond site boundaries. The concentrations return to ambient levels within the period allowed for initial mixing (4 hours). In fact, except for the most abundant constituents (fluorides and iron), concentrations usually return to ambient conditions within 1 hour. There is one noticeable harmless change in the water quality at the site. The ferric hydroxide floc, which forms when acid-iron waste is released, persists for eight to twelve hours (Charnell et al., 1974; ERCO, 1978c), and has been reported to persist for several days (Vaccaro et al., 1972).

Continued use of the site for acid waste disposal will probably produce similar results for measurements of the water and sediments. Background values of trace metals at the site are in the micrograms-per-liter range. Values slightly above background levels, resulting from disposal, may be masked by variability due to various factors (e.g., sample contamination,

TABLE 4-2
WORST-CASE CONTRIBUTION OF WASTE METAL INPUT TO THE
TOTAL METAL LOADING AT THE NEW YORK BIGHT ACID WASTE DISPOSAL SITE

	Cadmium	Copper	Lead	Mercury	Zinc
Background Concentration (μg/liter)*	3.1	8.0	140	0.04	11.0
Total Amount (g) in 7.7×10^{11} liters†	2.4×10^{6}	6.2×10^{7}	1.1×10^{8}	3.1×10^{4}	8.5×10^{6}
Estimated Input (g) from 1978 Waste Volumes and Mean Concentrations	1.47×10^{5}	3.08×10^{6}	1.25×10^{6}	4.3×10^{3}	1.52×10^{7}
Estimated Input in 7 Days (g)**	4.02×10^{2}	8.44×10^{3}	3.42×10^{3}	1.18×10^{2}	4.16×10^{4}
Percent of Loading due to Waste in 7 days	0.1	0.1	0.1	0.1	0.5

* Source: from Klein et al., 1974.
† The total volume of the Site to 10-m depth.
** The estimated flushing time for the Site (Redfield and Walford, 1951).

natural variability). Consequently, projections of disposal effects on the water and sediments must be based on the present knowledge, allowing for the inherent weaknesses. This also applies to trace metal chemistry work at the other disposal sites.

106-MILE SITE

A similar lack of effects is anticipated for the 106-Mile Site. Table 4-3 shows maximal metals additions due to acid waste, and the amounts are insignificant (2% or less in all cases). Investigations of dissolved oxygen, pH, organic carbon, and trace metals after waste disposal at the 106-Mile

TABLE 4-3
ESTIMATED WASTE METAL INPUT TO THE TOTAL METAL LOADING AT THE 106-MILE SITE

	106-Mile Site Dumpers					106-Mile Site Dumpers and Acid Waste Dumpers				
	Cadmium	Copper	Lead	Mercury	Zinc	Cadmium	Copper	Lead	Mercury	Zinc
Background Concentration*	0.37	0.9	2.9	0.72	8.0	0.37	0.9	2.9	0.72	8.0
Total Amount (g) in 6.2 x 10 liters†	2.3×10^6	5.6×10^6	18.0×10^6	4.5×10^6	49.6×10^6	2.3×10^6	5.6×10^6	18.0×10^6	4.5×10^6	49.6×10^6
Estimated 1978 Input (g)	1.7×10^5	1.9×10^6	1.3×10^7	11.0×10^3	5.3×10^7	3.2×10^5	5.0×10^6	1.4×10^7	1.5×10^4	6.8×10^7
Estimated Input During 7 days (g)**	6.5 x 103	7.3 x 104	5.0×10^5	4.2×10^2	2.0 x 106	1.2×10^4	1.9×10^5	5.5×10^5	5.9×10^2	2.6×10^6
Percent Loading Due to Dumping During 7 Days	0.2	1.3	2.8	0.009	4.0	0.5	3.4	3.1	0.013	5.2
Percent Loading Due to Acid Waste Dumping						0.3	2.1	0.3	0.004	1.2

* Source: from Hausknecht (1977).
†Total volume of one quadrant of the 106-Mile Site to 15 m.
**The maximum residence time for a water parcel at the site, assuming a flow rate of 10 cm/sec and a distance of 32 nmi in a diagonal across the site.

Site, have shown that within four hours after disposal the values are within the normal range of values reported from this site and similar oceanic regions (Hydroscience, 1978).

NOAA (1977) summarized the results of 1974 and 1976 investigations on trace metals at the 106-Mile Site and at similiar nondisposal areas:

> Results of the May 1974 cruise indicate that some metals were significantly elevated compared to normal ambient concentrations [Brezenski, 1975]. However, normal concentrations are only a very few parts per billion, and great care must be taken to avoid errors in measured values. A variety of factors can lead to misleading results, among them sample contamination during collection, storage, or analysis. More recent observations support the conclusion that heavy metal concentrations in the...[site]...water column are typical of shelf-slope regions [Kester et al., 1977; Hausknecht and Kester, 1976a,b]. Moreover, calculations show that the total amount of metals added in dumping contributes less than 1 percent to the total normal amount of metals in the water at the dumpsite region [Hausknecht, 1977]. None of the observations occurred near the time of or in the immediate vicinity of dumping, so that ambient concentrations would be expected to be typical of the background for the region.

Therefore, investigations by NOAA (1977) and Hydroscience (1978), of effects from waste disposal on the water chemistry of the site, have not detected concentrations elevated above ambient conditions after the initial mixing period.

Metal concentrations in sediments of the 106-Mile Site were measured in 1974 by Pearce et al. (1975), and in 1976 by Greig and Wenzloff (1977). The metal concentrations reported for 1976 are consistent with those for 1974. Sediment metal concentrations varied little in samples from depths greater than 180 m. Although the heavy metal content of sediments taken beyond the Continental Shelf appears to be elevated relative to sediments on the Shelf/Slope break, the elevated metal concentrations cannot be attributed to present disposal practices at the 106-Mile Site, since they are not unique to the site vicinity. Therefore, there is no evidence that the wastes released at the site have affected the sediments (Pearce et al., 1975).

NORTHERN AND SOUTHERN AREAS

The Northern and Southern Areas, which have never been used for waste disposal, share a number of environmental features in common with the Acid Site, except that they are deeper. Disposal of acid wastes at the sites will probably have little effect on water chemistry, but minor effects on the benthos may occur (similar to those observed at the Delaware Bay Acid Site). Such effects in the Southern Area would adversely affect humans since an exploitable shellfish resource exists near the site. If a new site were established for acid waste disposal, the environmental consequences of disposing the wastes would be much less in the Northern Area.

As with the Acid Site, the potential effects of disposal-related metal input on the concentrations at these sites have been estimated (Tables 4-4 and 4-5). The near-surface currents in these areas are quite strong (16-20 cm/sec), and the residence time is short, therefore acid waste constituents would not measurably raise the ambient concentrations.

EMERGENCY DUMPING

The Ocean Dumping Regulations specify that, in emergency situations, the master of a transport vessel may discharge the waste load at any location and in any manner to safeguard life at sea. Such emergency situations may derive from (1) severe weather conditions typical of the North Atlantic in late autumn, winter, and early spring, and (2) vessel breakdowns, equipment failure, or collisions with other vessels or stationary objects.

The potential for illegal short dumping exists. The USCG ocean disposal surveillance program discourages such illegal activities through a system of shipriders, patrol vessels, aircraft overflights, and checking of vessel logs. The procedures for administering ocean dumping permits discourages these activities by requiring notification of departures and commencement of disposal, providing overlays of the barge track, and examining ship logs. If violations do occur the permit provides for civil and criminal penalties ranging from revocation of the permit to a $50,000 fine and/or a jail term.

TABLE 4-4
ESTIMATED WASTE METAL INPUT TO TOTAL METAL LOADING
AT THE SOUTHERN AREA

	Cadmium	Copper	Lead	Mercury	Zinc
Background Concentration (μg/liter)*	1.6	7.0	2.7†	0.08†	18.3
Total amount (g) in 2.1×10^{12} liters**	3.4×10^{6}	5.7×10^{6}	1.7×10^{5}	3.8×10^{5}	3.8×10^{7}
Estimated Input (g) from Waste Volumes and Mean Concentrations	1.47×10^{5}	3.08×10^{6}	1.25×10^{6}	4.3×10^{3}	1.52×10^{7}
Estimated Input in 2 Days (g)††	8.05×10^{2}	1.69×10^{4}	6.85×10^{3}	2.36×10^{1}	8.33×10^{4}
Percent of Loading Due to Waste in 2 days	0.02	0.1	0.1	0.01	0.2

* Source: from NOAA-MESA, 1976.
† Source: from EPA, 1976.
** The volume of the site to 10-m depth.
†† Based on the lowest observed current velocity at the site.

Twenty-four possible violations of permit regulations sufficient to cause follow-up actions were reported to EPA-Region II between 1973 and 1977. Three were for the Acid Site and seven were for the 106-Mile Site. Of the three violations at the Acid Site, one was upheld and a civil penalty assessed; one had the charges withdrawn, and one is pending (EPA, 1978a). At the 106-Mile Site, four citations were upheld and civil penalties assessed, one was dismissed, and two had the charges withdrawn. No enforcement actions were initiated against permittees at either site in 1978 (EPA, 1979a).

The probability of an emergency rises as the round-trip transit time increases. (See Table 4-1 for estimated transit times.) The decision to locate a site far from shore carries the increased risk of emergencies leading

TABLE 4-5
ESTIMATED WASTE METAL INPUT TO TOTAL METAL LOADING
AT THE NORTHERN AREA

	Cadmium	Copper	Lead	Mercury	Zinc
Background Concentration (μg/liter)	3.3	4.4	2.7†	0.08†	33.3
Total Amount (g) in 2.1×10^{12} liters	6.9×10^{6}	9.2×10^{6}	5.7×10^{6}	1.7×10^{5}	7.0×10^{7}
Estimated Input (g) from 1978 Wastes Volumes and Mean Concentrations	1.47×10^{5}	3.08×10^{6}	1.25×10^{6}	4.3×10^{3}	1.52×10^{7}
Estimated Input in 2 Days (g)††	8.05×10^{2}	1.69×10^{4}	6.85×10^{3}	2.36×10^{1}	8.33×10^{4}
Percent of Loading Due to Waste in 2 Days	0.01	0.2	0.1	0.01	0.1

* Source: from NOAA-MESA 1976.
† Source: from EPA, 1976.
** The volume of the site to 10-m depth.
†† Based on the lowest observed current velocity at the site.

to short dumping. The effects of a short dump of toxic waste materials would depend on the location of the dump. Acid wastes are liquid and diluted rapidly upon discharge, thus a single load of waste in a new area might cause local immediate acute effects, but should not cause any long-term adverse effects. Effects of emergency dumping during inclement weather would be mitigated by the rapid dilution caused by storm activity.

Use of any of the alternative sites involves the possibility of legal or illegal short dumping. Based on distance of a site from port, the probability of a short dump is highest for the 106-Mile Site and lowest for the Acid Site. Except for the Acid Site, however, the effects of a short dump would be short-term and the ecosystem would rapidly recover. Short dumping at the Acid

Site causes more concern because of close proximity to shore and the possibility of waste constituents reaching the New Jersey or Long Island shorelines.

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS AND MITIGATING MEASURES

Some unavoidable adverse environmental effects of disposal of liquid acid wastes will occur in all sites designated. Field and laboratory observations show the most important short-term adverse impacts to be:

- Acute mortality in plankton.
- Rise in waste constituent concentrations in the water.
- Lowering of pH.
- Possible avoidance of the area by fish.

These effects occur immediately upon release of the wastes, but do not persist beyond the period allowed for initial mixing.

The most important potential long-term adverse impacts are:

- Possible accumulation of waste constituents by the benthos in shallow waters.

- Sublethal effects on zooplankton and fish. These have been observed only in the laboratory at higher waste concentrations than occur at the site.

The volumes and rates of waste discharges specified in disposal permits have been established to reduce the possibilities of persistent short-term effects. The continuous monitoring program, by permittees and the Federal government, was established to determine if short-term or long-term adverse effects are occurring.

None of the effects described in this section apparently persist for more than a few hours after the waste is discharged; consequently, none of the impacts are irreversible and additional mitigating measures are not required.

RELATIONSHIP BETWEEN SHORT-TERM USE OF THE SITE AND LONG-TERM PRODUCTIVITY

For some of the alternative sites, there appears to be conflict between the short-term use of the area as a waste disposal site and the area's long-term productivity as part of the mid-Atlantic Bight ecosystem. Exploitable shellfish and possible mineral resources in the Southern Area would cause conflicts. Adverse effects are probably reversible, but it is not certain. Neither the 106-Mile Site nor the Northern Area appear to offer conflicts between short-term use and long-term productivity. The Northern Area is more likely to show adverse effects (if any) than the 106-Mile Site because it is closer to shore and shallower.

The use of the Apex is affected by many waste inputs, and additional released wastes would not be readily detected. For the long-term, the wastes could exceed the total assimilative capacity of the Apex. However, continual monitoring should detect any changes, and EPA, the permitting authority for the site, can halt or modify disposal practices at the site. The magnitude of the contaminant inputs from acid waste must be kept in perspective; they are generally less than the inputs from the atmosphere. Acid waste disposal activities at this site over the past 32 years have not interfered with shipping, fishing, recreational activities, or the development of other resources. There is no evidence that the long-term productivity of the area has been adversely affected by the wastes.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Several resources will be irreversibly or irretrievably committed by the proposed action:

- Loss of energy (e.g., fuel for transporting barges to and from the site). Transport to distant sites requires more fuel.

- Loss of constituents in the waste, (e.g., acids or metals). Present-day technology or markets are not adequate to permit economical recovery.

- Loss of economic resources due to costs associated with ocean disposal. Ocean disposal costs, however, are almost always lower than the costs of land-based disposal methods.

Chapter 5
COORDINATION

PREPARERS OF THE EIS

Preparation of this EIS was a joint effort employing many members of the Oceanic Engineering Operations of Interstate Electronics Corporation scientific and technical staff. This chapter summarizes the backgrounds and qualifications of the primary workers on the document (Table 5-1).

The principal author wishes to thank those who assembled background information, wrote or commented upon sections, edited, and performed the data analysis for the EIS. The document has benefited greatly from their assistance.

TABLE 5-1. LIST OF PREPARERS

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Chapter 6

GLOSSARY AND REFERENCES

GLOSSARY

Abundance	The number of individuals of a species or taxon inhabiting a given area.
Abyssal	Pertaining to the great depths of the ocean beyond the limits of the Continental Slope, from 2,000 to 5,000 m.
Acute effect	The death or incapacitation of an organism caused by a substance within a short time (normally 96 hours).
Adsorb	To adhere in an extremely thin layer of molecules to the surfaces of solid bodies.
Aesthetics	Pertaining to the natural beauty or attractiveness of an object or location.
Alkalinity	The sum of anions of weak acids in seawater, plus hydroxide ions (OH^-), minus the hydrogen ion (H^+) concentrations. Alkalinity is usually calculated by the empirical equation meq/kg = 0.061 x salinity (g/kg).
Ambient	Pertaining to the undisturbed or unaffected conditions of the surrounding environment.
Amphipods	A large order of predominantly marine crustaceans, ranging from free-living, planktonic forms to benthic, tube-dwelling forms, which usually have laterally compressed bodies, e.g., sand fleas.
Anaerobic digestion	Digestion of organic matter by bacterial action in the absence of oxygen.
Anthropogenic	Relating to the effects or impacts of man on the ecosystem.
Anticyclonic	A rotation about the local vertical that is clockwise in the Northern Hemisphere.

Anticyclonic eddies	Mesoscale (50 to 100 km) features of oceanic circulation in which water flows in a circular (clockwise) pattern around warm core waters.
Apex	See New York Bight Apex.
Appropriate sensitive benthic marine organisms	Species representing different feeding types (filter-feeding, deposit-feeding, and burrowing), chosen from the most sensitive species accepted by EPA as being reliable test organisms to determine the anticipated impact on the site.
Appropriate sensitive marine organisms	At least one species each, representative of phytoplankton or zooplankton, crustacean or mollusk, and fish species chosen from the most sensitive species documented in the scientific literature, or accepted by EPA as being reliable test organisms to determine the anticipated impact of the wastes on the ecosystem at the disposal site.
Aqueous	Similar to, containing, or dissolved in water.
Assemblage	A recurring group of organisms having a common habitat.
Background level	The naturally occurring (or ambient) level of a substance within an environment.
Baseline data	Data collected prior to the initiation of actions which have the potential of altering an existing environment.
Baseline surveys	Surveys conducted to collect information prior to the initiation of actions which have the potential of altering an existing environment.
Benthos	All marine organisms (plant or animal) living on or in the bottom; also, the floor of the ocean.
Bight	A slight indentation or bend in shoreline, river, open coast, or bay.

Bioaccumulate	The intake and assimilation of materials, e.g., heavy metals, leading to an elevated concentration of the substance within an organism's tissue, blood, or body fluid.
Bioassay	Determination of the strength (potency) of a substance by its effect (on growth or survival) upon an organism--plant or animal.
Biochemical Oxygen Demand (BOD)	The amount of oxygen consumed by microorganisms while assimilating and oxidizing organic (and some nitrogenous) materials in water or wastewater under specified environmental conditions and time periods.
Biomass	The amount (weight) of living organisms inhabiting a given area or volume.
Biota	Collectively, plants and animals of a region.
Biotic groups	Organisms which are ecologically, structurally, or taxonomically grouped.
BLM	Bureau of Land Management.
Bloom	Relatively high concentrations of plankton in water resulting from their rapid growth and reproduction.
Boreal	Pertaining to the higher northern latitudes, as opposed to tropical.
°C	Degrees Celsius, formerly Centigrade.
C/N	Carbon/nitrogen ratio.
Carcinogen	A substance or agent producing cancer.
CE	U.S. Army Corps of Engineers.
Cephalopods	Squid, octopus, or cuttlefish. Members of the phylum Mollusca.
CFR	Code of Federal Regulations.

Chaetognaths	A phylum of small, elongate, free-swimming transparent, wormlike invertebrates, also known as arrow-worms, which are important carnivores in the zooplankton community, with chaetae (bristles) curved on each side of the mouth.
Chlorophyll	A group of green plant pigments which function as photoreceptors of light energy for photosynthesis.
Chlorophyll a	A specific green plant pigment used in photosynthesis, and used as a measure of phytoplankton biomass.
Chronic effect	A sublethal effect of a substance on an organism which reduces the survivorship of that organism after a long period of exposure to low concentrations of the substance.
cm	Centimeter(s).
cm/sec	Centimeters per second.
Coccolithophorid	Ultra-microscopic planktonic algae, the cells of which are surrounded by an envelope of small calcareous discs.
Coelenterate	A animal phylum which includes hydroids, sea anemones, jellyfish, and corals.
Compensation depth	The depth at which photosynthetic oxygen production equals oxygen consumed by plant respiration.
Continental margin	The zone between the shoreline and the deep ocean floor; generally consists of the Continental Shelf, Continental Slope, and the Continental Rise.
Continental Rise	A transitional portion between the Continental Slope and the ocean floor which is less steeply sloped than the Continental Slope.
Continental Shelf	The continental margin extending seaward from the coast to a variable depth, generally 200 m.
Continental Slope	The steeply descending slope lying between the Continental Shelf and the Continental Rise.

Contour line	A chart line connecting points of equal depth above or below a reference plane, generally sea level.
Copepod	A large subclass of usually small crustaceans; they are an important link in the oceanic food chain.
Coriolis Force	An apparent force acting on moving particles resulting from the earth's rotation. In the northern hemisphere moving particles are deflected to the right, and in the southern hemisphere to the left.
Crustaceans	Animals with jointed appendages and a segmented external skeleton composed of a hard shell (chitin). The group includes barnacles, crabs, shrimps, and lobsters, copepods, and amphipods.
Ctenophores	An animal phylum superficially resembling jellyfish, ranging from less than 2 cm to about 1 m in length. The planktonic organisms are commonly referred to as comb jellies or sea walnuts.
Cuesta	An asymmetrical ridge with one slope gentle and the other steep.
Current meter	Any device for measuring and indicating flow rate, velocity, or direction (often all three) of flowing water.
Current shear	The measure of the spatial rate of change of current velocity with units of cm/sec/m.
Decapod	The largest order of crustaceans in which the animals have five pairs of locomotory appendages, each joined to a segment of the thorax. Includes crabs, lobsters, and shrimps.
Demersal	Living at or near the bottom of the sea. Applies mainly to fish.
Density	The mass per unit volume of a substance.
Diatom	Single cell, usually planktonic plant with a cell wall of silica. Abundant worldwide.

Diffusion	The process whereby particles in a liquid intermingle spontaneously; net motion is from an area of higher concentration to an area of lower concentration.
Dinoflagellate	Single-celled, planktonic organisms with flagella, which are an important part of marine food chain.
Discharge plume	The region of seawater affected by a discharge of waste which can be distinguished from the surrounding water.
Dispersion	The movement of discharged material over large areas by the natural processes of mixing (turbulence and currents).
Dissolved oxygen	The quantity of oxygen dissolved in a unit volume of water; usually expressed in mg/liter.
Dissolved solids	Solid matter in solution, such as salt dissolved in water.
Diversity	A measure that usually takes into account the number of species and the relative abundance of individuals in an area.
Dominance	A species or group of species which strongly affect a community because of their abundance, size, or control of energy flow.
Dry weight	The weight of a sample of materials and/or organisms after all water has been removed; a measure of biomass.
EC_{50}	In bioassay studies, the concentration of a substance which causes a 50 percent reduction in the growth rate of the test organisms (usually phytoplankton) during a unit time (usually 96 hours).
Echinoderms	A phylum of benthic marine animals having calcareous plates and spines forming a rigid articulated skeleton or plates with spines embedded in the skin. This group includes starfish, sea urchins, sea lilies and sea-cucumbers.

Economic resource zone	The oceanic area within 200 nmi from shore in which the adjacent coastal state possesses exclusive rights to the living and non-living marine resources.
Ecosystem	A functional system which includes the organisms of a natural community or assemblage together with their physical environment.
Eddy	A generally circular water current moving contrary to the direction of the main current.
EIS	Environmental impact statement.
Endemic	Restricted or peculiar to a locality or region.
Entrain	To carry along with (e.g., eddies entrain other waters).
EPA	U.S. Environmental Protection Agency.
EPA Region II	U.S. Environmental Protection Agency, Region II, New York, N.Y.
Epifauna	Animals which live on the surface of the sea bottom.
Epipelagic	Ocean zone extending from the surface to 200-m depth.
Estuary	A semienclosed coastal body of water, which has a free connection to the sea and within which the sea water is measurably diluted with fresh water.
Euphausiids	Shrimp-like, planktonic crustaceans which are widely distributed in oceanic waters. These organisms, also known as krill, may grow to 8 cm in length and are an important link in the oceanic food chain.
°F	Degrees Fahrenheit.
Facies	Any observable attribute of a stratigraphic unit, such as overall appearence or composition.
Fauna	The animal life of a particular location, region, or period.

FDA	Food and Drug Administration.
Flagellum (pl. -a)	Whip-like appendage(s) used for swimming.
Flocculate	The process of aggregating a number of small, suspended particles into small masses.
Flora	The plant life of a particular location, region, or period.
FWPCA	Federal Water Pollution Control Act.
g/cm^3	Grams per cubic centimeter.
Gangue	Mineral matrix, useless rocks.
Gastropods	Mollusks that possess a distinct head (generally with eyes and tentacles) and a broad, flat foot, and which usually have a spiral shell, e.g., snails.
Geostrophic current	A stable current due to gravitational forces and the Coriolis force.
Gulf Stream	A warm, swift, northward flowing ocean current flowing through the Caribbean, Gulf of Mexico and up the North American East Coast.
Heavy metals or elements	Elements with specific gravities of 5.0 or greater.
High-level radioactive waste	The aqueous or solid wastes from reprocessing irradiated fuel of nuclear power reactors.
Histopathology	The study of tissue changes associated with disease.
H' values	Shannon-Wiener species diversity index.
Hydrography	The measurement and description of the physical features of bodies of water.
Ichthyoplankton	Fish eggs and weakly motile fish larvae.
IEC	Interstate Electronics Corporation.
Indigenous	Having originated in and being produced, grown, or naturally occurring in a particular region or environment.

Infauna	Animals which live or burrow below the sea bottom.
In situ	(Latin) in the original or natural setting.
Insolation	Solar radiation received at the earth's surface.
Invertebrates	Animals without backbones.
ISC	Interstate Sanitation Commission.
Isobath	A line on a marine chart joining points of equal depth below sea level.
kg	Kilogram(s).
kg/day	Kilograms per day.
km	Kilometer(s).
kn	Knot(s), nautical miles per hour.
LC_{50} (Lethal concentration 50)	In bioassay studies, the concentration of a substance which causes 50 percent mortality of the test organisms during a given time (usually 96 hours).
Limiting permissible concentration (LPC)	A concentration of a waste substance which, after initial mixing, does not exceed marine water quality criteria, cause acute or chronic toxicity, cause other sublethal effects, or cause bioaccumulation.
Loran-C	Long Range Aid to Navigation (Type C).
m	Meter(s).
m^3	Cubic meters.
m/sec	Meters per second.
μ	Micron(s), 10^{-6} m.
μg/kg	Micrograms per kilogram, or millionth gram per kilogram.
μg/liter	Micrograms per liter, or millionth gram per liter.

μm	Micron, micro-meter, millionth of a meter.
Macrozooplankton	Planktonic animals which can be seen by the unaided eye.
Marine	Pertaining to the sea.
Massif	A mountainous mass or group of connected heights, more or less clearly marked off by valleys (land or submarine).
Mesopelagic	Relating to depths of 200 to 1,000 m below the ocean surface.
mg	Milligram(s), or thousandth(s) gram.
MGD	Million gallons per day (3.785 million liters per day).
mg/liter	Milligrams per liter.
mi	Mile(s), 5,280 ft.
Micron (μ)	Millionth(s) of a meter.
Microorganisms	Microscopic organisms including bacteria, protozoans, and some algae.
Mid-Atlantic Bight	The Continental Shelf extending from Cape Cod, MA, to Cape Hatteras, NC.
Mixed layer	The upper layer of the ocean which is well mixed by wind and wave activity.
ml	Milliliter(s), or thousandth(s) liter.
$ml/m^2/hr$	Milliliter(s) per square meter per hour.
mm	Millimeter(s), or thousandth(s) meter.
Monitoring	As used herein, to observe environmental effects of disposal operations through biological, chemical, geological, and physical data collection and analyses.
mph	Miles per hour.
MPRSA	Marine Protection, Research, and Sanctuaries Act.
Mutagen	A substance which increases the frequency or extent of mutations.

Myctophids	A group of small mesopelagic fish which possess light-emitting organs and undergo large-scale vertical (deep to near-surface) migrations daily.
Nannoplankton	Minute planktonic plants and animals which are 50 microns or less in size. Individuals of this size will pass through most plankton nets and are therefore usually collected by centrifuging water samples.
NAS	National Academy of Science.
NASA	National Aeronautics and Space Administration.
Nekton	Free swimming animals which move independently of water currents.
NEPA	National Environmental Policy Act of 1969.
Neritic	Pertaining to the region of shallow water adjoining the seacoast and extending from low-tide mark to 200 m depth.
Neuston	A community of planktonic organisms which are associated with the surface film of water; mainly composed of certain copepods and the eggs and larvae of fish.
New York Bight	The Continental Shelf which extends from Montauk Point, Long Island, to Cape May, New Jersey.
New York Bight Apex	A portion of the New York Bight bounded at the south by latitude 40°10'N and at the east by longitude 73°30'W.
NJDEP	New Jersey Department of Environmental Protection.
nmi	Nautical mile(s), 6,076 ft or 1.852 km.
NOAA	National Oceanic and Atmospheric Administration.
NOAA-MESA	National Oceanic and Atmospheric Administration-Marine EcoSystems Analysis.

NOAA-NMFS	National Oceanic and Atmospheric Administration-National Marine Fisheries Service.
NSF	National Science Foundation.
Nuisance species	Organisms with no commercial value which outcompete, oust, or harm commercially important species.
Nutrient	Any substance which promotes growth or provides energy for biological processes.
OCS	Outer Continental Shelf.
ODSS	Ocean Dumping Surveillance System.
Organophosphate pesticides	A phosphorus-containing organic pesticide, such as parathion or malathion.
Ortho-phosphate	One of the possible salts of orthophosphoric acid, an essential nutrient for marine plant growth.
Oxygen minimum layer	The depth in the water column where the lowest concentration of dissolved oxygen occurs naturally.
Parameters	Any of a measurable set of physical, geological, chemical, or biological properties whose values determine the characteristics of the area under certain conditions.
Particulates	Fine solid particles which are individually dispersed in water.
Parts per thousand (ppt; o/oo)	A unit of concentration of a mixture indicating the number of parts of a constituent contained per thousand parts of the entire mixture.
Pathogen	Producing or capable of producing disease.
PCB('s)	Polychlorinated biphenyl(s).
Pelagic	Pertaining to water of the open ocean beyond the shore and above the abyssal zone.
Perturbation	Disturbance of a natural or regular system.

pH	Numerical range (0-14) used to describe the hydrogen ion activity; 0-7 are acid, 7 is neutral, 7-14 are alkaline.
Photic Zone	The layer in the ocean from the surface to the depth where light is reduced to 1.0% of its surface value.
Phytoplankton	Planktonic plants; the base of most oceanic food chains.
Plankton	Passively floating or weakly motile plants or animals in a body of water.
Polychaetes	The largest class of the phylum Annelida (segmented worms) distinguished by paired, lateral, fleshy appendages provided with setae on most segments.
ppb	Parts per billion.
ppm	Parts per million.
ppt	Parts per thousand.
Precipitate	A solid which separates from a solution or suspension by chemical or physical means.
Predator	A carnivorous animal which eats other animals as a source of food.
Primary Production	The amount of organic matter synthesized by plants from inorganic substances per unit time per unit area or volume. The plant's respiration may (net productivity) or may not (gross productivity) be subtracted.
Protozoa	Microscopic, single-celled organisms of extremely diverse characteristics.
Qualitative	Pertaining to the nature, being, attribute, trait, character, or status.
Quantitative	Pertaining to the numerical measurement of a parameter (quantity, mass, extent, range).
Recruitment	Addition to a population of organisms by reproduction or immigration of new individuals.

Redox potential	Measurement of the state of oxidation of the system.
Release zone	An area 100 m on either side of the disposal vessel extending from the point of first waste release to the end of the release.
Runoff	That portion of total surface precipitation on land that ultimately reaches streams or the ocean.
Salinity	The amount of dissolved salts in water usually measured in parts per thousand.
Sea state	The numerical or written description of ocean roughness.
sec	Second(s).
Shelf Water	Water which originates in or can be traced to the Continental Shelf. It has characteristic temperature and salinity values which identify it.
Shellfish	Any aquatic invertebrate having a shell or exoskeleton, especially any edible mollusk or crustacean.
Shiprider	An observer aboard a vessel, assigned by the Coast Guard to ensure that ocean disposal operations are conducted according to permit specifications.
Short dumping	The premature discharge of waste from a vessel anywhere outside designated disposal sites. This may occur legally under emergency circumstances or illegally to avoid hauling to a designated site.
Significant wave height	The average height of the one-third highest waves in a given wave group.
Slope Water	Water which originates from, occurs at, or can be traced to the Continental Slope. It has characteristic temperature and salinity values which identify it.
Sludge	Precipitated solid matter from sewage and chemical waste treatment processes.

Species	A group of individuals which closely resemble each other structurally and physiologically and interbreed in nature, producing fertile offspring.
Specific gravity	The ratio of the density of a substance relative to the density of pure water at 4°C.
SPM	Suspended particulate matter.
sq	Square.
SS	Suspended solids.
Standing stock	The biomass or abundance of living material per unit volume or area of water.
Stressed	A stimulus or series of stimuli which disrupt the normal ecological functions of an area.
Surfactant	An agent which lowers surface tension of a liquid, (in water — soap, bile, and certain detergents).
Surveillance	Systematic observation of an area by visual, electronic, photographic, or other means for the purpose of ensuring compliance with applicable laws, regulations and permits.
Suspended solids	Finely divided particles of a solid temporarily suspended in a liquid, e.g., soil particles in water.
Synergism	The interaction between two or more agents which produces a total effect greater than the sum of the independent effects.
Taxon (pl. taxa)	A group or entity sufficiently distinct to be distinguished by name and to be ranked in a definite category (adj., taxonomic).
TCH	Total carbohydrate content.
Temporal distribution	The distribution of a parameter over time.
Teratogen	A chemical agent which causes developmental malformations and monstrosities.

Terrigenous sediments	Shallow marine sedimentary deposits composed of eroded terrestrial material.
Thermocline	A sharp temperature gradient which separates a warmer surface water layer from a cooler subsurface layer, most pronounced during summer months.
TKN	Total Kjeldahl nitrogen.
TOC	Total organic carbon.
Trace metal or element	An element found in the environment in extremely small quantities.
Trend assessment Surveys	Surveys conducted over long time periods to detect shifts in environmental conditions within a region.
Trophic level	A feeding level in the food chain of an ecosystem through which the passage of energy proceeds.
Turbidity	A reduction in transparency which, in seawater, may be caused by suspended sediments or plankton growth.
Turnover rate	The time necessary to replace the entire standing stock of a population; generation time.
USCG	U.S. Coast Guard.
Water mass	A body of water usually identified by its temperature, salinity, and chemical content and containing a mixture of water types.
Water type	Water defined by a narrow range of temperature and salinity.
Wet weight	The weight of organisms before drying them to remove the internal water.
yd^3	Cubic yard(s)
Zooplankton	Usually small, passively floating or weakly swimming animals which are important in many marine food chains.

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_____1976c. Demersal finfish catches in the New York Bight by station and species, R/V ATLANTIC TWIN, October 1-November 7, 1973. NOAA DR ERL MESA-13. 102 pp.

_____1976d. Demersal finfish catches in the New York Bight by station and species, R/V DELAWARE II and ATLANTIC TWIN, April 1-May 2, 1974. NOAA DR ERL MESA-14. 101 pp.

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Appendix A

ENVIRONMENTAL CHARACTERISTICS OF THE NEW YORK BIGHT

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Appendix A

ENVIRONMENTAL CHARACTERISTICS OF THE NEW YORK BIGHT

An understanding of the oceanographic features of the New York Bight is essential for an evaluation of the effects of acid waste disposal. The Bight extends 430 nmi (800 km) from Cape May, New Jersey to Montauk Point, Long Island. Offshore New York City, the Continental Shelf extends 100 nmi (185 km) seaward, and a series of Shelf valley complexes has formed because of the postglacial sea-level rise (Swift et al., 1976). The Apex is north of 40°10'N (Shark River, New Jersey) and west of 73°30'W (Jones Beach, Long Island).

The Bight is adjacent to the most heavily populated, highly industrialized section of the eastern seaboard, and is a heavily used and environmentally "stressed" coastal area. It receives wastes from 20 million people and a number of major industries. Municipal and industrial wastewater effluents, urban runoffs, atmospheric fallout, and materials released at different dumpsites, add large quantities of heavy metals, nutrients, organic matter, and chlorinated hydrocarbons to the Bight waters. The Bight supports important commercial and recreational fisheries and other activities (NOAA-MESA, 1977).

Records are extensive for the region. The MESA New York Bight Atlas Monograph series describe the area excellently. Other MESA-sponsored works exist as data reports, technical reports, and technical memos (NOAA-MESA, 1978b). A detailed technical summary resulted from a symposium (Gross, 1976b) sponsored by the American Society of Limnology and Oceanography in November 1975. Earlier, workers from the Atlantic Oceanographic and Meteorological Laboratory had assessed the nonbiological aspects of the Bight (Charnell, 1975).

METEOROLOGY

Seasonal meteorological events affect man's use of the Bight for waste disposal, shipping, resources, and recreation. Meteorology is an important influence on physical characteristics of the area, which determine dispersion of wastes. Sufficient knowledge and predictability of meteorology exist to permit site designation for waste disposal, with minimal danger to workers on disposal operations. Excellent sources for the conditions in the Bight are Williams and Godshall (1977), Mohnen (1977), and Lettau et al. (1976).

WINDS AND STORMS

WINDS

Bryson and Lahey (1958) defined the primary seasons of the Bight as winter (November to March) and summer (July to August), separated by spring (April to June) and autumn (September to October). Wind speeds are usually moderate. During the winter, winds are offshore with average speeds of 9 to 13 kn, whereas summer winds are onshore with average speeds of 5 to 9 kn. Strong winds (between 28 and 40 kn) are more common in the winter (10% of all observations) than in summer (1% of all observations) but strong winds (greater than 40 kn) have occurred during every month.

Highest recorded winds in the Bight were due to tropical storms. In 1960, wind speeds recorded from hurricane Donna were 61 kn (70 mph) from the northeast at La Guardia Airport; wind speeds of 98 kn (113 mph) from hurricane Hazel were recorded at The Battery in 1954 (Lettau et al., 1976).

STORMS

Seasonal storms are characteristic of the Bight area. Extratropical (northeasterly) storms are common from November until April (Pore et al., 1974), but tropical storms (hurricanes) usually occur in the late summer or early autumn (Pore and Barrientos, 1976). Pore and Barrientos (1976) reported that an average of 6.8 storms per year cause moderate to severe coastal damage. The recorded frequency of northeasters (10 to 14 days) is greater

than hurricanes (4 to 7 years). Storms may restrict a particular disposal operation, but frequencies or severities are not sufficient to restrict all disposal operations.

VISIBILITY

Visibility in the Bight is influenced by fog, smoke, and haze. Thick fogs occur, but not frequently enough to restrict sailing to and from the site.

FOG

The maximal incidence of fog occurs from May to July, when the greatest differences between sea and air temperatures exist. Fog is not generally frequent between October and March, but heavy fogs occasionally occur. The monthly frequency of restricted visibility in the Bight is summarized in Table A-1.

TABLE A-1
INCIDENCE OF FOG IN THE NEW YORK BIGHT

Limit Of Visibility	Average Days/Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/4 Mile	1.1	0.8	3.3	0.8	7.4	4.0	4.6	0.3	0.6	1.9	1.8	0.5
1 Mile	4.2	3.6	5.6	3.0	11.5	7.7	6.6	4.2	3.0	3.3	2.9	1.6

Source: Modified from Williams and Godshall, 1977.

When necessary, disposal operations can be performed under conditions of restricted visibility and fog, smoke or haze (see below), and these are not important factors which restrict use of sites in the Bight.

SMOKE AND HAZE

Smoke is an anthropogenic product, and its effects decrease offshore. Haze is often composed of dust and salt particles, and haze frequencies are evenly distributed over the Bight. Maximal peaks of haze are associated with

southwesterly winds, however, minimal values are usually recorded when there are northwesterly winds (Lettau et al., 1976). Neither smoke nor haze significantly restrict navigation in the Bight area.

AIR TEMPERATURE

Air temperatures in the Bight range from a mean low of 2°C (36°F) in February, to a mean high of 22°C (approximately 72°F) in August (Lettau et al., 1976). Only a slight icing potential occurs between December and March (Table A-2).

TABLE A-2
ICING CONDITIONS IN THE NEW YORK BIGHT

Icing Potential	Percent Per Month			
	Dec	Jan	Feb	Mar
Light	---	4.8	6.2	1.3
Moderate	---	0.9	0.3	---

Source: Modified from Williams and Godshall, 1977.

PRECIPITATION

The winter months (November to March) have the highest incidences of combined precipitation (rain and/or snow), but average monthly Bight values indicate only slight seasonal changes (Table A-3).

TABLE A-3
AVERAGE PRECIPITATION PER MONTH
(Nearest 1.0 inch)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	4	4	4	3	4	5	3	3	4	4

Source: Modified from Lettau et al., 1976.

PHYSICAL OCEANOGRAPHY

Physical characteristics of the Bight are complex. Seasonal temperature, salinity, insolation, and river runoff are complicated by meteorological phenomena and intrusions of Slope Water (Bowman, 1977).

The Bight hydrography exhibits clear seasonal cycles in temperature, salinity, and density. Two distinct oceanographic regimes, with short intervening transition periods, prevail annually. In early winter, storm mixing and rapid cooling at the surface create a well-mixed, unstratified water column. A moderate stratification develops in early spring due to heavy runoff from the Hudson, Raritan, and other rivers. With increasing vernal warming, stratification changes rapidly from a saline to a thermally maintained formation. Transition is rapid, usually occurring within one month (Charnell and Hansen, 1974). Rapid formation of the seasonal thermocline divides the water column into upper and lower layers. Bottom waters retain specific characteristics with little modification until atmospheric cooling and storm activities break up the thermocline in the late autumn.

Familiarity with physical characteristics of Bight is necessary to understand waste disposal, because such factors determine immediate dilution and dispersion of wastes and the transposition of contaminants. Excellent sources for physical oceanographic patterns in the Bight are Hansen (1977) and Hardy et al. (1976).

WATER TYPES

Three water types have been identified in the Bight shelf waters by Hollman (1971): (1) Inlet Water (hereafter called Hudson River Plume Water, after Bowman and Wunderlich, 1977), (2) Surface Shelf Water, and (3) Bottom Shelf Water.

HUDSON RIVER PLUME WATER

The combined discharge of the Hudson and Raritan rivers flows from the Lower Bay into the northwest corner of the Apex as a low-salinity plume, less dense than Shelf Waters. Consequently, Hudson River Plume Water floats over Shelf Waters in the Bight. Discharge volumes are maximal in April and minimal in August. Approximately half the annual discharge occurs during March, April, and May (Bowman and Wunderlich, 1976). The plume persists throughout the year, and the extent and depth are highly dependent on flow rates from the Hudson and Raritan Rivers (McLaughlin et al., 1975). Generally, the plume flows southward between the New Jersey coastline and the axis of the Hudson Shelf Valley. During the winter, however, the plume may flow eastward between the southern coast of Long Island and the axis of the Hudson Shelf Valley, or, in some instances, the plume may split and flow both eastward and southward.

SURFACE SHELF WATER

With the onset of heavy river discharge in the spring, surface salinities in the Bight decrease and a moderate saline-maintained stratification occurs, separating Surface Shelf Water from Bottom Shelf Water. Decreasing winds and increasing insolation, however, cause a stronger thermocline to develop (Charnell and Hansen, 1974). The two-layer system reaches its maximum strength by August. Summer Surface Shelf Water is characterized by moderate salinity and high temperature.

BOTTOM SHELF WATER

During winter, the water is essentially homogeneous over the Bight Shelf. With the rapid formation of the thermocline and separation of Surface Shelf Water in the spring, bottom waters become isolated until the next winter. Bigelow (1933) found that this "cool pool" (temperatures typically less than 4°C) extended from south of Long Island to the opening of Chesapeake Bay. This cold water persists even after the surface layers have reached the summer maximum. Bigelow (1933) also found that the cool pool was surrounded on all sides by warmer water. The upper layer of the Bottom Shelf Water is usually

found between 30 and 100 m during the summer (Bowman and Wunderlich, 1977). Seaward, near the Shelf edge, steep temperature, salinity, and density gradients prevent large-scale mixing from occurring between Shelf and Slope Waters.

CURRENT REGIMES

Currents in the Bight are characterized by large temporal variability, which makes it impossible to resolve the "average" current patterns. The great variability results from several competing influences (e.g., tidal currents, estuarine and Hudson Shelf Valley circulation, and local wind effects). The currents may be so random that only statistical effects, not organized patterns, can be predicted (Hansen, 1977).

TIDAL CURRENTS

The flow of the tidal current in the Apex is anticyclonic (clockwise). Velocities decrease offshore and the tidal ellipse is on a northwest/southeast axis. Tidal currents are important in the initial distribution (mixing and dispersion) of dumped materials on the bottom. They may resuspend settled solids. Bottom tidal current velocities are low, about 10 cm/sec, but, coupled with wind-driven currents during storms, they can resuspend and subsequently redistribute sediments.

SURFACE CURRENTS

The synergistic effects of temperature, salinity, river runoff, prevailing winds, and tides produce complex and variable circulation patterns within the Bight (Hardy et al., 1976). Seaward of the 100-m contour, geostrophic drift induces westerly to southwesterly currents having an average speed of 10 cm/sec. Within the 100-m isobath, surface currents are highly variable and strongly influenced by winds and surface runoff. Currents within 30 km of shore still depend on winds for direction but have consistently higher velocities than the distant offshore areas. The southerly flow of the Hudson River plume along the coast forces an opposing northward flow of more saline waters to the east. Consequently, the nearshore water often contains a small anticyclonic (clockwise) gyre (Hardy et al., 1976).

In general, average surface currents inshore of the 100-m isobath (which includes the entire Apex) flow alongshore southward from Cape Cod to Cape Hatteras at mean speeds of about 5 cm/sec (Bumpus, 1973), except during periods of strong southerly winds and low runoff (Bumpus, 1969). Flows in the outer Bight are characteristically southwest with speeds of 4 to 5 cm/sec at the surface decreasing to 2 cm/sec, or less, closer to the bottom.

BOTTOM CURRENTS

Near the Hudson estuary, classical estuarine circulation occurs with low-salinity surface water flowing offshore and more saline water flowing onshore along the bottom. Hansen (1977) reported that average shoreward current speeds as great as 5 cm/sec have been observed in the Hudson Shelf Valley over periods as long as a month. Bumpus (1973), summarizing 10 years of sea-bed drifter returns, has inferred that onshore bottom Shelf current speeds average 0.9 to 1.3 cm/sec.

The axis of the Hudson Shelf Valley separates the general bottom currents. East of the valley, flow is westerly; west of it, the flow is northerly. This cooler, more saline bottom water, may reach the Hudson River estuary, dependent upon the season and amount of surface runoff; bottom water may reach the surface during periods of southwesterly winds, which cause upwelling south of Long Island (Hardy et al., 1976).

TEMPERATURE DISTRIBUTION

Water temperatures in the Bight follow well-defined seasonal cycles. Surface waters usually reach a minimum (2°C) in January when strong vertical mixing and low river runoff create a vertically homogeneous water mass. In April, the surface waters begin to warm with a thermocline developing during the late spring and early summer. The thermocline is strongest in the late summer, with surface temperatures peaking (24°C to 26°C) in early August. The thermocline begins to decay with normal cooling, and by late October the isothermal layer is 20 m thick. By mid-November further cooling and winter storms produce an almost homogeneous water mass within the 80-m contour (Bowman, 1972; 1977).

SALINITY DISTRIBUTION

The salinity cycle is more complex than the temperature cycle because of three factors which influence salinity: (1) the influx of river runoff (inner Bight), (2) evaporation minus precipitation, and (3) the advection and mixing of more saline Slope Water (outer Bight; Bowman, 1977). Maximum salinities (33 to 34 ppt) are found inshore during the winter (February and March) when subfreezing conditions reduce river runoff. River runoff during the spring thaw reduces the surface salinity, and strong vertical gradients may develop. In summer, surface salinities are minimal (27 to 31 ppt) and bottom salinities are 27 to 29 ppt. In the late summer, when the fresh water input decreases, salinities begin to increase towards the winter maximum (Bowman and Wunderlich, 1977).

WAVES AND WINDS

SURFACE WAVES AND WINDS

Waves are beneficial in diluting and dispersing the waste more rapidly, until they become too high and restrict disposal operations. Figure A-1 shows the distribution of the percentage frequency of waves greater than or equal to 1.5 m (solid lines), and greater than or equal to 3.7 m (dashed lines) for the mid-Atlantic Bight. Wave energies are greater in winter. The contours parallel the coast and most of the higher frequencies are seaward. Wave directions parallel the wind patterns over the northeast United States. There is a distinct reversal in the prevailing wind pattern between summer and winter. During the summer (May through August) wind and waves derive most frequently from the southwest. In the winter (September through April), wind and waves are most frequently from the northwest.

Wave heights greater than 6.1 m occur about 2% of the time in the winter months of December, January, and February. The median significant wave height for this region is about 1.2 m in winter and about 0.6 m in summer. The mid-Atlantic Bight is generally not subject to unusually high waves (U.S. Naval Weather Service Command, 1970).

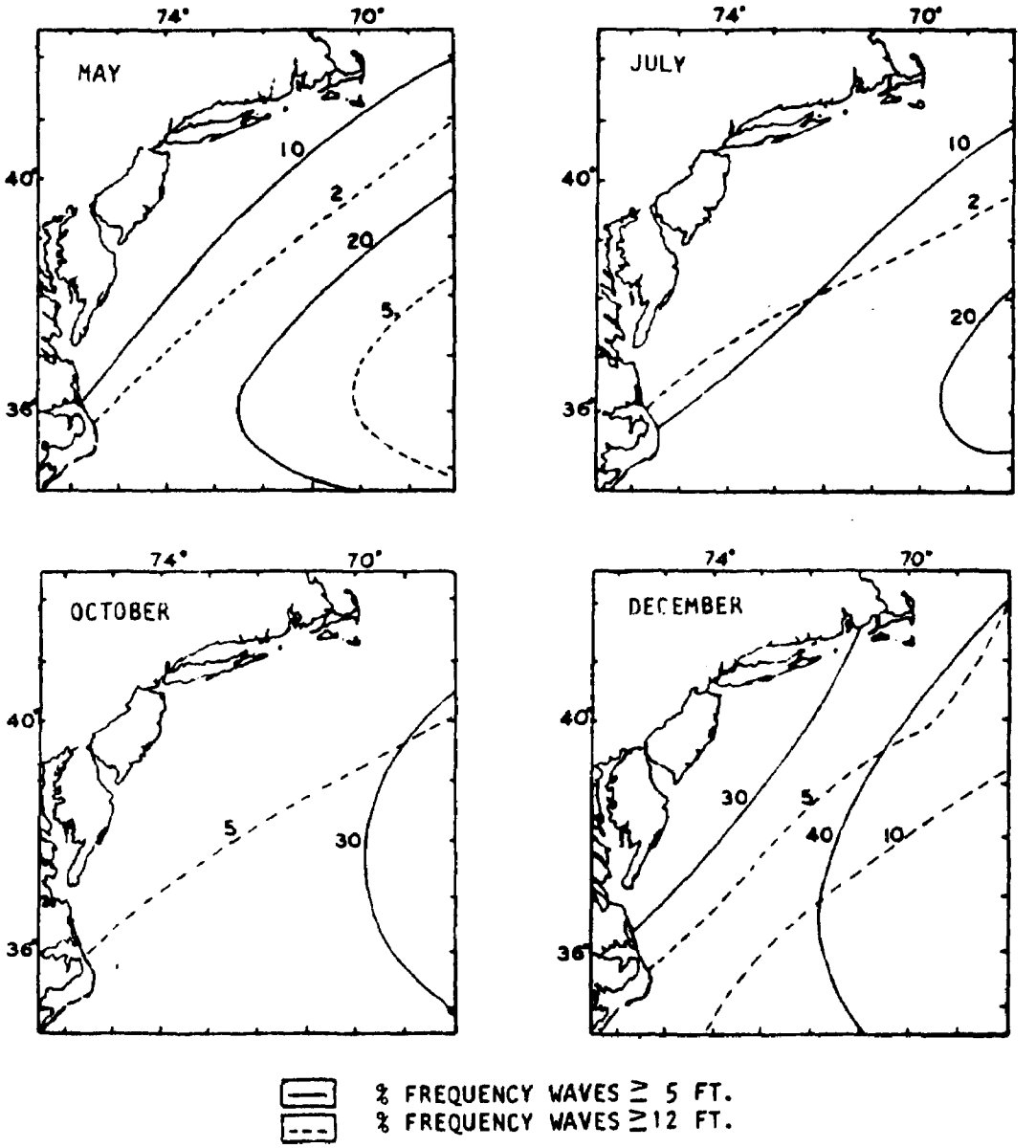

Figure A-1. Frequency of Waves on a Percentage Basis from Month to Month
Source: Bumpus, 1973

INTERNAL WAVES

Internal waves on the Continental Shelf and in the Hudson Shelf Valley have been identified in satellite imagery studies (Apel et al., 1974). Stratified water conditions must be present for the generation of internal waves which can contribute to sediment resuspension and must be considered in evaluating bottom sediment transport.

