United States
Environmental Protection
Agency

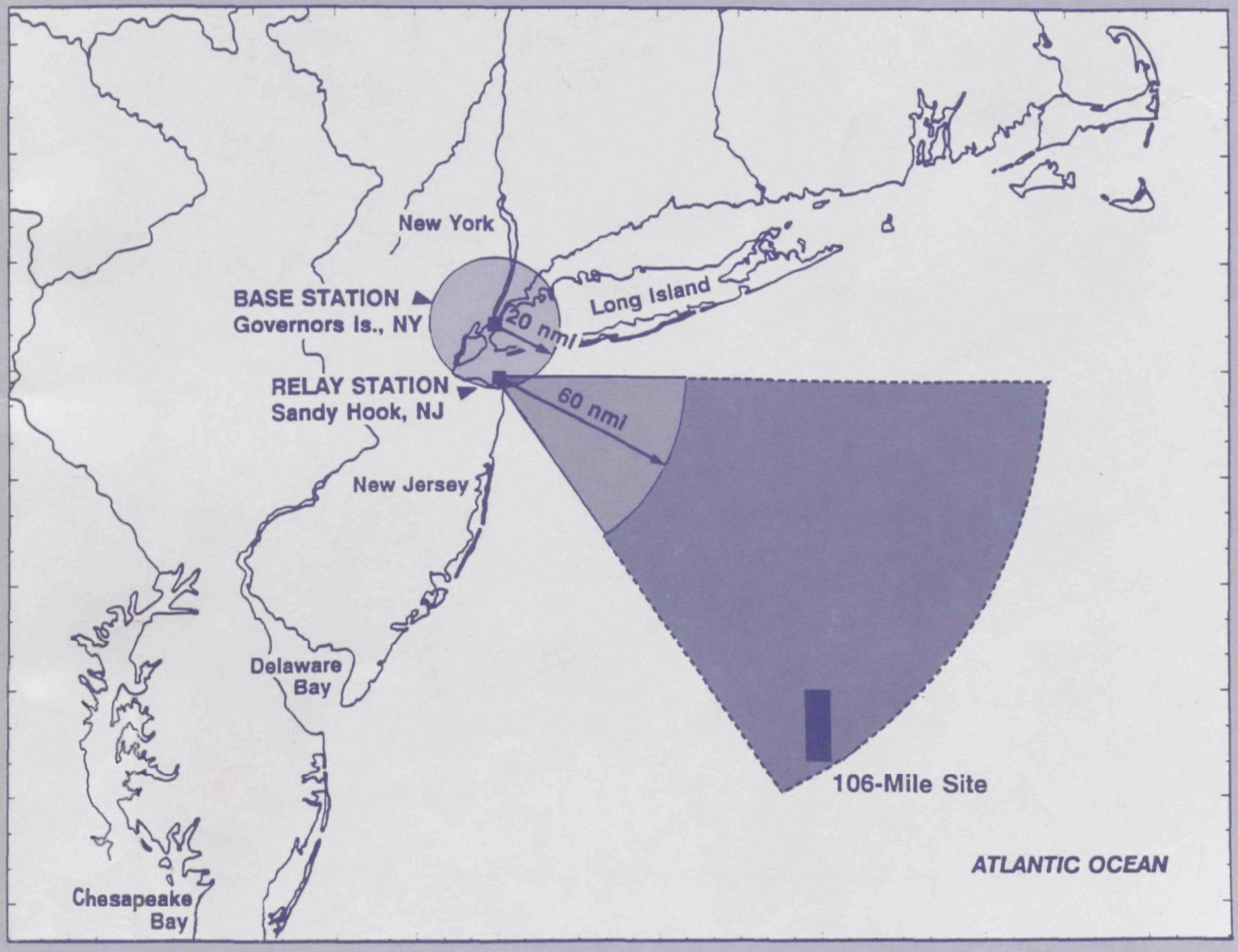
Office of Water
(WH-556F)

EPA 503/9-90/002
December 1989

EPA

Surveillance And Enforcement Of Sewage-Sludge Dumping

Report To Congress



Printed on Recycled Paper

REPORT TO CONGRESS

on

Surveillance and Enforcement of Sewage Sludge Dumping

July 14, 1988, to March 31, 1989

EXECUTIVE SUMMARY

This Report to Congress presents the progress of the United States Coast Guard and the United States Environmental Protection Agency (EPA) in the use of the Ocean Dumping Surveillance System (ODSS). The ODSS is the electronic surveillance system used to track barges that transport sewage sludge to the Deepwater Municipal Sludge Dump Site, commonly known as the 106-Mile Site. This report was prepared by EPA in consultation with the United States Coast Guard as required by Section 1004 of the Ocean Dumping Ban Act (ODBA) of 1988, which amends the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA, PL 92-532).

The ODBA requires EPA, in consultation with the Coast Guard, to report to Congress on the progress of the electronic surveillance system and other means to monitor and prevent illegal dumping of sewage sludge. This report covers the performance of the ODSS between July 14, 1988, and March 31, 1989. These dates are the effective date of ODSS operation, when enforcement began, and a cutoff date selected in order to analyze the ODSS data and comply with the legislative report requirement. The report summarizes EPA's related enforcement activities during this same period, and discusses future needs for installing and fabricating additional ODSS units and upgrading or modifying the system.

Historically, surveillance of ocean dumping operations has been carried out, to a limited extent, by shipriders, who are independent observers (usually Coast Guard personnel) that remain on board the towing vessel or self-propelled vessel for the duration of the dump mission. Airplane overflights and observations from nearby vessels were also used on occasion, but were found to be impractical and of limited value. All of these surveillance activities created a drain on Coast Guard resources and have been almost entirely phased out over the years.

In the early 1970s, the Coast Guard conducted research into the development of an Ocean Dumping Monitoring System. This system would have utilized a recording device to record vessel data on tape. However, this system was not adopted because collecting the tapes from the vessels and processing the data would have been manpower intensive. In 1984 the Coast Guard began research and development of the ODSS, using $500,000 in

funds allocated by Congress for this purpose. The ODSS was designed to provide full real-time coverage of the entire 12-Mile Site operational area. Data on each vessel's status would be almost instantaneously telemetered via radio signals from the vessel's "black box" to the Coast Guard base station on Governors Island, New York. If a violation occurred anywhere in the operational area, the Coast Guard would be almost instantly alerted and could contact the vessel via VHF-FM radio.

After the 12-Mile Site was closed and all vessels carrying sewage sludge were required to dump at the 106-Mile Site, the size of the operational area that the Coast Guard was required to monitor increased more than 10-fold. The Coast Guard had to decide whether it should revise the design of the system, or adopt a new configuration that uses satellite coverage to provide complete real-time coverage of the greatly expanded operational area. The Coast Guard decided against satellite coverage because it could not be certain when a geosynchronous satellite would be successfully launched from an Arian rocket. Although the design that the Coast Guard selected can only provide real-time coverage up to 60 nautical miles from its relay station at Sandy Hook, New Jersey, all components of the system are entirely under the control of the Coast Guard. When the vessel is outside of the range of the relay station, data on the vessel's status is stored in the on-board black box computer and is telemetered to the base station as the vessel returns to port. After the base station receives the data, a printout of the vessel's trackline and dump status for the entire mission can be made. If the printout shows a violation, EPA could use the printout as a basis for an enforcement action.

Sixteen ODSS units have been installed on the 16 oceangoing vessels authorized by EPA to dump sewage sludge at the 106-Mile Site. Each time a vessel dumps sludge at the 106-Mile Site it is considered to be one dump mission. The Coast Guard considers any dump mission printout that shows the time, date and coordinates of the vessel during the dumping operation, as well as draft readings from at least one transducer (or pressure sensor), to be complete. During the period covered by this report, there were typically 50 to 65 dump missions per month. During the first five months of its operation, the ODSS averaged almost 42 percent complete printouts. During the next four months of operation, its perfomance rating averaged only 14 percent, lowering the average ODSS performance rating for the whole reporting period. Overall, during the first 9 months of operation, the number of complete ODSS printouts obtained for each month ranged from 7 to 46 percent, with an average of 29 percent.

This performance rating of 29 percent complete printouts fell short of the Coast Guard's goal of 80 percent complete printouts. However, even partially complete printouts can provide valuable information. For example, if only the time, date, and coordinates of the vessel are obtained from the ODSS printout, EPA can compare the actual amount of time a vessel remained inside the 106-Mile site with the calculated amount of time it would take the same vessel to dump its sludge at the permitted rate of discharge. If the printout shows that the time that the vessel remained in the site was less than the time required to dump at the permitted rate, then the vessel must have exceeded its maximum permitted dumping rate, dumped outside of the 106-Mile Site, or both. Therefore, even if none of the transducers are functioning, an enforcement action may be possible.