GEOLOGY

The most common sediments in the Bight are fine to medium sands. Isolated patches of coarse sand and gravel occur near the Long Island and New Jersey shores. The Continental Shelf contains numerous ridges and troughs which resemble relic barrier islands. The Hudson Channel and Shelf Valley, a relict submarine canyon, transverses the shelf and extends from the mouth of New York Harbor south to the head of Hudson Canyon. The Hudson Canyon runs in a southeast direction, to the edge of the Shelf (Williams, 1974). Stubblefield et al. (1977) reported that the sediments in the Bight are in textural equilibrium with the existing hydraulic climate. Silts and muds accumulate naturally only below depths of 24 m.

BATHYMETRY

The well-defined Shelf valley complexes, which are narrow or broad shallow depressions, are scoured by currents and often terminate in delta-like terraces. Sand transported by littoral drift from nearby coasts frequently forms sills across valley heads. More extensive sand banks (called sand massifs) form on seaward shoals near estuary mouths (Figure A-2). The morphology of the Delaware, Great Egg, Hudson, and Block Shelf Valleys in the Bight follows this pattern (Swift et al., 1976).

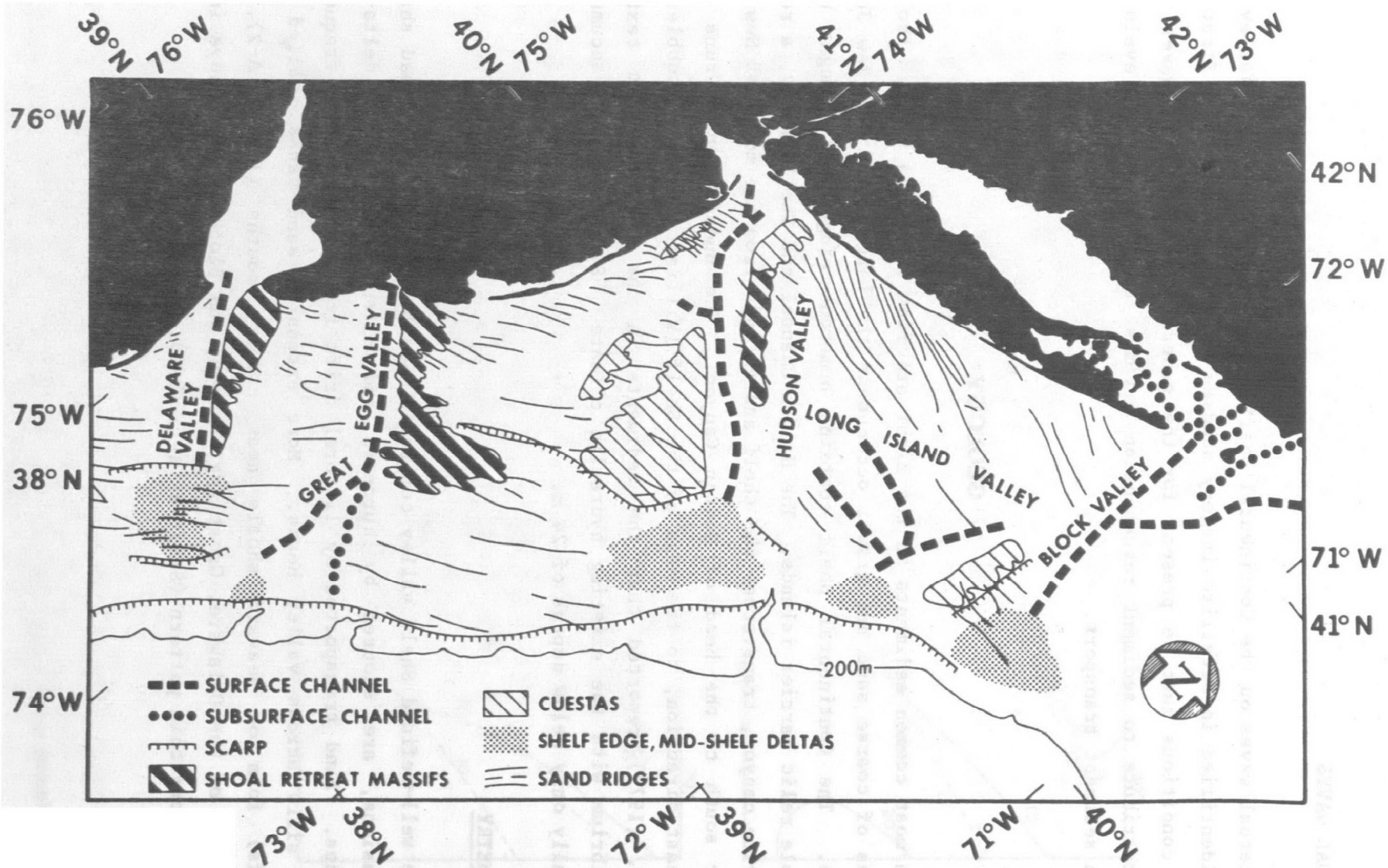

Figure A-2. Morphologic Framework of the New York-New Jersey Shelf
Source: Modified from Swift et al., 1976

Plateau-like expanses (stretching between Shelf valleys) vary from nearly flat plains to patterns of undulating sand ridges reaching 10 m high and 2 to 4 km apart. The ridges appear highest on the northeastern sides of the shoal massifs. This sand ridge and swale topography is characteristic of the mid-Atlantic Bight.

SEDIMENT TYPES

Clean sand facies occur in the Inner and Middle Shelf, and muddy sand facies on the Outer Shelf (McKinney and Friedman, 1970). Occasionally, remnants of the mud facies on the Middle Shelf are found embedded in shell fragments buried in the clean sand, indicating that the muds were deposited prior to the clean sand (Biscaye and Olsen, 1976).

The Shelf off New York is covered by sand-sized particles with isolated gravel patches (Schlee, 1973, 1975). Silt dominates seaward of the 60-m isobath and in the Hudson Shelf Valley. Silt is also present in lagoons and estuaries with only light wave activity. Small mud patches, often seasonal in nature, occur in the nearshore areas of Long Island to the west of Fire Island.

Sediment types have been mapped in the Apex (Freeland et al., 1976; Figure A-3). The topographically low Hudson Shelf Valley and the Christiaensen Basin contain fine-grained sediments; the other areas contain variously sized sands and both artifact and natural gravel deposits. The most common sediments are silty fine sand and slightly gravelly fine to medium sand (Harris, 1976).

SUSPENDED PARTICULATE MATTER

The sizes of inorganic particles in the Apex are similar to fine silt or clay. Suspended fluvial sediments discharged onto the Shelf are composed of 85% inorganic and 15% combustible organic materials (Hathaway, 1971). The inorganic constituents are carried from the Hudson River. The organic combustibles are from anthropogenic sources and are introduced via river

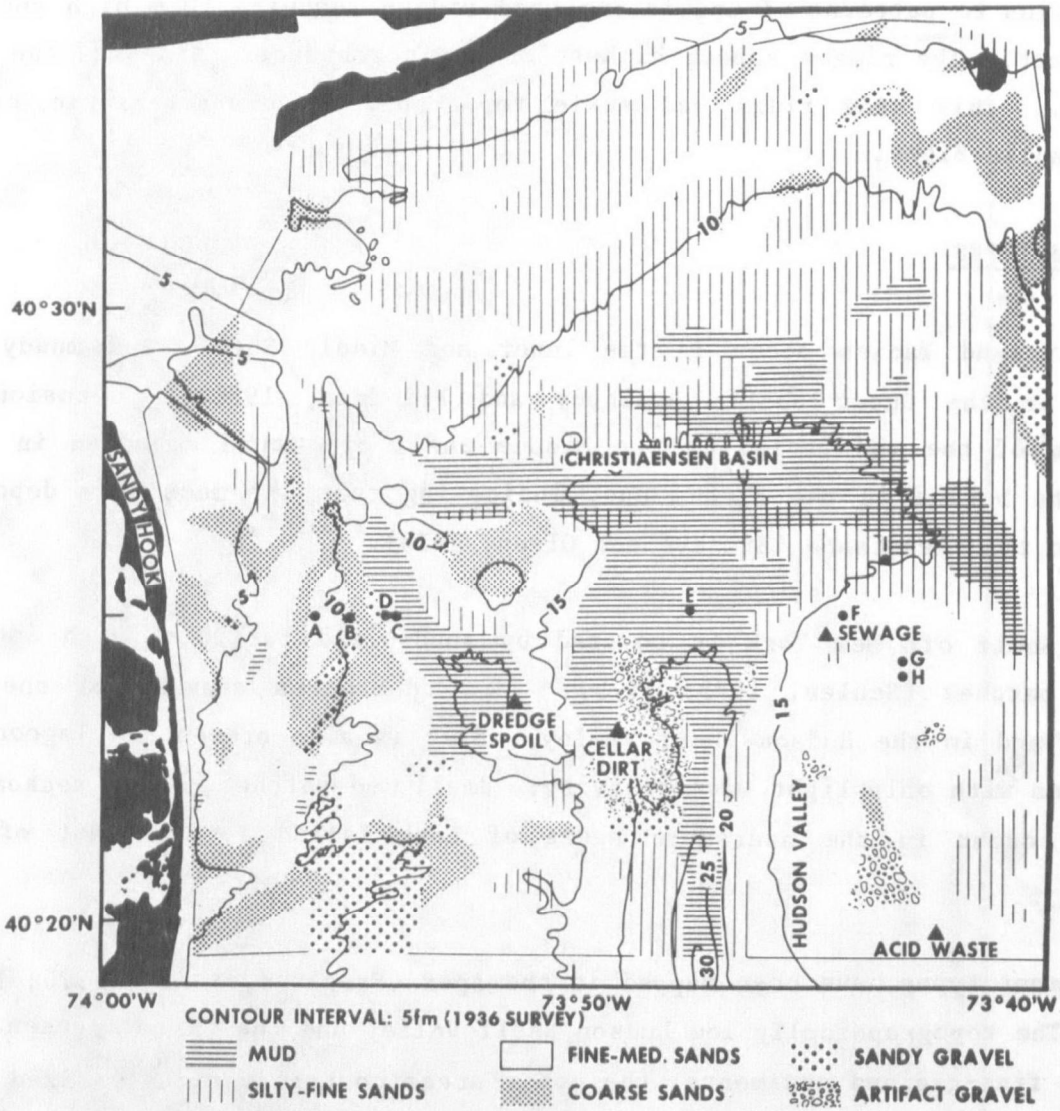

Figure A-3. Distribution of Surficial Sediment Based on Visual Sample Examination. Source: Freeland et al., 1976

outflow, surface runoff, atmospheric fallout, and ocean disposal. In general, particulate concentrations decrease with distance from the shore, especially in surface waters. Vertical mixing of suspended particles, however, is limited by the seasonal thermocline (Biscaye and Olsen, 1976).

Only about 10% of the riverborne suspended solids reach the coastal waters, and the solids are carried in the less saline, surface layer plume. Some SPM is carried back into the Lower Bay by the onshore bottom flow (Meade et al., 1975). The resuspension of fine, inorganic sediments near estuary mouths is related to the effects of wave surge and wind-drift currents in these shallow waters. Drake (1974) estimates that a single November storm resuspended 10,000 tonnes of fine sediments throughout the water column in the Apex, indicating the great influence of storms in sediment resuspension.

GRAIN SIZE

Medium-coarse sands predominate on the inner and middle Shelf, whereas silts are the major components of the Outer Shelf. Inner Shelf sediments off Long Island are of uniform size (well sorted), whereas Middle and Outer Shelf areas are more poorly sorted. This indicates that sediments on the Inner Shelf have undergone more mixing and transport than sediments in deeper water.

Stubblefield et al. (1977) identified two sand provinces in the Bight: the New Jersey Platform sand province and the Cholera Bank* sand province, where medium-grain sands predominate. Finer and coarser sands stretch out in a north- to northwest-trending band off New Jersey, but the Cholera Bank sands are more homogeneous.

The topographic highs surrounding Christiaensen Basin (Figure A-3) are covered by medium-grain sands; however, towards New Jersey, sand ribbon patterns with 10- to 200-m spacing appear. Stubblefield et al. (1977) report that mud facies occur only in the tributary channel of Christiaensen Basin and on the western side. They further reported that the basin floor deposits become coarser towards shallow water.

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* Located 3 nmi east of the Sewage Sludge Site.

TRANSPORT

Sediment transport is produced by two basic phenomena: tidal flow which stores sand in estuary mouths, and storm wave action which moves sand between estuary mouths. Sand discharges from surf zones off the Long Island and New Jersey coasts move towards the New York Harbor mouth, and have built Sandy Hook and Rockaway spits (Swift et al., 1976).

On the Shelf proper, westward and eastward currents measured from bottom, mid-depth, and surface locations showed that surface flows have an offshore component in both east and west directions (Lavelle et al., 1975). However, with increasing depth, the westward bottom flows begin to parallel isobaths and the eastern flows tend to move shoreward. The result is a net southwest migration of sand particles along the bottom.

Lavelle et al. (1975) concluded that transport occurred during brief, intense transport events separated by vast periods of quiescence. As a function of excess velocity, more efficient transport occurs during intense rather than mild storms. The potential consequences are that, if bottom currents in any of the dump sites exceed the threshold velocity and overcome the fractional components of the waste material (e.g., during storms), the dumpsite may be scoured clean of waste. The sequence may have occurred in the Sewage Sludge Site, where only traces of sewage sludge can be found.

Harris (1976) reported that substrate mobility is greatest near Long Island and northern Christiaensen Basin and varies seasonally. Mud dominates in the late spring and early summer and may even cross intervening sand-wave crests. Trough areas are mud-free from early autumn until early spring because of bottom current scour. The mud facies moved to within 5.0 km of Long Island between winter and summer, but later moved back to 9.3 km from Long Island. The distribution of muds are important in evaluating the effects of waste disposal since trace metals and other waste constituents are present in higher concentrations in muds than in sands.

CHEMICAL OCEANOGRAPHY

The Bight receives wastes from a large metropolitan area. The sources of the wastes include ocean disposal, sewage outfalls, river discharge, groundwater seepage, land runoff, petrochemical processes, and atmospheric fallout.

It is difficult to determine effects of any particular type of waste disposal, because contaminant sources are so varied and inputs are large. Contaminants may be changed from one chemical state to another by synergistic interactions with seawater, biologically assisted changes, or oceanographic events which affect mixing and sediment turnover (MESA, 1975).

This section covers the spatial and temporal variability in the water column, sediments, and biota relevant to the wastes presently released at the Acid Site. References are made to various sources for those parameters (e.g., nutrients) unaffected by acid waste disposal. Sufficient chemical data are available for site designation and future decision-making for wastes released at the site.

Excellent overview sources for chemical features of the Bight are Alexander and Alexander (1977), and Segar and Cantillo (1976).

WATER COLUMN

DISSOLVED OXYGEN

Dissolved oxygen concentrations in the surface waters of the Bight are greater than or equal to the saturation level (Corwin, 1970). At a 20-m depth (66 ft) in the Apex, the percentage of saturation in control areas located outside the disposal sites was 55% to 90%.

In contrast, at 20-m depth near the edge of the Sewage Sludge Site, the oxygen concentration was 1.6 mg/l (26% saturation), and at the center of the

site the saturation was 10% (Pearce, 1969). It is not known if this oxygen depression was due to sewage sludge disposal.

Subsurface oxygen concentrations may vary seasonally (Corwin, 1970). Below 10 m (33 ft), concentrations are lower in September than in November, due to stratification of the water column in the summer and higher biological and chemical oxygen demands. In April, oxygen concentrations usually approach saturation.

Garside and Malone (1978) suggest that the near-surface variation in dissolved oxygen is not significantly above zero. Oxygen production from photosynthesis in the Apex is sufficient to balance the respiration of organic material from naturally occurring and anthropogenic sources. With respect to total carbon respired in the Apex, 77% is derived from naturally occurring sources, sewage sludge contributes another 7%, surface runoff 7%, and the Hudson Estuary about 9% (Garside and Malone, 1978). The Apex-derived carbon supply is about three times greater than all other external carbon sources, therefore normal oxygen production has been adequate to balance the respiration demands of the system. Local anoxic conditions, which occurred in some deep Bight areas during the summer of 1976, are only likely below the thermocline, when the surface (oxygenated) and subsurface (oxygen depleted) waters do not mix.

pH

The pH of Bight waters ranges from 7.6 to 8.4; surface values are usually higher than bottom values because of the dynamic relationship with atmospheric CO_2 at the surface (which increases alkalinity) and the decomposition of organic material (which increases acidity) in subsurface waters (Alexander and Alexander, 1977).

Seawater is an extremely well-buffered solution. Changes in pH are temporary and usually the pH returns to normal ambient values almost immediately after it is perturbed (Duxbury, 1971; see Appendix B).

TRACE METALS

The effects of trace metals in the water column are determined by the concentrations, chemical species, and availability to the biota. Certain metals may stimulate or depress biological activity or may become concentrated in the food chain (Alexander et al., 1974). Segar and Cantillo (1975) noted large temporal and geographic variations of trace metal concentrations in the Bight, caused by river discharges, ocean waste disposal, or complex oceanographic and meteorological events. Normal levels of trace metals in unpolluted seawater samples are listed in Table A-4.

TABLE A-4
MEAN TRACE METAL LEVELS IN UNPOLLUTED SEAWATER SAMPLES

	μg/liter (ppb)								
Source	Cadmium	Chromium	Copper	Iron	Mercury	Manganese	Nickel	Lead	Zinc
(1)	0.1	0.05	3	10	0.03	-	500	0.03	10
(2)	--	--	3	10	--	2	--	--	10
(3)	0.1	0.05	3	6	--	2	--	0.03	10

Sources: (1) Goldberg, 1963; (2) Riley and Skirnow, 1965;
(3) Buelow et al., 1968.

These data (Table A-4) can be compared to trace metal levels in the Apex and offshore control sites (Segar and Cantillo, 1976; Table A-5). The area of disposal influence indicated in Table A-5 refers to all potential sources of contamination (acid waste, dredged material, sewage sludge, and cellar dirt).

Two conclusions can be drawn from these data. The values for metal concentrations in the Bight are higher than in uncontaminated seawater samples, but, apart from manganese, the ocean disposal sites do not raise actual levels in the overlying water.

TABLE A-5
MEAN TRACE METAL CONCENTRATIONS IN THE NEW YORK BIGHT

ug/liter (Standard Deviation)					
Metal	Cadmium	Copper	Iron	Manganese	Zinc
Surface					
Disposal Site Influence	0.6 (0.42)	4.3 (1.98)	15.3 (8.38)	5.3 (1.38)	32.5 (8.66)
Control	0.8 (0.40)	4.6 (1.62)	18.6 (16.5)	3.7 (1.50)	35.0 (12.25)
10 Meters					
Disposal Site Influence	0.6 (0.28)	4.7 (1.60)	16.4 (9.88)	9.6 (5.19)	32.5 (13.23)
Control	0.5 (0.19)	4.0 (2.08)	17.1 (8.09)	4.7 (1.70)	30.0 (10.80)

Source: Modified from Segar and Cantillo, 1976. Means are for 7 separate months between May 1974 and March 1975.

NUTRIENTS

Acid wastes do not contain significant levels of the elements required for phytoplankton growth (Appendix D, Tables D-2 and D-3). Consequently, the disposal of acid waste does not markedly affect the distribution or concentration of nutrients in the water column. Therefore, seasonal and spatial variabilities of the nutrients are not discussed in this EIS. The interested reader is referred to Corwin (1970), or Alexander and Alexander (1975, 1977) for discussions of nutrients, and to Mueller et al. (1976) for discussions of the sources and mass loads of nutrients from anthropogenic sources into the Bight.

ORGANIC COMPOUNDS

Acid waste does not contain significant amounts of organic compounds. Disposal operations, however, may affect the phytoplankton in the barge wake. Chlorophyll a concentrations in seawater can be used as indicators of

phytoplankton abundance, thus changes in concentrations can be used to interpret micronutrient fluctuations. In general, chlorophyll a concentrations are greater in the upper water column, because of increased productivity in the euphotic zone and, particularly in the Apex, because of large nutrient inputs. An increase in surface water concentrations of chlorophyll a from 0.5 to 8.0 ug/l in September 1969, to greater than 4.0 to 8.0 ug/l in April 1970, was associated with a spring plankton bloom (Hardy, 1974).

Corwin (1970) and McCarthy (1970) have additional information about particulate carbon and organic nitrogen in the Bight.

SEDIMENTS

TRACE METALS

Elevated concentrations of iron, manganese, titanium, copper, tin, chromium, zinc, lead, and nickel have been measured in many areas of the Bight (Biscaye and Olsen, 1976; Pearce et al., 1977). Iron and magnesium are common throughout the Bight; the other metals are more common in sediments near the Sewage Sludge and Dredged Material Disposal Sites and in areas of river discharge.

Greig et al. (1974) investigated trace metal concentrations in the Apex, and concluded that there were insignificant seasonal variations in the levels of copper, chromium, lead, nickel, and zinc, except near the Dredged Material Disposal Site. Elevated sediment concentrations were not observed near the Acid Site. Decreases in trace metal concentrations away from the center of disposal sites, and areas of elevated concentrations to the northeast of the sites, and in the Hudson Shelf Valley, imply dispersal of wastes by water currents (Carmody et al., 1973).

ORGANIC CARBON

Acid waste contains no significant amounts of organic carbon, nor does it affect the distribution of organic carbon in the Apex. The total organic carbon (TOC) content of sediments is important since sediments with different

levels of TOC may support different biotic communities. Trace metals are more abundant in sediments which have a high TOC content. Harris (1976) and Hatcher and Keister (1976a,b) discuss TOC in Bight sediments.

CHLORINATED HYDROCARBONS

Persistence and toxicity of chlorinated hydrocarbons, e.g., DDT (dichlorodiphenyltrichloroethane) and PCB (polychlorinated biphenyl), cause great concern about their abundance and distribution in marine environments. However, acid waste does not contain chlorinated hydrocarbons (ERCO, 1978a,b). West et al. (1976) have information about the distribution of PCB's and DDT near the Dredged Material Disposal and Sewage Sludge Sites.

BIOTA

TRACE METALS IN ZOOPLANKTON

Extensive species lists and zooplankton abundance measurements, including studies by Grice and Hart (1962), Jefferies and Johnson (1973), Falk et al. (1974) and Gibson (1973) exist for the Bight. Several species of Apex zooplankton were examined for trace metal contaminants. Levels of copper and lead varied among species examined, and zinc varied according to the location of the sample. It has not been possible to determine the source of the contaminants (Greig et al., 1977). At the Delaware Bay Acid Site (where the waste characteristics are similar to those at the Apex Acid Site), Johnson and Lear (1974) reported extreme variability in the concentrations of trace metals in the zooplankton, probably due to the complex nature of contaminant inputs and the dispersal of planktonic organisms by water movement and mixing.

Contaminants which accumulate in the eggs and in developing larvae of marine fauna may cause chromosomal mutagenesis at subtoxic levels (Longwell 1976; Westerhagen et al., 1974). Longwell (1976) determined that there was a significant increase in the number of chromosomal aberrations in eggs and larvae of the Atlantic mackerel, *Scomber scombrus*, near the Acid Site, along

Long Island, and halfway to the edge of the Continental Shelf. The "health" of the Apex (measured by abnormalities in fish eggs) is about equal to the "health" of waters of the New Jersey coast.

TRACE METALS IN BENTHIC BIOTA

Levels of trace metals in benthic macrofauna from the Bight are reported in SHL (1972), Pratt (1973), and Pararas-Carayannis (1973). Sedentary benthic organisms are the preferred indicators of the effects of environmental contamination, because they are directly exposed to sediment-bound trace metals and are unable to move from stressed areas (Pararas Carayannis, 1973). SHL (1972) reported that some specimens contained levels of lead, chromium, and mercury above the normal range of values for the animals. These animals were in the vicinity of the Dredged Material and Sewage Sludge Sites.

Vaccaro et al. (1972) measured elevated trace metal concentrations in some benthic animals collected from the Acid Site. Elevated concentrations of iron were detected, but no documented lethal or chronic effects exist for the epifauna and macroinfauna at the Acid Site. Earlier work by Redfield and Walford (1951) and Westman (1958) led to the same conclusion.

Pearce et al. (1976d) noted that some disposal areas, characterized by large heavy metal and/or organic concentrations, showed a decline in the number of benthic individuals from 1973 to 1974; however, the species composition did not vary significantly during the same period. It was concluded that the Bight biota are reasonably dynamic in abundance, and that correlations of abundance to trace metal concentrations must be made with caution.

BIOLOGICAL CHARACTERISTICS

The biota in the Bight demonstrate complex diurnal, seasonal, and longer-term cycles of species composition and abundance. Several factors contribute to these cycles: (1) the influence of various water masses, each with its characteristic biota; the location of the Bight, between boreal fauna

(found to the north) and temperate to subtropical fauna (found to the south); (2) the effects of unusual or aperiodic physical conditions; and (3) the varying locations and amounts of anthropogenic input.

The Bight is biologically heterogeneous. This section, however, only discusses those environmental aspects of the region which are directly relevant to the specific conditions at the Acid Site. The water column biota are described first, then the benthic biota are characterized. For the benthos, organisms characteristic of a sandy bottom are treated in the most detail. The sediment type at the Acid Site is medium to fine sand, thus the biota typical of other habitats (muds, canyon slopes, rocky outcrops, artificial structures, or coarse sand and gravel) in the Bight are not pertinent to this EIS. Appendix B describes the environmental characteristics and biota within the site proper.

WATER COLUMN

The dynamics of the water and its biota affect the entire Apex. The plankton (microscopic plants and animals moving passively with the water) have patchy distributions in space and time. Quantities of individual species vary seasonally; different species may be abundant in successive years, and species composition is not predictable. Physical and chemical parameters which influence plankton are known, but because the seasonal changes in species cannot be reliably predicted, it is difficult to determine why a species is present or absent in an area. Consequently, individual species are poor indicators of pollution. The plankton move with the water throughout the Bight, thus it would be extremely difficult, if not impossible, to relate long-term changes in the populations to any specific disposal site or other pollutant source.

The nekton contain several species of commercially or recreationally important fish. As with the plankton, the motility of the fish makes it difficult to demonstrate that changes in the population dynamics are related to a specific dump site or pollutant source. However, fish have been extensively surveyed and are economically important. Fish are the most direct links between man and potentially toxic contaminants in the acid waste.

MICROBIOTA

The waste released at the Acid Site does not contain pathogenic organisms, nor does the disposal of acid-iron waste significantly affect the distribution and abundance of the microfauna in the Bight.

PHYTOPLANKTON

Phytoplankton in the Bight have been extensively investigated for the past 75 years. Work has concentrated on seasonal changes and the major physical and biochemical factors controlling primary production in the Bight. The information in this section is taken from monographs by Malone (1977) and Yentsch (1977). Additional information, including species lists, can be found in Barber and Krieger (1970), Esaias (1976), Falkowski and Howe (1976), Freudenthal and Lee (1963), Hulburt (1963), Martin (1928, 1929a,b), Riley (1952), Ryther (1954), and Smayda (1973). Table A-6 shows the more abundant species in the Bight.

Phytoplankton in the Apex have strong similarities to those found in estuarine and bay waters. The chlorophyte, Nannochloris atomus, and the

TABLE A-6
PHYTOPLANKTON SPECIES WITH CELL DENSITIES GREATER THAN TEN THOUSAND PER LITER IN THE NEW YORK BIGHT

Species	Month	Maximum Observed Density x 10,000
Skeletonema costatum	Dec	50 to 60
Thalassionema nitzschioides	Dec	7
Rhizosolenia alata	Dec	2
Asterionella japonica	Feb	10
Rhizosolenia delicatula	Feb	2
Rhizosolenia alata	Sep	1
Chaetoceros socialis	Mar	10 to 90
Calycomonas gracilis	Apr	9

Sources: After Hulburt 1963, 1966, 1970; Hulburt and Rodman, 1963

dinoflagellate, Ceratium tripos, dominate the phytoplankton assemblage from the late spring until middle to late summer. Diatoms dominate during the colder autumn and winter months. Skeletonema costatum, Thalassiosira spp. and Leptocylindrus danicus are frequently, although not always, the dominant species.

Plankton cannot be used as indicators of water quality, but some phytoplankton species do reflect man's influence on the Bight. According to Smayda (1973), Nannochloris atomus is an indicator of eutrophication. Excessive population growth of Ceratium or Nannochloris has caused oxygen depletion in bottom waters, besides reducing the populations of more desirable phytoplankton food species for oysters and clams. Oxygen depletion of the bottom waters and associated fish kills had been reported earlier (Smayda, 1973), yet the most extensive oxygen depletion and benthic mortality occurred in the summer of 1976. Apparently, unusual meteorological events, a large population of Ceratium tripos, and a lack of herbivorous zooplankton produced the condition (Sharp, 1976; Steimle, 1976b). Barged ocean disposal of sewage sludge and dredged material may have contributed to the event, but Segar and Berberian (1976) stated that nitrogen input from the rivers (caused by waste water discharge) is the largest nitrogen source in the Bight.

ZOOPLANKTON

The distribution and abundance of zooplankton populations in the Apex have been extensively studied for many years. The material in this section is primarily from the monographs by Malone (1977) and Yentsch (1977). Further information and data are found in Austin and Dickinson (1973), Bigelow and Sears (1939), Deevey (1956), Grice and Hart (1962), Jefferies and Johnson (1973), and SHL (1972). Table A-7 lists species for the major seasons in the Bight.

Unlike phytoplankton, the zooplankton in the Apex have strong similarities to those found offshore in the outer Bight. Copepods (Oithona similis, Paracalanus parvus, Pseudocalanus minutus, Temora longicornis, and Centropages

TABLE A-7
SEASONAL OCCURRENCE OF ZOOPLANKTON IN THE NEW YORK BIGHT APEX

Species	Season			
	Winter	Spring	Summer	Autumn
HOLOPLANKTON				
Copepoda				
Oithona similis	A	A	A	A
Paracalanus parvus	A	A	A	A
Paracalanus crassirostris	A	A	A	A
Pseudocalanus minutus	A	A	A	A
Centropages hamatus	A	A	A	A
Centropages typicus	A	A	A	A
Temora longicornis	A	A	A	A
Tortanus discaudatus	B	A	A	B
Acartia clausi	B	A	A	A
Acartia tonsa	B	A	A	A
Labidocera aestiva	B	A	-	A
Corycaeus	B	B	-	A
Calanus finmarchicus	B	A	A	A
Eurytemora	B	B	B	-
Canadia	-	-	-	-
Eucalanus	-	-	-	B
Metridia	-	B	-	B
Rhincalanus	-	-	-	B
Clytemnestra	B	B	B	B
Cladocera				
Podon	-	-	A	B
Evadne	A	A	A	A
Penilia	-	-	A	A
Siphonophora	B	A	A	A
Ctenophora	-	-	-	B
Mysidacea	B	-	B	B
Amphipoda				
Gammaridae	-	-	B	B
Hyperiidae	-	-	-	B
Tunicata				
Thalacen	-	-	B	A
Oikopleura	B	B	B	A
Polychaeta				
Tomopteridae	B	-	-	-
Nematoda	-	B	-	B
Ectoprocta	B	A	B	A
Chartognatha	A	A	A	A
MEROPLANKTON				
Polychaeta	A	A	A	A
Gastropoda	A	A	A	A
Pelecypoda	A	A	A	A
Cirripedia	B	B	B	B
Decapoda	B	B	A	A
Phoronida	-	B	B	B
Echinodermata	-	B	B	A
Fish larvae	-	B	B	B
Fish eggs	B	A	A	B

- = No occurrence
A = Present at 50% or more of stations sampled
B = Present at less than 50% of stations sampled

Source: After Gibson, 1973

typicus) dominate the population throughout the year. Warm water oceanic species are often present during the summer and autumn months, but have not been reported in the Hudson estuary.

Seasonal peaks in abundance are usually bimodal with the highest numbers found in July and November (after the spring and autumnal phytoplankton blooms). Cropping by herbivorous zooplankton reduces the size of the summer phytoplankton population. Zooplankton densities are lowest during the winter months; the decline from the autumnal peak is accompanied by a rise in the numbers of carnivorous ctenophores.

Zooplankton are important biological components in assessing the impact of man's activities in the Bight. They may concentrate contaminants from the phytoplankton or the water, and many fish feed directly upon zooplankton. This feeding provides a direct link with such contaminants to humans. Greig et al. (1977), determined the levels of several trace metals in the zooplankton in the Bight, but could not determine any differences in metal levels which were related to the geographical locations of sampling.

NEKTON

Many finfish of commercial and recreational importance are found in the Bight. Their diversity and abundance is due to the geographical location of the Bight, which is the northern limit of temperate and subtropical migrants, and the southern limit of boreal migrants. Some species are found inshore, others offshore, and some migrate from inshore to offshore. Significant numbers of adults, planktonic eggs, and larvae can be found over the entire mid-Atlantic Shelf throughout the year. Consequently, waste disposal activity in any area of the Shelf carries a potential risk of adversely affecting the fish (Grosslein, 1976).

Numerous surveys of pelagic and demersal fish have been made (see Appendix B, Table B-1). However, because of the large area these surveys cover (usually Cape Cod to Cape Hatteras), the number of stations is limited; thus the precision of each survey is low, and only major changes in the fish

populations are detectable. In the Apex, finfish are potentially affected by widespread and varying inputs of contaminants; consequently, relating even major changes in the fish populations to a specific source is difficult.

The broad distribution and migration patterns of two important sport fish -- bluefish and Atlantic mackerel -- are known. The NOAA-NMFS has three categories for the North Atlantic fishery resources: based on the importance to man, bluefish are in the high category, while mackerel are in the medium category (Gusey, 1976). Whiting, which are fished commercially near the site, are in the low category. The first two species are occasionally abundant at the Acid Site.

Bluefish

The bluefish (*Pomatomus saltatrix*) is a warm-water fish which winters and spawns offshore, and moves inshore during the summer (Gusey, 1976). Wide fluctuations in its abundance have been reported since colonial times. The bluefish is a voracious predator on other fish; sea temperature plus the availability of prey are important determinants of bluefish distribution. They are much sought after as sport fish, and the value of bluefish taken by sport fisherman may be a multiple of the commercial catch (Saila and Pratt, 1973). This makes landings even more difficult to estimate because the recreational fisheries in New York are mostly unregulated; the amount of the catch and the fishing effort is not known (Ginter, 1974).

Atlantic Mackerel

The Atlantic mackerel (*Scomber scombrus*) is a wide ranging fish with its distribution centered in the mid-Atlantic Bight. Spawning is in the spring and early summer, but the fish do not prefer a particular region. Therefore, the location of greatest egg production can vary from year to year, depending on the local concentrations of the fish (Bigelow and Schroeder, 1953).

Mackerel abundances fluctuate widely from year to year. The determining factor for this fluctuation appears to be the comparative success of reproduction, but little is known about the factors which promote the

production and survival of larvae (Saila and Pratt, 1973). Young mackerel have higher survival rates when there are few adults and higher mortality when the adults are abundant (Gusey, 1976).

Mackerel are not as important commercially at this time as they were in the 1940's, because demand is low (McHugh, 1977). Landings are now 1 to 4 million kg (2 to 8.9 million lb) against the peak harvest of 33.5 million kg (74 million lb) in 1944 (Gusey, 1976). Mackerel are still an important sport fish, but, as with bluefish, the recreational value of the catch cannot be estimated.

BENTHOS

Benthos includes marine species which burrow into bottom sediments, species attached to the bottom, and species which live and move about on the bottom. Due to their ubiquitous nature, limited mobility, and comparatively long lifespan, benthic organisms are frequently used as indicators of water and sediment quality. They are often sources of food for fish and man.

Shellfish are not treated here, since the the Acid Site environs do not have commercially or recreationally important numbers of surf clams, ocean quahogs, or sea scallops. The site is next to the area closed to shellfishing (Figure A-4). Lobsters are taken northeast of the site. However, as shown in Appendix B, acid waste does not measurably affect the bottom.

The Apex benthos is composed of several different communities. Pratt (1973) recognizes three level-bottom faunal groups widespread on the mid-Atlantic Continental Shelf: sand, silty-sand, and silty-clay fauna (Figure A-5). Therefore, Apex sediments range from sandy gravel to mud (Freeland et al., 1976), elements of all three biotic communities can be, and are, within the Bight. The following discussion concentrates on sand fauna, the dominant community in the Apex, which are found at the Acid Site. Table A-8 lists the species and feeding types characteristic of the sand-bottom fauna.

Sandy bottom sediments have low organic carbon content, large grain size, and high mobility. Animals living on or in the sand are adapted to move

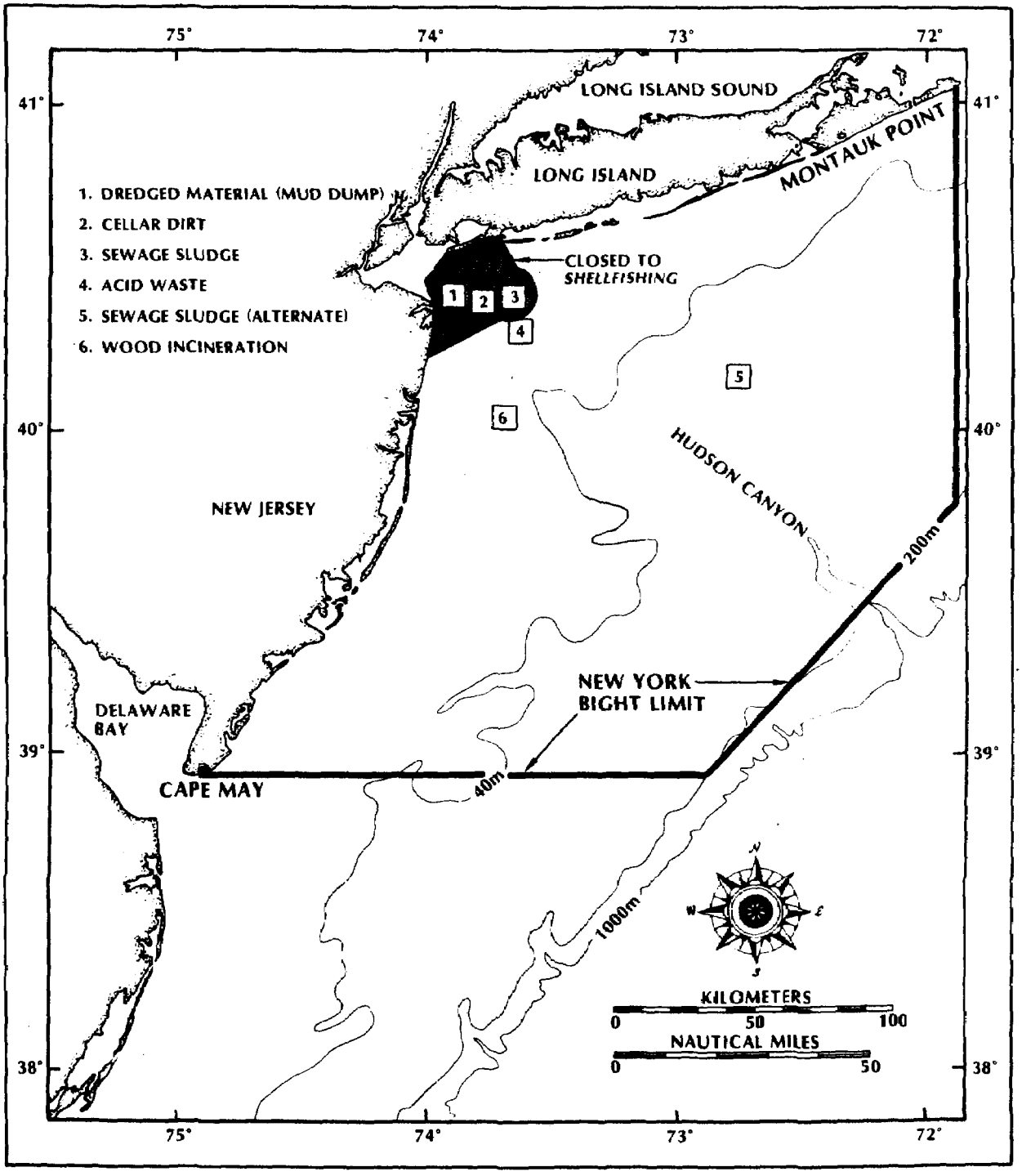

Figure A-4. Area Closed to Shellfishing in the New York Bight
Source: HEW, 1976

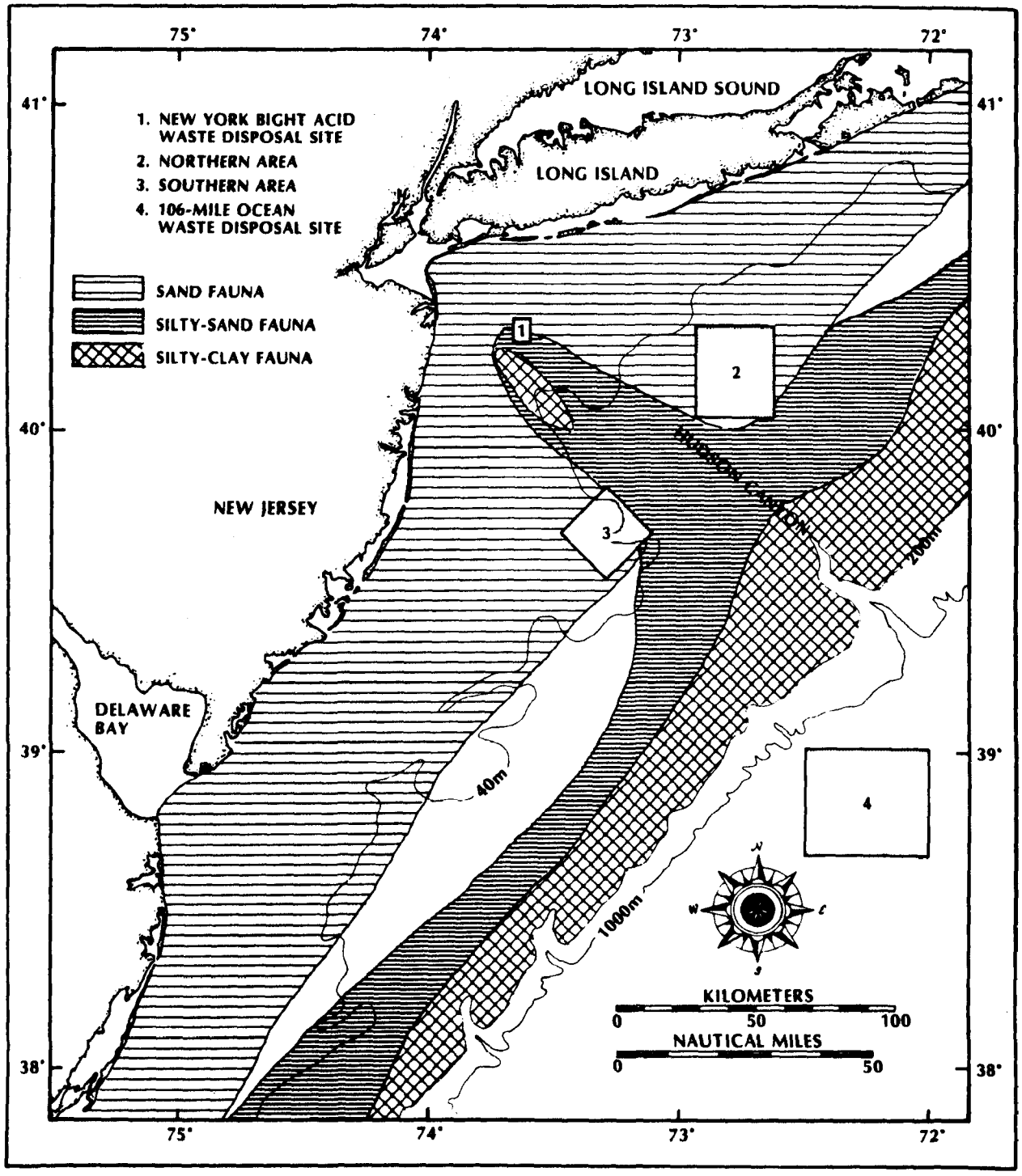

Figure A-5. Benthic Faunal Types in the Mid-Atlantic Bight
Source: Adapted from Pratt, 1973

TABLE A-8
BENTHIC SPECIES CHARACTERISTIC OF THE SAND FAUNA
IN THE MID-ATLANTIC BIGHT

Species	Deposit Feeders	Suspension Feeders	Predators of Bivalves	Scavengers
Polychaetes:				
Scoloplos fragilis	X			
Nephtys bucera	X			
Nephtys picta	X			
Nereis arenaceodentata	X			
Sthenelais limicola	X			
Spiophanes bombyx	X			
Prionospio malmgreni	X			
Ophelia sp.	X			
Goniadella sp.	X			
Clymenella sp.	X			
Aricidea sp	X			
Magelona sp.	X			
Bivalves:				
Spisula solidissima (surf clam)		X		
Astarte castanea		X		
Ensis directus (razor clam)		X		
Tellina agilis	X			
Gastropods:				
Polinices duplicatus			X	
Lunatia heros			X	
Amphipods:				
Haustorids		X		
Phoxocephalids	X			X
Lysianassids	X			X
Decapods:				
Crangon septemspinosus (shrimp)				X
Cancer irroratus (crab)				X
Echinoderms:				
Echinarachnius parma (sand dollar)	X			
Ascidians:				
Amaroucium (sea pork)		X		
Mogula arenata (sea squirt)		X		

Source: After Pratt, 1973.

within the sediment and to recover from burial; the communities are usually dominated by suspension feeders, although species with other feeding habits can be important (Pratt, 1973). In the Apex , deposit detrital feeders and scavengers are present. Invertebrate carnivores are rare and do not appear to have an important role in this community type. Demersal fish are probably the most important carnivores.

Productivity in this sediment type is usually low, although, if the surf clam, Spisula solidissima, is present, sandy bottoms can be extremely productive. Thomas et al. (1976) measured the seabed oxygen consumption over the entire Apex and found that the rates were comparable to other enriched coastal areas.

The inshore benthic fauna are dominated by organisms characteristic of a high-energy coastal environment; bivalves (Tellina agilis and Spisula solidissima), the sand dollar (Echinarachnius parma), and polychaetes (e.g., Spiophanes bombyx and Prionospio malmgreni; Pearce, 1972). Benthic populations in the Bight are not static. Pearce et al. (1976a, 1976b) report substantial annual variations in the distribution and abundance of benthic assemblages in the Apex, when compared to earlier surveys (Pearce et al., 1976c).

Most analytical studies of the Apex benthos investigated effects of use of the Sewage Sludge and Dredged Material Sites. Buelow et al. (1968) investigated the distribution of coliform bacteria in the Apex. As noted earlier, acid waste does not contain bacteria. The FDA has continued to monitor coliform bacterial levels (Verber, unpublished)*. Other benthos investigators are: Frey (1973, 1974), New York Ocean Science Laboratory (1973), Pararas-Carayannis (1973, 1975), Ropes and Merrill (1976), SHL (1972), and Buzas et al. (1972).

*Capt. J. Verber, Chief, NE Technical Services Unit, Shellfish Sanitation Branch, Davisville, RI 02854

Rowe (1971), SHL (1972), Pararas-Carayannis (1973), and Buzas et al. (1972) have evaluated some of the ecological effects of the pollution of the Bight. O'Connor (1975) summarized these impacts as:

- High prevalence of diseases in several species of finfish and shellfish.
- Alterations in the distribution and abundance of bottom living organisms.
- Widespread distribution, in exceptionally high numbers, of coliform and fecal coliform bacteria, indicates the presence of pathogenic bacteria.
- Presence of bacteria which are resistant to a broad spectrum of heavy metals and antibiotics.
- Noxious concentrations of suspended particulate material, flotsam, and surface slicks.

The listed effects are the result of all contaminant inputs to the Apex and most strongly associated with three sources: outflow from New York Harbor, and ocean disposal at the Dredged Material and Sewage Sludge Sites (Appendix C). The Acid Site contributes significantly only to the suspended solid load in the Apex.

Appendix B

ENVIRONMENTAL CHARACTERISTICS OF THE NEW YORK BIGHT ACID WASTE DISPOSAL SITE

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Appendix B

ENVIRONMENTAL CHARACTERISTICS OF THE NEW YORK BIGHT ACID DISPOSAL WASTE SITE

The Acid Site was established in 1948 for the disposal of waste generated from industries in the New Jersey area. At present (1980), the Acid Site is used by only two companies, NL Industries and Allied Chemical, both located in New Jersey. Before 1974, Du Pont disposed of caustic wastes from its Grasselli plant at the site; now, these wastes are dumped at the 106-Mile Site. The Acid Site is 10.6 nmi (20 km) southeast of Ambrose Light, and 14.5 nmi (27 km) off the New Jersey and Long Island coasts. Covering an area of 12 nmi^2 (41.2 km^2) and located on the Continental Shelf, the site is bounded by latitudes 40°16'N to 40°20'N, and longitudes 73°36'W to 73°40'W. Topographically, the bottom is almost flat, with an average depth of 25.6 m (84 ft), ranging from 22.6 m (74 ft) to 28.3 m (93 ft). The site abuts the northeastern edge of the Hudson Shelf Valley (Figure B-1).

Until 1948, industrial acid waste was deposited either at the Sewage Sludge Site or in Raritan Bay. In April 1948, a separate Acid Site covering 2.0 nmi^2 was established at 40°15'24"N, 73°46'42"W. In March 1949, the dumpgrounds were moved south of 40°20'N, and east of 73°40'W. In January 1950, seasonal dumping locations were established. The summer track was south of 40°20'N, and east of 73°40'W. The winter track was south of 40°20'N, and east of 73°43'W (Puplic Health Service Sanitary Engineering Center, 1960). The present site is over the summer track. The Acid Site is only 2.75 nmi (5.1 km) southeast of the Sewage Sludge Site and 7.9 nmi (14.6 km) from the Dredged Material Site (Figure B-1).