Even though the ODSS has not attained its performance goals, the design of the ODSS provides a deterrent effect because the ocean dumpers do not know when the system is or is not working properly. Therefore, any ocean dumper that engages in illegal dumping in the hope that the ODSS may not be working is taking a risk. However, because the performance of the ODSS has been inconsistent, EPA is concerned that the deterrent effect of the ODSS has been diminished.

There are no plans for installing ODSS units on the shallow draft, or feeder, vessels that transfer sludge to oceangoing vessels or land-based storage tanks. Navigation to some treatment plants can only be accomplished by feeder vessels because waters are too shallow or access is too narrow to permit passage of larger oceangoing vessels. The ODSS units are designed to provide surveillance of dumping operations and vessel movements to and from the designated dump site. Therefore, as now configured, the units are not practicable for use in monitoring the feeder vessels, which frequently load and unload sludge at different locations.

To provide additional surveillance, in February of 1989, EPA began implementation of a cradle-to-grave manifest and seal system designed to monitor all sludge transfers. Under this system all dump valves on each feeder vessel or oceangoing vessel will be sealed, with EPA-supplied seals, before any sludge is loaded onto the vessel. Immediately after each sludge transfer, an inspector approved by EPA will seal all other valves. These inspectors will also record the volume of sludge transferred and other pertinent information on sludge manifest forms. The Coast Guard will conduct spot checks of the feeder vessels and ocean-

going vessels while they are transporting sludge through the harbor. If any seals are found to be broken or missing, or show signs of tampering, the vessel may be required to immediately return to port, where a full investigation can be conducted. The purpose of this system is to prevent illegal short dumping of sludge and also to prevent any prohibited or banned substances from being surreptitiously loaded onto the vessels along with the sewage sludge. This system has been operating as a pilot program since February 1989. When the special ocean dumping permits became effective on August 14, 1989, the manifest and seal system became a permit condition.

Although the ODSS has fallen short of its goal of obtaining complete printouts for 80 percent of all dump missions, it must be remembered that the system has been fully operational for about one year. The Coast Guard has continued to work on difficulties encountered during this time period. However, some problems are persistent and have undermined the reliability of the entire system. EPA has strongly encouraged the Coast Guard to employ an independent contractor to evaluate and review the entire system from top to bottom.

Several plans for upgrading the ODSS to provide near real-time coverage of all or most of the operational area are discussed and evaluated in this report. EPA is encouraging the Coast Guard to implement and test one of these plans, as well as to increase efforts to improve the overall reliability of the system. EPA-approved shipriders, supplied by the permittee, will be required on all vessels transporting sludge to the dump site in the interim.

TABLE OF CONTENTS

Executive Summary i

Acknowledgements vi

Introduction 1
- The Regulatory Need for Electronic Surveillance 1
- Development of the Ocean Dumping Surveillance System 2
- About This Report 3

The ODSS 4
- Overview 4
- Components of the ODSS 4
  - Electronics Package 4
  - Transducers 5
  - Base Station 6
- Operation of the ODSS 7
  - Interrogation Intervals 7
  - Dump Determination 7
  - ODSS Screen Displays 9
- Advantages of the ODSS as a Surveillance Tool 12
- Accuracy of the ODSS 14

Installation of the ODSS 15

Sludge Manifest and Seal System 16

Effectiveness of the ODSS 19
- Completeness of ODSS Coverage 19
- Violations of Ocean Dumping Permits 21
- Limitations to the ODSS 22
- Need for Installation of Additional ODSS Units 24
- Improvements to the ODSS 25
  - Antenna on the World Trade Center or Loran Tower 25
  - Satellite Link 26
  - Communications Capability 27

Conclusions and Recommendations 28

Glossary and Acronyms 30

Appendix A 32
- Vessels Authorized to Dump Sludge 32
- Permittees Authorized to Dump Sludge 33

Appendix B 34
- ODSS Printout 34

ACKNOWLEDGEMENTS

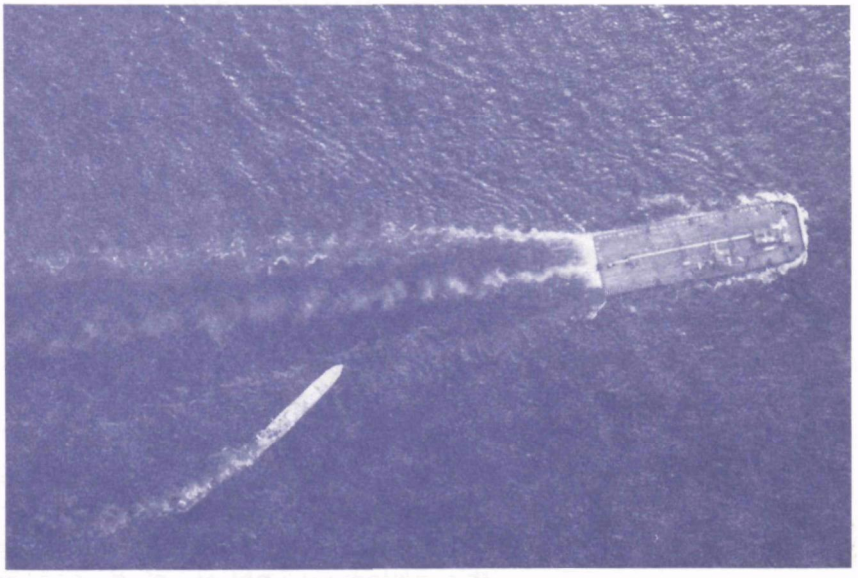
This report was prepared by Mr. Albert L. Visconti, U.S. EPA Region II, Ocean Dumping Task Force, New York, New York. The work assignment manager was Ms. Karen Klima, U.S. EPA Office of Marine and Estuarine Protection, Washington, DC.

Technical data and diagrams were supplied by the U.S. Coast Guard's Office of Research and Development, Groton, Connecticut. Support was also provided by U.S. Coast Guard Technicians and Officers at U.S. Coast Guard Headquarters, Washington, DC, and at Governors Island, New York, New York.

INTRODUCTION

The Regulatory Need for Electronic Surveillance

Ocean dumping of sewage sludge has occurred since 1924. The practice of ocean dumping developed over the years because it was a convenient and comparatively inexpensive means of waste disposal. In 1972, Congress passed the Marine Protection, Research, and Sanctuaries Act (MPRSA) to regulate the disposal of wastes in the ocean. As amended, MPRSA is the primary legislative authority directly related to ocean dumping. Under MPRSA, EPA is responsible for issuing permits for sewage sludge disposal and for designating, managing, and monitoring ocean disposal sites. Surveillance of operational aspects of permitted disposal and enforcement of permit conditions are joint responsibilities of EPA and the Coast Guard. Under Section 107 of MPRSA, the Coast Guard is required to conduct surveillance of ocean dumping activities.



A barge dumps and the 165-foot EPA Ocean Survey Vessel Peter W. Anderson *enters the plume to conduct monitoring studies.*

In 1984, EPA designated the 106-Mile Site to receive municipal sewage sludge. The 106-Mile Site is located 120 nautical miles southeast of Ambrose Light, New York, and 115 nautical miles from Atlantic City, New Jersey. In 1986, EPA instructed the sewerage authorities to begin shifting their dumping activities

from the 12-Mile Site to the 106-Mile Site. In December of 1987, dumping activities at the 12-Mile Site were phased out entirely, and all dumping of sewage sludge was conducted solely at the 106-Mile Site.

Several recent marine pollution events focused the attention of many legislators, the news media, and the public on a potential relationship between environmental degradation and dumping activities at the 106-Mile Site. In response to this increased attention, Congress passed the Ocean Dumping Ban Act of 1988 (ODBA), which makes ocean dumping of sewage sludge and industrial waste unlawful after December 31, 1991.

ODBA requires, among other activities, that EPA, in consultation with the Coast Guard, prepare a report to Congress on the progress made in using electronic surveillance equipment and other means to monitor and prevent dumping of sewage sludge outside of the designated 106-Mile Site by vessels carrying sewage sludge. This report fulfills that requirement.

Development of the Ocean Dumping Surveillance System

Over the years, the Coast Guard's ocean dumping surveillance goals have not been met for a variety of reasons. Bad weather can often force cancellation of aerial surveillance missions, and aerial surveillance at night is not feasible. Safety considerations can preclude a Coast Guard vessel from getting close enough to a barge to observe when it begins or stops dumping. Lack of personnel only allowed the Coast Guard to place shipriders on a limited number of vessels that transport sludge to the dump site.