Table B-1 lists the major studies which have analyzed samples from, or near the Acid Site. Most surveys in the Bight have encompassed the entire Apex, or concentrated on the Sewage Sludge or Dredged Material Sites. Agencies conducting or sponsoring most of the work in this area include the NMFS Laboratory at Sandy Hook, New Jersey, and the NOAA-MESA New York Bight

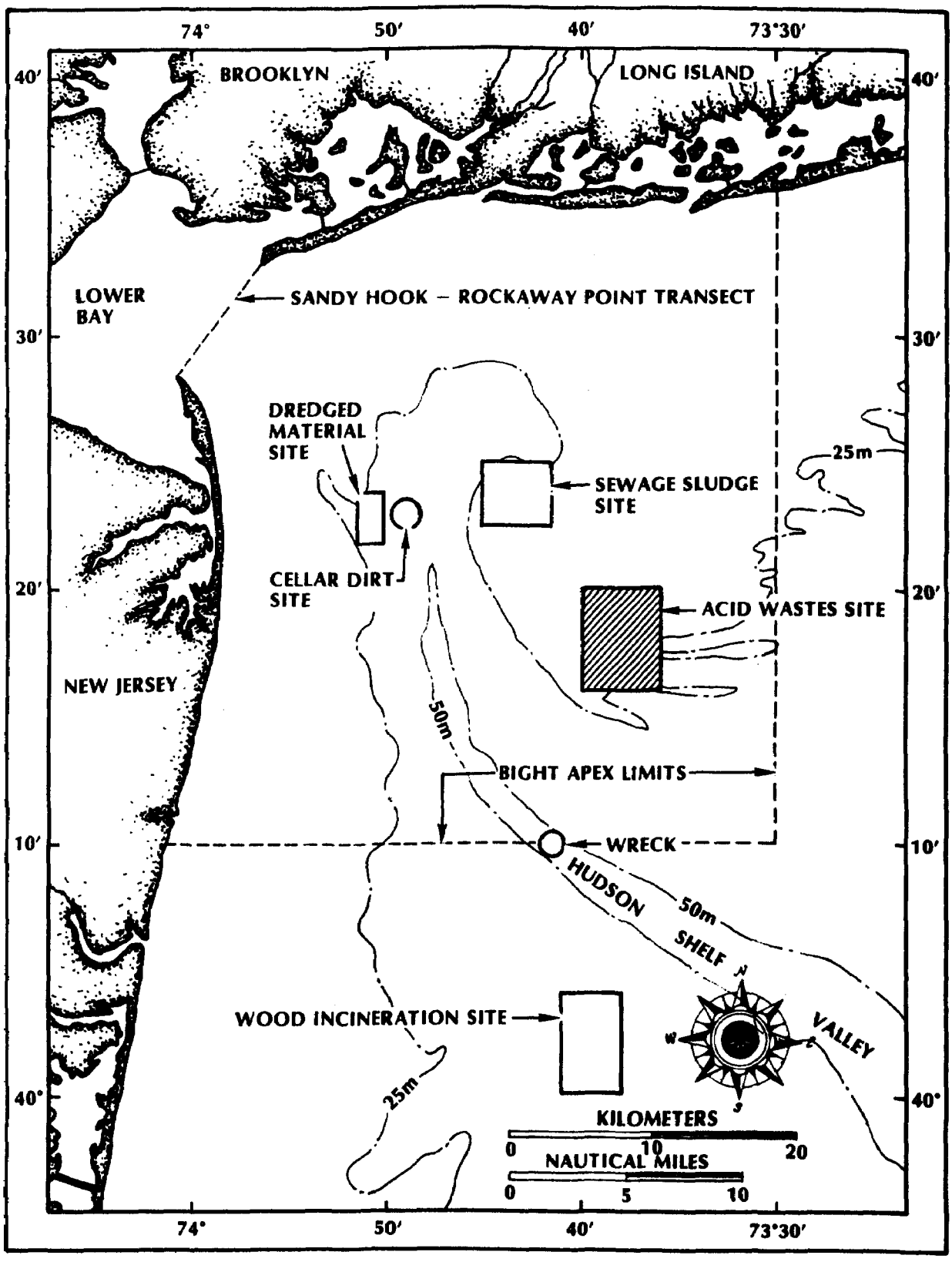

Figure B-1. Location of New York Bight Acid Waste Disposal Site

TABLE B-1
HISTORICAL SURVEYS IN THE VICINITY OF THE ACID SITE
(Abbreviations Listed at the end of this table)

Date	Sponsor/ Investigator*	Purpose	Source
Sept 10-18, 1978	Allied Chemical & NL Industries/ERCO	Dumpsite monitoring cruise	ERCO, 1978c
Mar 13-14, 1978	Allied Chemical & NL Industries/EG&G	Dumpsite monitoring cruise	EG&G, 1978b
Nov 14-16, 1977	Allied Chemical & NL Industries/EG&G	Dumpsite monitoring cruise	EG&G, 1978a
Aug 15, 16, 18, 1977	Allied Chemical & NL Industries/EG&G	Dumpsite monitoring cruise	EG&G, 1977c
Aug 13, 1977	Allied Chemical/ EG&G	Dispersion study of byproduct HCl wastes	EG&G, 1977b
Aug 12, 1977	NL Industries/ EG&G	Dispersion study of acid-iron wastes	EG&G, 1977a
Jan - Dec 1977	NOAA/NMFS	Monitor dissolved oxygen levels	Steimle, 1978
Sept 1976	NOAA†/AOML	Water column characterization cruise**	Hazelworth, et al., 1977a
July-Sept 1976	NOAA/NMFS	Investigate the oxygen depletion phenomena	Steimle, 1976a, 1976b
June 1976	NOAA†/AOML	Water column characterization cruise**	Starr et al., 1977
Apr 1976	NOAA†/AOML	Water column characterization for water movement analysis	Hazelworth, et al., 1977b

TABLE B-1. (continued)

Date	Sponsor/ Investigator*	Purpose	Source
Dec 1975	NOAA†/AOML	Water column characterization cruise**	Kolitz et al., 1976b
Sept 1975	EPA/Raytheon	Baseline survey of the New York Bight	Raytheon, 1975, a,b
Sept-Oct 1975	NOAA†/AOML	Water column characterization cruise**	Starr et al., 1976b
May-June 1975	NOAA†/AOML	Water column characterization cruise**	Kolitz et al., 1976a
Apr 1975	NOAA†/AOML	Water column characterization cruise**	Hazelworth and Darnell, 1976
Mar 1975	NOAA†/NMFS	Obtain data on demersal finfish	Azardvitz, et al., 1976f
Mar 1975	NOAA†/NMFS	Obtain data on demersal finfish	U.S. Dept. Commerce, 1975
Feb-Mar 1975	NOAA†/AOML	Water column characterization cruise**	Hazelworth and Darnell, 1976
Jan 1975	NOAA†/AOML	Water column characterization cruise**	Starr et al., 1976a
Oct 1974	Allied Chemical/ Int'l. Hydronics Corp.	Determination of immediate effect of HCl-HF waste disposal on seawater	International Hydronics Corp. Nov 1974
Sept-Oct 1974	NOAA†/NMFS	Study of demersal finfish catches by by species and station	Azardvitz et al., 1976e

TABLE B-1. (continued)

Date	Sponsor/ Investigator*	Purpose	Source
Aug-Sep 1974	NOAA†/NMFS	Determine distribution and abundance of benthic invertebrates	Pearce et al., 1976a
July-Nov 1974	NOAA†/AOML	Water column characterization cruise**	Hazelworth et al., 1975b
June 1974	EPA	Collected salinity, temperature, dissolved oxygen and coliform data	EPA, 1974
Mar-May 1974	NOAA†/AOML	Water column characterization cruise** with recovery of bottom pressure gauges	Charnell et al., 1976
May 1974	NOAA†/NMFS	Fish egg mutagenesis	Longwell, 1976
Apr-Jun 1974	NOAA†/AOML	Water column characterization cruise**	Hazelworth et al., 1975a
Apr-May 1974	NOAA/NMFS	Obtain data on demersal finfish	U.S. Dept. of Commerce, 1974b
Apr-May 1974	NOAA†/NMFS	Study of demersal finfish catches by species and station	Azardvitz et al., 1976d
Mar 1974 Feb 1975	NOAA†/NMFS	Determine baseline seabed oxygen consumption	Thomas et al., 1976
Mar-May 1974	NOAA†/AOML	Water column characterization cruise** with deployment of bottom pressure gauges	Charnell et al., 1976
Jan-Aug 1974	NOAA†/MSRC	To provide data on sea surface movements	Hardy et al., 1976

TABLE B-1. (continued)

Date	Sponsor/ Investigator*	Purpose	Source
Jan-Feb 1974	NOAA/NMFS	Collected phytoplankton, benthos, trace metals, salinity, and temperature data	U.S.Department of Commerce, 1974a
Oct-Nov 1974	NOAA†/NMFS	Study of demersal finfish catches by species and station	Azardvitz et al., 1976c
Sept-Nov 1973	NOAA/MESA	A study of suspended particulate matter	Drake, 1974
Aug-Nov 1973	NOAA†/AOML	Water column characterization cruise**	Hazelworth, 1974
Aug 1973	NOAA†/NMFS	Determine abundance and distribution of benthic invertebrates	Pearce et al., 1976b
June 1973	NOAA†/NMFS	Determine abundance and distribution of benthic invertebrates	Pearce et al., 1978
May-June 1973	NOAA†/NMFS	Study of demersal finfish catches by species and station	Azardvitz et al., 1976b
Oct-Dec 1972	NOAA†/NMFS	Study of demersal finfish catches by species and station	Azardvitz et al., 1976a
Nov 24, 1972	Allied Chemical	Studies on acid-fluoride wastes	Westman, 1972
Sept 1971	New York Ocean Sci. Lab.	Determine baseline data for physical, chemical, and biological characteristics of the New York Bight	NYOSL, 1973
June 25-29, 1970	NL Industries/WHOI	Detect relationships between the chemical and biological parameters of the area.	Vaccaro, et al., 1972

TABLE B-1. (continued)

Date	Sponsor/ Investigator*	Purpose	Source
Oct 9, 1969	NL Industries	Benthic study of the Acid Site	Westman, 1969
July 26, 1967	NL Industries	Benthic study of the Acid Site	Westman, 1967
Summer 1961	NL Industries	Determine the fishery conditions of the area	Westman et al., 1961
Sept 16-19, 1958	WHOI	Evaluate the effects of acid waste on sport fisheries	Ketchum et al., 1958a,b
July 24-Sept 9, 1958	NL Industries	Study the Acid Site in relation to certain fisheries of the area	Westman, 1958
Oct 1956	NL Industries/WHOI	Benthic photo-survey of the Acid Site	Owen, 1957

MULTIPLE-YEAR PROJECTS

June 1974-June 1975	NOAA/NMFS	Determine distribution and densities of fish	Wilk et al., 1977
Aug 1973-Sept 1974	NOAA†/SHL	Five cruises to determine distribution of benthic invertebrates	Pearce et al., 1977
Aug 1968-Dec 1971	NOAA†/NMFS	Determine distribution and abundance of benthic invertebrates	Pearce et al., 1976c; SHL, 1972; vol. 2
1968-1970	USACE/SHL	Collect data to determine the effects of ocean disposal on the environment	SHL, 1972
1965-1974	NOAA†/NMFS	Historical data on bivalve mollusks	Ropes and Merrill, 1976

TABLE B-1. (continued)

Date	Sponsor/ Investigator*	Purpose	Source
July 1964 May 1977	USPHS/NETSU	Collect coliform counts to determine safe shellfish fishing grounds	Verber, unpub.
Feb 1948- Jan 1950	NRC & USFWS/WHOI & MIT	Assess the hydrographic processes of the area	Ketchum, et al., 1951
1950	NL Industries/WHOI	Study the dispersion rates of barge discharges	Ketchum and Ford, 1952
1950	USDI	Observe effects of acid-iron waste on populations	Arnold and Royce, 1950

* AOML = Atlantic Oceanographic and Meteorological Laboratories
EPA = Environmental Protection Agency
ERCO = Energy Resources Company
MIT = Massachusetts Institute of Technology
MSRC = Marine Science Research Center
NETSU = North East Technical Support Unit, FDA
NMFS = National Marine Fisheries Service
NOAA = National Oceanic and Atmospheric Administration
NRC = National Research Council
SHL = Sandy Hook Laboratory
USACE = U.S. Army Corps of Engineers
USDI = U.S. Department of the Interior
USPHS = U.S. Public Health Service
USFWS = U.S. Fish and Wildlife Service
WHOI = Woods Hole Oceanographic Institution

† Cosponsored with the Marine EcoSystems Analysis Program (MESA)

** Data collected consisted of salinity, temperature, dissolved oxygen, nutrients, meteorology, and density.

Project. NOAA's goals were to develop a clearer understanding of the nature of the forces driving this complex marine ecosystem, and to assess man's impacts in the area. EPA-sponsored or required studies have concentrated on specific effects of ocean disposal.

METEOROLOGY

Appendix A summarizes the meteorological conditions in the Bight. Conditions at the site itself are, of course, the same as those prevailing in the Bight. Meteorological conditions in the Bight are not sufficient (either by themselves or in combination with other factors) to preclude or restrict use of the site for a significant length of time.

PHYSICAL OCEANOGRAPHY

WATER MASSES

Water mass characteristics at the Acid Site and in the Bight are generally the same, except that the site is probably not often influenced by the low salinity outflow from the Hudson estuary. This water is usually restricted to the area west of the Hudson Channel and Shelf Valley. Refer to Appendix A for a discussion of water mass characteristics in the Bight.

CURRENT REGIMES

Hardy et al. (1976) conducted a seabed drifter study to determine the bottom current patterns in the Bight. Sixty nine drifters were released at the Acid Site and sixteen (23%) were eventually recovered. Eleven drifters landed on Long Island, five landed in New Jersey; no drifters were recovered at sea or from within the New York Harbor. It was concluded that the Hudson Shelf Valley appears to form a boundary of divergence where the bottom drift east of the Valley (the Acid Site area) is northwest to northeast towards Long Island. The fact that only 23% of the drifters released at the site were recovered suggests that many of the remainder may have been trapped in the

Hudson Channel and Shelf Valley, which may be a "sink" for wastes released at the Dredged Material and Sewage Sludge Sites. Most of the denser waste components disposed at the Acid Site probably settle in this area.

GEOLOGICAL OCEANOGRAPHY

Several studies have examined the Bight sediments (e.g., Stubblefield et al., 1977; Freeland and Merrill, 1976). In addition, six reports, Pearce et al. (1977), Vaccaro et al. (1972), Ali et al. (1975), Owen (1957), and EG&G (1978a, 1978b), discuss sediments within the Acid Site boundaries.

The bottom sediments are medium to fine sand, with patches of silty-fine sand intruding from the northeast (Stubblefield et al., 1977). Mean grain size is 2.80 $\pm$0.32 mm for 14 samples taken at two of the MESA sample stations within the site (Pearce et al., 1977). Divers have reported the bottom as fine sand and silt, overlain by a flocculent brown particulate material which collected in the troughs of ripple marks (Vaccaro et al., 1972). Owen (1957) reported that the bottom sediments were medium-grained sand, with greenish-gray sand predominating. A dark or greenish ooze (not characterized) was reported at three sample stations.

EG&G (1978a) reported that the surficial sediments varied from gray, to dark gray, to brown, to dark brown in color. Texture was fine-grained sand, round to well-rounded grains, mainly quartz, with a dark mineral assemblage (glauconite or quartz sand) of 5 to 10%. In one case, the sediment was overlain by a "soupy" black layer. EG&G (1978b) reported the bottom surface sediments as varying in color from brown, to brown with some black. Texture was fine-grained quartz sand, well-sorted and rounded, with some silt present. The presence of a "pasty, tar-like" material is reported in one sample. None of the investigators analyzed the characteristics of these "oozes," "soups," or "tar-like" material, but speculated that these materials may have been sewage sludge, or the slops discharged from ship bilges or fuel tanks.

SEDIMENT TRACE METAL LEVELS

It has not been consistently demonstrated that the sediments within the confines of the Acid Site have significantly higher levels of trace metals than sediments in surrounding "control" areas. Ali et al. (1975) separated the sediments in the Bight into four "clusters", on the basis of trace metal content and location. The one Acid Site sample fell into their cluster facies IV, a group containing only a few, widely separated samples, which the authors were unable to characterize adequately. They suggested that cluster facies IV corresponded to some relict sedimentary feature of the area. Aside from relatively high silver (17 mg/kg) and lead (220 mg/kg) values, cluster facies IV was not comparable to cluster facies I, which corresponded to sediments sampled at the Sewage Sludge and Dredged Material Sites.

Vaccaro et al. (1972) reported higher concentrations of iron, zinc, cobalt, copper, lead, chromium, nickel, and cadmium in sediment samples taken from the Acid Site as compared with a control area. However, there is some doubt as to whether these results (which represent a single sampling time) reflect statistically significant differences between Acid Site and control sediments. Samples from the Hudson Shelf Valley contained substantially greater quantities of these metals than samples from either the Acid Site or control area. Vaccaro et al. (1972) concluded that "...the implication is that most of the heavy metal contamination of the Bight, other than the iron, is derived from sources other than the acid-iron dump."

EG&G (1978a) found that zinc, titanium, and copper concentrations in sediments from the site were significantly higher than the concentrations at one reference (control) station. The EG&G surveys only sampled one station not within the site; consequently, this is referred to as a "reference station" rather than a "control area." However, copper concentrations from the Acid Site (2 ppm) and reference station (1 ppm) sediments were more than one order of magnitude less than those found in other sediment samples from the Bight (mean: 68 ppm, range: 23 to 620 ppm for samples taken between 1968 and 1972; SHL, 1972), and from other nearshore sites (mean: 48 ppm; Chester, 1965). Two sediment samples from the Acid Site contained titanium; one had a concentration of titanium significantly higher than that of the reference

station, and one had approximately the same concentration as the reference station. Titanium concentrations in all samples ranged from 71 to 210 ppm. Wide variations in zinc concentrations occurred between reference station and Acid Site sediments. In some instances, zinc concentrations at the Acid Site were significantly higher than those at the reference sediments; at other times, the reverse proved true. However, all zinc concentrations (range: 17.5 to 105 ppm), were less than those reported for other samples from the Bight (mean: 142 ppm, range: 3 to 900 ppm for samples taken between 1968 and 1972; SHL, 1972).

The fact that significant accumulations of metals at the Acid Site have not been documented is not surprising. As shown in Appendices C and D, the relative contribution of metal contaminants released at the Acid Site is extremely low when compared with the total input to the Apex. One potentially toxic metal, vanadium, is present in high concentrations in the waste. However, within minutes of discharge into seawater, the vanadium complexes with other material (e.g., other ions, suspended particulates, organic ligands) and becomes biologically unavailable. Iron and titanium are significant inputs at the Acid Site, but both of these metals are nontoxic. The conclusion of Vaccaro's group (1972) is still valid: "...there is no clear indication that enhanced disposal activity has caused a significant build-up of iron within the sediments immediately below the acid grounds... Thus, the distribution of iron on the seabottom still appears to be regulated by natural phenomena."

SEDIMENT TRANSPORT

Sediment transport away from the immediate area of the Acid Site can be derived from bottom topography, current patterns in the Bight, and the distribution of ferric hydroxide particles, which are excellent tracers of suspended solids originating in the Acid Site. Net transport of coarse sediment away from the Acid Site is dominated by the "sink" provided by the proximity of the Hudson Shelf Valley. Movement towards the Valley and Hudson Canyon is accelerated by storm flow transport, which is the most important

force in coarse sediment movements. Fine sediments, suspended in the water column; e.g., ferric hydroxide particles, may move north towards shore, under influence of the surface gyre (NOAA-MESA, 1975).

The Hudson Shelf Valley is the accumulation area for coarse and fine sediments from the Acid Site. It also serves as a sink for suspended solids, sediments originating in other disposal sites, and from the Hudson River outflow. It is impossible to determine the relative contributions that each of these sources make to the total contaminant load reaching the Valley.

CHEMICAL CHARACTERISTICS

WATER QUALITY

EG&G (1978a) found no significant differences in water column pH values between the Acid Site and control samples taken to the northeast, irrespective of depth. In all cases, bottom waters were more acid (pH 7.70 to 7.86) than were surface waters (pH 8.18 to 8.26). This is normal and is caused by the oxidation of organic matter. Variations of mean pH values with depth during the summer are partially due to density stratification and the presence of a strong thermocline. Dissolved oxygen levels did not vary significantly between the Acid Site and control site.

Westman (1958) described the water color in the Acid Site area as green and somewhat turbid, in contrast with the blue and clear appearance of adjacent waters. Towards the center of the site, the water color was brown to brownish green. Water discoloration, a characteristic of the site, is the basis for locating water transport stations during recent monitoring surveys. The green discoloration is caused by the reaction of the ferrous sulfate in NL Industries waste with seawater. As the ferrous iron is oxidized to ferric hydroxide (rust), the color changes to a brown to reddish brown (Redfield and Walford, 1951).

IRON

Ferric hydroxide particles, introduced at the Acid Site through regular disposal activities, provide excellent tracers for the movement of suspended waste material away from the site, and can indicate the degree of incorporation of waste components in the sediment or biota (pelagic and benthic; Biscaye and Olsen, 1976). The particles range in size from colloidal to sand sizes (>62 μ) as orange and red aggregates having the appearance of floccules (NOAA-MESA, 1975). Particle distribution varies with depth in the water column. Surface particles are carried by the clockwise surface gyre, whereas Those near the bottom are under the influence of the Hudson Shelf Valley and the bottom water flow towards shore (MESA, 1975). EG&G (1978a) reported no significant differences in dissolved iron concentrations between the Acid Site and the reference stations.

Iron in Sediments

Table B-2 summarizes data on iron content (ppm) of the Acid Site and control site sediments. The iron concentrations in sediment are highly variable, and no clear distinction can be made between the Acid Site and control site parameters. Acid Site sediments do not always contain more iron than do control site sediments; on occasion they contain less. The conclusion from these data is that acid waste disposal cannot be consistently related to the concentration of iron in sediments because other sources are equally important. Vaccaro et al. (1972) concluded that there was no indication of an increase of iron in the sediments of the Acid Site over a 24-year period (1948-1972).

Vaccaro et al. (1972), Redfield and Walford (1951), and Corwin and Ketchum (1956) found that the highest concentrations of iron occur in the soft sediments of the Hudson Shelf Valley. Vaccaro et al. (1972) suggested that the distribution of iron in sediments was regulated by natural phenomena favoring an accumulation of fine sediments in the Valley.

TABLE B-2
IRON CONCENTRATION IN SEDIMENTS

Location	Range of Values (ppm)	Reference
Acid Site	2,200 - 2,500	ERCO, 1978c
	2,100 - 2,600	EG&G, 1978c
	9,000 - 10,000	EG&G, 1977b
	3,100 - 3,200	EG&G, 1977c
	3,000 - 12,500	Vaccaro et al., 1972
	0.16% ash	Vaccaro et al., 1972
	0.38% ash	Corwin and Ketchum 1956
Control Areas	3,100	ERCO, 1978c
	8,300 - 8,800	EG&G, 1978c
	37,000 - 58,000	EG&G, 1978b
	8,400 - 15,000	EG&G, 1977c
	2,200 - 3,300	Vaccaro et al., 1972
	0.15% ash	Vaccaro et al., 1972
Hudson Shelf Valley	31,300	Vaccaro et al., 1972

Iron in Biota

Zooplankton - Vaccaro et al. (1972) reported iron concentrations of 120 to 867 ppm in dried samples of zooplankton taken from the Acid Site and concentrations of 130 to 380 ppm iron in similar samples taken at a control site. Zooplankton from an oceanic site 65 nmi (120 km) south of the Acid Site contained 730 ppm iron. It was concluded that the iron precipitated in the discharge area does not appreciably affect the zooplankton. Ketchum et al. (1958b) found that the intestines of zooplankton collected in the discolored water of the Acid Site were packed with precipitated ferric hydroxide particles. Following a series of feeding experiments, it was further concluded that the particles were passed through the intestinal tracts of the animals with little or no change, and apparently without harmful effects.

Vaccaro et al. (1972) reported iron concentrations of 6,800 and 22,000 ppm in two ashed samples of benthos from the Acid Site, and 2,900 ppm in a sample from a control site. A sample from the Hudson Shelf Valley contained 5,600

ppm iron. These data suggest that iron may be accumulated by the benthic biota of the Acid Site. However, it is not possible to test this conclusion statistically, since replicate samples were not taken at the control site.

Nekton - Westman (1958) analyzed the stomach contents of ten chub mackerel (*Pneumataphorus colias*), five taken in the water of the Acid Site, and five taken near the waters of the Dredged Material Site. He reported the following values:

Stomach Contents	Dredged Material Site	Acid Site
Iron content (mg)/stomach	0.37	3.5
Percent iron in total stomach contents	0.66	0.47
Percent ash	4.08	5.03
Total contents (mg)/stomach	57.1	744

These data do not indicate that iron was assimilated by the fish, since differences in stomach iron content could be due entirely to the great variations in total stomach contents.

BIOLOGICAL CHARACTERISTICS

WATER COLUMN BIOTA

Vaccaro et al. (1972) found zooplankton biomass (both in terms of dry weight and displacement volumes) to be approximately 30% higher in the control area than in the area of the Acid Site. This difference could be due entirely to the patchy distribution of zooplankton in the Bight.

Wiebe et al. (1973) were unable to observe a trend in the spatial distribution of zooplankton which would suggest that acid wastes were an important factor in forming such distributions. Gibson (1973) concluded that "...under present conditions the disposal of acid waste ... in the New York Bight is having no discernible effect on the local zooplankton population."

Longwell (1976) found that developing mackerel eggs, collected from the waters near the Acid Site, showed an appreciably higher incidence of

chromosome abnormalities (60.6%, compared to a control site value of 12.7%). A sample taken southwest of the Acid Site showed 38.6% abnormalities while a sample taken to the south showed 52.1% abnormalities. Longwell implied that these abnormalities were due to the mutagenic properties of heavy metals. Chemical mutagenesis of fish egg chromosomes was first suggested by Kinne and Rosenthal (1967) in their studies of sulfuric water pollutants and larvae of the Atlantic herring, Clupea harengus. However, danger to fish eggs was noted only up to a dilution of waste by ocean water of 1:32,000. Minimal dilution of acid waste after initial mixing is 1:67,000 (ERCO, 1978a).

Westman (1958, 1967, and 1969) reported that acid waste disposal actually enhances fishing in the Acid Site area. The "acid grounds" did not exist as a recognized fishing area until acid waste disposal started. He concluded that darkening of the water (increased turbidity) due to the presence of suspended iron particles provided a sheltering environment attractive to fishes, particularly bluefish. No health problems associated with sport fish caught at the site have been reported. Long-term damage to the resource resulting from waste disposal has not been documented.

Trawl data (Table B-3) obtained by Wilk et al. (1977) do not clearly substantiate Westman's belief that there is improved fishing at the "acid grounds." These data show high variablity and do not indicate whether there is an impoverishment or an enrichment of fish populations at the Acid Site.

TABLE B-3
FISH IN THE VICINITY OF THE ACID SITE
(mean ± std. dev.)

Area	Number of samples	Number of individuals	Weight of catch (kg)	Number of species
Acid Site	3	201 ± 172	28.8 ± 32.3	11 ± 4
Near Acid Site	6	114 ± 89	47.0 ± 52.8	11 ± 3
Control site	5	511 ± 255	101.2 ± 47.8	13 ± 4

Source: Wilk et al., 1977.

Swanson (1977) concluded that although "... observational evidence of the impact of dumping on the biota at the [site] is limited.... past studies indicate no reduction of primary productivity or phytoplankton mortality.... surveys of benthic populations in the immediate vicinity of the Apex Acid Waste Dumpsite have not demonstrated an observable impact of waste acid.... existing scientific evidence indicates so far that ocean dumping [at the Acid Site] has had minor adverse impacts on the ecology."

BENTHIC BIOTA

Quantitative data on benthic biota of the Acid Site are summarized in Table B-4. There is no consistent trend in species diversity values (H'), and no clear indication that the benthic fauna of the Acid Site are particularly enriched or reduced, with respect to surrounding control areas. However, Vaccaro et al. (1972) did find significant differences between mean densities of benthic animals at the Acid Site and control site. Rowe (1971) noted that there was a decrease in the species diversity values from deep water towards the Acid Site, and that values for the Acid Site were lower than those in a control area. Evaluation of the data from Pearce et al. (1977), showed that differences in mean diversity values from the Acid Site and control site were not statistically significant. These data did not demonstrate any significant geographic trends which would support the findings of Rowe (1971). Pearce et al. (1976d) noted that there is a close correlation between the distribution of benthic organisms and sediment type, yet no correlation was found between the diversity value and either mean grain-size or percentage of organic material in 81 samples taken at MESA sampling sites in the Bight. However, two low-value samples from within the Acid Site were associated with high values for percentage of organic material. These findings and others in Table B-4 support the general conclusion that there is a high degree of spatial and temporal variability in the benthic fauna of the Bight (Pearce et al., 1976d).

TABLE B-4
COMPARISON OF SPECIES DIVERSITY AND ABUNDANCE VALUES FOR ACID AND CONTROL SITES IN THE NEW YORK BIGHT

Site	S	N	H'	Source
Control	-	$2984/m^2$	2.13	Vaccaro et al., 1972
Acid Site	-	$1694/m^2$	2.08	
Acid Site	6	73+	0.87	Westman, 1967
	7	120+	0.56	
	7	72	1.15	
	7	21	1.20	
Acid Site	6	24	1.39	Westman, 1969
	6	37+	0.80	
	7	80+	1.08	
	5	104+	0.24	
Acid (pre-dump)	9	512	1.09	Arnold and Royce, 1950
Control (pre-dump)	2	38	0.63	
Acid (post-dump)	4	548	0.94	
Control (post-dump)	4	178	0.78	
Control (35 samples)	-	-	2.08 ± 0.91	Pearce et al., 1977
Acid (14 samples)	-	-	1.55 ± 0.87	
Coastal (10 samples)	-	-	1.65 ± 0.52	

S = Total number of species
N = Total number of individuals
H' = Shannon-Wiener species diversity index

Appendix C

CONTAMINANT INPUTS TO THE NEW YORK BIGHT

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Appendix C

CONTAMINANT INPUTS TO THE NEW YORK BIGHT

Immense volumes of waste discharge enter the Apex by direct disposal operations, e.g., barge disposal, coastal discharge, rivers, or outfall effluents. Indirect waste inputs, e.g., atmospheric fallout, add to the total (Figure C-1). The largest single source of discharge (by volume) into the Apex region derives from New York Harbor across the Sandy Hook-Rockaway Point Transect* (Mueller et al., 1976).

Acid waste introduces a limited variety of contaminants to the Bight - several trace metals found in inorganic acids and compounds, suspended solids, and oil and grease (Figure C-1). Consequently, the discussion of contaminant inputs to the Bight is restricted to these contaminants, and an analysis of the relative contribution of sources other than the Acid Site.

In this Appendix, the relative contribution of sources of contaminants will be examined and, based on the available data, the mass loading (amount) of these contaminants will be estimated for the Apex. Trace metals are important contaminants. Some trace metals (e.g., lead and mercury), are extremely toxic to living organisms. Others, namely chromium, copper, and zinc are essential to life processes of living organisms, but may be toxic in high concentrations or in certain chemical forms (Segar and Cantillo, 1975). Cadmium, chromium, and mercury are discussed because of their significance as toxic contaminants. Iron, the principal metal contaminant introduced with acid wastes, is a fairly nontoxic metal, but its release in large quantities may influence activities of other, more toxic, metals. Suspended solids are discussed because of their importance in trace metal transport to, and removal from, waters of the Apex. Oil and grease, which can cause chronic effects on organisms, are present in the waste.

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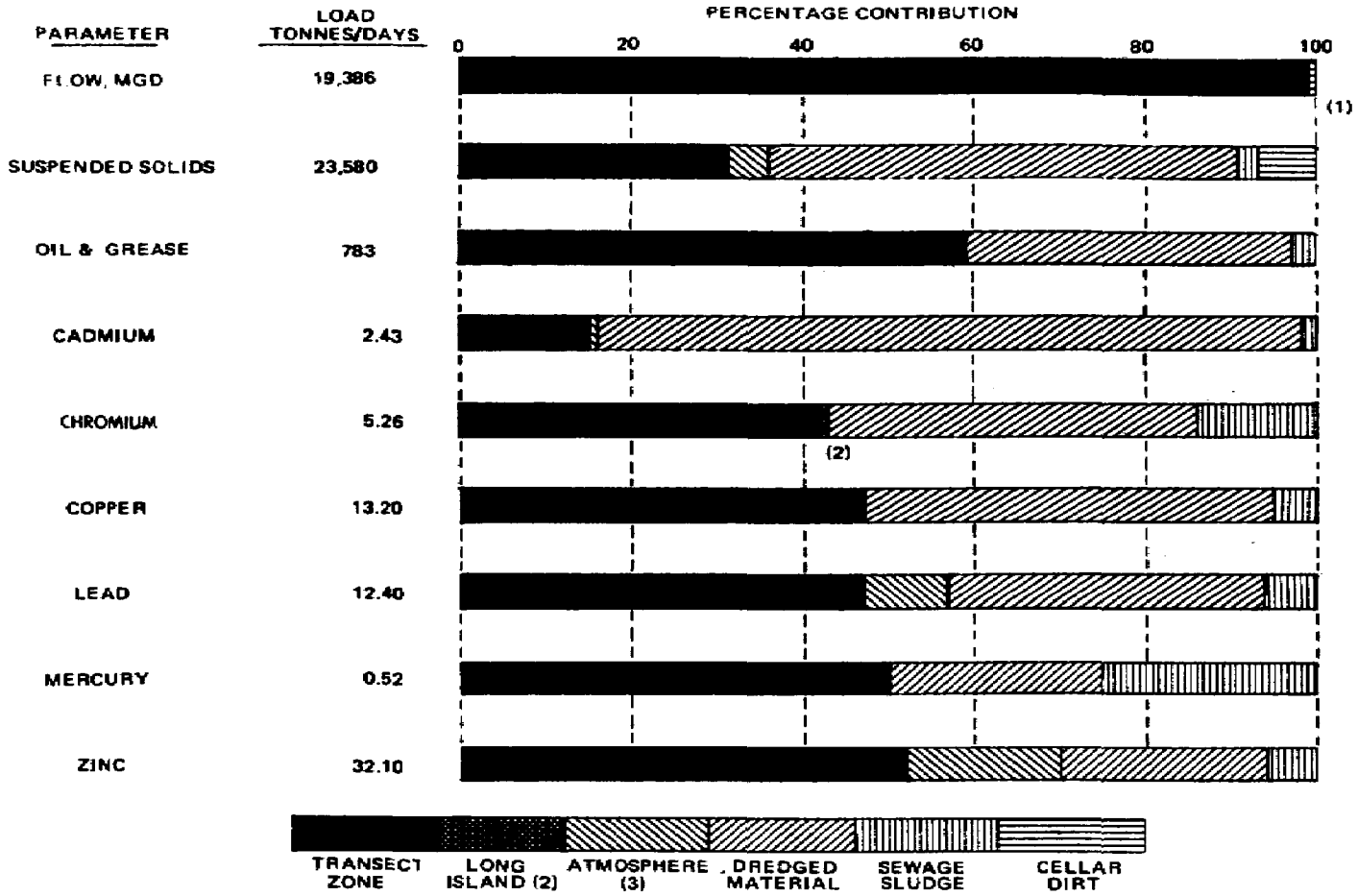
*Hereinafter, Transect Zone



1. FOLLOWING THE TRANSECT ZONE, ALL REMAINING CONTAMINANT SOURCES CONTRIBUTE ONLY ABOUT 0.5% OF THE TOTAL DAILY VOLUME.
2. LONG ISLAND CONTRIBUTES ONLY CHROMIUM ABOVE THE 0.5% LEVEL.
3. ATMOSPHERIC INPUT HAS BEEN ESTIMATED BY DUCE EL AL., 1976, FOR SUSPENDED SOLIDS, CADMIUM, LEAD AND ZINC OVER AN AREA 4 TIMES THE APEX AREA.

THE ACID SITE WAS CONSIDERED, BUT ALL CONTAMINANTS ARE BELOW THE 0.5% CONTRIBUTION LEVEL AND DO NOT APPEAR.

Figure C-1. Source Inputs of Selected Contaminants in the New York Bight

Source: Adapted from Mueller et al., 1976

In 1978, a panel of marine experts identified contaminants that are, or are likely to be, the most serious problems in the Bight (O'Connor and Stanford, 1979). In comparing contaminants present in acid waste with those identified by the experts, only mercury and cadmium are considered to be "major perceived threats." Arsenic, chromium, and lead are considered to be "substances not requiring priority attention;" thus, most of the contaminants discussed in this Appendix are not even considered to be potential problems and, as documented in Appendix D, acid wastes are insignificant sources of the five trace metals mentioned.

This Appendix is divided into three sections. The first section briefly describes the sources of contaminant inputs to the Bight, and the second and third sections present the same data from different viewpoints. The second section discusses each source and the contaminants it provides, while the third discusses the contaminants in terms of the major sources.

SOURCES

Five sources of contaminants are considered in this section -- the Transect Zone (representing outflow from New York Harbor and the Lower Bay), barged ocean waste disposal, atmospheric fallout, surface and effluent discharges from New Jersey and Long Island coastlines (Figure C-2). The Transect Zone contributes over 99% of the total volume while barged wastes and for some metals, atmospheric fallout, are important sources of contaminants.

The information presented in this section is based strongly on data presented in Mueller et al. (1976); however, reliability of these data has been questioned by Lee and Jones (1977). According to Lee and Jones, the estimated quantities of dredged material contaminants reported by Mueller et al. (1976) are of questionable accuracy. The information presented by Mueller et al. (1976) represents the best data presently available for total Apex contaminant input estimates, although contaminant input estimates for dredged material may be inaccurate. Lee and Jones (1977) cannot state if these estimates are high or low for each contaminant. Furthermore, Lee and Jones

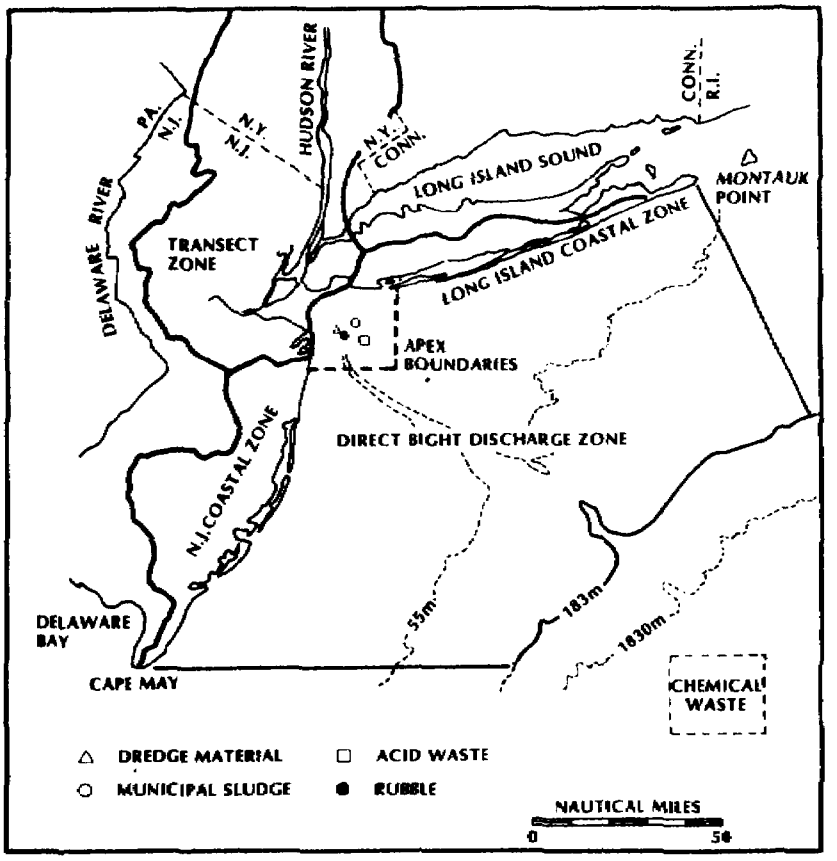


Figure C-2. Geographical Zones in the New York Bight
Source: Adapted from Mueller et al., 1976

(1977) point out that contaminants are not entirely released into receiving water when dredged materials are disposed, hence Mueller's estimates represent the worst-case condition.

TRANSECT ZONE

The Transect Zone of the lower New York Harbor is delineated across the channel entrance, from the tip of Sandy Hook peninsula to Rockaway Point. Numerous rivers in New York and New Jersey discharge into New York Harbor. The Hudson River and its drainage basin are the largest sources of water to the lower bay, and drain approximately 34,630 km^2. The Hackensack, Passaic, and Raritan Rivers in New Jersey drain approximately 6,790 km^2.

These rivers and their tributaries provide most of the municipal and industrial water requirements of approximately 15 million people (Mueller et

al., 1976). Most contaminants in these waters ultimately reach New York Harbor, and enter the Apex, either by the surfac outflow across the Transect, or by dredging operations which release materials at the Dredged Material Site.

OCEAN DISPOSAL SITES

Ocean disposal of waste materials within the Bight started before 1900. The Acid Site was first used in 1948. The first Dredged Material Disposal Sites (DMDS) was designated in 1888. Dredged Material Disposal Sites receive the largest amounts of dumped ocean materal. The DMDS (also known as the Mud Dump) considered here has been in use since 1914 (Gross, 1976a). The Sewage Sludge Site was first used in 1924 and the Cellar Dirt Site was established in 1940. Large volumes of trace metals, suspended solids, organic wastes, and nutrients are introduced into the marine environment at these sites.

A fifth site, located over the Hudson Shelf Valley at the edge of the Apex, was used for disposal of wrecks. Only eight ships have been reported sunk at this site, and none since 1973 (EPA, 1978a). Since the ships are stripped of potential contaminants prior to disposal, this site does not measurably contribute to anthropogenic inputs to the Bight. Designation of this site was recently (1980) terminated by EPA. Future use wil be controlled by a General Permit managed by EPA-Region II.

Two disposal sites are beyond the Apex. A site was designated for toxic chemical waste disposal in 1965. However, this site is 106 nmi southeast of Ambrose Light at the edge of the Continental Shelf. The 106-Mile Site is, therefore, outside the influence of the inshore Apex region. An area south of the Apex (at approximately 40°N, 73°40'W) has been used for the incineration of driftwood, harbor pilings, and other wood debris from harbor wharf destruction. Possible contaminants from this source can be neglected, since the site is outside the Apex and the burning does not affect the water column, with the possible exception of minute amounts of atmospheric loading. The ash and other residue is returned for sale or land disposal.

ATMOSPHERE

Contaminant inputs from the atmosphere have only recently been evaluated. Estimates provided by Duce et al. (1976) are based on samples taken near the New Jersey and Long Island coasts of the Bight (Table C-1). Their estimates are calculated on the assumption that no atmospheric contaminant gradient occurs from nearshore to the outer Bight, i.e., atmospheric concentrations of contaminants are equally dense at 100 km offshore and at 1 km offshore. Since settling velocity estimates of atmospheric particles do not conform to this assumption, Duce et al. (1976) concluded that their calculations probably overestimate metal inputs from atmospheric fallout. Direct measurements of trace metal inputs throughout the Bight are required for reasonably accurate estimates of atmospheric source loading by precipitation and dry fallout. These measurements should include at least one seasonal cycle.

TABLE C-1
TOTAL MASS LOADING - METALS - NEW YORK BIGHT APEX
(Tonnes/Day)

Input*	Cadmium	% Contrib.	Chromium	% Contrib.	Copper	% Contrib.	Iron	% Contrib.	Mercury	% Contrib.	Lead	% Contrib.	Zinc	% Contrib.
Transect Zone	0.36	14.8	2.2	41.8	6.2	47.0	35.0	16.0	0.26	49.9	5.8	46.8	17.0	52.9
Ocean Disposal**	2.04	83.9	3.03	57.6	7.0	53.0	180.0	81.0	0.26	49.9	5.4	43.5	9.1	28.3
Atmosphere†	0.03	1.2	††	--	††	--	6.1	3.0	††	--	1.2	9.7	5.9	18.4
Long Island Coastline	<0.01	<0.5	0.03	0.5	0.01	<0.5	0.6	<0.5	<0.01	<0.05	<0.01	<0.05	0.1	<0.5
Total	2.43		5.26		13.2		221.7		0.52		12.4		32.1	

Sources:
* All estimates, except atmospheric, from Mueller et al., 1976.
† Duce et al., 1976.
** Includes all ocean dumping activities.
†† Not measured.

Duce and Hoffman (1976) concluded that as much as 10% of the total anthropogenic vanadium injected into the atmosphere in North America may be deposited in the central North Atlantic by northern hemisphere westerlies. Three models, which may be accurate only to within one order of magnitude, were compared in deriving this estimate.

Atmospheric input of most metals is an insignificant contribution in comparison to the Transect Zone and ocean dumping (Table C-1). This source of input can be neglected when evaluating the effects of contaminants in the Bight, because of the diffused input from this mode of contaminant entry.

NEW JERSEY

Contaminant inputs along the coast of New Jersey were examined by Mueller et al. (1976). They listed 5 industrial wastewater sources, 50 municipal wastewater sources, and surface runoff water contaminants. Contaminants in groundwater are included in the surface runoff.

The New Jersey coastline is an unimportant source of contaminants (Table C-2). Mueller et al. (1976) reported values only from the coast south of the Shark River (at the edge of the Apex). Contaminants north of the Shark River are included in the Transect Zone figures. Surface currents usually move south along the New Jersey shoreline (see Appendix A), thus contaminants are transported out of the Apex and do not add to its contaminant load. Therefore, New Jersey coastline contaminants are not included in total mass loading figures (Tables C-1 and C-4).

LONG ISLAND

Contaminant sources along the Long Island coastline were examined by Mueller et al. (1976), including sources between Pines Brook in western Nassau County and Montauk Point. Six municipal and 20 industrial (duck farm) waste sources were considered in waste loading estimates. Groundwater produced a significant flow, but contained insignificant waste loads.

TABLE C-2
CONTAMINANT INPUTS FROM THE NEW JERSEY COASTLINE
(Tonnes/Day)

Input	Municipal & Industrial Wastewater	Surface Runoff	Total
Volume (MGD)	105	3,300	3,400
Suspended Solids	55	79	134
Oil and Grease	6.6	69.0	75.6
Metals			
Cadmium	0.0036	0.0084	0.012
Chromium	0.026	0.0064	0.032
Copper	0.057	0.065	0.12
Iron	0.22	5.2	5.4
Mercury	0.017	Nil	0.017
Lead	0.055	0.012	0.067
Zinc	0.067	0.26	0.33

Source: From Mueller et al., 1976

Approximately 85% of the Long Island coastline is beyond the borders of the Apex. Therefore, in evaluating Long Island's importance as a contaminant source, a linear relationship between the total contaminant loading from Long Island coastline, and that portion of the coastline inside the Apex region was included. Table C-3 represents the estimated total average daily input contributed by the entire Long Island coastline. Tables C-1 and C-4 represent one-seventh (15%) of the total contribution, estimated to be entering the Apex region from the Long Island coastline. Currents may bring contaminants from eastern Long Island into the Apex, but at other times currents will flow eastward and remove contaminants from the Apex. In either case, Long Island is an insignificant contaminant source.

TABLE C-3
CONTAMINANT INPUTS FROM THE LONG ISLAND COASTLINE
(Tonnes/Day)

Input	Municipal & Industrial Wastewater	Surface Runoff	Groundwater	Total
Volume (MGD)	88.0	225.0	280.0	593.0
Suspended Solids	11.3	5.4	0.0	16.7
Grease & Oil	4.8	0.55	0.0	5.4
Metals				
Cadmium	0.00091	0.00066	0.00003	0.0016
Chromium	0.19	0.0005	0.0	0.19
Copper	0.024	0.0036	0.0009	0.029
Iron	0.096	0.27	0.023	0.39
Mercury	0.0017	Nil	Nil	0.0017
Lead	0.014	0.0052	0.0003	0.02
Zinc	0.66	0.022	0.0024	0.68

Source: From Mueller et al., 1976.

TABLE C-4
TOTAL MASS LOADING - NEW YORK BIGHT APEX
(Tonnes/Day)

Input	Volume (MGD)	Percent Contrib.	Suspended Solids	% Contrib.	Oil & Grease	% Contrib.
Transect Zone	19,291	99.5	7,300	31.0	460.0	59.0
Ocean Disposal	10	<0.5	15,108	64.0	322.0	41.0
Atmosphere	NA	--	1,170	5.0	0.0	0.0
Long Island Coastline	85	0.5	2.4	0.5	0.7	0.5
Total	19,386		23,580		782.7	

Source: From Mueller et al., 1976.

MASS LOADS BY SOURCE

TRANSECT ZONE

Mueller et al. (1976) estimated the average volume of contaminant loaded water entering the New York Harbor complex from industrial, municipal, urban, and surface runoff to be 850 m^3 per second. This volume and the estimated contaminant mass loads are derived via mean sample values from various records (government, industrial and academic) for the period 1960 to 1974 (Table C-5). Surface runoff contributes approximately 80% of the average daily volume, industries contribute 14% of the daily average, and urban discharge contributes about 6% of the total.

TABLE C-5
CONTAMINANT INPUTS FROM THE TRANSECT ZONE
(Tonnes/Day)

Input	Municipal & Industrial Wastewater	Surface Runoff	Urban Runoff	Total
Volume (MGD)	2,700	15,430	1,160	19,290
Suspended Solids	870	3,500	2,900	7,300
Oil and Grease	193	64	202	460
Metals				
Cadmium	0.14	0.10	0.12	0.36
Chromium	0.92	0.51	0.77	2.2
Copper	2.73	1.24	2.23	6.2
Iron	12.95	9.10	12.95	35.0
Mercury	0.20	0.04	0.02	0.26
Lead	2.67	0.75	2.38	5.8
Zinc	3.23	6.46	7.31	17.0

Source: From Mueller et al., 1976.

Suspended solids constitute the largest amount (by mass) of contaminant materials. The river-suspended load is the single largest source, approximately 3,500 tonnes/day (48%), and urban runoff contributes 40% of the total.

Industrial discharge of suspended solids averages only 12% of the contribution (approximately 870 tonnes/day). Urban runoff (44%) and municipal/industrial wastewater (42%) are the main sources of oil and grease.

The input of cadmium (Table C-5) is evenly distributed among the three effluent categories: municipal and industrial wastewater, surface runoff, and urban runoff. Inputs of zinc are nearly equal between surface runoff (38%) and urban runoff (43%).

Industrial and municipal discharges, combined with urban runoff, contribute about three quarters of the total input of other metals. The former averages about 42% of the total input, and urban runoff is about 37% of the total.

An estimated 35 tonnes of iron is discharged into the New York Harbor daily (Mueller et al., 1976; Table C-5). This is the largest amount among all metals studied. Other metals with high inputs are zinc and, to a lesser extent, lead and copper.

Sediments of the harbor complex are not considered here because their contaminants are immobilized, and thus do not influence the Apex region. Harbor sediments are an important contaminant source when dredged and released at the Dredged Material Site.

OCEAN DISPOSAL

Mueller et al. (1976) examined the volume of material dropped at the Dredged Material, Sewage Sludge and Cellar Dirt Sites (Table C-6). The greatest volume of waste material is released at the Dredged Material Site, which receives approximately 24,100 m^3/day, or 64.5% of the daily average of material dumped at the three sites. The Sewage Sludge Site receives approximately 31.8% (11,820 m^3/day) and the Cellar Dirt Site receives approximately 3.7% (1,364 m^3/day).

The greatest tonnage (86%) of suspended solids is introduced at the Dredged Material Site (Table C-6). Mueller's group estimated that the Cellar Dirt

TABLE C-6
CONTAMINANT INPUTS FROM OCEAN DISPOSAL
(Tonnes/Day)

Waste Type	Volume (m^3/day)	Suspended Solids	Oil and Grease	Cadmium	Chromium	Copper	Mercury	Lead	Zinc
Dredged Material	24,100	13,000	300	2.0	2.3	6.3	0.013	4.7	7.3
Sewage Sludge*	11,820	450	22	0.044	0.73	0.70	0.013	0.72	1.8
Cellar Dirt	1,364	1,650	--	--	--	--	--	--	--
Total	37,284	15,100	322	2.044	3.03	7.0	0.026	5.42	9.1

*1973 Data only

Source: From Mueller et al. (1976)

Site contributes about 1,650 tonnes/day, or 11% of the total suspended solid load, but the amount is probably only about 300 tonnes/day, or only 2% of the total input (Interstate Electronics Corp., 1978). The oil and grease input is primarily from dredged material disposal, with approximately 300 tonnes/day entering the Apex (93% of the total).

For the metals, the Cellar Dirt Site is an insignificant source and the Dredged Material Site contributes from 50% to 98% of all metals examined (Table C-6). Except for mercury, the Dredged Material Site contributes an average of 86% of the metals, and the Sewage Sludge site the remaining 14%. Iron, copper, lead, and zinc are significant contaminant inputs from direct ocean disposal.

Approximately 0.026 tonnes/day of mercury is deposited at the Dredged Material and Sewage Sludge Sites combined (half of the total at each site). However, due to the larger average daily volume of dredged material, these values suggest that sewage sludge is more highly contaminated with mercury.

Mass loading estimates of iron at these sites were not calculated by Mueller and his co-workers, but an estimate of loading from all dumping activities (including the Acid Site, which is the most significant source of iron) is given as 180 tonnes/day. MESA (1975) estimated that the Acid Site and outflow from the Transect Zone contained about equal amounts of iron. MESA (1975) concluded that the three most important sources of metals are the Dredged Material Site, the Sewage Sludge Site, and the Transect Zone.

ATMOSPHERE

The potential atmospheric transport of trace metals into the water of the Bight has only recently been examined. Duce et al. (1976) measured atmospheric metal concentrations from samples taken over a 10,000 km^2 area of the Bight. It was found that atmospheric concentrations were generally 10 to 20% of the mean concentrations observed at several locations in New York City over a 2-year period.

Samples collected by Duce et al. (1976) indicated that the quantities of metals entering the Apex from the atmosphere are considerably less than those from all other sources (see Table C-1). Lead, for example, is 10% of the total from the previous two sources but cadmium is only 1% of the total. Dry fallout values are based on sample observations. Wet fallout values (primarily rain) are based on an estimate of 67% removal factor, thus wet fallout is given as double the dry fallout. Duce and his co-workers emphasized that these estimates of atmospheric transport may be high, by a factor of five or more. Long-term studies are required to produce reasonably accurate values. However, since the absolute input is low, these are sufficient data for this EIS.

Mueller et al. (1976) calculated input values for airborne metals using measured data collected in a one-year study from the Upper Great Lakes (Table C-7). They considered the entire Bight, approximately 39,000 km^2, for estimation purposes. Thus, their input estimates consider an area four times the size sampled by Duce et al. (1976). Comparing Mueller's estimates to Duce's estimates does not show a consistent trend (Table C-7), emphasizing the approximate nature of these values.

Estimates reported by Duce et al. (1976) are used in this report since these data represent direct source measurement from the area of interest. The primary factor limiting the use of these data is the fact that they represent a small sample from a short sampling period and are, at best, rough estimates.

The sources of the metals are both natural and anthropogenic. Northeasterly and southeasterly winds blowing across the mainland accumulate large quantities of iron in soil, smoke, and ash. Iron is the most abundant metal present. Levels of zinc may be the result of a similar accumulation process.

Atmospheric lead is derived from the combustion of leaded gasoline in internal combustion engines (Zoller et al., 1973) and would therefore be expected in significant quantities.

TABLE C-7
CONTAMINANT INPUTS FROM ATMOSPHERIC FALLOUT
(Tonnes/Day)

Input	Cadmium	Iron	Lead	Zinc
Dry Fallout	0.01	3.40	0.55	0.74
Wet Fallout	0.02	6.80	1.10	1.98
Total (Duce et al., 1976)	0.03	10.20	1.65	2.72
Total (Mueller et al., 1976)	0.054	6.10	1.20	5.90

Atmospheric cadmium (for example, from the wear of automobile tires) is present in minute quantities. The source of contamination is not apparent, it may be either natural, anthropogenic, or a result of combined sources.

NEW JERSEY COASTLINE

Contaminant sources from the New Jersey coastline are restricted to two major categories: municipal and industrial wastewater, and surface runoff. In terms of volumes, surface runoff contributes more than 30 times the average amount of municipal and industrial wastewater. However, municipal and industrial waters often contain more concentrated amounts of specific contaminants (Table C-2).

Suspended solids are about equally divided between the two sources. Municipal and industrial wastewaters contain approximately 41% of the average daily total. Surface runoff contains about 79 tonnes/day, or 59% of the total. Oil and grease is primarily from the surface runoff (91% of the total).

In metals derived from surface runoff the results are: cadmium (70% of the total), copper (53%) iron (96%), and zinc (80%); but primarily found in municipal and industrial wastewater are: chromium (80%), mercury (100%), and lead (82%).

Iron is found almost exclusively in surface runoff. The amount represents about 96% of the average daily total. This implies that the sources of iron are primarily natural, and man's activities contribute little iron. Mercury is found exclusively in municipal and industrial wastewater. This implies that the mercury contamination is entirely from anthropogenic sources along the New Jersey coastline.

These mass load estimates are provided for comparative purposes only, because these data from the New Jersey coastal region are outside the Apex region and the contaminants are transported to, or deposited in, other areas of the Bight.

LONG ISLAND COASTLINE

Contaminants introduced into the Bight from the Long Island coastal area are mainly from municipal and industrial wastewater discharge (Table C-3). Surface runoff and groundwater sources contribute minor amounts of most contaminants. The total volume of discharge averages approximately 2,248 m^3 (593 MGD). Of this volume, approximately 15% is of municipal and industrial origin. About 38% is surface runoff, and 47% (1,056 m^3) is ground water.

Included are 68% of suspended solids from municipal and industrial wastewater; the remainder is discharged with surface runoff. Groundwater does not contribute to the suspended solids load, and 90% of the oil and grease is carried by wastewater and the remainder in the surface runoff.

The levels of metal contaminants are low; the majority of the metals are found in the wastewater discharges. Surface runoff contributes an appreciable amount of cadmium (41%) iron (69%) and lead (27%). Groundwater discharge to the Bight contains low levels of all metals and it contributes only slightly to the iron load (6% of the total amount). Natural sources of iron are the most important inputs (69% of the total).

TOTAL MASS LOADING OF THE NEW YORK BIGHT APEX

This section evaluates the total mass loading of contaminants entering the Apex. Virtually all potentially contaminated material entering the Bight passes through the Transect Zone. Ocean disposal operations are low in volume (less than 0.5% of the total), but contribute a higher proportionate contaminant load. Dredged material disposal contributes most of the suspended solids. The fate of suspended solids in the Bight is complex and still not well understood. They are important because trace metals and other contaminants are adsorbed by them; these "secondary" contaminants may enter the food chain, either directly via filter feeding shellfish, or indirectly via the plankton.

Monitoring of trace metal contamination is important because of known toxic effects on humans and on the normal biota of the area. Ocean disposal of dredged material and sewage sludge is, in general, the predominant source of metals, and the Transect Zone source is almost equal. Dredged material is contaminated by the settling of riverborne particles carried into the harbor, therefore the problem of reducing the oceanic loading cannot be separated from reducing the river load. The Acid Site contributes minor amounts of all trace metals except iron (see Appendix D). In the same manner most oil and grease is released at the Dredged Material Site or is part of the outflow through the Transect Zone.

VOLUME

The following estimates of the contaminant volumes entering the Bight are based primarily on reports by Mueller et al. (1976) and Duce et al. (1976). Some sources, such as municipal and industrial wastewater, surface runoff, and ocean dumping are well documented through EPA and CE regulatory and monitoring programs. The least reliable estimates are atmospheric inputs, urban runoff, and groundwater discharge, either because of the difficulty in measurement or simply a lack of sufficient data (Mueller et al., 1976).

The Transect Zone contributes almost all the potentially contaminated water, over 99% (Table C-4). However, not all the contaminants which enter the harbor complex are eventually transported to the Apex region. Some of this material probably settles within the harbor where it remains until disturbed and resuspended. Greig and McGrath (1977) concluded that three "metal regimes" existed within Raritan Bay. Western Raritan Bay is an area of high metal concentrations. Concentrations diminish towards the lower New York Harbor area and reach their lowest values (near background levels) at the Harbor entrance (the Transect). However, much of the contamination from the Hudson River is transported to the Dredged Material Site in the Bight when the harbor and channels are dredged.

The Long Island coastline contributes the second largest volume of discharge (Table C-4). The data collected by Mueller et al. (1976) for the Long Island and New Jersey coastlines include areas well beyond the Apex region. Consequently, a large portion of the contaminant inputs from these sources enters the Bight outside the Apex. Data reported by Mueller's group have been modified in Tables C-1 and C-4 based on the assumption that there is a linear relationship between the amount of a given contaminant and the length of the coastline. Thus, since approximately one-seventh of Long Island's coastline lies within the Apex, the contaminant input values for Long Island are divided by seven. This may result in a somewhat low estimate of the mass loading occurring in the Apex from the Long Island coastline. Except for Shark River (at the edge), the rest of New Jersey's coastline considered by Mueller's group is outside the Apex. Accordingly, contaminant inputs from New Jersey are not included in total mass loading estimates of the Apex. Another assumption is that water motion is directed away from the Apex region along the coastlines. For New Jersey, this assumption is valid; surface waters tend to move south along the coast. Long Island coastal waters may move westerly into the Apex. However, most of the surface runoff and wastewater discharges are into Great South Bay and thus, most contaminants settle to the bottom and are not transported into the Apex.

Ocean dumping provides the smallest volume of all sources, although it is an important contaminant source, particularly for trace metals. Ocean disposal ranks first or second in percentage contribution for all the parameters examined.

SUSPENDED SOLIDS

Suspended solids are organic and inorganic particulate matter in water (EPA, 1976), which may contain both biogenic and non-biogenic debris (Biscaye and Olsen, 1976).

Table C-4 and Figure C-1 illustrate the relative contributions of suspended solid contaminant sources. Ocean disposal (principally dredged material and cellar dirt) is the largest source of suspended solids, approximately two thirds of the daily average. This estimate is high because the value used by Mueller's group in estimating cellar dirt contribution (Table C-4) assumed that all material released at the Cellar Dirt Site was suspended solid material. In 1974, approximately half of the cellar dirt was material six inches or larger; the estimate by Mueller's group is at least 50% too high. Interstate Electronics Corp. (1978) estimated that suspended solids amounted to only about 300 tonnes/day from 1973 to 1977 at the Cellar Dirt Site. Even if Interstate's estimate is more accurate, the total daily loading of suspended solids by ocean disposal will be reduced by less than 10%. This correction still leaves ocean disposal as the single largest contributor of suspended solids.

The Transect Zone provides the second largest source of suspended solids, or about a third of the daily average. Atmospheric fallout contributes the remaining amount; the Long Island coastline contribution is insignificant.

DREDGED MATERIAL AND THE TRANSECT ZONE

Gross (1970, 1976a) examined New York Harbor sediments. Metals and other contaminants are adsorbed by particles which, as they settle in the harbor complex, remove these contaminants from the water column (Biscaye and Olsen, 1976). Since material released at the Dredged Material Site originates in the

New York Harbor complex area, contaminants contained in dredged material are originally introduced to the harbor water from the Hudson River and other tributary rivers.

Gross (1972) reported that approximately 160 km^2 (41% of the harbor area) were covered by fine carbon-rich deposits, derived from suspended solids entering the harbor from the Hudson River, waste discharges, and surface runoff.

TRANSPORT

NOAA-MESA (1975) indicated that surface runoff of the Hudson River and the denser saline bottom water each flow in opposite directions across the Transect. In this model suspended sediments move out to sea across the Transect, then most of the material moves southward along the New Jersey coastline of the Apex, while some moves eastward along the Long Island coastline of the Apex. As these solids would settle into subsurface waters, they could return with the more saline flow into the harbor. Subsurface currents may also move waste materials deposited in the Bight into the harbor. Within the Bight, suspended solids stratify during periods of seasonal sea density stratification. A three-layer system is typically present year-round, but is most pronounced in the spring and summer. It consists of a turbid surface layer, a relatively clear mid-depth layer, and a turbid bottom layer. This turbid lower layer appears to be a permanent feature of the entire Apex (NOAA-MESA, 1975), and is thought to be a result of agitation and resuspension of bottom sediments caused by bottom currents.

Biscaye and Olsen (1976) suggest that strong seasonal thermoclines restrict the vertical movement and settlement of suspended solids in surface waters. While organic particles (suspended solids) containing detectable quantities of trace metals are generally most abundant in the Apex, they are only occasionally observed in upper and intermediate outer Shelf Waters. Biscaye and Olsen suggest that the most likely sources for trace metals bearing suspended solids are sewage sludge and dredged material deposited in the Apex.

Accumulation and resuspension also affect the movement and fate of suspended solids in the Bight. NOAA-MESA (1975) reported results of sediment sampling over the Apex. Shelf sediments are generally enriched in organic matter and clay particles, and the Apex region has a thin layer of ferrous oxide (Fe_2O_3). Comparing autumnal suspended-solid concentrations with samples after a November storm showed that resuspending bottom sediments resulted in a suspended-solid concentration equivalent to 12 days of sewage sludge dumping. In deeper areas (e.g., the Hudson Channel), muds accumulate due to reduced bottom turbulence. These muds are invariably rich in organic matter (NOAA-MESA, 1975) with measurable amounts of trace metals (Biscaye and Olsen, 1976).

TRACE METALS

Trace metals occur naturally in the marine environment; however, most metals exist only in minute quantities and accumulate slowly in sediments over long periods. The population density and industrialization of the coastal areas of the Bight have caused accelerated introduction of trace metals into the Bight. There are four sources of trace metals into the Apex: (1) New York Harbor and the Lower Bay (the Transect Zone), (2) ocean dumping, (3) atmospheric fallout, and (4) runoff from Long Island. Metal sources can be estimated from data by Mueller et al. (1976) and Duce et al. (1976). Table C-1 lists these sources and estimated average daily mass loads. Figure C-1 shows the relative importance of each source graphically.

BACKGROUND INFORMATION

Metals may be found in a number of chemical forms. The chemical form of hazardous trace metals is important since this determines the metal's bioavailability and toxicity. Metals can be simple or complex inorganic species, metallo-organic complexes, inorganic and organic colloids, and macro-solid particles, which differ in chemical and biological sorptive properties. Unfortunately, these reactions are poorly understood (Segar and Cantillo, 1976). However, organic complexing reduces the biological availability of many trace metals (Jeune and Luoma, 1977).

Once metals have been deposited in the sediment, several possible migration mechanisms between the sediment-water interface may occur: bio-oxidation, sorption, dissolution, precipitation, complexation, and diffusion. Iron is released under reducing conditions, and cadmium, copper, lead and zinc are precipitated under reducing conditions. In the oxidizing environment of the Bight, the opposite reactions occur.

Seven metals, cadmium, chromium, copper, iron, lead, mercury, and zinc, are either highly toxic or highly concentrated in acid waste (Appendix D).

Cadmium has no known useful biological function, but acute and chronic toxic effects have been demonstrated. It exists in solution as a free ion and in complex form (Sarsfield and Marcy, 1977). The redox potential (Eh) of the environment significantly influences the availability of the metal. In oxidizing environments, cadmium is generally found as a carbonate, and its toxicity to three marine decapod crustaceans ranged between 320 and 420 μg/l (EPA, 1976). Reducing environments generally contain a low solubility cadmium sulfate form (Lu and Chen, 1977).

Chromium is an essential trace element for many living organisms, and is usually present in the reduced hydroxide state. Jeune and Luoma (1977) reported that certain organic chromium compounds may increase the metal's bioavailability by forming more kinetically active species of the metal. Toxic susceptibilities of different animals are highly variable: extremes of 1.0 μg/l (the polychaete Nereis virens) to 200 μg/l (the mummichog, Fundulus heteroclitus) have been observed (EPA, 1976). Hexavalent chromium is more toxic than trivalent chromium; EPA (1976) recommends a maximum concentration of 0.10 μg/l in marine water.

Copper is important biologically because it is essential for synthesizing chlorophyll; it is required in animal metabolism, and is the respiratory pigment used for oxygen transport in some invertebrates. Organic complexing and precipitation decrease copper toxicity (EPA, 1976). At high concentrations (50 to 100 μg/l), photosynthesis is inhibited and marine animals are acutely affected.

Iron is the fourth most abundant element in the earth's crust, and is required by plants and animals in all habitats (EPA, 1976). In hemoglobin, it is the oxygen transport pigment in the blood of all vertebrates and some invertebrates. In marine environments, iron rapidly forms a floc which may coat gills of fish or invertebrates, and bury or smother eggs (EPA, 1976). Kinniburgh et al. (1977), and Krauskopf (1956) showed that iron hydroxide significantly affects other metals (e.g., copper, zinc, and lead). Zinc and cadmium are adsorbed more strongly on iron gels as pH increases.

Lead has no known beneficial biological function. It is a toxic metal which accumulates in the tissues of organisms (EPA, 1976). The toxicity of lead in an aqueous environment depends upon pH, organic materials, and other metals. Low pH increases its solubility, whereas organic or inorganic complexing changes its bioavailabilty. Toxicity in sea water is not well known, but concentrations of 100 to 200 $\mu g/l$ caused severe abnormalities in the oyster Crassostrea virginica (Pringle, 1968).

Mercury has no known useful biological function, and several forms, from elemental to inorganic and organic compounds, occur in nature (EPA, 1976). The most toxic form is methyl mercury accumulated in animals, which can threaten humans. Jeune and Luoma (1977) reported that organic complexing with naturally occurring materials in the marine environment reduces the potential toxicity of mercury.

Zinc is an essential element for all living organisms (Berry, 1977). Excessive levels cause either acute or chronic toxic responses in marine organisms. Acutely toxic concentrations in fish may cause gill breakdowns, and chronic concentrations may inhibit growth and maturation in juvenile fish, or cause general lethargy and histological damage to mature individuals (EPA, 1976). Zinc toxicity is reduced by complexing with organic materials.

SOURCE INPUTS

Table C-1 lists trace metals from the four primary sources. Ocean waste disposal (excluding acid waste) is the most significant contributor of metals except lead and zinc.

Dredged material (Table C-6) is the largest source of cadmium, copper, chromium, lead, and iron; dredged material and sewage sludge contain approximately equal quantities of mercury.

Sewage sludge is the second largest source of trace metals (see Table C-6) and contributes about 50% of the daily input of mercury, with chromium (24%), lead (13%) and zinc (20%) also high.

Inputs from the Cellar Dirt Site have not been estimated, but are probably insignificant sources of trace metals (Interstate Electronics Corp., 1978).

Passing through the Transect Zone are contaminated water and surface runoff from New York Harbor and Raritan Bay estuary (Table C-1). Many contaminants entering the harbor settle in quiet water areas and remain trapped in bottom sediments. They may be introduced into the Apex after dredging and released at the Dredged Material Disposal Site. The Transect Zone contributes the largest volume of wastewater, with the largest average daily quantities of lead (47%), zinc (53%), and the second largest quantities of cadmium (15%), chromium (42%), copper (47%) and iron (16%).

The Long Island coastline contributes only minute quantities of trace metals to the Apex. Of the seven metals examined, the Long Island coastline contributes less than one percent of the daily total in all cases.

IRON

Redfield and Walford (1951) examined iron accumulation in waste discharges at Raritan Bay and the Apex. The iron concentration at the mouth of the Lower Bay was four to six times that of the offshore water concentrations. The high concentrations were associated with low salinity surface outflows from the Lower Bay. In 1951, the Raritan River contributed approximately 45 tonnes/day of iron to the Apex. It was estimated that an equal quantity of iron (45 tonnes/day) was disposed at the "acid grounds".

Segar and Cantillo (1976) reported that most iron is associated with suspended sediments in the lower New York Bay with maximal concentrations occurring just after maximum ebb tide (NOAA-MESA, 1975). This implies that a significant "pool" of particulate iron exists within the harbor complex. The bulk of this iron is precipitated or dispersed within a short period upon entering the Bight. In addition, Segar and Cantillo (1976) reported a widely distributed nephloid layer containing a high concentration of fine particulate matter, including iron, at the sediment-water interface within the Apex.

New York Harbor sediments showed iron as 1.8% of the total dry weight. Samples from the Dredged Material and Sewage Sludge Sites averaged 1.05% of the total dried sediment weight, which was not greatly different (Gross, 1970).

It is not possible to estimate the iron concentrations at each disposal site, because dredged material and sewage sludge are not analyzed for iron concentrations. In 1977, NL Industries began to report iron concentrations in its waste. Based on these values and the volumes discharged, Table C-8 shows the approximate amounts of iron released by NL Industries compared to other inputs. Initially, NL Industries contributed about three quarters of the total input of iron. In more recent years, their contribution has decreased to two thirds of the total (Appendix D).

OTHER TRACE METALS

Toxic trace metals have been examined by numerous researchers. Within the harbor waters, MESA (1975) reported that cadmium, lead, and mercury were below detection limits in waters of the Transect Zone. Particulate and soluble copper varied with the tide and sampling location. Copper was found primarily in the soluble form. Alexander and Alexander (1977) reported that particulate lead and cadmium were always less than 0.5 $\mu g/l$ and 0.1 $\mu g/l$, respectively.

Segar and Cantillo (1976) examined trace metals in Apex waters. Copper and cadmium were uniformly distributed during spring, except for isolated areas of increased concentration.

TABLE C-8
AMOUNTS OF IRON RELEASED INTO THE NEW YORK BIGHT APEX
(Tonnes/Day)

	1973	1974	1975	1976	1977*	1978†
NL Industries**	182.2	157.1	145.6	111.9	62.5	100.5
Other Sources††	51.0	51.0	51.0	51.0	51.0	51.0
Totals	233.2	208.1	196.6	162.9	113.5	151.5
Percent NL Industries	78	75	74	69	55	66

* Calculated only for the months NL Industries released waste at the Acid Site.
† Estimated from eight separate months of data.
** Data from EPA Region II files.
†† Data from Mueller et al., 1976. Sources include the Transect Zone, atmospheric fallout, and the New Jersey and Long Island coastlines.

Discharge from New York Harbor contains low concentrations of cadmium and copper. During summer, copper concentrations remain uniform, between 2 and 4 μg/l. Levels north of the Acid Site were usually higher than other regions of the Apex. Cadmium concentrations over the Apex varied slightly, but estuarine and near-bottom samples contained higher concentrations of these metals.

Segar and Cantillo (1976) concluded that summer and mid-winter metal concentrations were higher than spring and autumnal concentrations. During summer, the water column is stratified and restricted circulation increases the water's residence time which leads to higher equilibrium constants. In winter, current and wave energy increase sediment movements, thus releasing metals from resuspended sediments. Iron appears to be found predominantly in the suspended phase while copper, cadmium, and zinc are found predominantly in the dissolved phase. Therefore, copper, cadmium, and zinc are present only in small quantities.

Gross (1976a) found that high concentrations of trace metals were widely distributed within New York Harbor sediments. Chromium concentrations were approximately 300 g/tonne in lower harbor sediments. Copper was estimated at 200 g/tonne and lead was estimated at 700 g/tonne of sediment. In comparison, sediment samples from the Dredged Material and Sewage Sludge Sites had concentrations of about 150 g/tonne chromium, 90 g/tonne copper, and 150 g/tonne lead. The dredged material is an important source of contaminants to the Apex, but the ultimate sources of these metals are the contaminated waters flowing into New York Harbor.

Segar and Cantillo (1976) state that many of the solid wastes dumped into the Apex are rapidly dispersed and transported, so that flushing of the Apex must be an efficient process. The wastes may move seaward or possibly back towards shore. Freeland et al. (1976) and Freeland and Merrill (1977), however, concluded that most of the dredged material released into the Apex remains in place. Comparing a 1936 bathymetric survey with a 1973 survey, approximately 87% of the material released at the Dredged Material Site was still in the vicinity of the site. Earlier, Pararas-Carayannis (1973, 1975) had reached similar conclusions. Apparently, those metals which are loosely bound to the sediment are mobilized and quickly carried out of the Apex. The remainder are tightly bound to the sediments and hence have a low bio-availability, but metal bioconcentration can still occur. Gross (1976a) reported that deposits from the Hudson Shelf Valley south of the disposal sites contain metal-rich sediments and that metal build-up in bottom-dwelling organisms may be occurring.

OIL AND GREASE

Oil and grease is a general category which includes thousands of organic compounds. These contaminants may have either anthropogenic or natural origins, and produce both acute and chronic toxic responses in marine organisms (EPA, 1976). Larval and juvenile stages of marine organism life cycles may be especially sensitive to increased levels of these contaminants. Oil and grease are present in all contaminant sources except the atmosphere and cellar dirt, and enter the Apex at a rate of approximately 780 tonnes/ day (Table C-4), constituting the second largest quantity of all contaminants examined (Mueller et al., 1976).

Mueller et al. (1976) estimated that the Transect Zone contributed approximately 460 tonnes/day (57%). Ocean dumping contributed approximately 322 tonnes/day, of which 93% (300 tonnes) is from dredged material, and 7% (22 tonnes) from sewage sludge. The Long Island coastline contributes only about 0.7 tonnes/day, less than 1% of the daily total.

Examinations of the sources of oil and grease indicate that they are entirely of anthropogenic origin. Within the Transect Zone (Table C-5) two primary sources of oil and grease can be identified: (1) municipal and industrial wastewaters, and (2) urban discharge. Each contributes about 200 tonnes/day to the harbor area. By comparison, dredged material (Table C-6) contributes an average of 300 tonnes/day, indicating that much of the oil and grease reaching the harbor is trapped and retained in harbor sediments, and later removed by dredging activity. Coastal discharges (Tables C-2 and C-3) are from municipal and industrial wastes and surface runoff. New Jersey, which is highly industrialized, discharges about 75 tonnes/day along its coast. Presumably, little of this contamination ever reaches the Apex because of prevailing currents moving southerly along the coast. About 90% of the oil and grease from New Jersey is from surface runoff. The remaining 10% is from municipal and industrial wastewater. Long Island, which is much less industrialized, discharges only about 5 tonnes of oil and grease per day, and of this only about 15% (0.7 tonnes) enters the Apex. About 90% of the Long Island discharge is from municipal and industrial waste water. The remaining 10% is from surface runoff.

Appendix D

CONTAMINANT INPUTS TO THE NEW YORK BIGHT ACID WASTE DISPOSAL SITE

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Appendix D

CONTAMINANT INPUTS TO THE NEW YORK BIGHT ACID WASTE DISPOSAL SITE

PERMITS AND WASTE VOLUMES

YEARS 1973 TO 1979

When the Acid Site came under EPA regulations in 1973, three New Jersey companies (Du Pont-Grasselli in Linden, Allied Chemical in Elizabeth, and NL Industries in Sayreville) were using the site for disposal purposes. In 1974, Du Pont-Grasselli moved its entire waste disposal operation to the 106-Mile Site, as required by EPA. In 1980, only Allied Chemical and NL Industries are disposing of wastes at the Acid Site.

Records of NL Industries waste disposal activities have been maintained since the late 1950's. However, when the EPA began to regulate and monitor ocean disposal activities in 1973, more detailed analyses were required. NL Industries disposes of waste on a nearly daily basis, occasionally barging wastes twice a day to the site.

NL Industries is the largest waste contributor to the Acid Site in terms of amount of waste. Annual quantities (Table D-1) fluctuated considerably between 1973 and 1978, although the long-term average from 1958 is fairly stable (Figure D-1). The recent fluctuation was caused by a plant shutdown in mid-1976 and start-up again in mid-1977. For approximately nine months, all plant production was halted. The mean annual quantity of waste material dumped between 1973 to 1979, was 1.6 million tonnes, ranging from 0.605 million tonnes in 1977 to 2.3 million tonnes in 1973. Since 1958, NL Industries has contributed over 90% of the total volume of waste material dumped at the Acid Site.

TABLE D-1
DISPOSAL QUANTITIES AT THE ACID SITE
(Tonnes/Year)

	1973	1974	1975	1976	1977	1978	1979	TOTAL
NL Industries	2,304,250	1,986,735	1,841,586	1,233,722	604,733	1,233,792	1,365,940	10,570,758
% Contribution	92.0	93.5	97.5	96.5	95.4	97.9	97.9	
Allied Chemical	58,967	56,245	48,081	47,174	29,030	26,259	29,930	295,686
% Contribution	2.3	2.6	2.5	3.6	4.6	2.1	2.1	
Du Pont-Grasselli	142,428	78,018	---	---	---	---	---	220,446
% Contribution	5.7	3.7	---	---	---	---	---	
TOTALS	2,505,645	2,120,998	1,889,667	1,280,846	633,763	1,260,101	1,395,870	11,086,890

Records of Allied Chemical waste disposal activities have been maintained since the EPA began regulating and monitoring waste disposal at the Acid Site in mid-1973. Since 1973, Allied Chemical has disposed of approximately 295,000 tonnes of waste material, averaging about 42,300 tonnes/year (data from 1973 to 1979).

Allied Chemical wastes are less than 5% of all waste material released at the Acid Site. Unlike NL Industries, Allied Chemical disposes of waste material intermittently, only once or twice a month. The total volume of Allied Chemical waste barged to the Acid Site has dropped 51% since 1973.

Du Pont-Grasselli discontinued disposal activity at the Acid Site in 1974. At that time, they transferred their entire disposal operations to the 106-Mile Site. During 1973-74, in which Du Pont dumped at the Acid Site, they disposed of approximately 220,000 tonnes of waste material, or about 5% of the annual input.

PROJECTED INPUTS

NL Industries' permit, which expires 9 April 1981, allows them to dispose of 2.7 million tonnes of acid wastes during the 2-year permit term, or about *1.4 million tonnes per year. This is lower than the previous 7-year average* (1.5 million tonnes). The maximum amount permitted in a year under this

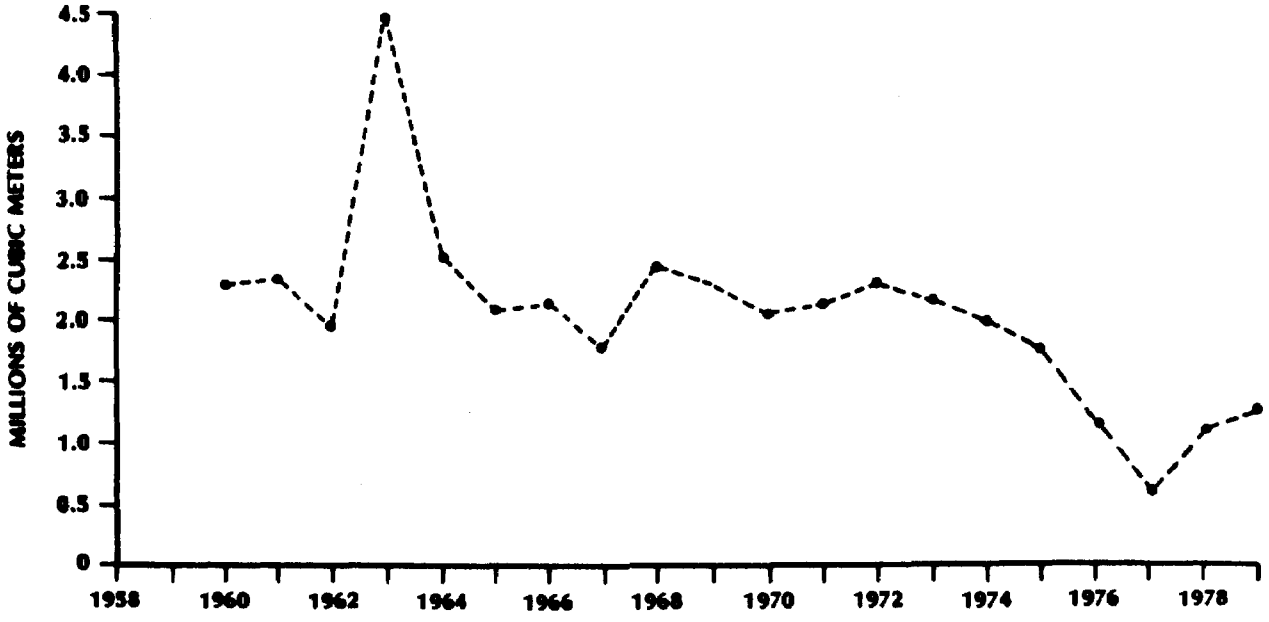

Figure D-1. Reported Dumping Volumes at the Acid Site
(Adapted from EPA, 1978a)

permit is 2.3 million tonnes, which is about equal to the long-term average of 2.2 million tonnes.

Allied Chemical's permit, which expires 14 January 1982, allows them to dispose of 52,000 tonnes of acid wastes per year, which is higher than the previous 7 year average annual input (42,250 tonnes). However, Allied Chemical anticipated that 1979 discharge volumes would be about the same as the 1978 volume (26,000 tonnes), which is about half of the permitted amount (Fitts, 1979). The actual amount dumped (30,000 tonnes) was slightly higher than this estimate.

Consequently, the two permittees are authorized to release approximately 1.4 million tonnes per year, which is 10% less than the previous 7-year average.

WASTE CHARACTERISTICS

Each barge sample analysis (for the Acid Site) since 1973 has been reviewed to estimate the total constituent loading. Interstate Electronics Corporation has developed an automated data handling and analysis system; the Oceanographic Data Environmental Evaluation Program (ODEEP). ODEEP was used to evaluate the wastes dumped at the Acid Site. The results of the analyses of NL Industries and Allied Chemical's wastes are presented in this section. Only yearly means and ranges are presented. There were no significant differences in waste characteristics during different seasons; consequently, the yearly values adequately represent the dumps at the site. Approximately 3,600 data points were used for these analyses. When evaluating this loading, two factors are important:

- The liquid waste does not appear to affect the bottom.
- The waste is neutralized rapidly (in minutes) and environmental effects have been associated only with unneutralized waste.

Waste constituents do not accumulate in the water column, thus the materials do not remain at the site, but are carried out of the Apex. The amounts per day of waste constituents are most relevant, since these represent roughly the inputs from a single barge load.

NL INDUSTRIES

NL Industries disposes of wastes produced in the manufacture of titanium dioxide, an inert, nontoxic white pigment used in paper, paint, plastic, drugs, and ceramics. Waste material consists of approximately 10.0% (by weight) ferrous sulfate ($FeSO_4$), 8.5% (by weight) sulfuric acid (H_2SO_4), and 1.5 - 2.0 g/l titanium. Other trace metals, and oil and grease are present in minute quantities.

The waste is released below the surface of the water through 30-cm diameter pipes in the wake of a barge. The barge is moving at 5 to 6 kn. The maximum permissible disposal rate is 376,000 liters (100,000 gal) per nmi. Using this discharge rate, an average barge load of 3.7 million liters of waste can be released in approximately 90 minutes, over a distance of about 9 nmi. As the waste is released into the seawater, the acid is neutralized, and the ferrous sulfate stains the water a characteristic green color. The ferrous iron is rapidly oxidized to ferric hydroxide (rust) and this gives the water a "muddy," red-brown color.

PHYSICAL CHARACTERISTICS

Specific gravity of NL Industries waste has, with one exception, ranged between 1.082 and 1.197 (a single value of 1.426 was reported in August 1976). The average specific gravity is 1.132. These densities are greater than seawater (1.025), therefore the waste sinks and disperses through the water column during periods of homogeneous water column density (winter). During summer months, when distinct thermocline and pycnocline stratifications occur, sinking and dispersion are restricted to the upper mixed layer, which is typically 10 to 15 m in depth.

The speed of the mixing of waste with seawater is a function of prevailing meteorological and oceanographic conditions. After discharge from the barge, mixing occurs rapidly (within the first 15 minutes), primarily as a result of barge generated turbulence. Later the wind, waves, currents, and density stratification determine the rate and direction of dispersion and dilution. The most recent dispersion study of NL Industries waste was performed by EG&G (1977a) in August 1977. Waste material sank to a depth of 10 m and rapidly dispersed laterally under conditions of high winds and moderate seas.

EG&G (1977a) recorded seawater iron concentrations and pH values to track the waste plume. A concentration of 2 μg/l (acid-waste) of seawater was equivalent to the ambient seawater iron level and a value of 5 μg/l indicated the presence of the waste plume. Before the disposal operation, iron

concentrations in the upper mixed layer and below the thermocline were measured at reference stations. The mean iron concentration of upper mixed layer water was 0.05 µg/l and the mean iron concentration of subsurface layer water was 0.02 µg/l. Immediately following discharge, the surface iron concentration was 25,500 mg/l. The concentration dropped rapidly and 14 minutes after discharge the maximum surface iron concentration was 1.9 mg/l.

By monitoring iron concentration, the dilution factor can be determined. Forty minutes after discharge, the waste was diluted to 9,400:1. After four hours the minimum waste dilution was 90,000:1, and after 18 hours one sample showed a minimal dilution of 116,000:1.

Federal environmental standards require that wastes do not change the ambient pH level more than 0.2 pH units beyond accepted limits of 6.5 to 8.5 (EPA, 1976). The EG&G (1977a) study had only one station with a pH change greater than 0.2 pH units below the previously observed ambient value. In that case, two 1-m samples had pH's of 7.95 and 7.99, reduced 0.25 and 0.21 pH units, respectively, from the mean ambient surface value of 8.2. The reduced values occurred about 15 and 35 minutes after discharge and were well within the normal pH range for this area of 7.9 to 8.2 (Hazelworth, 1974).

CHEMICAL CHARACTERISTICS

Table D-2 summarizes the characteristics of various waste constituents and the inputs into the Apex. For convenience, the total input from all sources of each constituent are shown for comparison. Obviously, the contaminants present in NL Industries waste are trivial (<1%) sources of total contaminant loading in the Bight. Comments about specific waste characteristics follow.

pH

The extremly low pH of NL Industries waste is rapidly neutralized by the buffering action of sea water. The time to reestablish ambient pH values has

TABLE D-2
WASTE CHARACTERISTICS -- NL INDUSTRIES

Chemical Parameters	Range (µg/l)	Mean (µg/l)	Average Yearly Input (tonnes)	Average Daily Input (tonnes/day)	Average Daily Input-other sources (tonnes/day)	Percent Acid Waste Input
Suspended Solids (mg/l)	2.0 - 20,500	3,760	2.980	12.6	23,580	0.05
Organics	190 - 50,600	5,440	6.0	0.02	783	0.014
Petroleum Hydrocarbons	200 - 48,200	4,650	3.7	0.01	no data	-
Cadmium	10 - 500	200	0.3	*	2.43	*
Chromium	2,000 - 18,900	10,900	14.2	0.04	5.26	0.8
Copper	123 - 140,200	4,100	4.8	0.01	13.2	0.08
Lead	270 - 880	1,670	2.1	<0.01	12.4	0.08
Mercury	0.5 - 8	4.7	0.005	*	0.52	*
Zinc	480 - 36,100	2030	26.4	0.07	32.1	0.2
Physical Parameters						
Specific Gravity	1.082 - 1.197	1.132				
pH	0.10 - 1.09	-				

* = Not meaningful.

ranged from minutes (Redfield and Walford, 1951) to 2.5 hours (EG&G, 1977a). Ambient pH levels are never depressed outside the site boundaries during the 4-hour period of initial mixing (ERCO, 1978a). The extremely low pH values which cause harmful effects to the plankton are present for only a brief period (less than 30 seconds; Redfield & Walford, 1951), and only around the barge discharge port.

Suspended Solids

Some inert materials, gangue and uncombined titanium ore, are present in the waste, and then are suspended solids reported in Table D-2. The iron floc which forms after waste release is not part of the values. However, even with this additional suspended material, there is no danger that waste constituents could reach the shoreline in measurable amounts. ERCO (1978a) calculated that minimum dilution of the waste, if it moved in a straight line directly to the beach, would be 2,000,000:1. The concentration of iron, the most abundant waste component, would be about half of the normal, ambient value.

Trace Metals

Four metals (arsenic, nickel, titanium and iron), in addition to the six in Table D-2, are measured in NL Industries' waste. Although toxic, arsenic forms compounds after release and the organometallic complexes do not appear to accumulate in the food chain, and are not highly toxic (EPA, 1976). This conclusion is supported by bioassay results which have shown low toxicity in neutralized acid wastes (see Bioassay Section). Nickel, titanium, and iron in these amounts are considered to be nontoxic to man (EPA, 1976).

Titanium and iron are present in high concentrations in NL Industries' waste; 1.9 g/l and 27.6 g/l, respectively. Daily inputs average 8.6 and 148 tonnes/day, and represent a major source of the metals at the Apex. Field observations and bioassay results have shown no adverse effects on the plankton from the metals (Appendix B).

TOXICITY

As outlined above, waste from NL Industries is an insignificant source of contaminants to the Apex. Iron and titanium, which are significant inputs, are nontoxic. However, the waste is released in a small area over a short time and localized effects may occur in the site region. Therefore, the EPA requires bioassays and field studies to evaluate the toxicity of the wastes. This work has demonstrated that wastes are toxic only for a few minutes after discharge; long-term, chronic effects have not been observed.

Bioassays

Bioassays of NL Industries' wastes must include analyses of the effects of various waste concentrations upon organisms indigenous to the disposal site. Bioassays are now conducted under procedures required by Federal standards (EPA, 1978b).

Bioassays have been performed upon waste samples since the permit program started. Representative species in these studies include the phytoplankter, Skeletonema costatum, and fish, Menidia menidia. Artemia salina (an estuarine copepod) was used extensively in the past, but the latest bioassay standards require the use of more representative marine organisms.

Phytoplankton test organisms are to be examined for the effective concentration (EC_{50}) which causes a 50% reduction in cell numbers (compared to a control group) after 48 or 96 hours. Zooplankton and nekton are examined for the lethal concentration (LC_{50}) at which 50% of the test organisms die after 48 or 96 hours.

Results of bioassay tests, conducted since 1973, show that the toxicity to Artemia salina varies between LC_{50} values of 100,000 mg/l to 1,155 mg/l. Variations are due primarily to changes in the Federal mandates for tests (before 1977, unneutralized wastes were used) and test organisms, and not because of radical changes in the toxicities of the material. The annual mean LC_{50} values for Menidia menidia bioassays ranged from 92.4 mg/l to 302 mg/l in non-aerated, 96-hour tests. Simultaneous bioassays on M. menidia in 96-hour, aerated tests, had mean LC_{50} values of 101 mg/l (1977) and 282 mg/l (1978). Bioassays on Skeletonema costatum had mean 96-hour LC_{50} values of 174 mg/l (1976), 241 mg/l (1977) and 106 mg/l (1978).

Tests demonstrate that waste materials dispersed by NL Industries will be acutely toxic to planktonic organisms for only a few minutes. The dilution of waste occurring immediately after discharge reduces concentrations to values below the levels known to be toxic to representative organisms. The concentration of iron, the most abundant waste contaminant, was 1.9 mg/l fourteen minutes after discharge (EG&G, 1977a). The tests do not, however, evaluate chronic effects which may impair reproductive or behavioral aspects of species at the individual or population levels. Field observations (see below) confirm the low toxicity of waste in the barge wake.

Field Studies

The first biological observations of effects due to acid waste disposal (Redfield and Walford, 1951), showed that fish or benthic populations were not being damaged or excluded from the area. Zooplankton entrained in contaminated wake water were temporarily immobilized but recovered when the contaminated water was diluted, which occurs rapidly in the barge wake.

Ketchum et al. (1958a) reported that plankton tows, taken shortly after acid-iron waste disposal, were clogged by flocculent iron precipitate ranging from 5 to 70 microns in diameter. Zooplankton (which normally feed on phytoplankton in that size range) captured in the wake did contain large quantities of "brownish material" which was "presumably the iron precipitate." The zooplankton appeared normal and it was stated that the "studies have failed to demonstrate any deleterious effect of this waste disposal on the plankton populations of the area."

The most recent comprehensive study of the effects of acid-iron wastes was reported by Vaccaro et al. (1972). A waste concentration four times greater than values observed in the field produced no adverse effect on phytoplankton growth or diversity. Only the zooplankton showed chronic effects. After eighteen days of exposure, reproduction and growth were affected by a concentration of 1:10,000 waste, showing a "failure of the organisms [zooplankton] to reproduce, or a delay in the time required to transform eggs into adults." The results, however, are not biologically significant, since this waste concentration occurs for only a few minutes after disposal.

Field studies discovered dissimilarities in zooplankton communities at the Acid Site and at control areas. The mean zooplankton abundance was greater in control areas but the ranges of abundance values were similar at the site. It was concluded that differences were due to a transitory, large-scale patchiness and not acid-iron waste toxicity.

Levels of eight trace metals in zooplankton, benthos, and sediments were examined. Concentrations in the Acid Site area were significantly higher than in the control area. However, samples from the Hudson Shelf Valley had the

highest assimilations of lead and chromium in benthos and the highest amounts of all eight metals in sediments, suggesting that Valley sediments may be the area of greatest heavy metal enrichment. The control area was located outside of the Apex, thus the results may only show that, in general, metal concentrations inside the Apex are higher than those outside.

Grice et al. (1973) concluded that short-term effects of acid waste disposal are due to short-term acidity fluctuations rather than toxic components of waste material. Mortality during short-term exposure to high concentrations of the waste material is small; it is notable that adults and larvae are not appreciably affected by heavy concentrations. It was noted that reproductive inhibition of adults and reduced survival of young copepods occurred only after 18 days of exposure. The pH was held below 6.5, but these levels occur for only minutes after actual discharges. No mortality was observed when the animals were passed through acid waste dilutions at pH levels and periods comparable to barge dumps. Gibson (1973) confirmed earlier experiments that the acidity of the waste is the toxic factor. Animals held in neutralized acid waste showed no mortality, whereas others kept in sulfuric acid solutions, simulating acid waste, showed high mortality at pH levels less than 5.5.

Some work on biological assimilation of trace metals was performed at the former Delaware Bay Acid Site. Until 1978, Du Pont-Edge Moor discharged an acid-iron waste at this site similar to wastes released by NL Industries. Pesch et al. (1977) investigated trace metals in scallops at two disposal sites offshore Delaware Bay: the Acid and Sewage Sludge Sites. The input of four metals (iron, manganese, vanadium, and titanium) were primarily due to the acid wastes, not the sewage sludge. Consequently, these four metals could be used as tracers of acid waste accumulations in an area which is isolated from other anthropogenic pollutant sources. Pesch et al. (1977) found an area of high vanadium concentrations in scallops south of the site, in the direction of projected plume transport. Examinations of the other three metals, however, did not follow the same trends; when all four metals were considered, "high" stations existed to the south and north of the site, occasionally near a "low" station. The findings, although indicating possible effects of acid-iron waste upon benthic organisms, require more confirmatory

evidence. Additional work (Reynolds, 1979) indicated that this method of "tagging" the acid wastes is unfeasible. (See Appendix F, Comment 23-14.) In the Apex, such effects would not be observable because of the high inputs of contaminants from sewage sludge and other sources.

ALLIED CHEMICAL

Allied Chemical Corporation disposes of wastes resulting from the manufacture of refrigerants. Waste materials consist of approximately 30% (weight) hydrochloric acid, 2% (weight) hydrofluoric acid, and trace constituents in aqueous solution. Trace metals and oil and grease are present in minute quantities.

Wastes are released below the ocean surface through 30 cm diameter pipes into the wake of a barge moving at 5 to 6 knots. The maximum permissible disposal rate is 45,400 liters (12,000 gal) per nmi. Therefore an average waste load of 1.6 million liters can be emptied in approximately six hours, over a distance of about 35 nmi. Allied Chemical waste does not discolor the receiving water.

PHYSICAL CHARACTERISTICS

Specific gravity (density) of Allied Chemical waste, with two exceptions, has ranged between 1.116 and 1.200 (values of 1.57 and 1.60 were reported March and April 1976). The mean value is 1.170 which is greater than seawater (1.025); thus waste sinks and disperses through the water column during periods of homogeneous water column density. In summer months, when the water column is stratified, sinking and dispersion are restricted to the upper mixed layer stratum, usually about 10 to 15 m deep.

Dispersion studies of Allied Chemical waste were conducted by EG&G, Environmental Consultants (EG&G, 1977b). Waste material sank rapidly to the bottom of the surface mixed layer and remained there. After several hours, no significant penetration of the thermocline was observed. The wastes were tracked by monitoring dye concentration and pH changes.

Waste concentration diminished uniformly with depth during the first few hours of dispersion. The maximum waste concentration was 360 mg/l one minute after discharge, and about 36 mg/l 45 minutes later. After about two hours, vertical waste distribution began to exhibit patchiness, with localized areas of high concentrations above the thermocline and near the surface. After three hours, maximum concentrations were found near the thermocline. Four hours after discharge, maximal waste concentration was 18 mg/l at 5 m.

One minute after discharge, the dilution ratio was approximately 2,700:1, increasing to 15,000:1 in 4 minutes. Three hours after discharge, the dilution ratio was 83,000:1, and 143,000:1 after four hours.

Current shear was a noticeable factor in waste dispersion. The upper 10 m (mixed layer) appeared to move eastward relative to the subsurface core at 10 m. The entire plume moved with tidal currents approximately 2 nmi (3.7 km) west of the original position.

Marine water quality criteria specify that pH must be maintained between 6.5 and 8.5, and may not be affected by more than ± 0.2 pH unit. Ambient pH values decreased 0.7 unit immediately after discharge, but, as natural neutralizing and dilution continued, the pH within the plume steadily returned to ambient values. Four hours after discharge, pH values had returned to within 0.2 pH unit of normal ambient levels.

CHEMICAL CHARACTERISTICS

Table D-3 summarizes characteristics of various waste constituents in Allied Chemical waste and inputs to the Apex. Inputs from all sources are shown for comparisons. Obviously, the contaminants present in Allied Chemical waste are trivial sources (<0.01%) of total contaminant loading in the Bight. Comments about specific waste characteristics follow.