To improve their surveillance capabilities, in the early 1970s, the Coast Guard conducted research into the development of an Ocean Dumping Monitoring System. This system would have used a recording device to record vessel data on tape. However, this system was not adopted because collecting the tapes from the vessels and processing the data would have been too manpower intensive. In 1984, the Coast Guard began development of a new technology to monitor ocean dumping activities, the Ocean Dumping Surveillance System (ODSS), using $500,000 in funds allocated by Congress for this purpose.

In 1985 and 1986, prototypes of the ODSS units were installed on New York City's self-propelled sludge vessel, the M/V *North River*, and on towed sludge vessels. Tests were conducted by the Coast Guard. Based on the results of these tests, the Coast Guard believed that complete coverage of the entire fleet of authorized sludge vessels could be achieved if ODSS units were installed on all of the vessels.

In November 1987, EPA instructed all waste transporters to coordinate the dry docking of their vessels with the Coast Guard to enable the Coast Guard to install the ODSS units on all EPA-authorized oceangoing vessels. EPA designated May 15, 1988, as the date after which only vessels equipped with an ODSS unit would be permitted to ocean dump sewage sludge. On July 14, 1988, it was announced that the Coast Guard had completed initial shakedown and testing of each of the installed ODSS units and the system was considered operational. However, further system engineering and shakedown testing was required to resolve various system problems.

About This Report

This report covers the performance of the ODSS between July 14, 1988, and March 31, 1989 and related EPA enforcement activities during this same period. These dates are the effective date of ODSS operation, when enforcement began, and a cutoff date selected in order to analyze the ODSS data and comply with the legislative report requirement. The report examines the scope and limitations of the ODSS and describes EPA and Coast Guard efforts to overcome these limitations. EPA's sludge manifest and seal system, a system developed to track and monitor barge operations in the New York and New Jersey Harbor areas, is also described and discussed. Finally, future needs for installing and fabricating additional ODSS units and upgrading or modifying the system are explored.

Overview

The ODSS includes three main components:

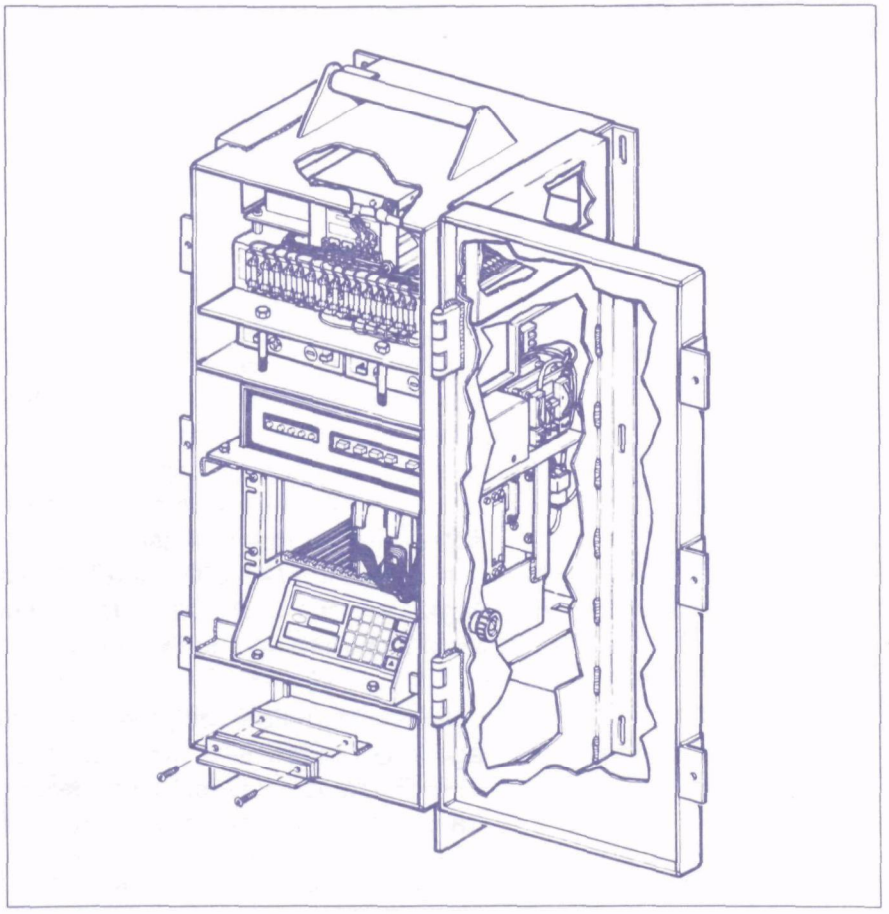
- The electronics package or "black box," which is installed by the Coast Guard on all 16 vessels authorized by EPA to dump sewage sludge.
- The transducers, or pressure sensors, which measure changes in the vessel's draft and are also installed on all authorized dumping vessels with the exception of two of the smaller vessels, the *Leo Frank* and the *Sotoco II*.
- The base station, located on Governors Island, NY, and the relay station located at Sandy Hook, NJ.