TABLE D-3
WASTE CHARACTERISTICS -- ALLIED CHEMICAL

Chemical Parameters	Range (μg/l)	Mean (μg/l)	Average Yearly Input (tonnes)	Input per Barge * (tonnes)	Average Daily Input-other sources (tonnes)	Acid Waste Input (%)
Suspended Solids (mg/l)	10 - 246	25 mg/l	0.7	0.06	23,580	**
Oil & Grease	100 - 20,000	4,450	0.2	0.02	783	<0.01
Petroleum Hydrocarbons	100 - 13,000	1,560	0.07	0.01	No data	-
Cadmium	2 - 200	16	0.01	**	2.4	**
Chromium	10 - 3,040	199	0.04	<0.01	5.3	0.2
Copper	10 - 2,400	124	0.03	<0.01	13.2	0.08
Lead	10 - 480	102	0.02	<0.01	12.4	0.08
Mercury	0.02 - 170	12.5	0.01	**	0.5	**
Zinc	2 - 1,200	156	0.03	<0.01	32.1	0.03
Physical Parameters						
Specific Gravity	1,116 - 1.200	1.170				
pH	0.10 - 2.20	-				

* Assume 12 barges/year.
** Not meaningful.

pH

The extremely low pH of Allied Chemical waste is neutralized by buffering action of seawater well within the 4-hour period of initial mixing mandated by the Ocean Dumping Regulations. The initial pH value is 7.5 after waste release (EG&G, 1977b), which is 0.7 unit less than ambient values and lower than the normal pH range of the site. The pH values rapidly return to ambient levels. Minimal pH values after initial mixing were: 8.07 at 1 m; 7.90 at 5 m; and 8.03 at 10 m. Normal ambient pH range for this area is 7.9 to 8.2 (Hazelworth, 1974).

Suspended Solids

Allied Chemical waste does not contain insoluble materials, and does not react with seawater to form precipitates. There is no danger of waste constituents reaching the shoreline in measurable amounts. ERCO (1978b)

calculated that minimum dilution of the waste, traveling directly to the beach, would be one million to one. The concentration of fluoride, the most abundant waste component, would be about 2% of the normal ambient value.

Trace Metals

Two metals, arsenic and nickel in addition to the six in Table D-3, are measured in Allied Chemical waste. Comments applied to NL Industries wastes are equally applicable to those from Allied. The nontoxic nature of neutralized acid waste is convincingly proven by bioassay results, from which conventional LC_{50} values cannot be derived (ERCO, 1978b).

TOXICITY

Bioassays

Allied Chemical does not dispose of waste daily, unlike NL Industries; Allied Chemical introduces waste in a pulsate manner. Wastes may accumulate for several weeks, and are barged to the site once or twice per month. Redfield and Walford (1951) concluded that total flushing of the entire Apex takes from 8 to 14 days. Therefore, Allied Chemical waste is extensively diluted and, in all probability, flushed from the Apex before any subsequent disposal occurs, thus eliminating the potential for compounds to accumulate in sediments or biota of the Apex.

Results of bioassay tests show annual mean 96-hour LC_{50} values in *Artemia salina* (copepod) ranging from 52,833 mg/l to 97,429 mg/l. Similarly, 48 hour LC_{50} yearly mean values for *A. salina* range from 123 mg/l to 235 mg/l. The differences in lethal concentrations do not suggest extreme toxicological effects, but are rather due to differences in test procedures.

Skeletonema costatum (phytoplankton) have mean 96-hour EC_{50} values ranging from 106 mg/l to 350 mg/l with respective standard deviations of 22 and 342 mg/l.

Menidia menidia (fish) have annual mean TL_{50} values for 96-hour aerated samples ranging from 203 mg/l to 278 mg/l. TL_{50} values from 48-hour tests have annual mean values ranging from 233 mg/l to 280 mg/l. Non-aerated tests produce approximately equal TL_{50} values for the same waste samples.

Acartia tonsa (an estuarine copepod) had a mean 96-hour LC_{50} value of 72 mg/l in 1975, and a mean 96-hour TL_{50} value of 89 mg/l in 1976.

All tests demonstrated that waste materials disposed by Allied Chemical have only short-term acute effects upon marine organisms. The highest waste concentration was 360 µg/l one minute after discharge, but only 36 µg/l 45 minutes after discharge. Waste dilution several minutes after discharge reduces concentrations to values below the toxic levels of representative organisms.

Field Studies

Allied Chemical does not dispose of acid waste material as frequently as NL Industries, nor are waste volumes as great as NL in single disposal operations. However, Allied Chemical waste is more acidic, thus necessitating a slower release into receiving waters in order to minimize short-term impacts upon biota.

Chemical analyses have confirmed that the compositions of NL and Allied wastes are similar (except for iron and titanium content), and bioassay studies show similarities in toxicity. Therefore, impacts of the two wastes are assumed to be similar in the dump area.

DU PONT-GRASSELLI

Du Pont-Grasselli produces production wastes from DMHA (N,O-dimethyl hydroxylamine) and Anisole. During 1973 and 1974 when Du Pont-Grasselli was dumping in the Acid Site, the contribution was approximately 5% of the annual input (Table D-1). Since 1975, however, all Du Pont wastes have been released at the 106-Mile Site.

The primary constituent of Du Pont-Grasselli waste is sodium sulfate (Na_2SO_4), with numerous trace metals, suspended solids, and various organic substances.

Specific gravity of Du Pont waste averaged 1.089, slightly greater than sea water, but less than NL Industries and Allied Chemical wastes.

Du Pont-Grasselli waste was alkaline, with a pH range from 12.5 to 13.3, during two years of waste disposal at the Acid Site. Mass loadings of the inputs are equivalent to those of Allied Chemical, i.e., insignificant compared to the total inputs. No adverse effects from Du Pont-Grasselli wastes were ever noted at the Site or in the Apex.

In the same manner as NL Industries and Allied Chemical wastes, releases would have been rapidly diluted, dispersed, and transported by currents to other Bight regions. Since Du Pont liquid waste was diluted, and transported out of the Apex, contaminants did not accumulate in the water; thus Du Pont-Grasselli dumping is important in a historical sense, but is not relevant to current mass loadings.

COMPARISON OF CONTAMINANT INPUTS

Table D-4 compares total inputs of selected contaminants into the Apex with total inputs of the two permittees presently (1980) using the Acid Site. All acid waste contaminants are less than 1% of the total (column 7). The materials now being released at the Acid Site do not represent significant sources of contaminants in the receiving waters.

TABLE D-4
MASS LOADING - NEW YORK BIGHT APEX
(Tonnes/Day)

	Suspended Solids	Oil and Grease	Cadmium	Chromium	Copper	Mercury	Lead	Zinc
Total Inputs to Apex	23,580	783	2.41	5.3	13.2	0.5	12.4	32.1
Total Inputs to Acid Site								
NL Industries	12.6	0.02	*	0.04	0.01	*	< 0.01	0.07
Allied Chemical	0.06	0.02	*	< 0.005	< 0.005	*	< 0.005	0.00
Total	12.7	0.04	*	0.04	0.01	*	*	0.07
Percentage of Apex Total due to Acid Wastes	0.05	< 0.01	*	0.8	0.08	*	*	0.2

* - Not meaningful.

Appendix E
MONITORING

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TABLE

Table

E-1 Physical and Chemical Oceanographic Monitoring Program at and Adjacent to the New York Acid Waste Disposal Site E-4

Appendix E

MONITORING

The Final EPA Ocean Dumping Regulations and Criteria (40 CFR 220 to 229) established the following monitoring requirements (Part 228.9):

(a) The monitoring program, if deemed necessary by the Regional Administrator or the District Engineer, as appropriate, may include baseline or trend assessment surveys by EPA, NOAA, other Federal agencies, or contractors, special studies by permittees, and the analysis and interpretation of data from remote or automatic sampling and/or sensing devices. The primary purpose of the monitoring program is to evaluate the impact of disposal on the marine environment by referencing the monitoring results to a set of baseline conditions. When disposal sites are being used on a continuing basis, such programs may consist of the following components;

(1) Trend assessment surveys conducted at intervals frequent enough to assess the extent and trends of environmental impact. Until survey data or other information are adequate to show that changes in frequency or scope are necessary or desirable, trend assessment and baseline surveys should generally conform to the applicable requirements of 228.13. These surveys shall be the responsibility of the Federal government.

(2) Special studies conducted by the permittee to identify immediate and short-term impacts of disposal operations.

(b) These surveys may be supplemented, where feasible and useful, by data collected from the use of automatic sampling buoys, satellites or in situ platforms, and from experimental programs.

(c) EPA will require the full participation of other Federal and State and local agencies in the development and implementation of disposal site monitoring programs. The monitoring and research programs presently supported by permittees may be incorporated into the overall monitoring program insofar as feasible.

SHORT-TERM MONITORING

Short-term monitoring surveys are the responsibility of the permittee, and are designed to assess the immediately observable effects of the waste (a "special study," as defined in the Ocean Dumping Regulations).

Special Condition No. 6 of the ocean disposal permits issued to Allied Chemical Corporation (Permit No. II-NJ-004) and NL Industries, Inc. (Permit No. II-NJ-014) requires these companies to "continue to implement [their] EPA approved monitoring program as a means of determining the short term environmental impacts of ocean dumping of [their] waste(s)." Applicants will be required to continue an EPA-approved monitoring plan as a condition of any future permit. The permittee's program will evaluate the short-term effects of the waste.

In May 1977, the companies submitted a site monitoring proposal (including quality assurance and quality control programs) prepared by EG&G, Environmental Consultants, to fulfill the site monitoring requirements. Four monitoring cruises have been completed at the site (EG&G, 1977c, 1978a, 1978b, 1978c; ERCO, 1978c). The information from these cruises provides a sufficient data base to detect any longer term changes at the site due to acid waste disposal.

Initially, surveys were made during the summer (strong thermocline) and winter (no thermocline) seasons. Nine stations were originally established: two (now one) permanent reference stations northeast of the site, five permanent stations within the site (a center and four corner stations), and two "waste transport" stations, which are established in a waste plume on each cruise (Figure E-1). Two changes were approved in July 1978 (between the

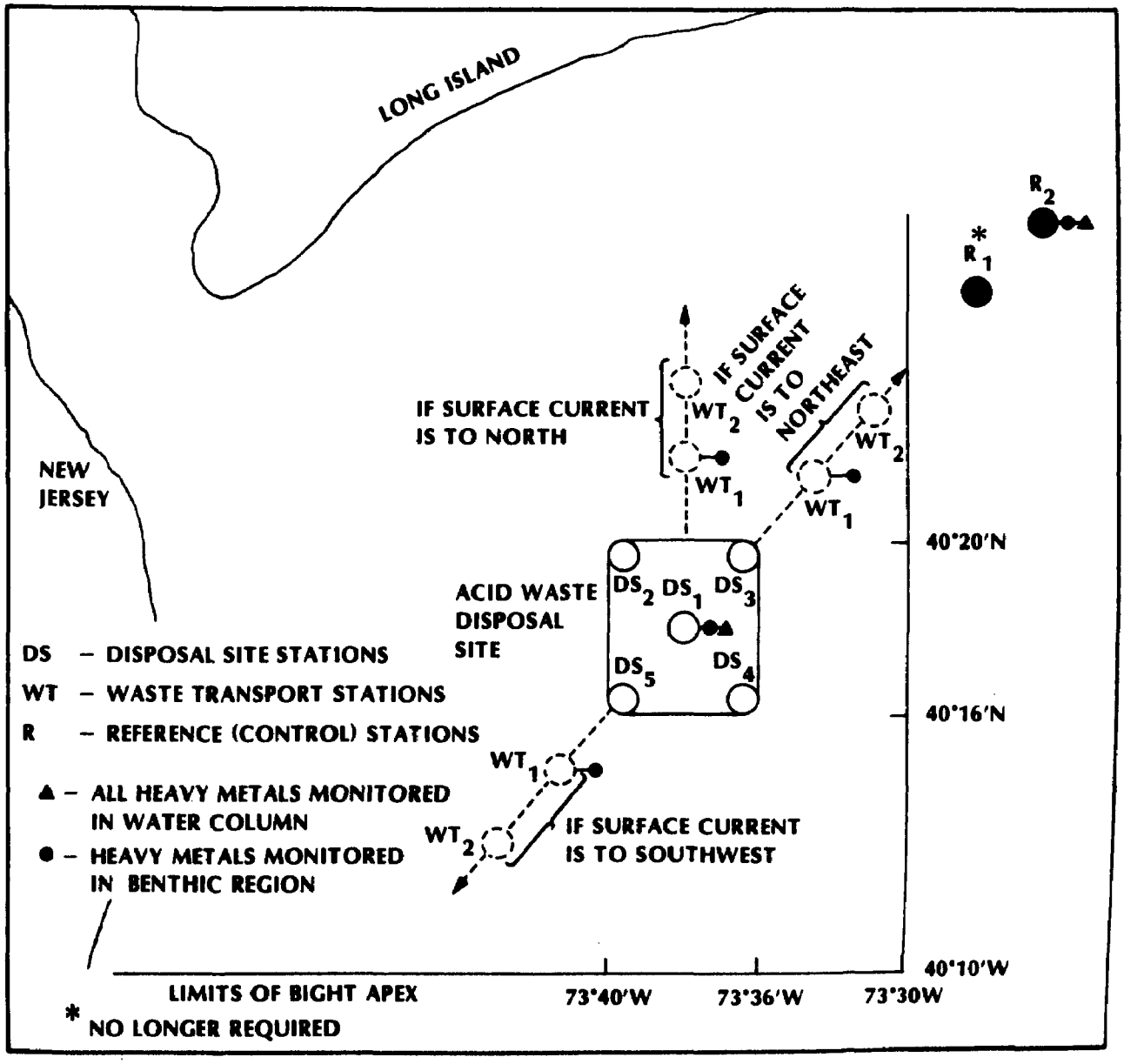

Figure E-1. Monitoring Stations at and Adjacent to the Acid Waste Disposal Site

TABLE E-1
PHYSICAL AND CHEMICAL OCEANOGRAPHIC MONITORING PROGRAM AT AND ADJACENT TO THE NEW YORK ACID WASTE DISPOSAL SITE

Water column sampling

- Winter - 3 depths (subsurface, mid, bottom) no longer required
- Summer - 4 depths (subsurface, above pycnocline, below pycnocline, bottom)

Parameter	Unit of Measure	Stations	No. of Samples
Temperature	°C	All	Profile
Salinity	°/oo	All	Profile
pH		All	2
Dissolved oxygen	ml/liter	All	2
Alkalinity	meq/liter	All	2
Fluoride	mg/liter	All	2
Suspended Particulate Matter	µg/liter	All	2
Chlorophyll a	mg/m^3	All	2
Iron-dissolved	µg/liter	All	2
-particulate	µg/liter	All	2
Nonferric trace metals - arsenic, cadmium, chromium copper, lead, mercury, nickel, titamium, zinc		Center of site and reference	
Dissolved	µg/liter		2
Particulate	µg/liter		2
Benthic Sampling (Surficial Sediment)			
Color	Qualitative	3-Site center,	2
Texture	Description	Reference,	2
Trace metals - iron, arsenic cadmium, chromium copper, lead, mercury, nickel, titanium, zinc	mg/kg dry weight	Waste transport	2

third and fourth survey). One reference station was eliminated and vanadium analyses in the water column and sediments were eliminated (Anderson, 1978). Since 1979, only the summer survey is required. Table E-1 summarizes the parameters measured for the monitoring plan.

This sampling program is the minimal design sufficient to detect changes resulting from acid waste disposal. The effects documented at the site are transitory (Appendix B) and have not caused long-term, measurable damage to populations of organisms indigenous to the site or adjacent areas. Chemical changes in the water column caused by disposal are brief, and all values return to ambient levels well within the 4 hour mixing period (ERCO, 1978a, 1978b). Harmful effects to the plankton have been shown but only last for a few minutes. Effects on the bottom have not been documented, although waste contaminants may reach the sediments during the winter, when the water column is well mixed.

The physical and chemical variables presently monitored were chosen based upon the composition of the wastes and the possible effects of waste discharge. The water column sampling is sufficiently adequate to detect unusual adverse effects of disposal, while the benthic sample analyses can show if waste constituents are accumulating in the sediments. Therefore, no changes in the present monitoring program are proposed.

LONG-TERM MONITORING

Long-term monitoring surveys are the responsibility of the Federal government, and are designed to assess progressive changes caused by waste disposal, which may be indicated only by subtle changes in selected characteristics over time. NOAA-MESA is involved in developing an overall program for monitoring the conditions in the Apex. One goal of the MESA Project is to "determine the requirements for an efficient monitoring program that will detect environmental change (NOAA-MESA, 1978)". The "Ocean Pulse" program being developed by the NMFS-Sandy Hook Laboratory, will further provide valuable monitoring data.

Impetus to the formal monitoring programs was provided by the passage of the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978 (PL 95-273), which requires NOAA to develop a 5-year plan for ocean pollution research and monitoring. Long range studies and trend assessment of waste disposal in a complex oceanographic area such as the Bight, with its multiple contaminant sources, are feasible only by the combined resources of several agencies under the NOAA five-year plan.

Appendix F

RESPONSES TO WRITTEN COMMENTS ON THE DRAFT EIS

The Draft EIS (DEIS) was issued on 6 December 1979. The public was encouraged to submit written comments. This Appendix contains copies of written comments received by EPA on the DEIS. There was a great variety of comments received; thus, EPA presents two levels of response:

- Comments correcting facts presented in the EIS, or providing additional information, which have been incorporated into the text and noted in this section.

- Specific comments, which were not appropriately treated as text changes, have been numbered in the margins of the letters, and responses have been prepared for each numbered item.

Some written comments were received after the end of the comment period. In order to give every consideration to public concerns, the Agency took under advisement all comments received up to the date of Final EIS production.

The EPA sincerely thanks all those who commented on the DEIS, especially those who submitted detailed criticisms which reflected a thorough analysis of the EIS. A list of the commenters by name and agency is presented in Chapter 5.

COMMENTS

1

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230
(202) 377-4335

February 20, 1980

Mr. Henry L. Longest, II
Deputy Assistant Administrator
for Water Program Operations
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Longest:

This is in reference to your draft environmental impact statement entitled, "For New York Bight Acid Waste Disposal Site Designation." The enclosed comments from the National Oceanic and Atmospheric Administration and the Maritime Administration are forwarded for your consideration.

1-1 Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight (8) copies of the final environmental impact statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosures Memos from: Mr. Robert B. Rollins
National Ocean Survey - NOAA

Mr. Garry F. Mayer
RFx51 - NOAA

Capt. George S. Steinman
Chief, Division of Environmental
Activities
Office of Shipbuilding Costs - MarAd

2

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
MESA New York Bight Project
Old Biology Building, SUNY
Stony Brook, New York 11794

Rec'd PPIEC FEB 1980

DATE: January 30, 1980

TO : PP - Richard L. Lehman

FROM: RFx51 - Garry F. Mayer

SUBJ: Review of DEIS 7912.25 - New York Bight
Acid Waste Disposal Site Designation

Dr. Joel O'Connor has requested that I respond for the MESA New York Bight Project to your memo of 26 December 1979 regarding the review of subject DEIS.

I have reviewed the document and find no major problems. As the DEIS indicates, the existing site has been used for many years without apparent problems. No new evidence is presented that would speak against the final designation of the Acid Waste Site for continued industrial waste disposal. On the basis of existing knowledge and current waste disposal practices, the choice to use the existing site over the alternatives is a correct one. However, if loadings contributed by other sources, such as sewage sludge dumping or dredged materials disposal, are markedly reduced in the future, the continued use of the Acid Waste
2-1 Site will have to be reexamined. As is suggested in the DEIS, acid waste disposal in coastal waters (no matter how minor) has undesirable effects on the benthic environment. Ultimately, the most desirable alternative would be to eliminate the ocean disposal of such wastes, which is consistent
2-2 with current NOAA policy, and to perhaps substitute a strategy of recycling.

On the attached pages I have listed a number of minor problems that should be addressed in the preparation of a revised DEIS and/or final EIS. Among these are overestimates of the value of past and present NOAA field activities for monitoring environmental change at the Acid Waste Site, and minor misstatements of NOAA/MESA New York Bight Project findings.

Please do not hesitate to call upon me if I can be of further assistance.

Enclosure

Comments on DEIS

P.xv, para. 1, lines 5-6: 2-3 I question the value of including the synergy argument. There would be synergy anywhere in the apex. This would tend to speak against the use of the proposed site.

Table 5-1 (p.xvi): 2-4 Re: the 106 mile site -- the entry pertaining to navigational hazards is unclear and should be rephrased.

2-5 Re: Northern site -- do water masses move offshore? MESA studies show that current flow is generally to the southwest with variations in this flow sometimes showing an onshore component.

2-6 Re: Southern site -- shoreward movement of wastes should be mentioned as a negative factor.

P.xv, para. 3, lines 4-5: 2-7 Effects last only a few minutes. Table S-1 indicates the effects may last up to several hours.

P.xviii, para. 3, lines 4-5: 2-8 I question whether the 106 mile site is inherently more complex. It would seem that both the mix pollutants and the large number of factors affecting the movement of coastal waters (e.g., topography, winds, tides) would make the existing site more complex.

P.2-4, line 28: line 30: 2-9 Replace "aesthetic" with "visual." The Westman reference is incorrectly cited. The bibliography indicates the paper was never published; hence, the reference should read "Westman (unpublished ms.)." This and similar errors occur on other pages of the DEIS.

P.2-5, lines 2-3: 2-10 The charter boatman are very adamant about the detrimental effect of the acid dumping on fishing. The text does not adequately convey the intensity of their assertions. Also, these assertions were voiced prior to 1978.

P.2-6, line 17: 2-11 The word "irretrievable" is inappropriate and unnecessary and should be removed.

P.2-6, lines 22-24: 2-12 The sentence beginning "Although effects of acid waste disposal..." is very misleading. While it is true that considerable research has been done on the Bight, it still would be extremely difficult to detect all but the most obvious environmental changes. This is particularly true, given the limited resources available for monitoring activities.

P.2-7, para. 3: 2-13 The point being made in this paragraph is not clear. Why is timing important? Are there a limited number of vessels that have to be shuttled back and forth if there is to be no back-up of wastes?

para. 4: 2-14 The MESA sampling grid was set up to observe conditions in the entire Bight and not to monitor any specific dump site. While MESA sampling may provide some limited insight on the Acid Waste Site, it basically is inadequate to serve as a tool for monitoring oceanic acid waste disposal. Neither the frequency of sampling, the density of sampling points, nor the parameters measured are tailored for the needs of the Acid Waste Site.

P.2-9, first bullet: 2-15 See discussion presented for p.xv, para. 1.

P.2-11, second bullet: 2-16 This argument would appear to speak against use of the current site. Certainly, traffic is much heavier (and hence the likelihood of navigational hazards are greater) at the apex site than at the 106 mile site.

P.2-12, para. 4: 2-17 The second sentence is misleading. While there may be no long-term effects at the 106-site, the possibility for such effects cannot be ruled out by past research, which has been conducted over a relatively short period of time.

P.3-1, sentence 3: 2-18 Not quite true. While the biota outside the Christiaensen Basin and upper portions of the Hudson Shelf Valley is reminiscent of that of the middle-Atlantic Bight, benthos from the Basin and upper Shelf Valley are very atypical.

P.3-3, para. 2, sentence 1: 2-19 The slow flow to the southwest is not only characteristic of the outer Continental Shelf but is also frequently prevalent on the mid-and inner shelf.

P.3-4, para. 2, sentence 3: 2-20 Freeland et al., (1979) indicate that coastwise shelf currents are also a major input of suspended fine sediments into the Bight apex.

para. 2, sentences 4-5: 2-21 These sentences are misleading. While turbidity may not be a major problem, SPM still is of concern because of the adsorption of toxicants on to such particles.

P.3-5, para. 1: 2-22 Please provide reference for statement on sediment iron at Acid Site and control area. Where was control area? What portion of Canyon had

higher iron levels? Could these have originated at Acid Site? If so, this would contradict statement at end of para. 1.

para. 4: 2-23 I doubt that the first sentence of this paragraph is correct; please cite reference.

P.3-7, Figure 3-2: 2-24 The area shown as being closed to shelf fishing is incorrect. A larger area is closed.

P.3-9, Figure 3-2: 2-25 This does not show the atypical faunal assemblages found on muddy sediments in the apex.

P.3-18, para. 2, lines 3-4: 2-26 The area referred to by Sanko is not in the Bight; it is in the Hudson estuary. The text should be revised to read: "Although this is the only marine environment in the New York area in which sand is mined ...."

P.3-41, para. 3, sentence 3: 2-27 This sentence contradicts statements made on pp. 2-19 - 2-20 about the value of shellfish resources in the southern area (i.e., "The site contains an important and established fishery resource.").

P.4-2, para. 1, line 1: Change "was" to "were."

first bullet: 2-28 The NOAA-MESA entry is misleading and should be revised to indicate that our studies addressed the Bight as a whole, rather than just the Acid Site. Virtually none of our interpretations specifically addressed the Acid Site.

P.4-4, para. 4, line 3: 2-29 Longwell (1976) did not indicate that the observed effects were the result of acid waste disposal. Potential mutagens could have been provided by a number of sources in addition to acid wastes (e.g., Hudson River discharge, atmospheric inputs, sewage sludge dumping and dredged materials disposal). Even if the effects were caused by acid wastes, the importance of such effects would be impossible to evaluate, since the contribution of eggs developing in the apex to the regional mackerel stock is not known.

P.4-15, para. 5, line 2: 2-30 Should read "in sediments ...."

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Rec'd PPIEC 7 FEB 1980

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
Rockville, Md. 20852

OA/C52x6:JLR

FEB 5 1980

TO: PP - Joyce M. Wood

FROM: OA/C5 - Robert B. Rollins

SUBJECT: DEIS #7912.25 - New York Bight Acid Waste Disposal Site Designation

The subject statement has been reviewed within the areas of the National Ocean Survey's (NOS) responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

Our substantive comments are attached.

Attachment

NEW YORK BIGHT ACID WASTE DISPOSAL SITE DESIGNATION

P. XVII, par. 2

3-1 Because long-term adverse effects have not been demonstrated does not imply there are none.

P. XVII, par. 3

3-2 It is stated that acid waste has no appreciable solid phase. Yet on page 3-8, par. 3, it is documented that the waste is 10 percent $FeSO_4$ by weight. Upon mixing with seawater the iron is oxidized and precipitates as a floc of $Fe(OH)_3$, that is, rust. This would yield 75 g of $Fe(OH)_3$ solid per liter of waste. The total solid is probably higher since the floc will be hydrated, but using the 75 g/l value, the waste is effectively 8 percent solid. This is a higher amount of solid than sewage sludge which is usually more than 92 percent water.

3-3 Waste accumulation in a water mass is determined by dumping volume and frequency relative to the flushing rate at the dumpsite. Adequate dispersion is important and is a function of dumping strategy. It does not follow, however, that dumping rates "allow adequate dispersion, thus preventing accumulation of waste constituents in the water mass."

P. 2-13, last par.

3-4 If the acid waste site were closed and material now being dumped there were to be dumped at the 106-mile site, the cost of dumping would rise considerably. This is a good argument for maintaining the present site.

3-5 The cost of permittee monitoring would change little. The once or twice a year that such monitoring cruises are made may require a larger vessel than one used at the present site.

3-6 The Coast Guard surveillance cost will not increase because the personnel occupied in the ship riding will be on Coast Guard duty in any case. More importantly the ship riding need is expected to be eliminated soon with the introduction of an Ocean Dumping Surveillance System which will automatically log ship position and dumping time. This system will apply at all ocean dumping sites.

P. XVIII, par. 3

If the 106-mile site were used, "should adverse environmental effects occur, however, they would be more difficult to detect because of the inherent complex oceanographic characteristics at the site."

3-7 Relative to the acid waste site this is hardly an argument against use of the 106-mile site. It is not shown in the DEIS that the oceanographic characteristics at the acid waste site are less complex than those at the 106-mile site. More importantly, on pages 4-9, par. 3; 4-11, par. 3; 4-13, par. 2; and 4-15, par. 3 it is stated (using the wording on 4-13, par. 2) that: "Any effects from acid waste disposal (at the acid waste site) would probably be overshadowed by effects from the numerous other contaminants introduced to the New York Bight, particularly the sewage sludge and dredged material sites. This complex interplay between natural variability and contaminants introduced by other sources makes it extremely difficult to isolate and quantify effects at the site solely due to the disposal of acid waste."

P. 2-12

3-8 "Long-term adverse effects are improbable" should be changed to "Long-term adverse effects have not yet been shown . . ."

P. 2-30, par. 2

3-9 Spelling error, line 5, beaon to beam.

P. 2-33, par. 2

3-10 Even if short-term transport of wastes would be difficult, a net long-term direction of the wastes should be predictable. There should be enough data available on water transport in that area to make an educated prediction.

P. 3-3, par. 1

3-11 Intrusions of slope water at the apex acid site would be rare indeed. --Not only storms break up the thermocline--there is atmospheric cooling in the fall which cools the surface waters which produces fall overturn which destroys the thermocline.

P. 3-4, par. 3

3-12 Typographical error, line 6, m tal to metal.

P. 3-5, par. 2

3-13 Flushing time for the Bight is 6-14 days and wastes are transported from the region. State here: based on current (meter) information where the wastes probably go.

P. 3-26, par. 1

3-14 First line poorly stated. It implies that the Gulf Stream itself is adjacent to the site--not so. Gulf Stream rings do periodically cross the site. Better stated: "The site is located just off the Continental Shelf in slope water with intrusions of shelf water in the upper 200 m and intrusions of oceanic water in the form of Gulf Stream rings. Each has distinctive physical, chemical, and biological characteristics."

P. 3-26, par. 3

3-15 What "entrains" Gulf Stream water? The eddy is Gulf Stream water surrounding Sargasso Sea water--the whole thing is entrained in the slope water region after breaking away from the Gulf Stream.

P. 3-27, last par.

3-16 Poorly written. Better: "As surface waters warm in late spring a thermocline forms in the upper 50 m. The thermocline persists until September/October until winter cooling destroys it. This thermocline disappears in winter where the water becomes nearly isothermal to approximately 150-200 m which is the beginning of the permanent thermocline. These seasonal changes are important because they affect the density gradients which affects the fate of the discharge of wastes." --The statement "Deeper water always has a lower temperature." is unnecessary.

P. 3-28, last par.

3-17 The discussion of the fate of waste on the bottom at the 106-mile site is irrelevant.

P. 3-29, first par.

Under "Chemical Conditions"

3-18 Dissolved oxygen does not necessarily follow temperature gradients. Oxygen concentration changes with seasons in the upper layers. As the water warms there is biological activity which changes the oxygen concentration.

P. 3-28, first par.

3-19 Poorly written. Better: "Although . . . site, the literature indicates a general net flow to the southwest along the margins of the Continental Shelf. In addition to this, there is always a general surface flow seaward and a subsurface flow shoreward in the upper 200 m. This is usually minor except in spring when there may be a larger influx of shelf water over the continental slopes. In deeper water (below 200 m) the net direction of the currents is also to the southwest. When eddies traverse the area, the flow within the eddy is anticyclonic (clockwise)."

3-20 --The "permanent stratification level" is poor wording. What you are talking about is the beginning of the permanent thermocline which ranges between 200 m - 800 m for the deep ocean. At the 106-mile site it ranges between 150-200 m to 500 m. It is not a sharp gradient, and the layers are not distinctly different. Mixing does occur across these boundaries, generally as a slow, small-scale process. This entire paragraph should be rewritten.

P. 3-29, par. 3

3-21 What are "trace metal currents?"

P. 3-30, last line

3-22 What "other factors" are important?

P. 4-12, under <u>106-mile site</u>

3-23 Eliminate "non-eddy conditions have not been studied."

P. A-2, par. 1

3-24 What happened to spring and fall? --Line 3, leave out "breezes."

P. A-4, par. 2

3-25 Again, "intrusions of slope water" would be rare, if ever at the acid site.

P. A-4, par. 3

3-26 Temperature and salinity are variables; density is a parameter.

P. A-5, first par., line 3

3-27 Believe it is meant that the water is isothermal in winter, and with increased vernal warming, a strong thermocline develops forming a highly stratified 2-layered system.

Last line

3-28 Atmospheric cooling along with storm activity will destroy the thermocline. In a highly stratified system such as the Bight is during the summer, a passing storm will only temporarily destroy or depress the thermocline.

P. A-5, last par., line 6

3-29 Beginning "This river flow . . ." change to:

"The plume persists throughout the year in the Bight; the extent and depth are highly dependent on the flow rates from the Hudson and Raritan Rivers."

5

P. A-6, par. 2, line 2

3-30 Put a comma after "decrease."

Line 3

3-31 Change to: "With a decrease in winds and an increase in solar radiation, the seasonal thermocline begins to develop forming a strong two-layered system reaching maximum strength by August."

Last line

3-32 What about winter when temperatures are low, and salinity is moderate? Isn't this still surface shelf water?

P. A-6, line 4

3-33 "Cool pool" is introduced without any lead-in explanation. A "core" of water is formed which remains below 8° C in the summer surrounded by warmer temperature. Some people call this residual winter water. This "cold pool" persists throughout the summer months.

P. B-9, first line

3-34 What is the reference for the canyon being a "trap" for wastes from the dredged material or sewage sludge sites?

P. D-12, par. 3, line 6

3-35 Change ". . . and pycnocline stratifications" to ". . . hence pycnocline stratification . . ."

4

UNITED STATES DEPARTMENT OF COMMERCE
Maritime Administration
Washington, D.C. 20230

February 6, 1980

MEMORANDUM FOR: Dr. Sidney R. Galler
Deputy Assistant Secretary for Environmental Affairs
(Attention: Mr. Cox)

Subject: Environmental Protection Agency - Draft Environmental Impact Statement (DEIS) for the New York Bight Acid Waste Disposal Site Designation

The subject DEIS has been reviewed as requested by your memorandum of December 21, 1979. We concur with the analyses and conclusions contained in the subject document and submit the following comment for your consideration.

Ocean Dumping Surveillance, pages 1-6 and 7

4-1 The Coast Guard recently proposed in the Federal Register of December 13, 1979, the issuance of regulations (33 CFR Part 158) requiring waste transporters to install electronic surveillance equipment on vessels engaged in ocean dumping. Present surveillance methods are labor intensive and do not provide 100 percent coverage of all dumping activities. Installation of surveillance equipment would result in increased surveillance, while reducing overall costs. Although the cost to the dumping industry would increase because of equipment requirements, the total cost of surveillance of ocean dumping operations would decrease. The proposed system would provide a record of an ocean dumping mission on cassette tape furnished by the Coast Guard by periodically recording geographic movements of the vessel, the times when the mechanisms for dumping cargo are activated, and data identifying the mission.

George C. Steinman

GEORGE C. STEINMAN
Chief, Division of Environmental Activities
Office of Shipbuilding Costs

5

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology

KKK 4335

March 6, 1980

Mr. Henry L. Longest, II
Deputy Assistant Administrator
for Water Program Operations
U.S. Environmental Protection Agency
Washington, D. C. 20460

Dear Mr. Longest:

The Department of Commerce reviewed the draft environmental impact statement by the Environmental Protection Agency relative to the "For New York Bight Acid Waste Disposal Site Designation", and forwarded comments to you in our letter of February 20, 1980.

5-1 Since that time, additional information has developed which is pertinent to the project. This additional information from the National Oceanic and Atmospheric Administration is enclosed for your consideration.

We are pleased to have been offered the opportunity to review this statement.

Sincerely,

Bruce R. Barrett

Bruce R. Barrett
Acting Director
Office of Environmental Affairs

Enclosure Memo from: Mr. Allen E. Peterson, Jr.
National Marine Fisheries Service
F/NER NOAA

6-1

6

Waste Disposal Site

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Federal Building, 14 Elm Street
Gloucester, Massachusetts 01930

February 11, 1980

TO: PP/EC - Joyce M. Wood

FROM: F/NER - Allen E. Peterson, Jr. Marvin F. Bonsen

SUBJECT: Draft Environmental Impact Statement -- New York Bight Acid Waste Disposal Site Designation -- EPA -- DEIS #7912.25

General Comments

6-1 Based on the information provided in this document, research performed by the National Oceanic and Atmospheric Administration, and the realization that land-based waste treatment methodologies are not presently available, it is our opinion that, of the open-water sites discussed, disposal of authorized wastes is best continued at the interim site. However, we continue to believe it inappropriate to use our nation's waters for disposal of toxic wastes and encourage the search for suitable alternatives.

CLEARANCE: SIGNATURE AND DATE:

F/HP:JRote

7

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
26 FEDERAL PLAZA
NEW YORK, N. Y. 10007

NANEN-E

3 March 1980

Mr. T. A. Wastler
Chief, Marine Protection Branch
Environmental Protection Agency
Washington, DC 20460

Dear Mr. Wastler:

This is in response to your request to the North Atlantic Division, Corps of Engineers for comments on the Draft Environmental Impact Statement for New York Bight Acid Waste Disposal dated 18 December 1979.

7-1 We are not aware of any plans to dispose of dredged material off the continental shelf and therefore it would seem that New York District's ocean dumping activities would not directly interact with disposal of acid waste at the 106 mile site.

Sincerely,

P. A. DESCENZA
Chief, Engineering Division

8

DEPARTMENT OF THE ARMY
NORTH ATLANTIC DIVISION, CORPS OF ENGINEERS
90 CHURCH STREET
NEW YORK, N. Y. 10007

IN REPLY REFER TO

NADPL-R

31 December 1979

SUBJECT: Draft Environmental Impact Statement for New York Bight Acid Waste Disposal

District Engineer, New York

Attached for your review and comment is a copy of the subject EIS. Your comments or a negative response on this document should be furnished directly to Mr. T. A. Wastler, Chief, Marine Protection Branch (WH-548) Environmental Protection Agency, Washington, D.C. 20460, with a copy to this office.

FOR THE DIVISION ENGINEER:

1 Incl
as

HERBERT HOWARD
Chief, Planning Division

9

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

February 5, 1980

Mr. T. A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Wastler:

We have reviewed the Draft Environmental Impact Statement (EIS) for the New York Bight Acid Waste Disposal Designation. We are responding on behalf of the Public Health Service and are offering the following comments.

9-1 We understand that the proposed designation is for the continued disposal of acid wastes in the New York Bight Acid Waste Disposal Site. Based on the information provided in the EIS, the proposed action does not appear that it will result in any significant short-term public health hazards. However, it is important that a surveillance program be conducted during and after disposal to assure satisfactory compliance with EPA's ocean dumping criteria and to monitor any potential long-term adverse effects particularly in food fish and shellfish. Since "long-term damage to the resources resulting from acid waste disposal have not been documented" (page 4-4), continued studies by the applicants and EPA should be made.

9-2 The areas closed to shellfishing as revealed on Figures 3-2 and 4-4 in the EIS are different. This inconsistency should be corrected. While the designated New York Bight Acid Site lies in a shellfish zone of ocean quahogs, it does not appear that the proposed site is closed from shellfishing. The reasons for this should be explained. The potential health hazards in allowing a continuation of this zone designation with future dumping should also be discussed. This discussion should also consider the possible adverse effects upon local shellfish populations from any emergency dumping operation at the proposed site.

9-3 In the discussion on alternatives, the EIS points out that the use of the other alternative sites in lieu of the New York Bight Acid Site would not provide any measurable environmental benefits. We recognize that the cost-effectiveness and environmental effects of each alternative must be weighed to select an action with maximum benefits. Nonetheless, the use of the 106 Mile Site may be more conservative from a health standpoint until more is known of the long-term effects of the proposed site. The 106 Mile Site appears to have a lower density of biota and be further removed from commercial fishery areas.

In view of the current national need to conserve energy and materials, the EIS should briefly mention whether the permittees for acid waste disposal have considered alternatives to recycle or reuse the acid wastes for some useful purpose.

We appreciate the opportunity to review this EIS. Please send us one copy of the final document when it becomes available.

Sincerely yours,

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Bureau of State Services

10

United States Department of the Interior

OFFICE OF THE SECRETARY
Northeast Region
15 State Street
Boston, Massachusetts 02109

ER-79/1170

February 14, 1980

Mr. T. A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, DC 20460

Dear Mr. Wastler:

This responds to Mr. Henry L. Longest's request for comments on the draft environmental statement for the New York Bight Acid Waste Disposal Site Designation, New Jersey and New York. The Department of the Interior submits the following review comments on the statement for your consideration.

General Comments

10-1 In our view the draft statement is inadequate in its discussion of alternatives other than ocean dumping. The statements "Land-based alternative disposal methods are currently less environmentally acceptable..." (page xiii), "...wastes...cannot be treated on land for environmental or economic reasons" (page 1-2), and "...technically feasible alternative disposal methods are environmentally less preferable..." (page 1-2) are not supported within the draft statement. Several alternative methods have been advanced by the producers of these wastes as a requirement of Special Condition 7 (page 2-37), but there appears to be no hard incentive to switch to land-based disposal, install acid neutralization, implement new by-product recovery, or institute other alternative methods once the ocean dumping site has been approved. The permit applicant need only show no other "reasonable" alternative to ocean dumping exists (page 1-12).

10-2 We further note that the draft statement does not adequately discuss project-caused chronic effects on fish and wildlife resources nor cumulative impacts on those resources which result from this and other designated dumping grounds within the New York Bight.

10-3 The draft statement does not adequately document the cumulative impacts (if any) of anticipated OCS oil and gas leases in the involved area. Page 3-18 states that: "No existing or planned oil and gas lease tracts are located in any interim or designated ocean disposal site." Further

10-4 mention is then made of past and future sales in the region with an accompanying map, however, there is no mention or reference of the special relationship of these tracts to the four disposal sites. There is no mention of recent communication nor synopsis of the Bureau of Land Management's environmental work regarding lease sales.

What makes this omission even more blatant is that no mention of oil and gas and required/increased navigation is addressed in Chapter Four, Environmental Consequences.

Detailed Comments

10-5 The final environmental statement should include information on the net effects, beneficial or adverse, concerning the ferric hydroxide waste plume formed when acid-iron wastes are released (pages 2-4 and 2-5).

One of the purposes of this draft statement is to discuss the environmental consequences associated with the designation of an ocean dump site for acid wastes. The statement is made in Chapter Four: "Most importantly, 30 years of study at the existing New York Bight Acid Waste Disposal Site have not demonstrated any adverse effects resulting from the disposal of these wastes".

However, in the Summary section (page xviii) it states: "The effects of acid waste in the Southern Area could be more severe than at the existing site. Since wastes have never been released in the area, detectable accumulations may occur and adversely affect the ecosystem." It goes on to state: "If wastes were released in the Northern Area, effects on the ecosystem would parallel those in the Southern Area. Such effects are potentially more severe than those resulting from continued use of the existing site."

10-6 These two statements in the Summary section lead the reader to believe that there are measurable impacts at the New York Bight Acid Waste Disposal Site, while the statement in Chapter Four leads the reader to believe otherwise. In addition, the matter is further confused by the statement which appears on page 4.1: "...effects (if present) at the Acid Site are obscured by the multiple contaminant sources...." This statement indicates that the impacts at the site cannot be properly assessed and refutes all previous contradictory statements. This confusion should be cleared up in the final environmental statement.

Summary Comments

This draft statement offers no substantiation that other reasonable alternatives do not exist such as land-based disposal, recycling, reprocessing, etc. It would appear that this would be at the very heart

10-7 of the permit process as well as being an integral part of the NEPA process. A detailed discussion of alternatives, other than ocean disposal, should be included in the final environmental statement.

10-8 We further suggest that the final statement include an analysis of the cumulative impacts on fish and wildlife, their habits, and the public's use thereof, which result from ocean dumping of wastes at this Acid Dump Site and all other designated dump sites within the New York Bight.

With respect to further consideration of oil and gas lease sales and the designated ocean disposal sites, it is recommended that contact be made with Mr. Frank Bonfiglio, Manager, Outer Continental Shelf Office, Bureau of Land Management, Federal Building, Suite 32-120, 26 Federal Plaza, New York, New York 10007.

Sincerely yours,

William Patterson

William Patterson
Regional Environmental Officer

11

DEPARTMENT OF STATE

Washington, D.C. 20520

BUREAU OF OCEANS AND INTERNATIONAL
ENVIRONMENTAL AND SCIENTIFIC AFFAIRS

February 7, 1980

Mr. T. A. Wastler
Chief Marine Protection
Branch (WH-548)
Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Wastler:

Officials of the Department of State have reviewed EPA's Draft EIS for the New York Bight Acid Waste Disposal Site Designation and have the following comments on the document:

11-1 1. The Ocean Dumping Convention, Annex III (c)(4) states that among "general considerations and conditions" to be taken into account in establishing criteria governing permit issuance must be "the practical availability of alternative land based methods of treatment, disposal or elimination, or of treatment to render the matter less harmful for dumping at sea". In view of this, we believe that the DEIS should give somewhat more discussion as to why land disposal alternatives are not feasible. Also, we believe that additional discussion of the existing research findings pertaining to alternative disposal methods might be included.

11-2 2. In light of the Ocean Dumping Conventions Annex III, which provides for establishing criteria governing the issuance of permits for dumping matter at sea, including "accumulation and biotransformation in biological materials or sediments," we believe additional discussion of the potential effects of acid iron wastes and toxic heavy metal contaminants in the acid iron wastes as well as iron waste floz would be useful.

3. Annex III of the Ocean Dumping Convention stipulates as well that "possible effects on marine life, fish and shellfish culture, fish stocks and fisheries, seaweed harvesting and culture" should be considered in permit

issuance criteria. In this respect, it is not clear if there is a relationship between the DEIS conclusion that dumping operations do not have any significant impact on biota and later statements in the document that the waste plume which drifts outside the site harms fishery, accord-
11-3 ing to fishermen, and that chromosome abnormalities in mackerel eggs in the site are greater than in the control area.

Thank you for the opportunity to comment on the draft impact statement.

Sincerely yours,

Donald R. King

Donald R. King
Director
Office of Environment & Health

12

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

February 7, 1980

Mr. T. A. Wastler
Chief, Marine Protection Branch (WH548)
Environmental Protection Agency
Washington, DC 20460

Dear Mr. Wastler:

The Draft Environmental Impact Statement for New York Bight Acid Waste Disposal Site Designation was circulated to relevant areas in the Foundation for review. Their comments follow:

".....Given the limitations of oceanic sampling, the factual results presented are probably accurate. The only major point of concern that arises is the differences between conclusions in the summary and those in the actual body of the report. The report seems to stress that it is very difficult to assess any possible impact of additional acid dumping for two reasons: (1) the area is already heavily impacted; (2) the biota are so patchy that pollution effects cannot be separated from natural variation. The conclusion in the summary seems to stress that there is little impact or that impact is unlikely. It cannot be concluded that there is no impact just because none can be found when working in this highly variable natural environment. It would be highly desirable if support were made available
12-1 for innovative methods of assessing environmental impact in naturally variable environments. Such research could be made part of continuing monitoring efforts."

"Generally, the DEIS is very repetitious. As one express function of the
12-2 CEQ Regulations for Implementing NEPA is to eliminate repetition, the document can be shortened considerably by eliminating repetition...." "For example:

1. The Acid Site is described not only on page 2-3, but also on pages 2-27 and 3-8.

2. Impacts are described not only in the Environmental Consequences Chapter, but also in Chapter 2--Alternatives Including the Proposed Action (e.g., Public Health and Water Quality, pages 2-4 and 2-12). Chapter 2 should be designed to discuss the dumping process, transit time, potential sites for dumping and what is being dumped. A list of the acids being dumped and the volume of material was not even presented until page 3-8.

3. The iron-hydroxide floc is discussed on many separate occasions including pages 2-4, 2-30, and 3-4. The floc is an environmental consequence of the action and, as such, should be discussed in Chapter 4."

"Specific comments follow:

	Page	Para.	Comment
12-3	xiii	3	Who corroborates the data submitted by NL Industries and Allied Chemical?
12-4	xiii	4	'The amount of pollution introduced by acid waste is slight when compared with other sources....' I find this an illogical statement as pollution refers generally to an increase over the typical background levels. No information for the Acid Site prior to 1948 is presented, and "normal" concentrations of trace metals in Table A-4 suggest that pollution has been significant.
12-5	xv	3	'When compared with waste inputs from all sources...' the argument under xiii 4, above, holds.
12-6	xvii	(1)	How do you know aqueous wastes will not measurably affect benthos at deep sites? I find no evidence to support this contention.
12-7	xvii	(2)	This is a qualified statement based on release rate. The statement suggests that effects may be otherwise, given high release rates.
12-8	xvii	(3)	A subjective statement not corroborated by any evidence.
12-9	xviii	2	'Since wastes have never been released in the area, detectable accumulations may occur...' This is an illogical statement if your statement on pg. xvii (3) were acceptable.
12-10	xix	2	Table D-3 does not suggest low concentrations of solids.
12-11	xix	8	Should read 'Each barge load should be sufficiently small <u>and release rate sufficiently slow</u> to permit.....'
12-12	1-4	2	Last sentence. Reference should be cited to 40 CFR 227 B, D, and E or a list given if indeed this is what you mean.
12-13	2-1	Summary	Why would monitoring costs to the Federal Government increase if Site 106 is already being monitored (Excluding shiprider costs)?
12-14	2-13 & 2-14		Extra pages.
12-15	2-15	2	Last sentence. '...shipriders are not normally used.' But then the disposal operation is not observed as is the aim of C.I. 16470. 2B.
12-16	2-16	2	The probability of short dumping should be calculated.
12-17	2-35	3	'Samples are taken monthly for analyses.' Considering the frequency of dumping, weekly or biweekly sampling procedures would be more appropriate.
12-18	3-21	2	'Barnegat Lane' should read 'Hudson Lane' (according to Figure 3-10).
12-19	4-16	2	'The 14-day residence for water.....' Table 4-2 says 7-days, so the concentration may differ by 100% or twice as much!
12-20	4-16	4	Line 3.'milligrams-per-liter'should read 'micrograms-per-liter' (according to Table 4-2).
12-21	4-16	4	Lines 6-10. Good analytical chemistry would avoid and/or account for this error.
12-22	4-17	Table 4-2	Very confusing to interpret. I suggest using ug/l (ppb) throughout, so that Cadmium at $2.4 \times 10^{6}/7.7 \times 10^{11}$ would read 3.0 ppb (or an addition of 100% over background)."

12-23 "Generally, my opinion would be to have the Acid Waste dumped at Site 106 and use automated monitoring equipment and stagger the shipriders. But, as presented, the overriding influence of transit time and costs creates a strong case for continued use of the acid site. The alternatives analysis is an economics choice (use of the Acid Site) or an environmental one (use of Site 106)."

Thank you for giving NSF the opportunity to comment.

Sincerely yours,

for Adair F. Montgomery
Chairman
Committee on Environmental Matters

13

STATE OF DELAWARE
EXECUTIVE DEPARTMENT
OFFICE OF MANAGEMENT, BUDGET, AND PLANNING
DOVER DELAWARE 19901

OFFICE OF THE DIRECTOR

PHONE (302) 678-4271

January 17, 1980

Mr. T. A. Wastler
Chief
Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, DC 20460

Dear Mr. Wastler:

The Draft Environmental Impact Statement for New York Bight Acid Waste Disposal Site Designation has been reviewed by this Office by reason of its responsibility for implementation of Delaware's coastal management program under terms of the Federal Coastal Zone Management Act.

The Draft EIS contains several key statements which the EPA apparently expects the reader to take at face value with little or no evidence given to support the statements.

On page 1-2, there is a statement that technically feasible alternative acid waste disposal methods are environmentally less preferable than continued use of the site (the N.Y. Bight site). No evidence is mentioned to support this conclusion. What alternative disposal methods were examined and what is the basis for the conclusion that alternative methods are environmentally less preferable?

Also, on page 1-2, there is a statement that NL Industries and Allied Chemical acid wastes cannot be disposed of by land-based methods. What is the basis for this statement? Was any attempt made by the EPA or anyone else to examine alternative land-based disposal methods?

13-1 It is strongly recommended that the Final EIS provide supporting information, if there is any, for these important statements and conclusions.

Thank you for the opportunity to comment on this Draft EIS. I look forward to receiving a copy of the Final EIS on this subject.

Sincerely,

David S. Hugg, III

DSH/JS/jad

14

MARYLAND
DEPARTMENT OF STATE PLANNING
301 W PRESTON STREET
BALTIMORE, MARYLAND 21201

HARRY HUGHES
GOVERNOR

CONSTANCE LIEDER
SECRETARY

February 15, 1980

Mr. T.A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, D.C. 20460

SUBJECT: PROJECT NOTIFICATION AND REVIEW
Applicant: U.S. Environmental Protection Agency
Project: Draft EIS - New York Bight Acid Waste Disposal Ocean Site Designation
State Clearinghouse Control Number: 80-12-677
State Clearinghouse Contact: James McConnaughhay (383-2467)

Dear Mr. Wastler:

The State Clearinghouse has reviewed the above statement. In accordance with the procedures established by the Office of Management and Budget Circular A-95, the State Clearinghouse received comments from the following:

14-1 Department of Transportation, Department of Economic and Community Development, including their Historical Trust section, Environmental Health Administration, University of Maryland Center for Environmental and Estuarine Studies noted that the statement appears to adequately cover those areas of interest to their agencies.

Department of Natural Resources provided comments (copy attached) suggesting that basic information, e.g. pH of acid waste be included even though the report is a summary. The Department also recommended that monitoring of disposal activities be initiated or continued to reduce the frequency of unnecessary "short" dumping.

Worcester County and Ocean City have not responded to inquiries as of this date; however, if comments are received they will be forwarded.

We hope these comments will be useful in your agency's continuing evaluation of this project and appreciate your attention to the A-95 review process.

Sincerely,

James W. McConnaughhay
Director, State Clearinghouse

JMc:SB:pw

TELEPHONE: 301-383-2451
OFFICE OF SECRETARY

cc: L. Frederick/M. Eisenberg/H. Silbermann/C. Pyers/J. Yankus/Mayor Kelley/P. Wagner

Maryland Department of State Planning
State Office Building
301 West Preston Street
Baltimore, Maryland 21201

Date: [illegible] 1980

RECEIVED

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT OR ENVIRONMENTAL EFFECTS REPORT

Applicant: U.S. Environmental Protection Agency

Project: Draft EIS - New York Bight Acid Waste Disposal Ocean Site Designation

State Clearinghouse Control Number: 80-12-677

We have reviewed the above draft environmental impact statement and our comments as to the adequacy of treatment of physical, ecological, and sociological effects of concern are shown below:

	Check (X) for each item: None	Comment enclosed
1. Additional specific effects which should be assessed:	✓	
2. Additional alternatives which should be considered:	✓	
3. Better or more appropriate measures and standards which should be used to evaluate environmental effects:	✓	
4. Additional control measures which should be applied to reduce adverse environmental effects or to avoid or minimize the irreversible of irretrievable commitment of resources:	✓	
5. Assessment of seriousness of the environmental damage from this project, using the best alternative and control measures:	✓	
6. Activities which appear to be inconsistent with the State approved Coastal Zone Management Program.	✓	
7. Issues which require further discussion of resolution as shown:	✓	

Signature [illegible]

Title [illegible]

Agency [illegible]

Address

15

THOMAS C. ANDREWS
DIRECTOR

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
WATER RESOURCES ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS, MARYLAND 21401

January 24, 1980

MEMORANDUM:

TO: Lester Levine

THRU: Kathleen Adgate

FROM: Frank L. Ramons, Jr. FLR

SUBJ: 80-12-677 - New York Bight Acid Waste Disposal Ocean Site Designation

This is to advise you that the above referenced Clearinghouse Project has been reviewed by Bill von Schulz of the Planning Division.

We find this project is not inconsistent with this agency's plans, programs, or objectives.

It appears that the proposed action will have no direct effect on Maryland's coastal waters. However:

15-1 1) Even though the report is a summary, basic information, eg. pH of acid waste, should have been included.

15-2 2) The report states that alternative disposal techniques are not yet available. If this acid is so easily diluted with seawater, why can't some form of pre-treatment (or dilution) occur before ocean disposal of acid?

15-3 3) Part of the rationale for continued dumping is that the Bight area is already degraded from other wastes. This type of logic often precludes adequate consideration of other alternatives.

15-4 4) The report states that "combination of different waste types at a single site is generally undesirable..." Yet is is also stated that the Bight area receives other types of wastes. Why continue an undesirable practice?

15-5 5) The intent (and spirit) of regulating ocean disposal sites should be to reduce contaminant input; not to maintain status quo.

15-6 6) Monitoring of disposal activities should be initiated or continued to reduce the frequency of unnecessary "short" dumping.

In view of all of this, however, the report claims that EPA criteria are being met, that environmental effects are short-lived and reversible, and that the search for alternative disposal techniques will continue.

vem:pw

16

Harry Hughes
GOVERNOR

MARYLAND
DEPARTMENT OF STATE PLANNING
301 WEST PRESTON STREET
BALTIMORE, MARYLAND 21201
TELEPHONE: 301-383-5801

Constance Lieder
SECRETARY OF STATE PLANNING

December 26, 1979

Mr. T.A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, D.C. 20460

RE: State Clearinghouse Project - Draft EIS - New York Bight Acid Waste Disposal Ocean Site Designation
80-12-677

Dear Mr. Wastler:

16-1 The State Clearinghouse has received the above project. The review of this project has now been initiated and you may expect a reply from us by February 11, 1980. If you have any questions concerning this review, please contact Bryan Gatch (383-2499) of this Clearinghouse.

We are interested in your project and will make every effort to ensure prompt action. Thank you for your cooperation with the Clearinghouse program.

Respectfully,

James W. McConnaughhay
Director, State Clearinghouse

BG:pw

17

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
JOHN FITCH PLAZA, P. O. BOX 1390, TRENTON, N. J. 08625

T.A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, DC 20460

Re: New York Bight Acid Waste
Disposal Site Designation

Dear Mr. Wastler:

The New Jersey Department of Environmental Protection has completed its review of the Draft Environmental Impact Statement for New York Bight Acid Waste Disposal Site Designation.

The Department concurs that disposal at this site, as opposed to other oceanic sites, is the most acceptable alternative. However, it is our position that the DEIS has failed to give a complete evaluation of the land based disposal alternatives and the recycle and reuse alternatives available. Without an evaluation of these alternatives it is not possible to make a decision on the most environmentally sound method for disposing of this waste. We suggest that a discussion of non-oceanic disposal options should include the methods of neutralization and upland disposal, the technology presently available for recycling of acid wastes or conversion of the wastes into useable by-products, the costs and commitment of resources required for these alternatives, and an evaluation of the environmental impacts associated with their implementation. In light of the stated potential for heavy metal input into the Bight Apex and the possible long-term or chronic effects on the Bight Apex biota, land based acid disposal alternatives may be the more acceptable method of protecting aquatic resources. 17-1

The Department would also like to provide the following technical comments on the DEIS. Responses to these comments are required to aid in selecting the most environmentally sound disposal alternative.

New Jersey Is An Equal Opportunity Employer

F-19

1. It would appear that some potentially adverse effects could result from the iron hydroxide floc produced by the NL Industries, Inc. waste material. This floc is known to persist in the water column as long as 48 hours. The final EIS should address what eventaully happens to this floc material. The final EIS should include information as to whether this material is transported beyond the boundaries of the acid site and if benthic sediment sampling has been done to document its accumulation on the ocean floor. Quality Criteria For Water, published by the U.S. Environmental Protection Agency (1976) states that ferric hydroxide flocs coat the gills of fish and can be detrimental to fish eggs. Long term effects from the floc can include, "...consolidating bottom gravels into pavement-like areas...". The DEIS has noted the increased turbidity at the site and the incorporation of the floc into the gastrointestinal tracts of copepods and ctenophores at the site. Although no direct effects have been shown thus far, there is a need to determine any long-term, sublethal effects attributable to the floc material. Therefore, continued monitoring and sampling of this material (is necessary) at the site. This program should include testing of bottom substrates for consolidation due to long-term dumping of wastes which produce the ferric hydroxide floc. Tests should also be conducted to determine if this floc tends to aggregate the trace heavy metals contained in the acid waster and transport them rapidly to the bottom sediments or increase their availability to the biological community. 17-2

2. It is noted that the bluefish have been attracted to the acid waste site since dumping operations began. The final EIS should address any adverse effects resulting from bluefish encountering the increases turbidity at the site or ingesting organisms which have ingested the ferric hydroxide floc. It has been stated in the DEIS that copepods and ctenophores incorporate the floc material, do other prey species also incorporate the floc in their digestive tracts? 17-3

3. The DEIS states on page 3-34 that "...even maximal concentrations of waste constituents are diluted well below predischarge ambient levels within 4 hours after a waste disposal operation." This statement was made in reference to waste disposal at the 106-mile chemical waste site. The final EIS should address how waste constituents can be dilutes below predischarge ambient levels. 17-4

4. Table 3-8 on page 3-37 should state the units which the values are representing. One would assume that these values are in parts per million. 17-5

5. On page 4-9, the DEIS states that, "Evidence of chromosomal damage in mackerel eggs collected in the vicinity of the site has been reported (Longwell, 1976), but the cause of the damage cannot be definetly linked to the disposal of acid wastes." Test procedures should be implemented to determine if the constituents in the acid wastes are responsible for this damage and which concentrations produce significant mutagensis. 17-6

Thank you for giving the Department of Environmental Protection the opportunity to review the DEIS. I believe that the comments in total will assist the Environmental Protection Agency in its preparation of the Final EIS.

The Office of Environmental Review coordinates Departmental reviews of all environmental impact statements issued pursuant to NEPA. Therefore, both with final EIS for the New York Bight Acid Waste Disposal Site Designation and future environmental impact statements generated by your office, copies should be forwarded to my office for review. Six copies of each draft EIS and three copies of each Final EIS are required for distribution. I trust that you will understand that this coordinating mechanism provides for the best possible Departmental response.

Sincerely,

Lawrence Schmidt, Chief
Office of Environmental Review

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State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
P. O. BOX [redacted] CN 029
TRENTON, NEW JERSEY 08625

Arnold Schiffman
Director

JAN - 4 1980

Mr. T. A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, DC 20460

Re: Ocean Dumping Sites/N.Y. Bight Acid Waste

Dear Mr. Wastler:

We have reviewed the Draft Environmental Impact Statement for designation of the New York Bight Acid Waste Disposal Site. We concur with the USEPA's proposed action to designate the site for continued use in the disposal of wastes which comply with the criteria for ocean disposal. 18-1

Very truly yours,

Dr. Marwan M. Sadat, P.E.
Assistant Director
Water Quality Management

GS2:njf

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State of New Jersey

DEPARTMENT OF COMMUNITY AFFAIRS

JOSEPH A. LeFANTE
COMMISSIONER

363 WEST STATE STREET
POST OFFICE BOX 2768
TRENTON, N.J. 08625

December 20, 1979

Mr. Henry L. Longest, II
Deputy Assistant Administrator
for Water Program Operations
United States Environmental Protection
Agency
Washington, D.C. 20406

RE: OSRC-FY-80-778 EIS for New York Bight Acid Waste Disposal Site Designation

Dear Mr. Longest:

The New Jersey State Clearinghouse has received and is processing your Project Notification as required by the provisions of the U. S. Office of Management and Budget Circular A-95 Revised and Chapter 85, New Jersey Laws of 1964. This project has been designated OSRC-FY-80-778.

The State Clearinghouse has assigned a 30 day review period effective with the date of this letter. This review period is consistent with our internal procedures and federal regulations relevant to your program. The appropriate state agencies have been requested to comment on your application while the State Clearinghouse will perform its own review. If comments are received and any conflicts or issues arise, the Clearinghouse will notify you. 19-1 It may be necessary to request additional information and/or to schedule a conference in order to resolve the issues prior to clearance; otherwise you are cleared at the end of the review period to forward your final application to the federal funding agency, accompanied by a copy of this letter. It is the responsibility of the applicant to attach any comments to the application forwarded to the federal agency.

Please feel free to call upon the State Clearinghouse at any time to assist you with any problems or questions you may have with the A-95 review procedure.

Very truly yours,

Richard A. Gilman
State Review Coordinator

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20

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233
Division of Regulatory Affairs

Commissioner
Robert F. Flacke

March 4, 1980

Mr. T. D. Eastler, Project Officer
U.S. Environmental Protection Agency
Oil and Special Materials Central Division
Marine Protection Branch
Washington, D.C. 20460

Re: DEIS, the New York Bight Acid Waste Disposal Site Designation
DEC No. 012-003

Dear Mr. Wastler:

The Department of Environmental Conservation has completed its review of the above subject document. This Department has the responsibility for managing the anadromous species of New York State. Of particular note, the following anadromous species of the Hudson River; shad, striped bass, Atlantic sturgeon, shortnose sturgeon (an endangered species), blueback herring and alewife, are known to utilize the apex of the New York Bight, the proposed site for continued dumping of acid chemical wastes.

The Department brings to attention contamination of the State's fish and wildlife resources by improper disposal of chemical wastes. The improper disposal of mirex by Hooker Chemicals has led to the contamination of great amounts of Lake Ontario fish necessitating health advisories warning individuals to limit their consumption. On the Hudson River, polychlorinated biphenyls (PCB's) discharged by General Electric led to the closure of commercial fishing for most Hudson River species and advisories on consumption of fish caught in the recreational fishery.

The above two incidents are not the only contaminant problems in New York State, but do serve to show how untreated or improperly discharged wastes can permeate through entire ecosystems. Continued dumping of acid wastes, at the acid site, as proposed by EPA is considered by this Department as improper. The EIS clearly acknowledges that the acid wastes are unsafe for land disposal without treatment, and that the wastes contain, at a minimum, suspended solids; oil and grease; petroleum hydrocarbons; zinc; copper; cadmium; lead and mercury. The last four heavy metals are known to bioaccumulate in aquatic ecosystems and depending on its composition, the petroleum hydrocarbon fraction can bioaccumulate also.

The Department regrets that EPA has made the determination that the acid wastes are too hazardous to be deposited in a secure land chemical repository without treatment and, therefore, must be dumped at sea at a site that appears to be stressed as indicated by a high incidence of fin rot in winter flounder, the lack of surf clams and the high concentrations of heavy metals in the sediment. The Department also disagrees with EPA's justification of continued dumping of the acid wastes on the basis that these wastes are only a small percentage of the total toxic materials being disposed of in the Bight apex region. In this regard, it should be noted that the sewage sludge dumping referred to by EPA is scheduled to end in 1981. Continued pollution should not be justified because there exists another polluter of greater magnitude.

20-1 The Department recommends that the proposed permit for continued dumping at the acid site not be issued, and that the wastes be detoxified and secured in a chemical land site. If land disposal is still deemed unfeasible, then the Department recommends that the dumping be permitted only at the alternative 106-mile site which has a much lower biological activity than the current acid site and, therefore, lower probability of harm to the ecosystem. The 106-mile site is also more favorable when the theory is "dilution is the solution to pollution" because the known turbulence of this site is greater than the current acid site.

It should be noted that the 106-mile site is more in line with Section 228.5 of the EPA Ocean Dumping Regulations, general site selection criteria, than the current acid dump site. Of the criteria a through e stated on p. 1-9 of the EIS, the 106-mile site fits the criteria (a), (b), (c), and (e) better than the current 15-mile acid site. Neither site fits criteria (d) since the wastes are aqueous and could extend beyond the arbitrary borders EPA could create.

Attached is a list of specific comments on a page-by-page basis of the EIS. Thank you for the opportunity for review and comment. We request review of the final document when available.

Sincerely,

Jerome M. Jensen
Acting Director

JMJ:EMM:lmp

Attachment

cc: K. Wich
G. Calvin
File DEC No. 012-003

Specific Comments on the Draft Environmental Impact Statement (EIS) for New York Bight Acid Waste Disposal Site Designation.

Page XV. It is stated, when compared with waste inputs from all sources, the contaminated acid wastes are insignificant. It is inappropriate to justify dumping of contaminated acid wastes because there are other entities that are dumping greater amounts of waste.

Page XV. EPA recognizes the Hudson Canyon is an important migration route for some animals. EPA's recommended proposed site abutts the Hudson Canyon. A waste disposal site should not be chosen in a known migration route.

Page XVII. EPA recognizes that the alternative southern area site has potentially exploitable shellfish resources. The dumping of toxic wastes in this southern area therefore should be avoided.

Page XVII. The alternative 106 mile site is recognized by EPA to contain no known exploitable mineral or biological resources. Such conditions are ideal for a waste disposal site, provided that the toxic materials can be maintained within this confined region.

Page XVII. EPA recognizes that aqueous acid wastes will not measurably affect the benthos at deep sites, but some waste constituents may accumulate in sediments at shallow sites. From this aspect, the 106 mile alternative site is the best site since it is in depths of greater than 1500 meters of water. The current waste site and the one that is being proposed to be continued for dumping is the worst choice of all the sites in this respect since it's the shallowest of all sites.

Page XVII. EPA recognizes the aqueous acid wastes have short-term effects on the water when released at rates that allow adequate dispersion. EPA also recognizes that the 106 mile site has the most turbulent hydrological and meteorological behavior. The 106 mile site therefore is more suitable in providing better dispersion to reduce toxicity of the acid wastes.

Page XVII. EPA states that bioaccumulation of waste constituents in organisms that inhibit the water column is unlikely. Bioaccumulation of waste constituents is most unlikely at the 106 mile site because of the rapid dilution of the acid waste and because of lack of biological activity in this site.

Page XVII. EPA states that acid waste disposal has had minimal adverse impacts on the environment of the acid site in New York Bight and that assessments over the 30-year period show that there are no long-term adverse effects from the waste with the accumulation of waste constituents in the sediments that represent less than 1% of total contaminant inputs to the Bight. EPA has not pointed out that the New York Bight has been highly impacted in the past 30 years by dumping. What it has stated is that no conclusive proof that acid waste has contributed to this environmental impact has been demonstrated.

Page XVIII. EPA states that one of the reasons not to dispose of acid waste in the southern area is because more severe effects are possible at this site. On the previous page, EPA has stated that there is no documentation of long-term adverse effects from the waste. However, on this page, EPA states that waste released in the southern area may adversely affect the ecosystem and that detectable accumulations may occur. EPA is therefore, inconsistent in determining the probable effects of the acid waste. EPA is concluding that no more biological damage will be done at the current acid site. However, biological damage could occur at new, unused sites such as the southern area. The Division of Fish and Wildlife disagrees with EPA's rationale that the continuation of dumping at an existing site is an acceptable practice. If the acid wastes are capable of perturbing the biota of the southern area they are also capable of perturbing the same biota in the current acid dump site. Observing perturbations to the native biota of the current dump site, would be difficult because those biota that have established themselves at this site are those biota that are capable of withstanding the stresses due to continual dumping.

20-2

Page XVIII. EPA states that the disposal of acid waste at the 106 mile site would give similar effects to those at the existing 15 mile site and that those effects would be more difficult to observe because of the inherent *complex oceanographic characteristics at the site. This claim is not* justified as EPA indicates later on in the document. The 106 mile site is more turbulent, is deeper and has minimal amount of biota. It is, therefore, highly unlikely that the effects at the 106 mile site will be similar to that of the current site with its less turbulent environment, shallower waters and abundant biota. EPA also states that the risk of emergency short dumping is further increased at the 106 mile site. However, there is no presentation of the probability of short dumping or the number of times short dumping has occurred in the past as a result of an emergency. Furthermore, *any* emergency short dumping would occur at a distance greater from shore than the current 15 mile acid site.

20-3

Page XVIII. EPA states that research and development that is relevant will be a condition imposed by EPA on waste generators making ocean disposal permits. EPA, however, has not included in this document a proposed permit defining the research and development that the waste generators are to perform. A proposed permit should have been included in this environmental impact statement which would define requirements and limitations to be imposed upon the waste generators.

20-4

Page XIX. EPA states that the waste permitted for disposal at the site should have the following characteristics: 1) aqueous acidic waste with low concentrations of solids. 2) neutrally to negatively buoyant in sea water. 3) contains no materials prohibited by MPRSA. 4) demonstrate low toxicity of neutralized wastes to representative planktonic and nektonic marine organisms and, 5) contain no constituents in concentrations detectable outside the site or above normal ambient levels more than 4 hours after discharge. If the permit is issued, these characteristics should become part of the permit language. EPA indicates later in the document that the sea water is colored by iron compounds and this color

20-5

persists from 8 to 12 hours, therefore, it seems highly unlikely that the permittee will be able to meet condition #5.

Page XIX. EPA states the disposal operation should have the following characteristics: 1) waste should be discharged from a vessel underway to facilitate rapid and immediate dilution. 2) each barge load should be sufficiently small to permit adequate dispersal of the waste constituents before dispersal of the next load so that accumulation of waste materials does not occur due to successive dumps. 3) except in emergency situations only one barge should be permitted within the site for disposal operations within the 4 hour period for initial mixing. These recommendations should be included in the proposed permit language. The permit should clearly define what an emergency situation is considered to be.

Page 1-1. EPA states that some industries and municipal waste treatment facilities produce wastes which cannot using present day technology, be treated or dispersed safely or economically on land, but can be ocean dumped without seriously degrading the marine environment. The Division of Fish and Wildlife does not believe that the best manner of disposing of the acid waste is by ocean dumping. These wastes contain heavy metals which are known to bioaccumulate. EPA is relying on dilution as the solution to detoxifying these wastes. However, bioaccumulation by organisms may *severely challenge this hypothesis.*

Page 1-2. EPA states that all research work done at the acid site since 1948 has not uncovered significant adverse effects caused by acid waste disposal. Later in the document EPA indicates that the New York Bight is highly impacted, however, the origin of this impact cannot be pinpointed to the acid waste but as a result of all dumping including acid waste at this site.

Page 1-2. EPA states that NL Industries and Allied Chemical have demonstrated that their wastes comply with EPA's environmental impact criteria and that technically feasible alternative disposal methods are environmentally less preferable than continued use of this site, therefore a present and future need exists for the continued use of this site. This claim by EPA has not been substantiated in this document because the environmental impacts of other technically feasible alternative disposal methods have not been discussed. EPA only discusses environmental consequences of changing the current ocean dump site to other ocean dump sites. It does not discuss environmental consequences of other disposal methods. It does however, mention that other disposal methods are less economical. EPA should include specifics about feasibility and environmental acceptability of land based disposal methods, so that EIS reviewers can make comparisons amongst disposal methods.

20-6

Page 1-8
and
Page 1-9. EPA has established criteria for designating ocean dump sites in Part 228 of the Ocean Dumping Regulations. General site selection criteria are listed in Section 228.5. The following are site selection criteria: a) the dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with

other activities in the marine environment. Particularly, avoiding areas of existing fisheries or shell fisheries in regions of heavy commercial or recreational navigation. b) locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient sea water levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary or known geographically limited fishery or shell fishery. c) if at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis do not meet the criteria for site selection set forth in Section 228.5 and 228.6 the use of such site will be terminated as soon as suitable alternate disposal sites can be designated. d) the sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-term impacts, the size configuration and location of any disposal sites will be determined as a part of a disposal site evaluation or designation study. e) EPA will wherever feasible designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used. The current acid site does not satisfy criteria a. It is surrounded by a shell fishery, a recreational fishery and a commercial fishery and is in a region of heavy commercial or recreational navigation. The southern and northern areas are intermediate in their impacts in this respect. The 106 mile site is by far, the most preferable in satisfying this criteria. There is no existing shell fishery and no potential for such a fishery. Any fishery for fin fish is minimal and the site is too far from shore to interfere with recreational navigation and is outside normal commercial navigation channels. The current acid site is less likely to fulfill criteria "b" of any of the ocean dump sites suggested by EPA. The current acid site is closest to any beach or shoreline and is within a recreational and commercial fin fishery and surrounded by an active shell fishery. The northern and southern sites better meet criteria "b". However, the 106 mile site meets criteria "b" best. This site is 106 miles from the closest beach or shoreline, is in water too deep for a shell fishery and the fin fish that inhibit the area are extremely transient and not that abundant. Section 228.5(c) provides for the moving of an existing disposal site to another site when the criteria for site selection are not met, the current acid site clearly does not meet the general site selection criteria and therefore should be moved. The 106 mile ocean dump site meets the criteria best and should be the location for an ocean dump site should continued ocean dumping be needed. The current site and the 106 mile ocean dump site have been defined on nautical charts and in this respect would fulfill the criteria of Section 228.5(d). Though EPA has defined the borders of both these sites the acid waste do not respect these boundaries. The acid wastes are capable of traveling in ocean currents which pass beyond the boundaries as defined by EPA. It is, therefore, very difficult for monitoring and surveillance at either the 15 mile current dump site or the 106 mile dump site or any other ocean dump site for that matter. The only means for containing the acid wastes within the configurations of the boundaries defined by EPA would be to place the acid wastes in containers and dispose of them at these sites. This, however, is not the proposed action. The Division of Fish and

Wildlife concludes that no ocean dump site considered by EPA meets the criteria of Section 228.5(d) with the disposal methods proposed. The 106 mile dump site is the only dump site considered by EPA that would meet the criteria in Section 228.5(e). This site is beyond the edge of the continental shelf and has been historically used. The other three sites considered by EPA are all well within the continental shelf. Two have not been historically used and the other has. The Division of Fish and Wildlife considers the 106 mile site the best site according to EPA's criteria in Section 228 of the Ocean Dumping Regulations.

Page 1-9. The Ocean Dumping Regulations have specific criteria for site selection in Section 228.6. The following 11 factors were considered: 1) the geographical position, depth of water, bottom topography and distance from coast. The 106 mile site meets these criteria better than any other site proposed by EPA. It is 106 miles from shore and in more than 1500 meters of water. The current acid site meets these criteria the least, it is 15 miles from shore and in 22 to 28 meters of water. Furthermore, this site lies in line with the Hudson Canyon making it a less desirable site because of the known migratory habits of fish in this region. 2) the location in relation to breeding, spawning, nursery, feeding or passage areas of living resources and adult or juvenile phases. The 106 mile site is more favorable than any site considered by EPA and by far better than the 15 mile site currently used with respect to these criteria. The 15 mile site is in a strategic position for spawning, nursery, feeding and passage of living organisms in adult and juvenile stages. Oceanic fish which use the Hudson estuary must pass through the 15 mile site. Such fishes as the striped bass, shad, Atlantic sturgeon, shortnose sturgeon, bluefish, whiting, yellowtail flounder, winter flounder, alewife and blueback herring utilize this 15 mile site region. Most of these fish utilize the Hudson estuary during part of their life cycle. If is, therefore, advisable not to subject these fish to possible stress or contamination from continued acid dumping. The 106 mile site would be much more favorable for dumping since very few fish occur in this area and those that do are highly pelagic therefore, having only a limited exposure time to the acid wastes. 3) the location in relation to beaches and other amenity areas. The 15 mile site is least suitable from this criteria and the 106 mile site is the best. The 15 mile site is obviously closer to beaches and in addition is much more accessible to recreational fishermen and commercial fishermen as well. The 15 mile site is less desirable because its location is in a highly trafficked navigational region. 4) the types and quantities of waste proposed to be disposed of and proposed methods of release including methods of packing the waste if any. Of the four ocean dump sites considered, none of them have an advantage over any other with regards to this criteria. 5) the feasibility of surveillance and monitoring. EPA maintains that the current acid site is the most feasible from the standpoint of surveillance and monitoring and that the 106 mile site is the least feasible. However, in this regards, both the 15 mile site and the 106 mile site have been surveyed and monitored, and the northern and southern regions that EPA has considered, have not. EPA contends the 106 mile site is the hardest to survey and monitor because of its distance from shore and because of the dispersal and transport characteristics within the 106 mile site. Though that reasoning may be correct EPA's own criteria suggest that the site should

be as far from shore as possible and that the waste dispersed as rapidly as possible. The more rapid the dispersal the more difficult the monitoring procedures become and the more difficult it is to access the environmental impacts. Since EPA is relying on rapid dilution of the toxic wastes to minimize environmental impacts, it must accept the difficulty of monitoring these conditions. 6) the dispersal, horizontal transport, vertical mixing characteristics of the area including prevailing current direction and velocity if any. The 106 mile site is by far the best site for meeting these criteria. It has the most rapid dispersal, the greatest horizontal transport and the largest amount of vertical mixing characteristics of any of the sites considered by EPA. 7) the existence and effects of current and previous discharges and dumping in the area including accumulative affects. The 15 mile and the 106 mile sites are the only sites where previous discharges or dumping has occurred. There have been no reported accumulative effects at the 106 mile site. Whereas at the existing 15 mile site, accumulative effects have occurred though possibly not due to acid waste dumping. The Bight area in the vicinity of the 15 mile site has been closed to shell fishing by the Health Department, and the existence of fish with fin rot has occurred. It is likely that some of these effects are chronic. 8) the interference with shipping, fishing, recreation, mineral extraction, desalinization, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the ocean. With respect to this criteria, the 106 mile site is by far the best site of the four that EPA has considered and the 15 mile current acid site is the worst. The current acid site is in a region which is highly trafficked for shipping purposes to New York Harbor and is a known commercial and recreational fishing area.

20-7 Dredging of sand is done in nearby areas to the 15 mile site. There are no existing fish and shellfish cultures or areas of special scientific importance at any of the four ocean dump sites considered by EPA. 9) the existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys. The existing water quality at the 15 mile acid site is in a stressed condition due to the current ocean dumping occurring in the apex of the Bight. The ecology at the 15 mile site is more diverse than that at the 106 mile site. However, the ecology at this site is beginning to show signs of stress with certain species of fish i.e. yellowtail flounder and winter flounder developing fin rot. Also, the Bight apex in the area of the acid site is devoid of surf clams whereas in the surrounding areas surf clams are abundant. Trend assessment and baseline surveys have been performed at the 106 mile and 15 mile sites. The 106 mile site is a better choice for a dump site because of the paucity of the biota. 10) the potential for the development of recruitment of

20-8 nuisance species in a disposal site. The 106 mile site is least likely to develop nuisance species in the disposal area whereas the current 15 mile site is the most likely. This reasoning is based on the fact that the acid wastes are more rapidly dispersed at the 106 mile site and that the greater depths prevent the accumulation of acid wastes on the bottom. The current 15 mile site is most likely to develop nuisance species because of its lesser depths and lower transport velocities. The northern and southern sites are intermediate in their probability of developing nuisance species because of the intermediate depths and transport velocities. 11) the existence at or in close proximity to the site of any significant natural or cultural features of historical importance for all ocean dump sites is

approximately equivalent with respect to this criteria.

The general criteria in Section 228.6 of the ocean dumping regulations are more fully met by the 106 mile dump site. The Division of Fish and Wildlife, therefore, recommends use of the 106 mile dump if ocean dumping is to be permitted and that the current use of the 15 mile dump site discontinued.

Pages 1-10. Once EPA establishes an ocean dump site, the site must be monitored for adverse impacts of the waste disposal. EPA monitors; 1) the movement of materials into estuaries or marine sanctuaries or onto ocean front beaches or shorelines. 2) the movement of materials toward productive fishery or shell fishery areas. 3) the absence from the disposal site of pollution sensitive biota characteristic of the general area. 4) the progressive non-seasonal changes in water quality or sediment composition at the disposal site when these changes are attributed to the materials disposed of at the site. 5) progressive non-seasonal changes in composition or numbers of pelagic, demersal or benthic biota at or near the disposal site when these changes can be attributed to the effects of materials disposed of at this time. 6) the accumulation of material constituents including without limitation human pathogens in marine biota at or near the site. The 106 mile site is the most difficult to monitor for these effects because of its distance from land. However, this distance from land acts as a buffer zone to prevent these effects from occurring. The 15 mile site is most likely to have these effects because of the proximity of this site to estuaries, ocean fronts and shorelines and because of the nearness of productive fisheries and shell fisheries to this site. The 15 mile site is more likely to interfere with pollution sensitive biota because there are more biota in the apex of the New York Bight than exist at the 106 mile site. It is also more likely that the 15 mile site will have marine biota that will accumulate toxic substances than the 106 mile site. Currently the 15 mile site has heavy metals accumulating in the sediments. These accumulations have the potential for being incorporated into the marine biota.

Page 1-11. EPA has established impact categories Section 228.10(c) in its ocean dumping regulations which specify impacts detected by site monitoring which dictates modifications and use of a disposal site. EPA has categorized the current 15 mile acid site into Impact Category II. The Division of Fish and Wildlife disagrees with this classification and believes that the 15 mile acid site belongs in an Impact Category I. An ocean dump site should be in an Impact Category I if the biota sediments or water column of the disposal site, or any area outside the disposal site where any waste or waste constituents from the disposal site is present in detectable concentrations above the normal ambient values are adversely effected by the toxicity of such waste or waste constituents to the extent that there are statistically significant decreases in the populations of valuable commercial or recreational species or of specific species of biota essential to the propagation of such species within the disposal site and such other area as compared to populations of the same organisms in comparable locations outside such

20-9 site and area. The surf clam, an important, valuable, commercial species

is absent from the acid site benthos. Whereas surrounding areas have abundant populations of this clam. EPA has identified accumulations of heavy metals in the benthos at the acid dump site. For this reason, the Division of Fish and Wildlife believes that the current acid dump site belongs in an Impact Category I.

Page 1-12. EPA's environmental impact criteria state that trace contaminants in the liquid fraction must neither exceed the marine water quality criteria (EPA 1976) nor existing toxic and bioaccumulative forms. On Page D-7 of this document, EPA lists some of the constituents of the waste liquids of NL Industries. Amongst these wastes, are listed cadium, chromium, lead, and mercury. All these compounds are known to bioaccumulate. In addition, EPA lists petroleum and organics. Depending upon specific composition, these materials may also be capable of bioaccumulation. EPA criteria also requires bioassays

20-10 of ocean dumped wastes. This document does not present the results of bioassays on any marine form. Bioassays on marine fauna should be performed using the acid wastes. Benthic fauna should be utilized for bioaccumulation and toxicity assays and the results presented in the EIS.

Page 2-5. EPA states that the effects of acid wastes on the ecosystem are undetectable. It presents the following evidence to support its premise. Although the standing crop of zooplankton and numbers of benthic animals were less on the acid ground than the control area, we have been unable to attribute these differences to acid waste. In any scientific investigation, any difference which is determined between the treatment and control is considered to be due to the

20-11 treatment. If this were not the case, then there would be little purpose in doing the experiment. It is, therefore, illogical for EPA to conclude that acid wastes were not the cause of the differences in the standing crop of zooplankton and numbers of benthic animals.

Page 2-5 and Page 2-6. EPA cites laboratory experiments by Grice have shown that the mortality of adult copepod populations occur mainly due to the low pH of the waste and that the mortality of adult copepod populations behind the barge are minimal because the low pH exists for a very few minutes only. EPA further cites a study by Wiebe which was performed in the laboratory and determined that the mortality of copepods appear to be due to the acidity of the waste product rather than some toxic component in the material. Wiebe's studies concluded that the mortality of zooplankton resulting from acid waste discharge is negligible because potentially lethal concentrations of low pH do not persist for sufficient time to produce a noticeable effect in the field. EPA has not performed or cited experiments that have been performed which measured percent moribund zooplankters after wastes have been discharged and compared them to the percent moribund zooplankters prior to discharge of wastes. Such field experiments would

20-12 appear to be necessary to establish the effects of the acid wastes under actual field conditions. Should EPA issue a permit for continued acid waste dumping this should then be made a permit condition.

Page 2-7. EPA does some very sketchy economic calculations on this page. NL Industries is reported as spending 1.84 million for disposal of its wastes. Allied Chemical spends approximately $170,000 per year for the disposal of its waste. EPA offers no explanation why the per trip costs for Allied Chemical is nearly 5 times the cost on a per trip basis

20-13 as that of NL Industries. EPA also appears to be lax in the record keeping required for barge dumping since NL Industries estimates that 640 trips were made in the year preceeding October 1977. A record should be required to be kept of each trip that is made, and the quantity and content of the waste. EPA suggests that the monitoring costs are difficult to estimate for the current site but says the costs to the Federal Government is low since monitoring programs are required for the other ocean disposal sites in the apex. EPA should have presented, in dollar value the costs for monitoring at each of the disposal sites, so that a fair comparison can be made. It should be pointed out that EPA already monitors the existing 106 mile site so that the additional cost of monitoring the acid wastes may possibly be minimal. EPA states the permittees are required to conduct a summer survey each year to evaluate the short-term effects of the waste. These surveys cost approximately $17,000 each. EPA further states that the cost is lower for this near shore shallow site than it would be for a site further off shore in deeper water. The dollar value is not presented, however, for this off shore monitoring. Such a value should be presented for comparison.

Page 2-8. EPA states there are no documented losses of biological or mineral resources in the apex of the Bight due to the acid waste discharges. While the absence of the surf clam from the acid waste site may not be caused by the acid waste specifically. This absence must be attributed to the generally degraded condition in the New York Bight apex. The actual monetary value which would be lost due to the absence of the surf clam will be hard to calculate. However, a rough idea of the loss could be estimated by the area which contains no surf clams comparing it to the area surrounding the disposal sites and proportionately increasing the monetary value of the surf clam catch.

Page 2-8. EPA makes a claim that except for whiting, important species are either not present at the site, not affected by acid wastes or become contaminated by other sources such as sewage sludge. If this claim is true, then the conclusion must be drawn that the acid wastes are affecting biota in this region because in the surrounding areas in the New York Bight apex there are many important species which are present such as striped bass, bluefish,

20-14 Atlantic and shortnose sturgeons, blueback herring, alewife, weakfish, surf clam and shad.

Page 2-13. EPA argues that the monitoring of the site off the continental shelf is much more difficult than at the shallower, in-shore site. EPA states that in the case of the 106 mile site, the difficulty of measuring and predicting the effects of waste disposal is further complicated by the interactions of major water masses, shelf water, slope water and gulf stream eddies. The site is a complex, oceanographic area in which to assess natural and environmental conditions and the impact of man's activities upon those conditions. If EPA is to rely upon these conditions

for rapid dispersal of the toxic substances, then it has to accept the more difficult monitoring regime necessary at a site off the continental shelf. Rapid dispersal and easy monitoring are mutually exclusive for the proposed action that EPA describes.

Page 2-13. EPA argues that a distant off shore site is less desirable because the risk of emergencies and short dumping increased. EPA does not however indicate in this document how often emergencies and short dumping has occurred in the past at the current 15 mile site. It also does not

20-15 present the increase in probability that would be had should the ocean dumping be permitted at the 106 mile site. EPA says that should emergency disposal be necessary during inclement weather the effects would be mitigated by the rapid dilution caused by storm turbulence. This suggests that a possible permit condition would be that disposal of acid wastes would not occur when certain weather patterns are eminent. Thus, minimizing the need for emergency disposal of acid waste.

Page 2-13. In its economic discussion, EPA says NL Industries has estimated operating costs to barge to the 106 mile site at 9.4 million per year. This is about 5 times more expensive than the present cost at the 15 mile site.

20-16 There is no presentation of how this figure was arrived at. On the surface it does not appear that increasing the distance approximately 7 times will increase the cost 5 times. EPA should provide a more detailed accounting of the economics associated with the 15 mile site and the 106 mile site so a comparison can be made.

Page 2-14. EPA states that moving to the 106 mile site has logistic problems because the round trip transit time would increase from 12 to 38 hours, the present loading dock at NL Industries would be unfeasible, there would be a higher probability of weather delays, the requirement to pass through 2 draw bridges during certain tidal conditions and a need for increased

20-17 temporary land storage facilities. EPA should include in this EIS a table which is capable of quantifying these parameters of the 15 mile versus the 106 mile site. The details which EPA has given about logistic problems is sketchy and the analyzer of this document has no indication why the original docks cannot be used, what the increase of probability due to weather delays would be, how the 2 draw bridges will interfere with the disposal operations and why there is a need for increased temporary land storage facilities. EPA should provide this information.

Page 2-14. EPA states the cost of monitoring the 106 mile site is high compared to other areas due to the complexity of the environment and distance from shore. EPA should present a table comparing all four sites outlining the cost for monitoring each site. The Division of Fish and Wildlife *would like to point out that the 106 mile site is already being monitored* and the additional costs would be those due to the specific nature of the acid wastes.

Page 2-15. For the purposes of calculating surveillance at the 106 mile site, EPA has assumed that NL Industries will be making 400 trips per year. On

20-18 Page 2-17, NL Industries estimated it made 640 trips per year. EPA should be consistent in the number of trips per year made to the site throughout its impact analysis unless it can justify the need for different

estimates. It is very difficult for the reader not to use uniform assumptions throughout the document. This deficiency should be corrected.

Page 2-15. EPA and the Division of Fish and Wildlife recognizes that the 106 mile site is not a uniquely productive location for fishermen and does not obstruct migration routes of commercially important species. Therefore, the probability of fish stocks accumulating toxic levels of waste constituents is extremely low. The 106 mile site is far superior to any other site recommended by EPA from this aspect.

Page 2-16 to Page 2-23. The Division of Fish and Wildlife supports EPA in its position that new sites should not be established on the continental shelf. The use of the northern and southern areas should be avoided. These sites have potentially exploitable resources and should remain free from contamination. Existing sites such as the 106 mile site which already have contamination should be utilized if possible.

Page 2-23. EPA presents a summary evaluation of alternative locations on and off the continental shelf as potential disposal sites. The following reasons are offered by EPA in support of its choice of the acid waste site as the most desirable location on all alternatives examined. 1) It conforms to the ocean dumping regulations recommendation to use either historical sites or sites off the continental shelf whenever feasible. While it is true that the current acid site is a historical site it is also true that the current acid site is not off the continental shelf. Using this reasoning the 106 mile site is a better site because it is a historical site and it is also off the continental shelf. 2) It has been studied extensively for more than 30 years. It is probably true that the acid site has been studied for more than 30 years, however, the reason for this is likely to be related to the general degraded condition of the

20-19 New York Bight apex. The 106 mile site has also been studied for a long period of time. Data having been collected for approximately 20 years. 3) Only minor, short-term adverse environmental changes and no long-term effects caused by acid waste disposal have been demonstrated at this site. Though, no short-term or long-term adverse environmental effects can be attributed to acid wastes specifically there is no doubt that heavy metals have built up in the sediments and that surf clams are absent from the acid waste site. The most likely reason for these effects is the continued dumping in the general New York Bight apex region. It is highly unlikely that the 106 mile site would present any short-term or long-term effects relative to the acid waste site because of the high turbulence of the waters in this region and because of the low biological activity. The 106 mile *site has not shown any short-term or long-term effects accept for abernations* in mackerel eggs. 4) Moving the acid waste disposal from the New York Bight apex would not create a measurable environmental benefit nor would the area closed to shellfishing be re-opened. Though this may be true at the present time, this situation is not expected to continue since ocean dumping of sewage sludge will end in 1981. The presence of pathogens at some future time shall be removed from the water and the possibility of re-opening the shellfish grounds exists. 5) The site is convenient to New York Harbor.

The 106 mile site is convenient to New York Harbor though the distance from the harbor has been increased.

Page 2-23. EPA states that after considering all reasonable alternatives the proposed action, the designation of the New York Bight acid waste disposal site continued use, is the most favorable alternative. The Division of Fish and Wildlife disagrees with this conclusion. Fish and Wildlife believes a technology for land disposal should be established and if the decision is made that ocean dumping is necessary that the 106 mile dump site is the most preferable for reasons stated in other comments previously. In support of its conclusion, EPA says that although there are risks involved in this action, environmental risks of waste disposal at this site is considered to be less serious than the risk of disposing of waste at a different location on or off the continental shelf. EPA does not offer convincing arguments explaining the reason the environmental risks is less at the 15 mile site than the 106 mile site. And in fact, the 15 mile site does not fill the general and specific criteria of the ocean dumping regulations as well as the 106 mile site.

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Page 2-28. EPA states the ocean dumping regulations and criteria Part 227 sub-part (c) requires that a need for ocean disposal must be demonstrated before issuance of a permit. EPA should include in the EIS the demonstration which was submitted by the two permittees which shows the need for ocean disposal. Without the specifics of this demonstration, it is very difficult for reviewers of this document to accept the need for ocean disposal.

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Page 2-29. EPA states that wastes from both permittees are diluted and dispersed well within the allowable time for mixing. This, however, is not true. As EPA recognizes that the colored waste plume is detectable up to 48 hours after a disposal operation. Though EPA considers this colored plume due to rust not a toxic situation, this plume is certainly indicative that waste materials remain in detectable quantities for periods longer than the 4 hour mixing period. Why hasn't EPA considered color as part of the *criteria in establishing an allowable mixing period?*

20-23

Page 2-29. EPA states that consideration of the general rate of exchange water between the New York Bight and the adjacent parts of the ocean make it extremely unlikely that the quantity of waste discharged during more than a few days could be found in the region at any one time. No evidence has appeared which indicates that undesirable effects of any sort has arisen from these waste disposal operations. If this is true, why are areas devoid of surf clams, restrictions placed on the taking of shell fish in the neighborhood of the dump sites and instances of fin rot on winter flounder very high in the New York Bight?

Page 2-30. EPA states that adverse effects resulting from acid waste disposal have not been documented and cites Swanson in support of this statement. EPA says that Swanson has determined that hydrated iron oxide precipitates from acid wastes coats suspended particles including biota, it might be suspected that coatings could adversely affect some membrane transport functions. No observational evidence can be found to indicate any affects on biota from such coatings. Surveys of benthos populations in the immediate vicinity of the apex acid waste dump site has not demonstrated any observable impact of waste

acid. Such an observation at the site would not be expected for two reasons. First, the acid waste materials do not accumulate in the sediments of the site and second, any impacts would be the sum of all activities affecting the site and could not be attributed to acid waste alone. Long term, sub-lethal, toxic effects on organisms at and near the apex site have not been investigated.

Considering the above, it should be pointed out that respiration in fish proceeds over the gills and that the respiratory process is a membrane transport function. Discovering any adverse effect on the respiratory process of fish would be very difficult without simultaneously trawling behind the discharging barge. Without such a supportive trawling effort, claims about the adversity of the hydrated iron oxide precipitates are ambivalent. As was pointed out in the previous comment, referring to Page 2-29, adverse effects had been observed at the acid dump site. The Division of Fish and Wildlife, recognizing the possibility that the adverse effects observed at the acid dump site may be from other wastes at other sites, is for the purpose of reviewing this document, considering the adverse effects due to acid waste dumping since this is the only dumping permitted at this time.

Page 2-31. EPA states the acid wastes do not contain constituents which promote phytoplankton growth. EPA has not presented a table listing all the materials present in the acid waste and giving the quantities of each. The most complete list of the materials present in the wastes are on pages D-7 and D-14. The terminology utilized in these tables is sketchy. Using the term organics and petroleum hydrocarbons, does not allow the reviewer of the EIS to make a decision about toxicity of these components. Other materials such as iron and fluorides are known to be present in the waste and yet are not included in the list on these pages. The EIS should contain a list of all materials, relative concentrations of each, and the absolute quantities in the waste discharged. This list is a prerequisite to the Division of Fish and Wildlife drawing any conclusion about EPA's *claim that the waste do not contain constituents which promote phytoplankton* growth.

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Page 2-32. EPA states "essentially these are liquid wastes which comply with the ocean dumping regulations concerning environmental impact need for ocean disposal, and impact on esthetic recreational, economic and other uses of the ocean". Why does EPA use the qualifying word, "essentially"? The wastes must meet the ocean dumping regulations not "essentially" meet the regulations.

Pages 2-34 through Pages 2-38. EPA discusses special conditions for the current and for future permits for waste disposal at the acid site. These special conditions seems to be a very sketchy description of future waste disposal permits. EPA should have reproduced in this EIS the permit issued to NL Industries and Allied Chemical so that the permits could be referred to by the reviewer of the EIS. EPA has required special condition #2, that the permittees report the volumes of waste delivered or transported. Reporting the volumes of materials be be

transported for ocean dumping is a poor descriptive of the material in the waste. The quantities of the constituents of the waste should be reported for each barge load as well as the volume discharged. The Division of Fish and Wildlife recommends that special condition #3 specify the disposal site to be the 106 mile chemical site. Special condition #4 specifies the discharge rates for NL Industries and Allied Chemical. NL Industries is allowed to discharge 100,000 gallons per nautical mile and Allied Chemical 12,000 gallons per nautical mile. What is EPA's justification for allowing NL Industries the high rate of discharge?

20-25 Considering that, NL Industries wastes are more concentrated for every constituent listed on pages D-7 and D-14 except for mercury, it would seem that the more concentrated the waste and the more wastes that are discharged, the greater the dilution factor would have to be. Why is it that EPA's permitted discharge rates do not reflect this rationale. EPA's special

20-26 condition #5 specifies the waste conditions to be monitored. EPA has not presented in the EIS a list of the waste constituents to be monitored. Such a listing should be included in the document. Special condition #5 specifies that samples need to be taken monthly for analysis. The Division of Fish and Wildlife recommends that samples should be taken on each barge load and that the number of replicates be specified in this condition. EPA's special condition #6 requires continuation of the EPA approved monitoring program to be determined as short-term environmental impacts

20-27 of the ocean disposal of acid wastes. EPA should also require a study plan for the long-term environmental impacts of the ocean disposal of wastes. The Division of Fish and Wildlife recognizes that such a program is more difficult to specify but knowledge of the constituents of the acid wastes as presented on Pages D-7 and D-14 shows constituents which are known to bioaccumulate. Such effects cannot be determined by a short-term monitoring program. EPA special condition #7 pertains to the implementation of alternative disposal methods. EPA mentions several alternative disposal methods which have been or will be investigated by the permittees. These

20-28 conditions as described by EPA in the EIS do not specify the time by which the permittee should establish safe land based disposal methods on changing their manufacturing process so that ocean dumping may cease. Such time limits should be specified in each industry's permit.

In summary, the Division of Fish and Wildlife was not able to give sufficient consideration to the special conditions of the permits. Presentation of the permits in the appendix of the EIS would have allowed for a more meaningful review of the waste disposal operations.

Page 3-1. EPA recommends that the current acid site be preferred for designation because of the lack of adverse effects at the proposed New York Bight acid waste disposal site. The following evidence indicates that adverse effects have been observed at the New York Bight acid waste disposal site. 1) The numbers of large surf clams taken in 4 to 6 minute tows by hydraulic clam dredges have indicated the absence of clams at the acid waste disposal site[1]. 2) Twenty-two species of fishes in the Bight have been identified with fin rot. Fin rot disease in several species of fishes in the Bight is a manifestation of environmental stress. Of the species observed, the winter flounder is much more susceptible than any other species. Of 1,489 winter flounder from 435 off-shore trawl hauls were examined for fin rot. Of these flounder, 14% from the apex had fin rot where as only 1.9% of them

20-29 from other areas have the disease[2]. 3) Resistence to toxic heavy metals has developed in some bacteria in the Bight. The resistence established in one species can be transmitted to different genera and species of bacteria. Coliform bacteria having resistence to heavy metals have been found in New York Bight[3].