All of the components of the ODSS and the roles they play in the operation of the system are discussed in this section.

Components of the ODSS

Electronics Package

An electronics package, or "black box" is installed on each vessel that is authorized by EPA to dump sewage sludge at the 106-Mile Site. The electronics package consists of a modified Loran receiver to determine the vessel position, a real-time clock to establish the date and time when the vessel is at a given position, circuitry to read the transducers and Loran, a communications package, and battery back-up. The communications package contains a radio transmitter, a radio receiver, a linear amplifier, and a packet controller. The entire electronics package is encased in a tamper-resistant box to which only Coast Guard personnel have access. Also mounted on the vessel are a communications antenna and a Loran antenna.



Cutaway view of the electronics package or "black box."

Transducers

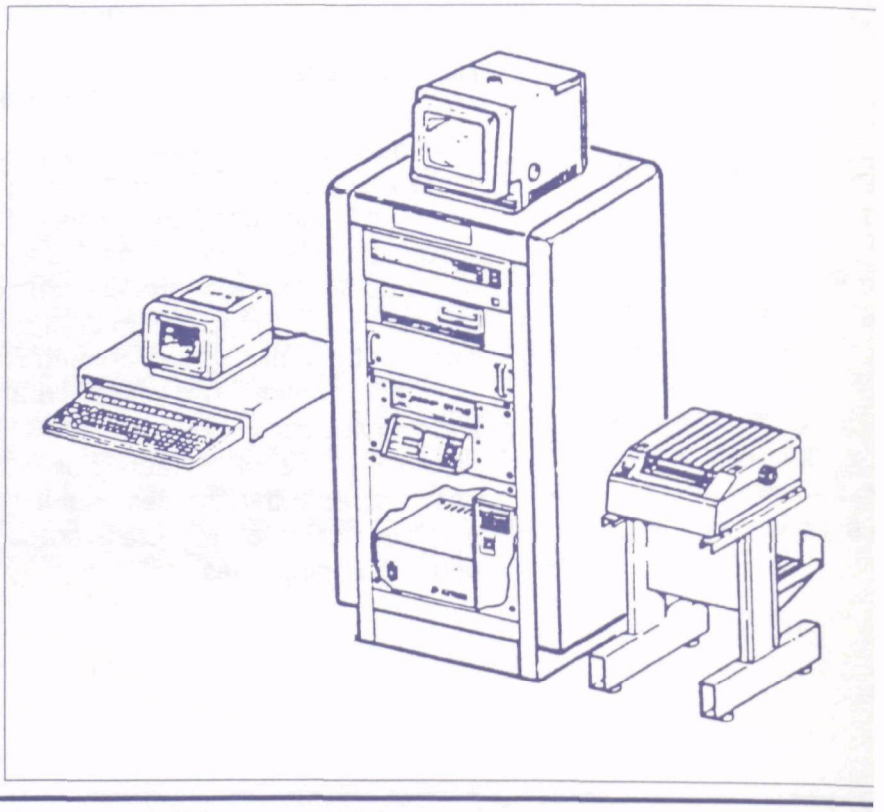
Transducers, or pressure sensors, are used to measure changes in the vessel's draft. Typically, there are three transducers mounted in the hull of the vessel in three locations: fore, aft and amidships. These are connected through circuitry to the on-board computer inside the black box. The computer converts the pressure sensor readings to draft readings. As a vessel dumps sludge it becomes lighter, consequently its draft decreases as it rises in the water. The vessel's draft and its position in latitute and longitude are shown on the ODSS printouts. (Refer to Appendix B.) This information is used to determine whether a vessel has dumped within the designated site. ODSS printouts have only been used to measure average discharge rates, not instantaneous dumping rates.