Page 3-3. A major disadvantage to using the 15 mile acid waste site is that the Bight circulation is a slow flow to the southwest over most of the continental shelf. This anti-cyclonic eddy is often present in the Bight. This pattern of circulation has a tendancy to blow any acid wastes which have been disposed of at this site towards the New Jersey shore or the New York shore. Moving to the 106 mile site minimizes any chance of wastes reaching to shore. The possibility of wastes reaching the shore should always be considered as is evidenced by thin

20-30 layers of black muds reaching within 1½ nautical miles of Long Island beaches. These black muds have a total organic carbon concentration that is similar to those found at the actual dump site. Though this is not conclusive proof that sewage sludge or toxic acid wastes will reach the shore it certainly suggests in is a possibility.

Page 3-5. EPA states although some material may reach the bottom during unstratified winter conditions there is no indication of build up of contaminants from acid waste in the sediments. While this statement may be true, if evidence is looked for to explain the build-up of contaminants from acid waste specifically, it is also true that high concentrations of mercury, cadmium, arsenic, lead, copper, zinc and chromium were found in the sediments of the ocean dumping grounds. Each of these elements is more abundant in the

20-31 waste sediments by a factor of at least 2 to as much as 20 times the typical concentrations observed in shales[5].

Page 3-5. EPA states there is no indication of abnormally depressed oxygen levels

20-32 near the acid site. Are there any indications of depressed levels of oxygen at the acid site?

Page 3-6. EPA states that even though plankton have been studied for about 75 years, the data are insufficient to assess the effects of man's activities on

20-33 plankton populations in the Bight. In light of this fact, how does EPA expect to show any effects of acid waste dumping on plankton populations with short-term monitoring program?

Page 3-6. EPA states many fin fish of commercial and recreational importance are found in the New York Bight. Their diversity and abundance are due to the geographical location of the Bight which is the northern limit of tropical and sub-tropical migrations. Some species are found in shore and others off-shore and some migrate from in shore to off shore. However, because of wide seasonal fluctuations in the Bight, the important fish species are migratory and not unique to the apex of the Bight. EPA is implying that

20-34 because important fish species are migratory or cosmopolitan they do not have to be protected to the same degree as species that are not. The Division of Fish and Wildlife disagrees with this implication, in fact, EPA and its guidelines for the implementation of Section 316a recognizes the importance of migratory routes and demands that such routes be paid special attention. It should be pointed out that the 106 mile site does

not have the diversity and abundance that exists in the New York Bight apex, nor does it have the commercial and recreational fisheries that exist in the Bight apex.

Page 3-6. EPA states eggs, larval stages and immature forms can be found all year round throughout the area and spawning and larval growth usually spreads over a broad geographic area and that it is difficult to assess man's effects on the stock. The need for assessment of man's effects on the stock would not be necessary at the 106 mile site, since the lower diversity and abundance of all stages of biota at the 106 mile site makes the 106 mile site much more preferable than the Bight apex.

Page 3-6. EPA states that there are minor fishing activities around the acid site and that the area is closed to shell fishing. It should be pointed out that since 1974, the area closed to shell fishing has increased in size because of the threat to human health. The increase in the size of the area closed to shell fishing can only be due to the increased degradation
20-35 of the New York Bight apex. Continued use of the acid site can only aggravate this situation.

Page 3-10. EPA states in its section on the effect of waste on organisms that observations on minor effects were reported by a number of authors and that severe effects were reported by the National Marine Fisheries Service, Sandy Hook Laboratory. EPA should state what effects were observed by the authors. Without reporting the facts about the effects the reader of the EIS is not in position to judge whether EPA's classification of effects as minor is correct.

Page 3-10. EPA states that a variety of phytoplankton and zooplankton has been collected in the wake of an acid waste discharge. Animals may be immobilized immediately after disposal but recover quickly when the waste
20-36 is diluted by an equal volume of sea water. EPA should have reported how dilute the waste must be in order that phytoplankton and zooplankton survived. It should also state how long it takes for the wastes that are disposed of at sea to reach such a concentration. The calculated volume over which mortality conditions exist should be stated.

Page 3-10. EPA states that laboratory work indicated that phytoplankton were unaffected by a concentration of acid waste four times higher than concentrations observed in the field and that zooplankton were chronically affected by
20-37 concentrations of one part waste per 10,000 parts sea water. Have determinations been made on zooplankton at concentrations less than one part per 10,000 to determine chronic effects?

Page 3-12. EPA states that NL Industries conducted comprehensive studies on the effects of acid iron waste which concluded that there were no conflict between the waste disposal operations and sport fishing activities in the Bight apex. EPA does not give any particulars about the study. In what respect were there no conflicts? Were there no conflicts due to the actual maneuvering the barges or no conflicts due to the mortality caused by acid waste or no
20-38 conflicts because sport fish were more active in the area because other creatures had suffered some mortality due to previous acid disposal?

Page 3-12. EPA cites a study that concluded that bluefish and yellow fin tuna were attracted to the site and that a fishery for these species had begun in the area. Had studies been done at a previous date to establish whether
20-39 there had been the same fishery prior to this study? Is it not possible that bluefish and yellow fin tuna are attracted to the area because the species that they prey on have been made easy prey due to the acid waste dumping? Westman, the author of this study did not observe adverse effects caused by the waste disposal. Is this a casual observation made at the surface or was this a more definitive study using sample gear that was appropriate to draw this conclusion?

Page 3-12. EPA states that the waste does not appear to be toxic to bottom dwelling animals, the benthos, and the site supports a typical sand bottom community. EPA further states that biomass and species diversity are comparable to
20-40 control areas although the number of animals is significantly less than other investigators have reported for benthic conditions at the site. EPA again concludes that the acid wastes are not toxic to organisms even though there are differences between the acid site and the control areas. This is not in line with good scientific procedure that says that the differences between controls and the treatments will be assumed to be due to the treatment.

Page 3-13. EPA Region II requires permittees to monitor the respective sites and determine if the disposal operations have short-term adverse impact. Monitoring surveys are made at the acid site once a year and at the sewage sludge site daily during the summer. Though EPA does not state in the EIS the specifics of monitoring surveys, it is hard to conceive that any monitoring program which requires sampling once a year can
20-41 produce any usable results. This requirement appears to be a token monitoring requirement so that EPA can justify its following the ocean dumping regulations. The physical, chemical and biological entities in the Bight are highly variable and the composition of the waste as indicated on Pages D-7 and D-14 are also highly variable. One can only wonder what utility there would be in sampling once a year at this site. There is also no indication that this once a year inadequate monitoring program is done at the same time disposal operations are taking place or is done at some time thereafter.

Page 3-18. EPA recognizes the majority of recreational fishing in the New York Bight is confined to the inner shelf waters which is more accessible to the public, and more sports species are found there, than in the outer Bight. EPA also recognizes the sport catch often equals or surpasses the commercial catch for certain species and significantly contributes to the economics of several coastal areas. Acid waste disposal at the 15 mile site has a greater potential for affecting recreational fisheries than disposal at the 106 mile site. Very few recreational fishermen are likely to fish at the 106 mile site.

Page 3-34. EPA states the authorized discharge rates of the acid waste at the site have been established by EPA Region II to prevent long term adverse effects caused by the waste discharges. What criteria was used to determine the
20-42 appropriate discharge rates? Are these same criteria used to determine

appropriate discharge rates for the acid waste at the acid site?

Page 4-1. EPA states the release of acid wastes at any of the alternative sites would produce similar environmental consequences and that there will be minor short-term adverse effects on the plankton and minimal effects on bottom living organisms. This statement is unjustified since there are different resources at the southern, northern and 106 mile area as EPA has noted in previous chapters.

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Page 4-1. EPA states that no effects are expected at the 106 mile site which is located in water depths of greater than 1500 meters. The Division of Fish and Wildlife agrees with this conclusion and recommends that acid dumping move from the current acid site to the 106 mile site.

Page 4-19. EPA states the northern and southern areas which have never been used for acid waste disposal share a number of environmental features in common with the New York Bight acid waste disposal site, except that they are deeper. Disposal of acid waste at these sites will probably have little effect on water chemistry but effects on the benthos may occur. How does EPA justify previous conclusions that acid wastes will have little effect on the benthos in the New York Bight acid waste disposal site, yet it concludes at deeper sites such as the northern and southern areas, will be effected.

20-44

Page 4-21. EPA states that it had 24 possible violations of permit regulations sufficient to cause follow-up actions between 1973 and 1977. Three of these violations were for the acid site and 7 were for the 106 mile site. This number of citations indicates it is very difficult to regulate ocean dumping and see that the regulations are properly carried out. The Division of Fish and Wildlife believes this is a strong argument for developing land based disposal techniques and that land disposal should be the primary objective for EPA.

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Page 4-22. EPA states that the probability of an emergency rises as the round trip transit time increases and suggests the decision to locate a site far from shore carries with it the increased risk of emergencies resulting in short dumping. EPA should present a short table of facts of how many time short dumping has occurred in the past and compare this to the expected short dumping that would occur should the site be changed to the 106 mile site.

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Page 4-23. EPA suggests that because impacts are reversible they do not require additional mitigating measures. The Division of Fish and Wildlife does not agree with the thinking that additional mitigating measures are not required just because an impact is reversible. Mitigation is necessary even for reversible impacts.

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Summary of Specific Comments on the Draft Environmental Statement EIS for New York Bight Acid Waste Disposal Site Designation.

EPA has concluded that the New York Bight acid waste disposal site that is in current use should be continued as a designated site for acid waste disposal. The Division of Fish and Wildlife disagrees with this conclusion. The Division concludes that the current site is the worst site of all sites considered for acid waste disposal and should an ocean waste site be needed, that the 106 mile site is the best of the alternatives considered by EPA. The 15 mile site has abundant benthos, plankton and nekton resources, it is in active shipping lane and is most accessible to the recreational fishermen. Furthermore, the 15 mile site has been shown to be in a severely degraded state with concentrations of heavy metals in the sediments, fin rot present in fish, absence of surf clams at the disposal site and bacteria that are resistant to heavy metals. The 15 mile site meets fewer of the criteria of the ocean dumping regulations than any of the sites considered. The 106 mile site is the least active biologically and should be the first choice for an acid waste disposal site. In addition, the 106 mile site fits all the criteria of the ocean dumping regulations. The Division of Fish and Wildlife recommends that no ocean dumping be permitted because of the known bioaccumulation properties of some of the components of the waste. However, should an ocean dumping permit be granted, the 106 mile site is the best choice. A safe land disposal method should be the primary objective of EPA.

Kenneth F. Wich
Director
Division of Fish and Wildlife

cc: Reg. 3
Reg. 4
Div. of Marine Resources

References

1. NOAA Technical Report ERL 321-MESA 2 Ocean Dumping in the New York Bight, Boulder, Colorado. March 1975 p. 55.

2. Ibid. p. 56.

3. Ibid. p. 64

4. Ibid. p. 42.

5. Abstracts Special Symposium. The Middle Atlantic Continental Shelf and New York Bight, 3-4-5 November 1975 American Museum of Natural History, New York City p. 52.

21 Allied Chemical

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February 11, 1980

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. T. A. Wastler, Chief
Marine Protection Branch (WH548)
U.S. Environmental Protection Agency
Washington, DC 20460

Subject: Draft Environmental Impact Statement (EIS) for New York Bight Acid Waste Disposal Site Designation, Dated November, 1979

Dear Mr. Wastler:

Allied Chemical Corporation welcomes the opportunity to provide comments on the draft "Environmental Impact Statement (EIS) for New York Bight Acid Waste Disposal Site Designation," filed on December 14, 1979 (44 FR 75714). Allied Chemical Corporation's plant, located at Elizabeth, NJ, is one of two permittees utilizing the acid waste disposal site in the New York Bight. By-product hydrochloric acid from this facility which cannot be sold is disposed of at the "acid grounds" under the provisions of Ocean Dumping Permit II-NJ-004.

We concur with the U.S. Environmental Protection Agency's recommendation to designate the New York Bight Acid Waste Disposal Site for continued use for acid waste disposal.

We have reviewed the draft for technical accuracy and our comments are attached for your consideration. Should you have any questions or require additional information, please contact me at (201)455-2807. We have appreciated the opportunity to participate in this review.

Very truly yours,

R. Sobel/jp

R. Sobel, Director
Environmental Controls

RS/jp
Attachment
cc: Dr. P. W. Anderson, Chief
Marine Protection Program
USEPA II
Edison, NJ 08817

Comments on "Draft Environmental Impact Statement (EIS) for New York Bight Acid Waste Disposal Site Designation"

by

Allied Chemical Corporation
Morristown, New Jersey

Page xix, paragraph 6 - We believe that the statement regarding the characteristics of the waste material may be misleading (i.e., "contain no constituents in concentrations detectable outside the site or above - normal ambient levels more than 4 hours after discharge.") It has been well documented that acid-iron wastes can be detected visually well beyond the disposal site (i.e., page 2-4, paragraph 4). We recommend that this paragraph be modified to be consistent with the requirements of 40 CFR Part 227, Subpart G (Section 227.29(a)) of the ocean dumping regulations. The suggested change is:

21-1 • Contain no constituents in concentrations greater than the Limiting Permissible Concentration (LPC) outside the site or inside the site after initial mixing (i.e., four hours).

Page 1-12, paragraph 2 - The summary section of the USEPA's ocean dumping environmental impact criteria (40 CFR Part 227, Subpart B) are misleading and technically incorrect.

• "Trace Contaminants in the liquid fraction must neither exceed the marine water quality criteria (EPA, 1976) nor exist in toxic and bioaccumulative forms."

21-2 We believe nor should be replaced with or to be consistent with the requirements of the regulations (40 CFR, Part 227, Section 227.6).

Our interpretation of the regulations also indicates that trace contaminants in the liquid fraction can be either determined by bioassays or by comparison to water quality criteria (WQC) after initial mixing. By definition, comparison to the specific marine water quality criteria should provide adequate protection for health effects. We also note that no bioaccumulation tests are required for wastes that only possess a liquid phase.

• "Bioassays on the suspended particulates or solid fractions must not indicate occurrence of significant mortality or significant adverse sublethal effects, including bioaccumulation due to waste dumping."

21-3 Our interpretation of the regulations indicate that significant mortality is allowed to exist in bioassay laboratory tests with the suspended particulate phase. The regulations permit extrapolation of the laboratory results to the dumpsite environment and comparison to the LPC for that particular constituent.

We also note that bioassays must also be conducted on both the suspended particulates and solid fractions to comply with the provisions of Section 227.27(b).

Page 2-7, paragraph 2 - The statement "Allied Chemical has estimated costs at about five times NL Industries' cost" is somewhat misleading. Allied's costs involve dedicated use of one specific barge (AC-5) for ocean dumping by-product hydrochloric acid. There are only about 12-14 trips per year to the "acid grounds." Thus, barge depreciation and maintenance are amortized over only 12-14 dumps per year. When wastes are not being dumped, the barge is not used to transport other materials.

21-4 In view of the limited quantity of acid being dumped and use of a dedicated barge, our costs per ton of acid dumped may be higher than those of the other permittee.

Page 2-7, paragraph 4 - Allied Chemical and NL Industries jointly participate in the required annual site monitoring cruise at the "acid grounds." Total monitoring program costs for both permittees are approximately $45,000-$50,000 annually, not $17,000 each as stated in the report.

21-5

Page 2-24, paragraph 3, subparagraph 2, lines 3 & 4 - Based on our interpretation of the regulations (Section 227.8), we believe that this sentence should read "can be expected to be reduced to the Limiting Permissible Concentration"...rather than "to normal ambient seawater levels."

21-6

Page 2-29, paragraph 4 - Reference is made to "30 years of operations at the site." On page 2-31, paragraph 2, reference is made to "31 years of disposal." This discrepancy should be resolved.

21-7

21-8 Page 2-33, paragraph 3 - While the statement "pH changes are detected only occasionally behind the barge and rarely exceed 0.2 pH units below ambient conditions, even a few minutes after discharge," favorably represents the effect of ocean disposal of acidic wastes, it is misleading. It would be more appropriate to state that "In all cases, pH changes in the seawater behind the barge rarely exceed 0.2 pH units below ambient conditions after initial mixing."

This modified paragraph is consistent with subsequent statements regarding pH values on page D-13 (i.e., "Four hours after discharge, pH values had returned to within 0.2 pH units of normal ambient levels").

21-9 Page 2-34, paragraph 2 - The term of Allied Chemical Corporation's permit is January 15, 1979 to January 14, 1982, not the period specified (April 10, 1979 to April 9, 1981).

21-10 Page 3-8, paragraph 2 - Background information covering studies and the technical basis for initial selection of the acid site should be included in the EIS. This information will provide the public with continuity between the initial basis for site selection and the current criteria.

21-11 Page 3-8, paragraph 4 - Allied's waste composition is reported on a weight percent basis, not volume percent as stated in this section of the report. The first sentence should read "....30% by weight hydrochloric acid (HCl), 2% by weight hydrochloric acid (HF),...." Correct units are used on page D-12 to describe the waste.

21-12 Page 4-16, paragraph 3 - As noted in a previous comment, it has been well documented that acid iron wastes can be detected visually beyond the disposal site (i.e., page 2-4, paragraph 4).

It is also appropriate to note that the joint site monitoring program was designed to measure the dispersion of the waste materials by selecting waste transport stations beyond the dumpsite boundaries. The Limiting Permissible Concentration (LPC) is the proper criteria to measure the effect of the waste material beyond the site boundaries, not "ambient concentration."

21-13 Definitions - The following changes in the listed definitions are recommended:

Page 6-3 - Bioassay: Determination of the toxicity of a substance.... [delete strength (potency)].

Page 6-9 - LC_{50} (Median Lethal Concentration): In bioassay studies, the concentration of a substance which causes 50 percent mortality of the test organisms during a given time (usually 96 hours).

Page 6-9 - Limiting Permissible Concentration (LPC): Add to the existing definition: "....or cause other sublethal effects or cause bioaccumulation" to make the definition consistent with 40 CFR Part 227, Subpart G, Section 227.27.

21-14 Page D-3, paragraph 2 - Allied Chemical's ocean dumping permit expires January 14, 1982 not April 9, 1981.

21-15 Page D-14, paragraph 2 - Line 5 specifies "conventional LD_{50} values...." This is technically incorrect and should be reported as LC_{50}.

21-16 General - Typographical Errors

page 1-3, paragraph 1, line 1: decision-making.

page 2-28, paragraph 1, line 5: companies.

page 4-15, paragraph 5, line 2: sediment.

E. I. DU PONT DE NEMOURS & COMPANY
WILMINGTON, DELAWARE 19898

ENGINEERING DEPARTMENT
LOUVIERS BUILDING

January 28, 1980

Mr. T. A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
Washington, DC 20460

Dear Mr. Wastler:

This is in response to a request for comments on "Draft Environmental Impact Draft Statement (EIS) for New York Bight Acid Waste Disposal Site Designation." While the Du Pont Company does not use the Acid Waste Disposal Site, we submit comments primarily to point out some inaccuracies relative to the Industrial Waste (106-Mile) Site, one of the sites considered in the EIS as an alternate to the Acid site.

We are encouraged to note the conclusion, similar to that in EPA's draft EIS of the 106-Mile site, that no significant adverse effects have been demonstrated because of acid waste disposal.

Our comments are attached herewith. We appreciate the opportunity to comment on the draft EIS. We would also appreciate receiving a copy of the final EIS for the Acid Waste Disposal Site as well as that for the 106-Mile site.

Very truly yours,

ENGINEERING SERVICE DIVISION

L. L. Falk

L. L. Falk

LLF:mes

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cc: Dr. P. W. Anderson - EPA - Region II
Dr. W. M. Dunstan - Interstate Electronics Corporation
Mr. Marshall Holstrom - Interstate Electronics Corporation

COMMENTS OF E. I. DU PONT DE NEMOURS & CO.
ON DRAFT ENVIRONMENTAL IMPACT
STATEMENT (EIS) FOR NEW YORK BIGHT
ACID WASTE DISPOSAL SITE DESIGNATION

The following are submitted primarily to comment on the 106-Mile Industrial Waste Disposal Site which was considered in the EIS as an alternative to the Acid Waste Disposal Site. Du Pont does not dispose of wastewaters in the latter site. Most of the following comments were made relative to the draft EIS on the 106-Mile site (reference letter L. L. Falk to T. A. Wastler, September 26, 1979).

Page	Comments
2-11 22-1	The text indicates the 106-Mile site is located 167 km (90 n. mi) east of Cape Henlopen, Delaware. Scaling the western boundary of the site on Figure 2-1 shows it is 232 km (126 n. mi) east of Cape Henlopen. The site is farther from Cape Henlopen than it is from Ambrose Light.
3-36 22-2	Table 3-7 contains some incorrect values: 1. The range for copper concentrations of Du Pont-Grasselli wastewater is given as 25 - 154,700 ug/l. The maximum value is in error because of a faulty analysis. EPA-Region II had been provided a correct value. Therefore, the maximum value (observed since 1974) should be shown as 1470 ug/l. Consequently, the mean value should be changed from 3150 to 330 ug/l (1974-1978 analyses). 2. Arsenic analyses were not performed on Grasselli wastewater prior to 1977. Since then, concentrations have not been measured higher than 21 ug/l, and have averaged less than 6.
3-37 22-3	In Table 3-8, the range of aerated 96-hour TL50 values for Grasselli wastewater to the Atlantic silversides (M. menidia) is given as 1.8 to 6950 (no units are given in Table 3-8). Data submitted to EPA-Region II beginning with monthly wastewater samples taken in January, 1976, through December, 1978, show that the range for aerated M. menidia 96-hour TL50 was 750 to 6950 microliters/liter (ul/l).

Correspondingly, the range of unaerated 96-hour TL50 values for Grasselli is given in Table 3-8 as 1.7 to 6170 for M. menidia. For the same period when the aerated tests were conducted, the unaerated TL50 values ranged from 730 to 6170 ul/l.

We believe the 1.8 and 1.7 values reported as the lowest values in Table 3-8 may have come about because bioassay data for a standard toxicant was incorrectly taken as wastewater toxicity. The toxicity of sodium lauryl sulfate was determined each time a test was run. Its toxicity to M. menidia is in the range of 0.87-3.50 mg/l, averaging 1.6.

The range in Table 3-8 of 96-hour EC50 values for the diatom Skeletonema costatum for Grasselli is shown as 29 to 8600. Our review of the data beginning in 1976 show the range to be 160 to 8600 ul/l.

4-18 In Table 4-3, the volume of a quadrant of the 106-Mile site (down to 15-m depth) is shown as "3.1 x 10^9 liters (row 2, left column). What is the value of "g"? In

22-4 the Draft EIS for the 106-Mile site (June, 1979), the corresponding value in its Table 4-1 is 3.1 x 10^{13} liters for the entire site. These numbers need to be reconciled and put on an entire-site basis.

As in the case of EPA's Draft EIS on the 106-Mile site, the Acid Waste Site draft makes several recommendations on characteristics industrial wastes should have for disposal. Because the recommendations on the 106-Mile site are similar to those for the Acid Waste Site, we believe it may be helpful to comment on them.

The fourth recommendation on page xix (also the third on page 2-32) is that the wastewater characteristics "demonstrate low toxicity of neutralized wastes to representative planktonic and nektonic marine organisms." The toxic effect of a wastewater is a function of its concentration. Therefore, the toxic effect of wastewater disposed of in the ocean depends on the dilution achieved, a function of the rate of release and barge speed (ie, tons released per unit of distance traveled). Falk and Gibson (1977) and Falk and Phillips (1977) demonstrated, for both Du Pont-Grasselli and Du Pont-Edge Moor wastes, that a time-concentration curve can be developed by proper release rate such that concentrations at any time after release can be kept below the corresponding toxic effects concentration for the same time. (See EIS page 3-38.)

The same concept can be applied to any wastewater of almost any toxicity by use of an appropriate release rate. The higher the toxicity, the lower the release rate. Therefore, the logistics and economics of ocean disposal become the determinants. The recommendation that the wastes have low toxicity is not relevant. What is relevant is that the toxicity be mitigated by proper

dispersion practices. Therefore, we suggest that the recommenda-

22-5 tion be modified to provide for demonstrating low toxicity to representative planktonic and nektonic marine organisms at wastewater concentrations achieved after dispersion (see EPA regulations, 40 CFR Part 227, Subpart B).

The fifth recommendation on page 2-32 is vastly different in phraseology than the fifth one on page xix. The latter is too vague (it could exclude wastes with sodium chloride). The version

22-6 on page 2-32 is preferable except for the phrase "nor will it be exceeded anywhere in the environment after initial mixing." We suggest: "nor will it be exceeded within the disposal site after initial mixing."

LLF:mes
1/28/80

23

National Wildlife Federation

1412 16TH ST., N.W., WASHINGTON, D.C. 20036 202—797-6800

February 12, 1980

Mr. T.A. Wastler
Chief, Marine Protection Branch (WH-548)
Environmental Protection Agency
401 M Street S.W.
Washington, D.C. 20460

Re: Comments on Draft Environmental Impact Statement for New York Bight Acid Waste Disposal Site Designation

Dear Mr. Wastler:

The National Wildlife Federation ("NWF") has carefully reviewed the referenced draft environmental impact statement ("DEIS") and wishes to offer the comments which follow. Our major criticisms of the DEIS can be grouped into the following categories: (1) failure to adequately discuss non-ocean dumping alternatives to the proposed site designation; (2) failure to adequately consider the role of the persistent ferric hydroxide floc as a concentrator of toxic chemicals (derived both from dumps of acid wastes and from other sources of contamination of the N.Y. Bight); (3) failure to adequately consider the active attraction of certain fish species to the floc as a means of potentially enhancing the bioavailability of toxic contaminants; and (4) excessive tendency to equate the lack of demonstrated harm with acceptable assurance of safety.

While NWF does not at this time oppose formal designation of the acid waste for continued ocean dumping use, we believe that continued use of the site should be subject to satisfactory accomplishment of two prerequisites: (a) a demonstration that unacceptable bioaccumulation does not occur (based on suitable
23-1 field and/or laboratory bioaccumulation assessment studies; these studies should emphasize potential bioaccumulation of contaminants associated with NL Industries' ferric hydroxide floc); and (b)
23-2 a detailed evaluation (and, if possible, implementation) of measures to minimize floc formation and/or floc persistence (e.g., total or partial neutralization of barged wastes; recycle of iron sulfate; etc.).

Our detailed comments follow:

I. FAILURE TO ADEQUATELY DISCUSS NON-OCEAN DUMPING ALTERNATIVES

23-3 The present DEIS goes further than the previous site designation EIS's prepared by Interstate Electronics in at least listing the alternatives to ocean disposal which have been

considered (at least by the permittees). DEIS, at 2-37. Unfortunately, the DEIS does not go far enough. Apart from the bald statement that, "to date," land-based alternatives "have not been economically and/or technically feasible," no information is provided on the actual economics or feasibility--so that the reader cannot judge for himself (or herself) whether, in fact, ocean dumping is the only feasible alternative.

Indeed, the very fact that EPA has imposed a Special Permit Condition (i.e., No. 7) on both acid waste site dumpers, requiring them to further explore (and, in some cases, implement) certain process change and disposal technique alternatives, suggests that EPA Region II itself regards land-based alternatives as at least potentially feasible. See, DEIS, at 2-36 - 2-37.

We recognize that the Marine Protection Branch has taken the position (and has so instructed Interstate Electronics Corp.) that site designation EIS's are to consider only ocean-based, and not land-based alternatives. However, we firmly believe that this position is logically and legally untenable. As a matter of logic, we cannot imagine how the need to designate an ocean dumpsite can be evaluated without careful consideration (in the site-designation context) of the availability of non-ocean alternatives. As a matter of law, Article IV(2) of the London Dumping Convention requires dumpsite studies to consider Annex III factors including "[t]he practical availability of alternative land-based methods of treatment, disposal or elimination ...." (Emphasis added). Similarly, Section 102(c) of the Marine Protection, Research, and Sanctuaries Act ("MPRSA") requires the EPA Administrator, before designating "recommended sites or times for dumping," to consider factors under Section 102(a) including "[a]ppropriate locations and methods of disposal or recycling, including land-based alternatives ...." (Emphasis added).

The consideration of land-based alternatives is simply not a matter that can properly be left solely to project-specific review in the context of permit-issuance.

II. FAILURE TO ADEQUATELY CONSIDER THE ROLE OF THE FLOC

The DEIS makes passing reference several times to the fact that "[c]ombinations of different waste types at a single site is generally undesirable because synergistic interactions may occur between the wastes." DEIS, at xv, 2-9. It states repeatedly that "adverse effects" due to the dumping of acid wastes "last only a few minutes following disposal," DEIS at xv, 2-4, "do not accumulate," DEIS at 2-33, and that "[w]hen compared with waste inputs from all sources, the contaminants in acid wastes are insignificant," DEIS, at xv, xvii, 3-10, D-6. At the same time,

the DEIS points out that "[a]cid-iron wastes form a visible plume of ferric hydroxide (rust) which is persistent (48 hours)," DEIS at xvi, 2-4, 2-29, 3-4, 4-16, and that the ferric hydroxide plume attracts bluefish, yellowfin tuna (and other species), DEIS at 2-4, 2-8, 2-30, 3-12, 4-4. It also points out that suspended particulate matter ("SPM") "can be toxic or can bind or adsorb toxic materials which are eventually carried to the bottom" where "the toxic material can be consumed by marine organisms," DEIS at 3-4, but makes only elliptical reference to the fact that the ferric hydroxide floc shares this property with SPM (the DEIS states only that "[a]cid-iron waste does contribute to the elevated levels of SPM in the Apex," DEIS at 3-4). (The fact that "there is no indication of a buildup of contaminants from acid waste in the sediments" at the acid waste site, DEIS at 3-5, is of course no reason to rule out localized build-ups within the extensive zone of influence (but outside of the site per se) of the persistent ferric hydroxide floc).

As the DEIS states: "Many finfish of commercial and recreational importance are found in the New York Bight ...," DEIS at 3-6, 3-3. So, although "[c]ommercial fishing activities are minor around the Acid Site" itself, id., and although "[t]he site location was specifically chosen to avoid conflict with fisheries ...," DEIS at 3-8, 4-4, these facts alone do not eliminate the potential for food-chain contamination. This is not a hypothetical concern. As the DEIS reports: "The gastrointestinal tracts of copepods and ctenophores collected at the site after a discharge were full of iron particles from the waste ...," DEIS at 3-10, A-22, B-14, B-15. The mere fact that "the animals did not appear to show ill effects," id., does not of course mean that they did not bioaccumulate floc-associated toxic contaminants (which were undoubtedly ingested along with the iron particles), which could then be biomagnified through the food-chain to the potential detriment of higher predators, including man.

In short, the DEIS consistently paints a selective and misleading picture of the potential for adverse impacts associated with ocean dumping at the acid waste site. Among the Draft's omissions or distortions are the following:

23-4 --Failure to discuss the role and significance of the ferric hydroxide floc as an active scavenger and concentrator of toxic heavy metals (cf.,DEIS at C-1) and other toxic chemicals (whether these toxicants are derived from ocean-dumped acid wastes or from other New York Bight contaminant sources).

23-5 --Failure to discuss the potential negative consequences of fish attraction to the ferric hydroxide plume (i.e., enhanced opportunities for contaminant bioaccumulation); instead, the Draft dutifully spouts the industry "party line" that the plume attracts

fish, so it must be good. See, e.g., DEIS at 4-1, B-16. Completely unaddressed is the possibility (or probability) that fish attracted to the plume will bioaccumulate undesirable contaminants which--although they may not immediately injure the fish themselves--may cause problems for higher level predators, including man.

23-6 --Failure to consider the zone of influence of the plume (i.e., how far can a ferric hydroxide floc travel in 2 - 4 days?), the fisheries present within this zone (not just at the dumpsite itself), and potential impacts on these fisheries.

23-7 --Failure to consider synergistic interactions between acid-iron wastes (notably the floc) and other contaminants introduced into the New York Bight. The scavenging of contaminants by the floc is one aspect of this. Another might be the fact that low pH increases the mobility and bioavailability of heavy metals (i.e., is there a potential for interacting with nearby [See, DEIS at 4-4]dredge spoil and sewage sludge dumping activities?).

23-8 --Failure to acknowledge the fact that toxicity or contamination associated with acid-waste ocean dumping may be more a function of localized buildups than of pervasive buildups throughout the New York Bight. The repeated comparison of contaminants introduced with acid-iron waste to overall contaminant loadings in the Bight from all sources is misleading and disingenuous. Harmful effects can occur without elevating ambient levels of heavy metals throughout the entire Bight (or even throughout the acid-waste dumpsite).

23-9 --Repeated references to the floc persisting for up to 48 hours, DEIS at xvi, 2-4, 2-29, 3-4, whereas in fact the floc has been reported to persist for "several days." DEIS, at 4-16.

Although the Draft recognizes at one fleeting point that "subtle adverse impacts can accumulate and combine, to cause long-term consequences which are as serious as any readily observed impacts" (DEIS at 4-8), with the example given that "an organism may accumulate waste constituents in its tissues at concentrations that do not cause its death immediately, but instead act at a sub-lethal or chronic level" (id.), the authors of the DEIS never discuss the relevance of this truism to the ocean dumping and potential impacts of acid-iron wastes.

III. FAILURE TO CONSIDER THE NEGATIVE ASPECTS OF FISH ATTRACTION

As previously discussed, the Draft consistently equates the attraction of bluefish, yellowfin tuna, and other species, and the associated "enhancement" of recreational fishing, as beneficial consequences of acid-iron waste ocean dumping. DEIS at 2-4, 2-8, 2-30, 3-12, 4-4, 4-1, B-16. Nor do the authors of the DEIS find

any inconsistency in also heralding as a significant safeguard the fact that the location of the acid waste dumpsite was chosen to avoid conflict with fisheries, DEIS at 3-8, and to avoid points of concentration for fish or fishing, DEIS at 4-4. (At least the DEIS is consistent in classifying "[p]ossible avoidance of the [dumping] areas by fish" as an "important short-term adverse impact"; DEIS at 4-22).

23-10 The Draft's total disregard of even the possibility that fish attraction to the floc (particularly attraction of fish that are actively caught by recreational fishermen and presumably eaten by them) might have negative aspects to it--such as enhancing the bio-availability and bioaccumulation of floc contaminants--is a serious defect. We trust that the Final EIS will give this concern the prominent attention it deserves.

IV. FAULTY ASSUMPTION THAT LACK OF DEMONSTRATED HARM MEANS ACCEPTABLE ASSURANCE OF SAFETY

The DEIS is replete with statements such as the following:

--"no adverse long-term effects attributed to the wastes have been detected or documented" (at 2-5).

--"Although the standing crop of zooplankton and number of benthic animals were less on the acid grounds than the control area, we have been unable to attribute these differences to acid waste" (at 2-5).

--"Only minor, short-term, adverse environmental changes and no long-term effects caused by acid waste disposal have been demonstrated at the site" (at 2-23).

--"we have no evidence to suggest that waste materials from the Apex Acid Waste Dumpsite have reached shore" (at 2-27).

--"Adverse effects resulting from acid waste disposal have not been documented" (at 2-30).

--"any impacts [at the acid waste site] would be the sum of all activities affecting the site, and could not be attributed to acid wastes alone" (2-30).

--"Long-term, sublethal, toxic effects on organisms at and near the Apex site have not been investigated" (at 2-30).

--"It is certain that historical average volumes [of acid-iron waste] are acceptable ..." (at 2-32).

--"Since the current patterns in the Bight are highly complex and have large, unpredictable variations, even the short-term (days) transport of the waste cannot be predicted" (at 2-53).

--"The proposed site ... has been used since 1948 with no adverse effects on the environment ..." (at 3-1).

--effects (if present) at the Acid Site are obscured by the multiple contaminant sources ..." (at 4-1).

--"Important spawning grounds and nursery areas lie within the Bight, but critical assessments of the effects of man-induced contamination on fish and shellfish populations are lacking" (at 4-3).

--"assessing the effects of ocean disposal includes uncertainties due to the weaknesses of existing fisheries information" (at 4-3).

--"Although adverse effects have been observed in mackerel eggs exposed to moderately high concentrations of acid waste ..., tainting or harmful accumulations of waste components in the flesh of fish taken from the area have not been reported" (at 4-4).

--"Many contaminant inputs to the Bight Apex, other than those at the Acid Site, make it unlikely that any deterioration of fish health or populations could ever be proven as caused by acid waste disposal" (at 4-11).

--"Any effects from acid waste disposal would probably be overshadowed by effects from the numerous other contaminants introduced to the New York Bight .... This complex interplay between natural variability and contaminants introduced by other sources makes it extremely difficult to isolate and quantify effects at the site solely due to the disposal of acid waste" (at 4-13).

--"no changes in the water or sediment chemistry have been positively linked to acid waste disposal .... The New York Bight Apex is a difficult region in which to assess impacts ..." (at 4-15).

--"There is one noticeable harmless change in the water quality at the site" [i.e., formation of a ferric hydroxide floc] (at 4-16).

--"The magnitude of the contaminant inputs from acid waste must be kept in perspective; they are generally less than the inputs from the atmosphere" (at 4-24).

--"the precision of each survey [of pelagic and demersal fish] is low and only major changes in the fish populations are detectable" (at A-26).

--"Since waste constituents do not accumulate in the water column, the material does not remain at the site but is carried out of the Bight" (at D-4).

--"there is no danger that waste constituents could reach the shoreline in measurable amounts" (at D-7).

23-11 Thus, although the DEIS acknowledges in effect that only the most widespread and catastrophic impacts would be capable of being measured and attributed to acid waste dumping, the DEIS is willing to make the flat statements that "no adverse effects on the environment" have occurred since dumping began in 1948 (at 3-1) and that "it is certain" that as long as historical dumping levels are not exceeded, the dumping effects will be "acceptable" (at 2-32).

These efforts to minimize the harm potential of acid waste dumping in the face of overwhelming uncertainty is regrettable enough given the MPRSA's mandate that ocean dumping be permitted only where the EPA Administrator is able to determine that there "will not" be unreasonable degradation or endangerment--a showing which seems, by the Draft's own admissions, to be impossible in this case. The dismissal of the potential for harm is even more unfortunate in this case because it also requires inconsistent evidence to be disregarded.

Among the evidence of harmful effects downplayed by the DEIS is:

23-12 --Evidence of a significant increase in the number of chromosomal aberrations in eggs and larvae of the Atlantic mackerel near the Acid Site, with a lower percentage of abnormalities observed away from the dumpsite in the general area of the apex, Longwell (1976). DEIS at A-22, B-16, 4-4, 4-9, 4-11. As noted in the DEIS, "[e]ggs, larval stages, and immature forms can be found all year round throughout the area," DEIS at 3-6.

23-13 --Evidence of impaired reproduction and growth of zooplankton exposed to 1:10,000 concentration of acid waste (after 18 days of exposure); specifically, a "failure of the organisms [zooplankton] to reproduce, or a delay in the time required to transform eggs into adults ...," Vaccaro, et al. (1972). DEIS at D-10. The DEIS dismisses these results as "not biologically significant since this waste concentration occurs for only a few minutes after disposal" --although the concentration involved is only "four times greater than values observed in the field." When one considers, however, that the ferric hydroxide floc (along with adsorbed and entrained contaminants) persists for upwards of 48 hours following each dump and that NL Industries ocean-dumps a new load of wastes once or twice every 24 hours (DEIS at 2-34), the potential for cumulative

buildups in association with floating floc becomes particularly significant. This potential is particularly important if Dr. Longwell (1976) is correct that the mackerel egg abnormalities she observed near the Acid Waste site "were due to the mutagenic properties of heavy metals" (DEIS at B-16)--because it is heavy metals that are most likely to be scavenged by the ferric hydroxide floc.

23-14 --Evidence of bioaccumulation of high vanadium concentrations in scallops south of the former Du Pont-Edgemoor Industrial Waste Site (which received titanium dioxide acid-iron wastes quite similar to those dumped at the Acid site by NL Industries), in the direction of projected plume transport, Pesch, et al. (1977). DEIS at D-11. Not only does the DEIS dismiss this evidence as requiring "more confirmatory evidence" (despite the fact that it served as the basis for EPA's decision to transfer Du Pont's dumping to the 106-Mile Site), and as being inapplicable to the New York Bight because "[i]n the New York Bight such effects would not be observable because of the high inputs of contaminants from other sources" (as though something that cannot be observed can therefore not be harmful) DEIS at D-11, but it compounds the problem by failing to provide any information whatsoever on the vanadium content of NL Industries' acid wastes. *This is particularly disconcerting in* light of the Draft's statement that "[o]ne toxic metal, vanadium, is present in high concentrations in the [acid-iron] waste" (DEIS at B-11]. The Draft's attempts to minimize the significance of this vanadium by asserting that it complexes with other material "and becomes biologically unavailable" is unconscionable in light of the contrary evidence reported by Pesch, et al. (1977).

In short, the Final EIS needs to do a more candid and objective job of identifying the potential risks associated with continued ocean dumping at the Acid Waste disposal site.

V. MISCELLANEOUS COMMENTS

1. Although 40 C.F.R. §227.5(d) prohibits "under any circumstances" the ocean dumping of "*[p]ersistent inert synthetic* or natural materials which may float or remain in suspension in the ocean in such a manner that they may interfere materially
23-15 with fishing, navigation, or other legitimate uses of the ocean...," the DEIS never so much as mentions this porvision or its potential applicability to the ferric hydroxide floc formed by the dumping of NL INdustries' acid-iron wastes. The Final EIS should discuss this question in detail, along with the feasibility of alternatives to reduce the potential for formation and/or persistence of a floc.

2. The DEIS makes the flat statement that "[a]cid wastes do not contain constituents which promote phytoplankton growth"
23-16 (at 2-31). In fact, is it not the case, that iron--present in the acid wastes in great abundance--is an important micronutrient for many phytoplankton species? See also, DEIS at A-19.

23-17 3. Although the DEIS indicates that arsenic is present in both NL Industries' and Allied's wastes, no information is provided on the actual levels present. DEIS, at D-8, D-14.

23-18 4. The DEIS states at the outset that: "NL Industries and Allied Chemical have demonstrated that their wastes comply with EPA's environmental impact criteria and that technically feasible alternative disposal methods are environmentally less preferable than continued use of the site; therefore, a present and future need exists for the continued use of this site." DEIS at 1-2. Unfortunately, this is the foregone conclusion which permeates the entire EIS. An EIS is supposed to discuss impacts and alternatives, not affirmatively advocate a particular proposed action. The Final EIS should be modified accordingly.

Sincerely,

Kenneth S. Kamlet

Kenneth S. Kamlet
Assistant Director for
Pollution & Toxic Substances

KSK/jl
cc: Henry Longest
Dr. Pete Anderson
Ed Mainland

RESPONSES TO WRITTEN COMMENTS

1-1 The EPA appreciates the careful review given to the EIS by several NOAA agencies.

2-1 As stated in the DEIS, use of the site will be reexamined whenever monitoring indicates that the acid wastes are having significant adverse effects on the marine environment. See Response 23-14 for a discussion of the probable effects (slight, if any) of acid waste on the benthos at any site.

2-2 As stated in the DEIS, the permittees are required by EPA to continue to examine land-based alternatives.

2-3 This statement refers to different wastes being released at the same site within hours of, and in close proximity to each other. As noted in Response 23-7, interactions between the acid waste and other contaminants in the Apex are unlikely.

2-4 Change made.

2-5 The text and table have been changed slightly. The currents in the Bight are complex and variable. The FEIS on the Sewage Sludge Site (EPA, 1978a) used the current patterns at the Northern Site, described in this EIS, as one of the justifications for designating the Alternate Sewage Sludge Site in the Northern Area, rather than in the Southern Area.

2-6 Change made.

2-7 The most significant adverse effects last only a few minutes, until the acid wastes are neutralized by the buffering action of sea water. The floc which forms, when acid-iron wastes are released, may persist as a distinct entity for one or two days, but unreasonable adverse effects have not been reported for this material.

2-8 The 106-Mile Site is influenced by several water masses, each with characteristic chemical and biological properties. The combination of natural variability and changing water types results in a complex environment. The proposed site is in a complex environment, however, more is known about the Apex than the 106-Mile Site. The probability of detecting change is higher at a site with better known characteristics.

2-9 There are numerous sources used in preparation of this EIS which are not part of the "conventional" scientific literature (e.g., letters, company reports, [scientific] consultant reports submitted to the companies, and data reports). In order to make the EIS uniform, and to indicate the date of this unpublished work, the author-date system of referencing was used for all material. The "References Cited" section in Chapter 6 clearly indicates which documents are unpublished.

2-10 The feelings of the charter boatman are well known; the DEIS has been changed to reflect the intensity of their feelings.

2-11 Change made.

2-12 It may be difficult to detect the more subtle environmental changes. However, the site has a long history of site-specific studies conducted by scientists from research institutions (e.g., WHOI), and private firms for the required monitoring of the permittee. The MESA project collected some site-specific data and has provided an extensive data base for the entire Apex. Combination of these information sources yields an excellent data base for detecting changes.

2-13 See Responses 20-16 and 20-17.

2-14 The comment is valid; however, the project did provide considerable information and data about background variation in the Apex, as well as limited data about anthropogenic effects. The probability of detecting changes due to acid waste disposal is best at the Proposed Site where the background characteristics are well known.

2-15 See Response 2-3.

2-16 This EIS stated that increased traffic would be one of several problems resulting from designation of one of the alternate sites. Irrespective of the designated site, disposal barges will pass through the Apex. However, the possibility of an accident or other emergency (e.g., deteriorating weather) increases proportionately with the transit time and distance.

2-17 *This sentence refers to long-term effects of acid waste at the 106-Mile Site.* Research at the 106-Mile Site has been conducted only for a short time, but the effects of acid waste disposal have been investigated for more than thirty years. Wastes affect the water column; consequently, long-term effects in the water at the 106-Mile Site would not be expected.

2-18 EPA agrees with this comment. However, in the general case the statement in the EIS is correct for the entire mid-Atlantic Bight. Where appropriate, exceptions are noted in the text.

2-19 Change made.

2-20 Change made.

2-21 See Responses 23-4 and 23-7.

2-22 Reference provided. The conclusion of the investigators (Vaccaro et al., 1972) was that the elevated iron levels in the Hudson Shelf Valley were due to all inputs, and not strictly acid-iron waste inputs.

2-23 Paragraph revised.

2-24 Figure changed. Figure A-4 shows the correct closure area.

2-25 The scale of the figure is too small to show the small areas. In general, the figure is correct. The presence of muddy bottom assemblages is noted, where appropriate, in the text.

2-26 Change made.

2-27 The NOAA study did not evaluate the commercial potential of the areas, but did report the presence of commercially important species. Fishing does occur in the area.

2-28 Although not specifically addressing the Acid Site, seven stations (one water, six benthic) of the standard MESA sampling grid are located within the Acid Site. See Response 2-8.

2-29 EPA agrees with this statement of Longwell's results and the text has been modified. See Response 23-12 for additional information.

2-30 Change made.

3-1 EPA agrees; this is the reason that EPA supports the continuation of site-specific monitoring programs by NOAA and the permittees.

3-2 Laboratory studies performed on acid waste and reported by Ketchum et al. (1958a) listed settling rates for a complete spectrum of particle sizes. The fastest settling rate recorded was 1.7 cm/min. The average depth of the site is approximately 26 m, therefore the minimum time for the first acid waste particles to reach the bottom is 25 hours. Only 8% of the acid waste had this

settling rate. Furthermore, 85 hours are required for half of the waste to reach the bottom. Thus, although the acid waste has a significant solid phase, the material will be widely dispersed and diluted, greatly minimizing effects on the bottom.

3-3 The permitted dumping rate is derived from the desired dispersion values, not the reverse. If there were data showing the accummulation of harmful waste constituents in the water column, the dumping rate would be decreased.

3-4 EPA agrees.

3-5 No matter what amount of change, the cost of permittee monitoring would increase if the 106-Mile Site were used.

3-6 The Coast Guard would not be able to maintain its desired surveillance level without assigning additional personnel as shipriders. The "expense" may be direct, if the needed people were assigned to the District; or, it may be indirect, if different tasks performed by the Coast Guard cannot be completed. Additional information about the ODSS has been incorporated into Chapter 1 of the EIS.

3-7 The limited and transient effects caused by acid waste make it difficult to detect long-term or chronic effects anywhere in the ocean. The environmental characteristics of the 106-Mile Site are not as well known as in the Apex. Changes due to acid waste disposal would be more difficult to detect against a lesser studied background.

3-8 Change made.

3-9 Change made.

3-10 Some evidence of a semi-permanent anti-cyclonic eddy in the Apex exists, but the direction of average flow in the area may change by 90° or 180° with depth (Hansen, 1977). Some monitoring cruises have observed the waste plume moving in different directions at depth (e.g., EG&G, 1977a). The overgeneralization is that benthic effects would be expected to be most observable south-southwest of the site. However, this location is within the Hudson Shelf Valley, a natural "sink" for the wide variety of contaminants introduced into the Bight.

3-11 Text modified.

3-12 Corrected.

3-13 As stated in the DEIS, the currents in the Apex are so variable that predictions of net transport are not reliable.

3-14 Change made.

3-15 Change made.

3-16 Change made.

3-17 Acid-iron waste contains settleable materials and it is appropriate to discuss the probable effect on the benthos if wastes were released at the 106-Mile Site. Other commenters have expressed concern with possible benthic effects even at deep sites.

3-18 Change made.

3-19 Change made.

3-20 Change made.

3-21 Typographical error corrected. "Trace metal currents" has been changed to "trace metal contents."

3-22 The statement has been expanded. Other factors include the numerous anthropogenic inputs to the Bight and the transport of the contaminants away from the source.

3-23 Change made.

3-24 Change made. The oceanographic seasons in the Apex are dominated by summer and winter with short transition periods.

3-25 Agreed, but Slope Water intrusion could effect some alternative locations, especially the 106-Mile Site.

3-26 Change made.

3-27 The initial vernal stratification is haline, which is transformed into a thermocline with increased warming.

3-28 Change made.

3-29 Change made.

3-30 A comma is not required here.

3-31 Change is not required.

3-32 Change made.

3-33 The explanation of the "cool pool" follows its first mention. The EPA agrees with the remainder of this comment.

3-34 Phrase modified.

3-35 Change made.

4-1 This comment has been incorporated into the FEIS.

5-1 The EPA thanks NOAA for their continuing review of the DEIS.

6-1 The EPA is pleased that the National Marine Fisheries Service concurs with the conclusions reached in the DEIS. As stated in the DEIS, the permittees are required by EPA to continue to examine alternative disposal methods for their wastes.

7-1 Acid waste disposal should not interfere with dredged material disposal at any site, on or off the Continental Shelf.

9-1 Surveillance of the disposal operations and monitoring the short-term and long-term effects of the waste material will continue as required by the MPRSA and EPA Ocean Dumping Regulations.

9-2 Figure 3-2 has been corrected. The proposed site is not in the shellfish closure area, which is based on the sanitary quality (i.e., bacterial contamination) of the sediments and overlying water. As discussed in Response 23-14, the acid wastes do not create a potential human health hazard in shellfish. The site does contain ocean quahogs, but there are no shellfishing activities and abundances are not high. Any emergency dumping operation which could hazard shellfish populations would, most probably, occur in transit to the 106-Mile Site, and would not adversely affect shellfish populations in the Apex.

9-3 Long-term studies (beginning in 1948) have not yet demonstrated potential adverse health effects from use of the Proposed Site. The Proposed Site is

closest to shore and its use will conserve energy. As required by EPA, the waste material is reused or recycled to the maximum feasible extent. Additional information about alternatives evaluated by the permittees has been added to Chapter 2.