Base Station

The base station is located on Governors Island, New York. The heart of the system is the base station's minicomputer. The base station computer interrogates the vessel's computer, deciphers the vessel's replies, puts the information in the data base, and backs up the data base.

Instructions to the computer are entered through the system manager's console, a desktop computer with a standard CRT display and keyboard. Another desktop computer with a touch-sensitive screen serves as the watchstander's console, where the operator can interrogate any vessel in the system. A printer is available to print out copies of the video display. A major factor ir the selection of the computers used as the watchstander's consoles was the touch-sensitive video display. This feature allows the user to interact directly with the screen without the need for a keyboard, and is important for a user interface that non-technical watchstanders can use with confidence.

Other base station equipment includes a communications package, a Loran receiver, two antennas, and a battery backup. The VHF-FM radio communication system uses a commercial-grade transmitter and receiver with a multi-tone, time-diversity modem.



Base station equipment.

Operation of the ODSS

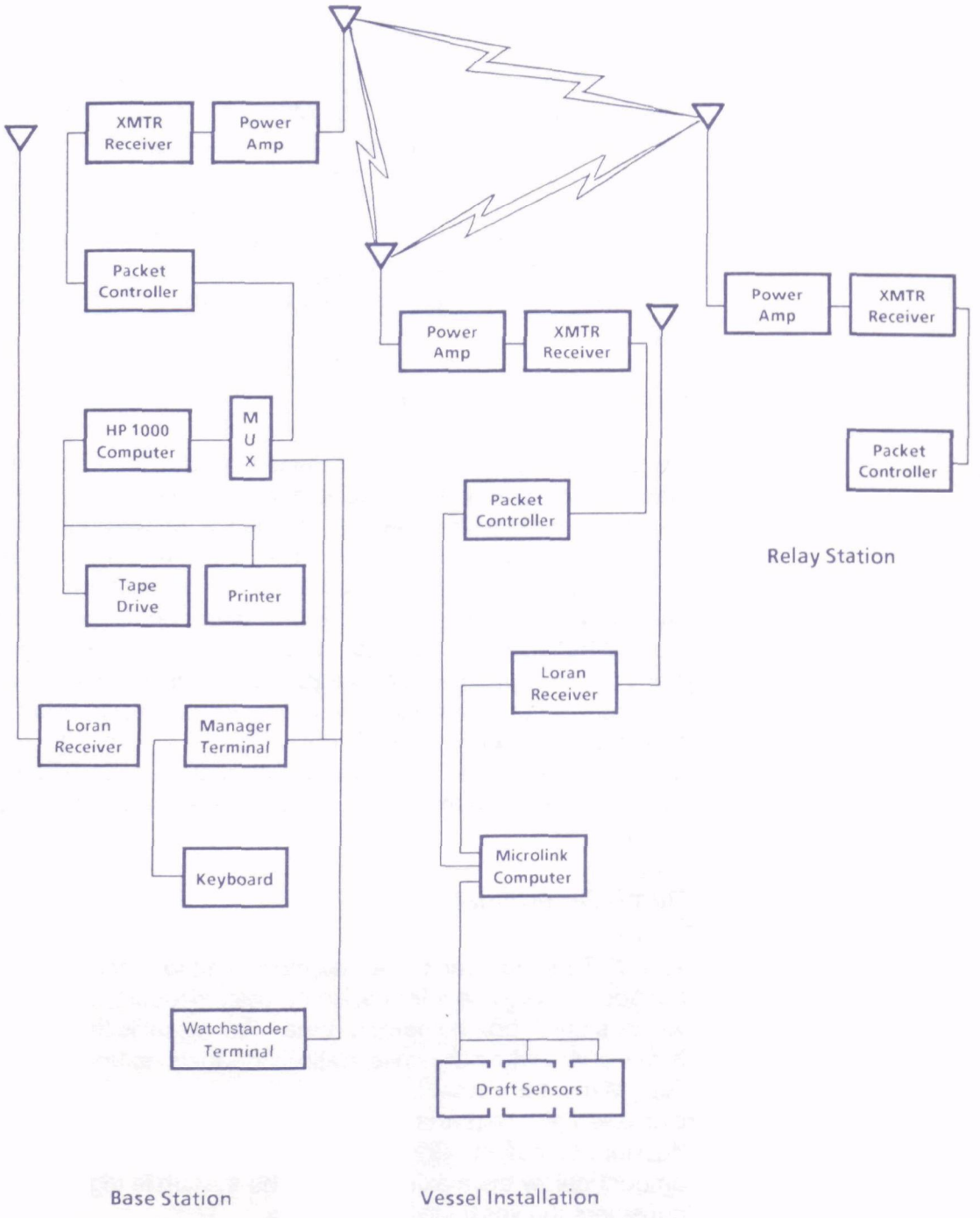
The ODSS monitors all vessels that are authorized by EPA to dump sewage sludge at the 106-Mile Site. Basically, the ODSS operates as follows: The base station interrogates each vessel in its data base at least once each hour, and the vessel's black box replies, giving the vessel's status and providing information on the location, draft, and back-up battery status from each unit. Each vessel is assigned a three-digit identification number so that the base station can identify which ODSS remote unit it is interrogating.