10-1 See Response 23-3.

10-2 The DEIS discussed acute and chronic effects on fish and wildlife resources in:

Chapter 2 - Continued Use of the Proposed Site
Chapter 3 - Waste Disposal at the New York Bight Acid Waste Disposal Site
Chapter 4 - Effects on Public Health and Safety
- Effects on the Ecosystem
Appendix B - Chemical Characteristics
- Biological Characteristics
Appendix D - Waste Components - Chemical Characteristics and Toxicity

The DEIS evaluated the contribution of acid waste to the overall generally degraded condition of the Apex described in the above Chapters and Appendices. The amount of pollution introduced by acid wastes is slight.

10-3 OCS oil and lease tracts are not within any of the alternative dumpsites, thus cumulative effects are not expected. (See Response 23-7.) As stated in the DEIS, the only interaction between resource development and acid waste dumping is in the field of navigation. Navigational requirements, for developing and

producing any resources found, cannot be reliably estimated until the sizes of resources are known. Results to date have not been encouraging, and exploitable reserves have not been discovered (Kerr, 1979).

10-4 Bureau of Land Management data in the area of any of the alternative sites (e.g., Southern Area) were used to describe the environment in these areas and predict the effects of waste disposal at those locations.

10-5 See Responses 23-4, 23-5, and 23-6.

10-6 Significant adverse impacts have not been demonstrated at the Acid Site due to the nature of the waste (aqueous, only short-term toxicity) and the multiple contaminant imputs to the area. Impacts might be demonstrable in an area without other anthropogenic inputs, although field and laboratory work indicates that such is unlikely. The EIS takes the environmentally protective position that the Site should not be moved until adverse effects are clearly demonstrated at the present Site. See Responses 23-11 and 23-14 for additional information.

10-7 See Response 23-3.

10-8 The EIS is concerned with assessing the effects of acid waste disposal and the adverse impacts which have been demonstrated. An analysis of the cumulative effects from all ocean dump sites and other contaminant sources, is beyond the scope of the EIS.

11-1 See Response 23-3.

11-2 See Responses 23-4, 23-5, and 23-6.

11-3 See Responses 12-1, 23-4, 23-5, 23-8, 23-12, 23-13, and 23-14.

12-1 The DEIS concluded that the probability of impact was low at the Acid Site, based on: (1) periodic studies especially investigating the effects of acid waste in the Apex, (2) studies of a similar waste-type dumped offshore Delaware Bay, and (3) laboratory work on the biological effects of the waste. Fundamental investigations for the purpose of assessing environmental impact in naturally variable environments will continue to be of scientific interest. Future work of this nature at the Acid Site should be addressed in NOAA's ocean monitoring plan. See also Response 10-6.

12-2 The EIS was prepared in accordance with the CEQ Regulations. Chapter 2 summarizes the affected environment and environmental consequences of the proposed action. Some material is repeated in different sections of the EIS; however, excessive repetition has been avoided in the document. Chapter 2 discusses alternatives, including the proposed action, as required by the CEQ regulations.

12-3 EPA-Region II requires that the testing laboratories incorporate quality control and quality assurance factors into the analytical procedures. All analytical procedures are approved by EPA.

12-4 Data on concentrations of trace metals in waters at the Acid Site prior to 1948 are not available. However, considering advances in analytical techniques and water movements, such data would have little meaning. Waters in the Apex do have higher levels of trace metals than in some other coastal locations, due to all inputs in the area -- New York Harbor outflow, atmospheric fallout, and ocean dumping. When comparing acid waste to the total amount of pollution introduced from other sources, the amounts of contaminants in acid waste are miniscule. (See Response 20-1.)

12-5 See Response 12-4.

12-6 The fastest falling particles in the waste (including the floc) settle in an undisturbed tube at 1.7 cm/min, or 1.02 m/hr. The shallowest depth at the 106-Mile Site is about 1400 m; thus, it would take appproximately 2 months for the first particle to reach the bottom. The waste would be spread over a tremendous area, and, since effects are barely detectable at a site (offshore Delaware Bay) about 25 m deep, effects are unlikely to be detectable at deep sites. Aqueous wastes have been dumped at the 106-Mile Site since 1965 with no detectable benthic effects (EIS, Chapter 4).

12-7 The effects of waste disposal would be more severe if the release rates were higher. The EPA established the release rates from bioassay tests on the waste's toxicity. Surveillance by the USCG ensures that the permitted rates are not exceeded.

12-8 Bioaccumulation of contaminants by water column biota is unlikely, since the wastes are rapidly diluted and the same organisms are not exposed to repeated contaminant inputs. If some metals were bioaccumulated by pelagic organisms, the metal levels would be reduced in the organisms after levels in the surrounding water dropped.

12-9 This statement refers to accumulations in sediments, which are undetectable at the Acid Site due to (1) the nature of the waste, and (2) large inputs from other sources. Accumulation of waste constituents in the water column at any site is unlikely. (See Response 23-8.)

12-10 Agreed. See Response 3-2 for a discussion of the fate of the solid fraction of the waste.

12-11 EPA will continue to require that the discharge rates be sufficiently slow to prevent the limiting permissible concentration to be exceeded anywhere in the marine environment after initial mixing.

12-12 The Regulations are fully discussed in Chapter 1 of the EIS in the sections: Ocean Disposal Site Designation and Ocean Dumping Permit Program.

12-13 Monitoring costs would increase slightly, because wastes with different characterisitcs (e.g., fluoride) would be dumped at the 106-Mile Site. When Du Pont-Edge Moor ends ocean disposal, characteristics specific to NL Industries waste (e.g., iron) will still need to be monitored.

12-14 Deleted.

12-15 Surveillance, as described in the DEIS and the Coast Guard Commandant Instruction 16470.2B, consists of "...checking for valid permits, obtaining samples of materials to be dumped, verification of vessel logs and reports, obtaining radio reports of dump vessel position and activity, surveillance over transportation routes and disposal sites, escorting or riding of the dump vessels, monitoring of actual dumps, and utilization of electronic methods such as radar and Ocean Dumping Surveillance System (ODSS) monitoring."

12-16 See Response 20-3.

12-17 The EPA has determined that monthly samples are adequate to characterize the wastes being released at the Site.

12-18 Change made.

12-19 Change made.

12-20 Change made.

12-21 Change made.

12-22 This table compares the input of various metals in the waste to the levels of dissolved metal normally present in the water column. The total amount (line 2) is the metal naturally present and the estimated input (line 4) is the amount added by waste disposal. The last line shows the percentage increase in metal due to the waste disposal operations, which, for cadmium is 0.1%.

12-23 The alternative analysis was based on environmental considerations. After considering the demonstrated environmental effects at the existing Acid Site, it does not appear that moving disposal to the 106-Mile Site would offer any environmental benefits.

13-1 See Response 23-3.

14-1 The EPA is pleased to note that the EIS satisfied the requirements of several state agencies.

15-1 Details of the composition of the wastes currently released at the Acid Site, including pH, are presented in Appendix D of the DEIS.

15-2 See Response 23-3.

15-3 Alternative dumpsites were given equal consideration in the DEIS. Part of the rationale, in proposing designation of the Acid Site, is the fact that wastes might degrade an area where materials have not been previously dumped, and moving the disposal operation away from the Apex would not result in measurably improved water quality.

15-4 See Response 2-3.

15-5 EPA-Region II is moving to reduce contaminant input; the most recent permits issued were for maximum volumes lower than the historical average. As shown in Appendix D of the DEIS, the volumes of waste dumped at the Acid Site have declined markedly since passage of the MPRSA in 1972. Information about the phasing out of NL Industries ocean dumping operations is in Chapter 2.

15-6 As stated in the EIS, surveillance of dumping operations by the Coast Guard will continue. Additional information about the Ocean Dumping Surveillance System (ODSS), which will provide surveillance of 100% of dumping activities (the current objective is 10%), has been added to Chapter 1.

16-1 Transmittal noted.

17-1 See Response 23-3.

17-2 The ferric hydroxide floc will settle slowly to the bottom. However, most of the floc will be transported out of the site before impact. Benthic sediment sampling to date has shown no accumulation of the iron floc and no measurable increase in the iron content of the bottom deposits (Redfield and Walford, 1951; Vaccaro et al., 1972). Tests with zooplankton showed that ingestion and defecation of the floc does not appreciably increase the floc settling rate. Results from chronic bioassay tests are presented in Chapter 4 and Appendix D of the EIS.

The information cited by this commenter, from Quality Criteria for Water (EPA, 1976), pertains to fresh water and fresh water organisms. There is no evidence to suggest that the ferric hydroxide floc has coated fish gills, or has been detrimental to fish eggs at the Acid Site. As stated above, benthic sediment samples have shown no accumulation of the iron floc, thus consolidation of the bottom sediments into "pavement-like areas" is unlikely. Monitoring and sampling of the ferric hydroxide floc, for trace metal adsorption and biological effects, are efforts best handled by NOAA's ocean dumping research program. (See Responses 23-4 to 23-9.)

17-3 See Responses 23-5 and 23-10. Ctenophores are not prey species for bluefish, which are higher-level predators.

17-4 Text has been changed to state that the wastes are diluted below the limiting permissible concentration (LPC) within the time for initial mixing.

17-5 Change made.

17-6 See Response 23-12.

18-1 The EPA is pleased to note that the New Jersey Department of Environmental Protection, Division of Water Resources, concurs with the conclusions of the DEIS.

19-1 Transmittal noted.

20-1 This commenter disagrees with EPA's proposed action of designating the existing Acid Site for continued use, and recommends instead that the dumping operation be transferred to the 106-Mile Site. EPA believes that the numerous studies which have failed to document damage to the receiving waters or the benthos, and the low volumes of contaminants present in the waste, are sufficient to demonstrate that the probability of damage due to continued site usage is low.

EPA agrees that pollution cannot be justified because a larger polluter is present in the area. The fact that contaminants introduced by acid wastes are slight when compared with other sources does not mean that dumping should be allowed. The fact that dumping introduces small amounts of contaminants is the reason that it is permitted. As demonstrated in the EIS, the acid wastes have not had a measurable effect on the biota of the Apex during the past 32 years. In evaluation of the probable contribution from acid waste dumping to the overall degradation of the Apex, it is important to remember that the contributions of acid waste dumping are about the same as those from the atmosphere.

The wastes have been shown to be in compliance with EPA strict criteria to prevent environmental damage (40 CFR 227), therefore there would not be a significant environmental benefit in moving the disposal site to a more distant location (e.g., the 106-Mile Site). Conditions within the Apex would not improve measureably if the dumping were relocated. A similar conclusion was reached earlier when the decision was made not to relocate the Sewage Sludge Site (EPA, 1978a).

The EPA recognizes that the Apex is environmentally stressed by anthropogenic activities. However, several of the examples suggested by the commenter would never be affected by acid waste disposal. Moving the site location would not:

- Reduce the incidence of fin rot disease.
- Reduce the distribution or numbers of pathogenic organisms.
- Increase the quantity of benthic organisms (e.g., surf clams).
- Open the area presently closed to shellfishing.
- Reduce the levels of heavy metals in the sediments.

Acid wastes do not contain pathogenic organisms or other contaminants which may cause fin rot. Acid wastes do not measurably affect the benthos at the site. (See Responses 3-1, 12-5, and 23-4.)

The wastes remain in the water column for at least a day, and most of the material is carried out of the Apex before settling to the bottom. Bioaccumulation of toxic waste constituents from the water column are unlikely since organisms remain in contact with the waste for short time periods and, if some contaminants were adsorbed, the contaminant levels would be reduced when the animal returned to "uncontaminated" water.

EPA believes that most of the points raised by the commenter have been adequately addressed in the DEIS. The existing site complies with all of the site selection criteria of the Ocean Dumping Regulations and the wastes do not cause unreasonable adverse effects on the marine environment. Environmentally,

there is little difference between use of the Acid Site and the 106-Mile Site. Hence, moving the site would have little, if any, environmental benefit, and would incur a great economic cost.

The subject of this EIS is designation of an ocean disposal site for acid wastes, not for issuing a permit for the waste. As stated in the EIS, two companies hold currently effective permits for waste disposal at the Acid Site. The permit application and issuance processes are separate from the site designation process. Comments about issuing permits should be made at the time of permit applications and public hearings. The State of New York has not objected to permit issuance in the past.

Specific responses on other points raised by this commenter follow:

20-2 The work at the Delaware Bay Acid Site did not report "perturbations" of the benthos; the investigators used vanadium as a "tag" to trace the movement of the waste. The first survey indicated a possible valid approach, but further work showed only one or two stations on each survey with elevated vanadium levels, and there was no pattern following the predicted direction of waste movement. (See Response 23-14.)

20-3 The probability of short dumping cannot be quantified, because it occurs in emergency situations. The 106-Mile Site is further from shore and the possibility of an accident or a sudden storm is greater due to the increased transit time. Only one short dumping episode is documented (EIS, Chapter 2) for barges traveling to the 106-Mile Site during the period 1973-1980. Each

incident, however, must be reported to the Coast Guard and EPA-Region II, who evaluate the nature of the emergency and the need for short dumping. Administrative or civil action is possible if an emergency did not truly exist.

20-4 Chapter 2 of the EIS summarizes the relevant features of the current permits.

20-5 The waste plume does remain visible for many hours after a dump, but the waste concentration in the water is always less than the limiting permissible concentration and, hence, is in compliance with the permit.

20-6 See Response 23-3.

20-7 Some sand dredging occurs off the Long Island barrier beaches for beach nourishment. The marine sand mining which occurs in the New York area is restricted to the Lower Bay. The EPA is not aware of any existing or planned sand mining activities in the vicinity of the Acid Site.

20-8 As stated in the EIS, acid wastes do not contain constituents which would attract nuisance species, irrespective of the location of the site.

20-9 Surf clams are present in the Apex, but appear to be more abundant inshore than offshore (Franz, 1976), and were only infrequently collected during a series of five quarterly cruises covering the Apex (Pearce 1977). Acid wastes do not appear to affect the benthos, therefore it is unlikely that the distribution of

surf clams is affected by the wastes. The EPA has placed the site in Impact Category I, and mitigating measures are being taken by NL Industries to reduce the amount of iron (a nontoxic metal) in the water.

20-10 *Information about waste toxicity, including bioassay results, is presented in* Appendix D of the EIS.

20-11 This was a field study and not a laboratory experiment, so there is not a true "treatment" or "control" area. The investigators concluded that the observed differences were not due to acid wastes, but resulted from the natural variabilities found in the marine environment.

20-12 Field observations on waste disposal are summarized in Chapter 4 of the EIS; additional details are in Appendices B and D.

20-13 See comments by Allied Chemical which present further discussion on barging and monitoring costs (Comment 21 and Response 20-17).

20-14 The species, including whiting, are either not affected by the wastes or merely temporarily and reversibly affected by the wastes.

20-15 See Response 20-3.

20-16 The exact dollar values of the barging cost for NL Industries is company proprietary information. The added costs of barging to the 106-Mile Site are because of (1) requirements for a new barge in addition to the existing one, (2) additional, temporary storage tanks, and (3) a new dock facility downriver from the existing facility. (See Response 20-17.)

20-17 NL Industries, Inc., submitted, at the request of EPA, the "Report on Estimated Costs and Other Factors Involved in Barging to Site 106 Instead of 12-Mile Site" (Rodman, 1977a). The information requested in the comment is contained in the Report and is duplicated below:

> If the barging were to be carried out at the 106-Mile Site, the barge round-trip time increases from 12 to 38 hours. Under this condition, the compounding effects of increased barge trip time, the increased probability of weather delays, and the requirement to navigate the two drawbridges under specified tide conditions means that an inordinate number of barges is required, together with a large increase in land-based waste storage facilities. It is considered that the barge operation under these conditions is entirely impractical and unfeasible.
>
> In order to minimize this compound effect of weather-drawbridges-tides, a study has been made of the costs and other factors involved if a new dock and loading facilities were built on Raritan Bay on the seaward side of the drawbridges, with the waste liquor and mud slurry pumped from the plant site to this new facility by new pipelines. This new facility and operation, which were planned in consultation with Moran Towing Corporation, would consist of the following elements:

- a new barge, in addition to the existing barge, of approximately twice the size of the existing barge.

- additional storage tanks, at the plant site and at the remote dock site.

- a new dock.

- two new pipelines, one 24 inches in diameter and one 10 inches in diameter, from the plant site to the new dock site, assumed to be three miles distant.

- auxiliary facilities such as pumps, electrical installation, roads, etc.

The estimated capital cost for the required facility and equipment to barge to Site 106, shown in detail in the attached Table I, is $30,120,000. The estimated operating cost given in the attached Table II is $9,248,325 per year.

There are other important factors involved in the proposed barging to Site 106. The new shore-based facilities (piping, storage, and dock) would be located on Raritan Bay in the South Amboy area. The site would most likely be located in a Wetlands area. Obtaining the necessary approvals and permits from the appropriate regulatory agencies could be very difficult. State of New Jersey Department of Environmental Protection approval for construction would be required, involving the Office of Marine Services (Riparian Lands Management) and the Solid Waste Administration, since transport and storage of a waste is involved. Federal approval would be required from the Corps of Engineers and the U.S. EPA. It is most probable that an environmental impact statement would be required. Rights-of-way would be required for the piping from the plant site to the new dock site. There would undoubtedly be concern expressed, and probably objections

TABLE 1
ESTIMATED CAPITAL COSTS TO BARGE TO SITE 106

1.	New barge in operation, in addition to existing Moran 108	$11,250,000
2.	Additional storage at present plant site	
	2, 100-ft dia. acid tanks	2,500,000
	18, 19-ft dia. mud tanks	3,000,000
3.	Storage at remote dock location	
	1, 100-ft dia. acid tank	1,250,000
	6, 19-ft dia. mud tanks	1,000,000
4.	New loading piping	600,000
5.	New dock at remote site	1,350,000
6.	Property rights, leasing fees (including those for piping)	1,000,000
7.	Acid piping, 3 miles, 24" dia.	1,971,000
8.	Mud piping, 3 miles, 10" dia.	821,000
9.	Transfer pumps	250,000
10.	Access roads	100,000
11.	Electrical	100,000
	Subtotal	$25,100,000 [sic]
	Contingency, 20%	5,020,000
	TOTAL	$30,120,000

TABLE II

ESTIMATED OPERATING COSTS TO BARGE TO SITE 106

1.	Tugs 4,700-hp Class, $12,000/day, 330 days, including fuel	$3,960,000/yr
2.	Shore Waste Disposal Operation	160,000
3.	Annual Dry Docking Expense, including Maintenance Large Barge, $100,000 Small barge, $ 50,000	150,000
4.	Maintenance of Shore Facilities	2,410,000
5.	Barge Insurance	430,000
6.	Electrical Power	17,000
7.	Dredging at Dock	100,000
8.	Depreciation	1,957,800
9.	Taxes, Property, and Equipment	21,975
10.	Insurance, Shore-based Facilities	41,550
	TOTAL	$9,248,325/yr

raised, at the local level. In view of these circumstances, it is our opinion that construction and operation of the required new facilities would not be permitted.

Other adverse impacts of the proposal include increased energy consumption mainly for the increased barging, and increased barge traffic.

Barging of the wastes to Site 106 is not feasible because of the excessive capital and operating costs involved, the high probability that the construction and operation of the necessary facilities would not be permitted, and the fact that no environmental benefit would be achieved compared to the existing disposal operation which has been shown to have minimal, or no, impact on the marine environment.

20-18 When the volume of waste authorized for disposal decreases, fewer barge trips will be required. That is partly the reason for the variation in the number of barge trips required each year. If the 106-Mile Site were used, NL Industries would purchase a barge with twice the capacity, which would thus reduce the number of trips.

20-19 Studies of the effects of waste disposal at the 106-Mile Site began in the early 1970's (EPA, 1980). Another commenter (NOAA-MESA) has stated that there are insufficient data to predict long-term trends at the 106-Mile Site.

20-20 See Response 23-3.

20-21 See Response 20-1

20-22 These documents are part of the individual permit applications and are on file at EPA-Region II. This EIS deals with site designation; proving the need for ocean disposal is a part of the permit process. See Response 23-3 and Chapter 2 for additional information.

20-23 As stated in the EIS and in earlier responses, the waste constituents are less than the limiting permissible concentrations (LPC) after the period of initial mixing. Color is not a toxic component of the waste and does not have an LPC.

20-24 Tables D-2 and D-3 (Appendix D) of the EIS define the waste constituents which present possible adverse effects to the marine environment. The tables are summaries of laboratory analyses submitted by the permittees to EPA-Region II, as part of the permit process. Additional specific information concerning the acid waste is available in EPA-Region II permit files. (See Responses 23-16 and 20-26.)

20-25 The discharge rate is determined from bioassay toxicity (after neutralization) data. Wastes from both permittees are below the limiting permissible concentrations after initial mixing, which indicates that the allowable discharge rates are not excessive.

20-26 The complete list of measured parameters is in the disposal permit, which is on file at EPA-Region II. The EIS summarized data for those parameters of environmental concern (e.g., metals) or characteristic of the waste (e.g., pH). See Response 23-13 for additional information.

20-27 Under the MPRSA, NOAA is charged with research on the long-term effects of ocean dumping. As stated in the EIS, NOAA-MESA has conducted such research in the Apex since 1973.

20-28 The time limits for permittees to develop alternative disposal plans were given in Chapter 2 of the DEIS. (See Response 23-3 for more information on land-based alternatives.)

20-29 None of the cited conditions are affected or caused by acid waste disposal. (See Response 20-1.)

20-30 See Response 20-1 and 20-29.

20-31 These elevated concentrations have not been reported from the acid waste dumping grounds. (See EIS Chapter 3 [Waste Disposal at the New York Bight Acid Waste Disposal Site] and Appendix B [Chemical Characteristics].)

20-32 Oxygen levels in water are naturally depressed during certain seasons throughout the Apex. There is no indication of additional oxygen depletion of waters at or near the site affected by the waste dumping.

20-33 Studies on plankton populations are not part of the short-term monitoring program. The question of the waste effects on plankton is best answered via NOAA's research program.

20-34 EPA is not implying that migratory or cosmopolitan fish species do not need protection. However, the fish are able to leave the plume or to avoid it. No field study has observed dead or stunned fish in the barge wake or in the waste plume. Westman (1958) reported that mackerel were actively feeding in the plume and that their behavior was normal.

20-35 As noted in Response 20-1, acid wastes do not create a public health hazard because the wastes do not contaminate shellfish. It should be noted that the Acid Site has never been closed to shellfishing by the FDA.

20-36 Redfield and Walford (1951) estimated that the maximum volume of water showing an acid reaction was about 112,500 m^3. The entire area of sea surface made temporarily acidic is less than 0.25 mi^2. This reaction only lasts 3.5 min after passage of the barge.

20-37 Chronic effects were not observed at waste dilutions greater than 1:10,000.

20-38 As stated in the EIS, the site location was originally chosen in an unproductive fishing area where there were no existing fisheries. Bluefish and tuna prey species are not affected by the dumping.

20-39 As stated in the EIS, the site location was originally chosen in an unproductive fishing area so that conflicts would not occur. Bluefish and tuna appear to be attracted by the "shadow" effects of the waste plume. No one has observed dead or moribund baitfish, the food of predators, in the barge wake.

20-40 See Response 20-11.

20-41 Monitoring was conducted more frequently in the past. However, as the results were analyzed, and additional information about the behavior and toxicity of the waste became available, the EPA decided that a single monitoring survey, during the season with restricted mixing (summer), would be adequate to ascertain short-term effects of the dumping activities.

20-42 See Response 20-25.

20-43 Although the actual organisms affected would be different, the effects of the waste would be the same -- short-term effects on the plankton and, possibly, accumulation of some waste constituents in the sediments. (See Response 23-14.)

20-44 Work at the Delaware Bay Acid Site (see Response 23-14) indicated that slight effects of acid-iron waste might be detectable in an area having sewage sludge dumping 5 nmi southeast but without other anthropogenic inputs. In the Apex, with inputs of sewage sludge, outflow from the Lower Bay, nearshore atmospheric fallout, and other factors, such slight changes would not be detectable even if they did occur. At other Continental Shelf sites, if slight changes did occur, the changes would be detectable

20-45 During this 5-year period, thousands of barge trips were made to sites managed by EPA. Ten possible violations were reported for the Acid and 106-Mile Sites; however, only five were upheld. Considering the miniscule percentage of

barging operations reported and found to be in violation, and the fact that no citations were issued to permittees at either site in 1978 or 1979, the EPA feels that the ocean disposal program is quite effectively regulated and that the companies are dumping in compliance with the permits.

20-46 See Response 20-3.

20-47 The EPA agrees that mitigation measures are necessary for reversible impacts. However, the effects of the acid waste dumping are so short that additional mitigating measures are not required.

21-1 *Change made.*

21-2 Phrase, as stated, is grammatically correct.

21-3 The cited phrase was quoted from the Ocean Dumping Regulations.

21-4 Comment noted. The estimated cost was made on total annual operating costs, not cost per ton of wastes dumped.

21-5 Change made.

21-6 The cited section is quoted from the Ocean Dumping Regulations, 40 CFR 228.5b.

21-7 Change made to show that disposal of acid wastes began 32 years ago (1948-1980).

21-8 Change made.

21-9 Change made.

21-10 The site has been moved several times since acid waste was first dumped in 1948. The first location was 2 nmi^2 centered on 40°15'24"N and 73°46'24"W, over the axis of the Hudson Shelf Valley, about 5 nmi west of the present site. After complaints from fishermen, in March 1949, the site was moved to the area south of 40°20'N and east of 73°40'W. The site has been in this general area since 1949. This information is in Appendix B of the EIS.

21-11 Change made.

21-12 Changes were made to indicate that the wastes must not exceed the limiting permissible concentration after the period of initial mixing.

21-13 Change made.

21-14 Change made.

21-15 Change made.

21-16 Typographical errors corrected.

22-1 Text corrected.

22-2 Values in Table 3-7 have been corrected.

22-3 Values in Table 3-8 have been corrected.

22-4 Values in Table 4-3 have been corrected.

22-5 This recommendation has been rephrased.

22-6 The phrasing of the recommendations commented upon has been modified so that recommendations are consistent in the Summary and in Chapter 2. The recommendation has not been accepted because the Ocean Dumping Regulations do not restrict the limiting permissible concentration to the dumpsite after initial mixing, but state that it will not be exceeded "anywhere in the marine environment" after initial mixing (40 CFR 227.29).

23-1 The possibilities of pelagic or planktonic organisms accumulating toxic waste constituents from the water column are questions of continuing research interest to EPA, NOAA, and other scientists. For example, EPA has sponsored the use of Biotal Ocean Monitors (BOMs) in the Bight to test acute and chronic effects at the Dredged Material and Sewage Sludge Dump Sites (Pequegnat et al., 1978). Few studies have investigated the Acid Site; however Grieg et al. (1977) reported data showing that only lead was high in zooplankton collected near the Acid Site. Two other stations also had anomalously high values - one 15 nmi northeast of the site and the other 8 nmi to the west. Laboratory

observations showed that adult copepods ingest the floc and pass it through the gut, without experiencing any apparent effects after 18 days exposure. Chemical considerations (see Responses 23-4 and 23-7) suggest that metals or other contaminants adsorbing to the floc are tightly bound and not absorbed by the organisms.

23-2 NL Industries has evaluated various measures to neutralize the waste acidity before dumping, which would result in increased levels of floc or other suspended solids. NL Industries is in compliance with the permit conditions to reduce, and eventually eliminate, the insoluble gangue presently ocean dumped (DEIS, Chapter 2). This will not reduce formation of the floc or its persistence, but will reduce the overall suspended solid load to the Apex contributed by the Acid Site. Additional information has been added to the beginning of Chapter 2 and the complete reports are available in EPA-Region II permit files.

23-3 An applicant must demonstrate a need for ocean dumping and evaluate alternatives to ocean dumping before a permit for ocean disposal can be granted (40 CFR 227 Subpart C). Four factors are considered when evaluating the need for dumping:

- Degree of treatment useful and feasible for the waste.

- Raw materials and manufacturing processes used, and whether less polluting materials or processes could be used.

- Relative environmental risks, impact, and cost for ocean dumping as opposed to other feasible alternatives including:

- land fill
- well injection
- incineration
- spread of material over open ground
- storage.

- Irreversible or irretrievable consequences of the use of alternatives to ocean dumping.

A need for ocean dumping has been demonstrated when the above factors have been evaluated and the following conditions exist:

- There are no practicable improvements which can be made in process technology or waste treatment.

- There are no practicable alternative locations and methods of disposal or recycling available, which have less environmental risk than ocean dumping.

Therefore, when an ocean dumping permit is issued, the need has been established after evaluating all reasonable alternatives to ocean dumping, including land-based alternatives. Even after the need has been established, the Regional Administrator may require the permittees "to continue research and development of alternative methods of disposal and make periodic reports of

such research and development in order to provide additional information for periodic review of the need for and alternatives to ocean dumping..." (40 CFR 227.16c). The Ocean Dumping Regulations (40 CFR 227.16b) are quite clear: "...waste treatment or improvements in processes and alternative methods of disposal are practicable when they are available at reasonable incremental cost and energy expenditure, which need not be competitive with the costs of ocean dumping...."

The Summary and Chapter 1 have been changed to reflect such considerations. The alternatives which have been evaluated by the current permittees are listed in Chapter 2 of the FEIS. The primary adverse effects associated with each alternative are described. The alternatives are only the most technically feasible and economically reasonable ones which have been examined. Other alternatives were examined and rejected as being technically unfeasible or environmentally unacceptable, including landfill, containerization, long-term storage, deep-well injection, incineration, and some manufacturing process changes. The permittees are continuing to evaluate various alternatives to ocean dumping.

The evaluations were submitted in reports with the permit application and have been summarized in public hearings held before issuing a permit. The reports are public information, and are on file in the EPA-Region II offices.

By issuance of an ocean dumping permit, the need for the ocean dumping alternative has been proven. The next step is to determine the suitable ocean site in which to dump the wastes.

The proposed action of this EIS is to designate a suitable site. Therefore, only the proposed Acid Site location and its alternative sites are evaluated. Land-disposal alternatives for the wastes have been adequately and publicly addressed in the permit application process.

23-4 A study of acid-iron waste dumped at the 106-Mile Site (Kester et al., 1977) reported that the hydrous ferric oxide floc (i.e., ferric hydroxide) provides adsorptive surfaces for organic substances and metals, which could be toxic to marine organisms. The adsorption of toxic materials by the floc probably renders them unavailable to the biota, thus mitigating the initial toxicity. However, it is possible that the adsorbed constituents may be desorbed in the guts of organisms, after ingestion of the floc, and then return to the toxic forms. However, there is no empirical evidence to support desorption and return of toxicity. Stomachs of mackerel (herbivorous fish) caught within the waste plume at the Acid Site did not contain elevated levels of iron or floc particles (Westman, 1958).

23-5 The EIS has been modified to reduce the impression that "...the plume attracts fish, so it must be good." As noted in the EIS, many fishermen believe that the plume harms fishing, although no investigation has confirmed this. Bluefish, which are migratory pelagic predators, are unlikely to bioaccumulate waste constituents from the floc in measurable amounts. Few plankton remain in contact with the floc for extended periods. Herbivorous fish would have only a portion of their diet consisting of such zooplankton, and bluefish would ingest only a few of these herbivorous fish. The possibility of uptake from the floc by the zooplankton is thus extremely low, and the probability of

biomagnification of toxic waste constituents through the food chain is remote. Mears and Eisler (1977) reported metal levels from bluefish livers (which would have concentrations higher than edible tissue) to be three, or more, orders of magnitude below FDA action levels.

23-6 The distance that the floc travels depends upon the physical conditions at the time. Conditions which would transport floc long distances would naturally tend to disperse it. Calm conditions, which slow dispersion, would not carry floc far from the site. Floc is generally reported "close" (probably 5-10 nmi) to the southwest or west of the site.

23-7 Upon release into the site, the acid-iron waste has two characteristics which could have potential synergistic effects with other contaminants present in the New York Bight: the ferric hydroxide precipitate (floc), and low pH. As stated in Response 23-4, the ferric hydroxide floc may adsorb metals and organic substances; however, the significance of adsorption in relation to bioavailability is unclear. Synergistic effects of the low pH acid waste with contaminants from other sources, including sewage sludge, is not a problem, since (as stated in Appendix C of the EIS) the pH values of the barge wake return to ambient within minutes in most cases, and the pH levels are never depressed outside the site boundaries during the 4-hour period of initial mixing.

23-8 Wherever any industrial waste is disposed at sea, the potential for increases in contaminant concentrations in the receiving water always exists. However, the increases may be temporary and, therefore, not cause "localized buildups."

Acid wastes can potentially increase acidity, turbidity, trace metal concentrations of the site waters, and trace metal concentrations of the site sediments and biota. No significant differences were observed in water column pH values between the Acid Site and control samples (EG&G, 1978a), and the reduced pH values that were observed returned to ambient well within the four hour initial mixing period. Thus, although temporary acidity increases do occur, "localized buildups" do not occur at the Acid Site.

Increased turbidity at the Acid Site is due to disposal of acid waste and formation of ferric hydroxide floc. The floc has been observed to persist, on occasion, for several days, but is dispersed outside site boundaries in that time period. Therefore, due to dispersion of floc before the next dump, the turbidity of the disposal site is a dynamic characteristic and "localized buildups" of floc do not occur.

Acid wastes contain trace metals, thus the possibility for localized increases in the water column concentrations of trace metals after dumping does exist. However, no such increases or "buildups" have ever been observed, which is not surprising considering: (1) the magnitude of the minimum dilution factors within the initial mixing period of 4 hours (90,000:1 for NL Industries waste

and 143,000:1 for Allied Chemical waste), (2) increases in trace metal concentrations due to the inputs of such contaminants into the disposal site area from other sources, and (3) the dynamic forces within the ocean.

Elevated concentrations of trace metals in Acid Site sediments, relative to supposedly uncontaminated areas, have been observed; however, the values have generally been within the range of values from other locations in the Bight. Thus, the elevated values reflect the overall impact of human activities, and are not due solely to acid waste disposal. Concentrations of iron in zooplankton and benthos at the Acid Site were significantly higher than those at the control site. However, the Acid Site is near other sources high in metals (i.e., Dredged Material Site, Sewage Sludge Site, and the Hudson Shelf Valley), thus the relationship between the high values at the site and acid waste is not definitive. As stated in Response 23-1, bioaccumulation of other, toxic trace metals do not appear to be due to waste disposal.

23-9 Published observations of floc persistence vary from "a few hours" to "several days." The waste plume usually dissipates and cannot be detected within 4-8 hours after a disposal operation. However, the plume may persist longer under calm summer conditions, with little turbulence to dissipate it. Reports of detecting a plume after one day have always been speculative (no one has visually tracked a single plume for several days); the EIS reported the longest reasonable period of persistence to be about 48 hours. The EIS has been changed to indicate that plumes from the majority of dumps are not detectable 24 hours after waste release.

23-10 See Responses 23-4, 23-5, and 23-8

23-11 Several of the quotes from the DEIS are verbatim, or paraphrased conclusions of many scientists who have studied the effects of acid waste disposal at this site. The EPA acknowledges that the statement "acid waste dumping may eventually cause adverse environmental effects" cannot be disproved; this is the rationale underlying continued monitoring at the site, and other research on possible environmental effects. However, numerous studies by several investigators show clearly that there has not been unreasonable degradation at the site, because laboratory and field studies show minimal or no adverse environmental effects. If future work shows adverse impacts from acid waste, use of the site can then be modified or terminated, as provided for in the Ocean Dumping Regulations.

23-12 Longwell (1976) did not attribute increased percentage of abnormalities in mackerel eggs sampled near the Acid Site to the dumping activities at the site. The station closest to the Site (1 nmi south of the Sewage Sludge Site and 3 nmi northwest of the Acid Site) was not significantly different from stations off Long Island and halfway to the edge of the Continental Shelf. A station 4 nmi east of the Acid Site was not significantly different from stations covering this same broad area. The DEIS did not "downplay" this "harmful effect" because there is no evidence, nor did Longwell state, that the acid waste dumping caused the abnormalities or affected the eggs. Further work by Longwell (personal communication) confirmed that portions of the Apex have a

lower viability of fish eggs. The Acid Site is in an area of high impact, but so is a large area. In general, the Apex and New Jersey coast show high effects while the Long Island coast is comparatively "clean."

23-13 Impaired reproduction and growth in zooplankton were not observed at concentrations of waste less than four times the maximum concentration observed in the field. Chronic effects were apparent after an 18-day bioassay, but the maximum field concentrations persist for less than 15 minutes. Zooplankters which passed through a series of dilutions, reflecting field conditions, showed no acute or chronic effects. Adult copepods passed the iron floc through their intestines without adverse effects, and growth and reproduction were normal (Grice et al., 1973). As stated in Response 23-8, localized build-ups of the waste or floc are not expected to occur and have never been observed in the field.

23-14 Pesch et al. (1977) did not report any toxicity to the benthos from vanadium. The vanadium was used solely as a "tag" to trace the fate of the acid wastes dumped at the Delaware Bay Acid Site. Results from a March 1974 survey were reported and showed scallop tissue vanadium levels to be significantly higher at seven stations south of the dumpsite. However, three other metals (iron, manganese, and titanium), which were present in high concentrations in the acid waste, did not show a similar pattern.

Further work is reported by Reynolds (1979). Each survey found a single station with significantly higher metal levels -- one each to the southwest (August 1974), to the east (February 1975), and to the northeast (June 1975).

Analyses of the muscle tissue alone showed consistently low values (generally below detection limits) which demonstrate that the metal is not readily assimilated by the adductor muscle (i.e., edible tissue).

Results indicate that, although the acid wastes might affect the benthos at Continental Shelf sites, the impact is clearly marginal. Iron was not present in higher levels at the same stations as vanadium, therefore there is no indication that the floc acts as a "carrier" for toxic constituents of the waste.

The studies at the Delaware Bay Acid Site showed that there were no repeated patterns for the distribution of vanadium in scallop tissue. Within a single survey, the patterns of metal concentrations were not consistent for the contaminants in acid waste. There is not only no indication of adverse effects due to acid waste, but there is only limited evidence that the wastes might affect the benthos. The EPA, however, has taken the environmentally conservative view in not moving the interim site to the Northern or Southern Areas because of the possibility (although remote) of benthic effects. The potential risk of further dumping at the Acid Site is low, since adverse effects could not be demonstrated at the Delaware Bay Acid Site, an area which does not have other anthropogenic inputs for the metals discussed. EPA is unaware that it decided to transfer Du Pont-Edge Moor to the 106-Mile Site based on vanadium concentrations in scallops. Rather, Du Pont-Edge Moor requested that the permitted site be changed to the 106-Mile Site. The change was granted based on EPA's policy that dumping occur off the Continental Shelf, when feasible.

23-15 The ferric hydroxide floc has not been shown to have toxic or other detrimental effects on the fish at or near the Acid Site. Sport fishermen have complained about the floc "ruining" the fishing, but scientific investigations over the past 32 years have failed to confirm the complaint. Adverse effects from the floc would be associated with the temporary increase in turbidity. Since the floc has been demonstrated to cause only increased turbidity, neither navigation nor other legitimate uses of the ocean would be harmed or impeded by the floc.

23-16 Iron is an essential micronutrient for phytoplankton, and Menzel and Ryther (1961) showed it to be a limiting nutrient in some tropical and subtropical oceanic waters (e.g., Sargasso Sea). Ryther and Kramer (1961) showed that coastal phytoplankton species could not grow in waters with low iron concentrations; Strickland (1965) showed that growth of oceanic phytoplankton species could be inhibited in waters with high trace metal concentrations.

The Apex waters typically have high levels of iron, primarily due to the Hudson River outflow and acid waste dumping. The river plume may contain higher levels than an acid plume. Ketchum et al. (1958b) reported that a Hudson River plume station in the Apex (shown by lowered salinity) had higher iron content than an acid waste plume station (shown by discolored water). Redfield and Walford (1951) had earlier concluded that "the iron discharged by the barge would not greatly change the amounts available for growing plants."

Consequently, for the existing site and the Northern and Southern Areas (all coastal), the iron contained in the waste would probably not significantly change any phytoplankton population characteristics. Waste dumped into a Sargasso Sea Eddy at the 106-Mile Site might cause temporary perturbations to phytoplankton species composition; but these effects would be temporary, lasting only until the waste is diluted and dispersed throughout the water column.

23-17 The only metals reported in the DEIS were those of environmental concern (mercury, cadmium, lead) or those for which comparative data were available (chromium, copper, iron, and zinc). Since the toxic component of the waste has been demonstrated to be lowered pH, and not other waste contaminants (e.g., metals), not all metals analyzed by the permittees were detailed in the EIS. For arsenic, the relevant figures are:

Permittee	Range (μg/l)	Mean Concentration (μg/l)	Average Yearly Input (tonnes)	Average Daily Input (tonnes)
NL Industries	0.8-202	42	56.0	0.15
Allied Chemical	0.3-9943	395	14.3	0.04

23-18 The EIS strictly follows the CEQ guidelines and gives substantially equal treatment to each of the alternative dump sites. The benefits and disadvantages of possible use of each site are presented in a format to facilitate decision making. Many of the statements in the EIS, about the lack of adverse effects of acid waste, are the quoted conclusions of the scientists who have impartially evaluated the site. The statement on page 1-2 (Chapter 1) has been changed to show that "a present and future need exists for the continued use of an ocean dump site."

APPENDIX G

PROPOSED SITE DESIGNATION AND CRITERIA FOR MANAGEMENT OF THE

Appendix G

5-29-80
Vol. 45 No. 105
Pages 36043-36346

federal register

Thursday
May 29, 1980

Highlights

36043 **Delegation of Panama Canal Functions** Executive order

36079 **Educational Study Programs** ED changes the regulations for certain programs in order to increase stipend amount which provides for a cost of living increase

36110 **Grants—Education** ED invites applicants for new awards under the State Postsecondary Commissions Program–Intrastate Planning; apply by 7-7-80

36109 **Grants—Education** ED announces closing date for transmittal of applications for continuous projects under Gifted and Talented Children's Education Program. apply by 6-27-80

36047 **Wage and Price Controls** CWPS publishes questions and answers on gross-margin standard for gas. electric and water utilities

36049 **Petroleum Price Regulations** DOE/ERA responds to comments applicable to retailers of motor gasoline: effective 5-19-80

36172 **Continental Shelf** Interior/GS issues proposed revision to standards for training and qualifications of personnel in well-control equipment and techniques for drilling on offshore locations: comments by 7-28-80

CONTINUED INSIDE

[illegible] hearing or other trial-type proceeding, if

(1) such employee was a staff advocate in such trial-type proceeding or in a factually related trial-type proceeding or

(2) such employee was a staff investigator in a factually related formal investigation under § 1.5b.

(b) *Definitions.* For purposes of this section:

(1) *Factually related.* (i) A trial-type proceeding is factually related to another trial-type proceeding if there is substantial identity of facts which are material to both proceedings.

(ii) A trial-type proceeding is factually related to a formal investigation if the same conduct of a person is the subject of both proceedings.

(2) *Advise.* The term "advise" means advise as to the findings, conclusions or decision respecting a proceeding to be taken as witness or counsel in public proceedings.

PART 2—GENERAL POLICY AND INTERPRETATIONS

PART 20—STANDARDS OF CONDUCT

[illegible] Amended

2. Chapter I is further amended in the following sections: in § 1.4 by deleting paragraph (d); in § 1.27 by deleting the second sentence of paragraph (c); in § 1.80 by deleting paragraph (f); in § 1.80(j) by deleting "§ 1.4(d)" in this subpart" and inserting in lieu thereof "§ 1.83 of this part"; in § 1.80(k)(1) by deleting "§ 1.80(f) of this subpart" and inserting in lieu thereof "§ 1.83"; in § 1.80(k)(2) by deleting "§ 1.4(d)" and inserting in lieu thereof "§ 1.83 of this subchapter"; in § 20.1 by deleting "Section 1.400" and inserting in lieu thereof "Section 1.83 of this subchapter"; in § 20.112(a)(3) by deleting "Section 1.407" and inserting in lieu thereof "Section 1.810 of this subchapter"; and in § 20.112(b)(1) by deleting "Section 1.4(d)" and inserting in lieu thereof "Section 1.83 of this subchapter".

[illegible]

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 228

[FRL 1458-1]

Ocean Dumping; Proposed Designation of Site

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: EPA today proposes to designate the existing acid wastes dump site located in the New York Bight as an EPA approved Ocean Dumping Site for the dumping of aqueous acid wastes.

DATES: Comments must be received on or before July 28, 1980.

ADDRESS: Send comments to Mr. T. A. Wastler, Chief, Marine Protection Branch (WH-548), Oil and Special Materials Control Division, EPA, Washington, DC 20460.

FOR FURTHER INFORMATION CONTACT: Mr. T. A. Wastler, 202/472-2836.

SUPPLEMENTARY INFORMATION: Section 102(c) of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 et seq., (hereafter "the Act") gives the Administrator of EPA the authority to designate sites where ocean dumping may be permitted. The EPA Ocean Dumping Regulations (40 CFR Chapter I, Subchapter H, § 228.4) state that ocean dumping sites will be designated by publication in this Part 228. A list of "Approved Interim and Final Ocean Dumping Sites" was published on January 11, 1977 (42 FR 2461 et seq.) and extended on January 16, 1980 (45 FR 3053 et seq.).

The purpose of this notice is to provide the public an opportunity to comment on the proposed designation, as an EPA Approved Ocean Dumping Site, of the existing acid wastes dump site located in the New York Bight.

The location of the acid site is approximately 27 kilometers east of Long Branch, New Jersey, and south of Long Beach, Long Island, positioned approximately in a rectangle with coordinates as follows:

40°16′ N. to 40°20′ N.; 73°36′ W. to 73°40′ W.

The site occupies an area of approximately 41 square kilometers. Water depths within this area range from 22.6 meters to 28.3 meters. The site was selected in 1948 and has been used since for the disposal of aqueous acid wastes.

Section 102(c) of the National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq. (hereafter "NEPA"), requires that Federal agencies prepare Environmental Impact Statements (EIS's) on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. The object of NEPA is to build into the Agency decision-making process careful consideration of all environmental aspects of proposed actions.

The EPA has prepared a Draft EIS entitled "Environmental Impact Statement for New York Bight Acid Waste Disposal Site Designation." The Draft EIS was made available to the EPA Office of Environmental Review on December 14, 1979, and a notice of availability for public review and comment was published in the **Federal Register** on December 21, 1979 (44 FR 75713). The public comment period on this Draft EIS closed February 12, 1980.

Based on the information reported in the Draft EIS, EPA proposes to designate the site for: (1) continuing use for the ocean disposal of aqueous acid wastes where the applicant has demonstrated a need for ocean dumping, lack of alternatives to the dumping, and compliance with EPA's marine environmental impact criteria; and (2) use under emergency conditions where the applicant can demonstrate that there exists an emergency requiring the dumping of such materials which poses an unacceptable risk to human health and admits of not other feasible solution.

The designation of the existing New York Bight acid wastes dump site as an EPA Approved Ocean Dumping Site is being published as proposed rulemaking. Management authority on this site will be delegated to the Regional Administrator of EPA Region II.

Interested persons may participate in this proposed rulemaking by submitting written comments within 60 days of the date of this publication to the address given above.

Although this proposed site designation may have substantial local impacts in the vicinity of the dump site and to those who use it, we have determined that this proposed rule is not a "significant" regulatory action within the meaning of Executive Order 12044, Improving Government Regulations (March 23, 1978).

(33 U.S.C. Sections 1412 and 1418)

Dated: May 22, 1980.

Douglas M. Costle,

Administrator.

PART 228—CRITERIA FOR THE MANAGEMENT OF DISPOSAL SITES FOR OCEAN DUMPING

In consideration of the foregoing, Subchapter H of Chapter I of Title 40 is proposed to be amended by adding to § 228.12(b) an ocean dumping site for Region II as follows:

§ 228.12 Delegation of management authority for interim ocean dumping sites.

* * * * *

(b) * * *

(6) Acid Wastes Site—Region II.

Location: Latitude—40°18′ N. to 40°20′ N.; longitude—73°36′ W. to 73°40′ W.

Size: 41 square kilometers.

Depth: Ranges from 22.6 meters to 28.3 meters.

Primary Use: Acid waste (note restriction below).

Period of Use: Acid wastes dumped under Special Permits—continuing use but with Agency review every 5 years; Emergency Permit dumping—unlimited.

Restriction: Disposal shall be limited to aqueous acid wastes except under Emergency Permit.

[FR Doc. 80-16253 Filed 5-28-80; 8:45 am]

BILLING CODE 6560-01-M

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Health Care Financing Administration

42 CFR Ch. IV

Medicare Program; Reasonable Charge Limitations

AGENCY: Health Care Financing Administration (HCFA), HHS.

ACTION: Notice of decision to develop regulations.

SUMMARY: We propose to amend the Medicare regulations on reasonable charges to set forth the process and criteria by which HCFA will establish special reasonable charge rules and payment limits for individually identified high-technology items reimbursed under Part B of the Medicare program.

FOR FURTHER INFORMATION CONTACT: Paul Riese, Health Care Financing Administration, Department of Health and Human Services, HA-3 East Low Rise Building, 6401 Security Boulevard, Baltimore, Maryland 21235, 301-594-1843.

SUPPLEMENTARY INFORMATION: The reasonable charge for an item or service is generally compared as the lowest of (1) the actual charge, (2) the customary charge made by the particular physician or supplier, and (3) the prevailing charge (the 75th percentile in the range of customary charges for similar services in the locality). In addition, our current regulations authorize us to consider other factors that may be found necessary and appropriate, with respect to a specific item or service, to use in judging whether the charge is inherently reasonable.

However under unusual market conditions these rules may result in excessive or unreasonable levels of payment. This may occur, for example, when the Federal government is the primary payer for an item when there is a rapid spread of new expensive technology, or where an item is furnished by only one supplier.

The proposed regulation would establish a special rule for these situations. It would state general criteria for determining when a limit is appropriate for a specific item, set forth a process for public participation in subsequently establishing a limit on that specific item, and provide for exceptions when a supplier or beneficiary submits acceptable justification. Under the proposed process, once we have identified a situation in which the usual method of determining reimbursement does not appear appropriate, we would consider certain relevant factors on a national or regional basis such as price markup, utilization rate, etc. If we believe that a limit is appropriate we would publish a notice in the Federal Register and provide for a 60-day period for public comment on the need for the limit and the basis for the proposed dollar amount. After we review all comments, we would make a final determination on the need for and the amount of the limit, and publish any final limit in the Federal Register.

The item we have under review for the initial application of this regulation is the computerized tomography scanner. We will be issuing a notice shortly after publication of the proposed rule, setting forth proposed limits on scanner services and our basis for developing them.

The purpose of this proposed amendment is to curtail those health care costs that we can clearly identify as excessive under criteria set forth in published regulations, and to prevent the adverse effects on both Medicare beneficiaries and consumers in general that we believe would result from lack of such controls.

HCFA has classified the proposed regulation as policy significant. A regulatory analysis is not planned for this regulation, but may be appropriate for the subsequent notices proposing limits on specific items.

Dated: April 15, 1980.

Leonard D. Schaffer,

Administrator, Health Care Financing Administration.

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