Interrogation Intervals

The base station computer conducts interrogations of the vessel's black box computer at various intervals. The interrogation interval and number of updates depend on the last known location and status of the vessel. When the vessel is docked in port, the vessel is interrogated once each hour, and when the vessel is underway in port or at sea, it is interrogated once every 20 minutes. When the vessel is outside of communications range, its black box computer will store data on the vessel's status every 20 minutes, and upon entering the buffer, or near zone, around the 106-Mile Site, it will store data every 2 minutes. After the reduced dumping rates became effective on August 14, 1989, this interval was increased to 6 minutes to accomodate the longer dumping times.

Dump Determination

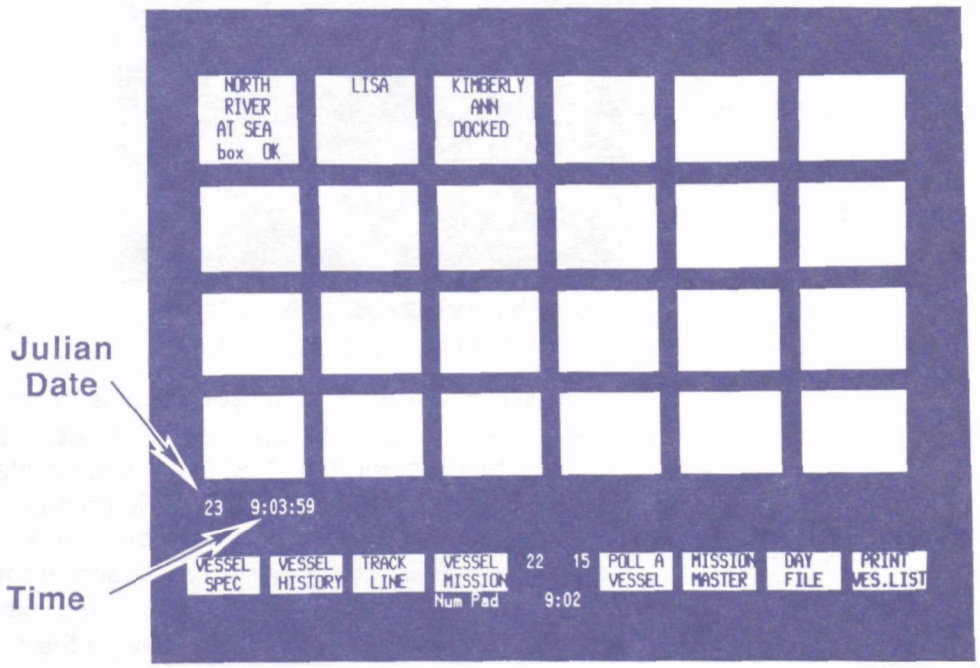
The ODSS keeps track of a maximum draft for each vessel. The transducers provide information on draft measurements to the vessel's black box computer. When the vessel is in port, the draft is measured when the base station conducts its hourly interrogation. When the vessel leaves port, the maximum draft can be increased (the vessel is allowed to take on seawater as ballast) but not decreased. Once the draft decreases by a specified amount below the maximum draft, the system is triggered and considers the vessel to be dumping.



ODSS Operations Diagram. A schematic representation of the ODSS, showing how the components are related to each other during operation.

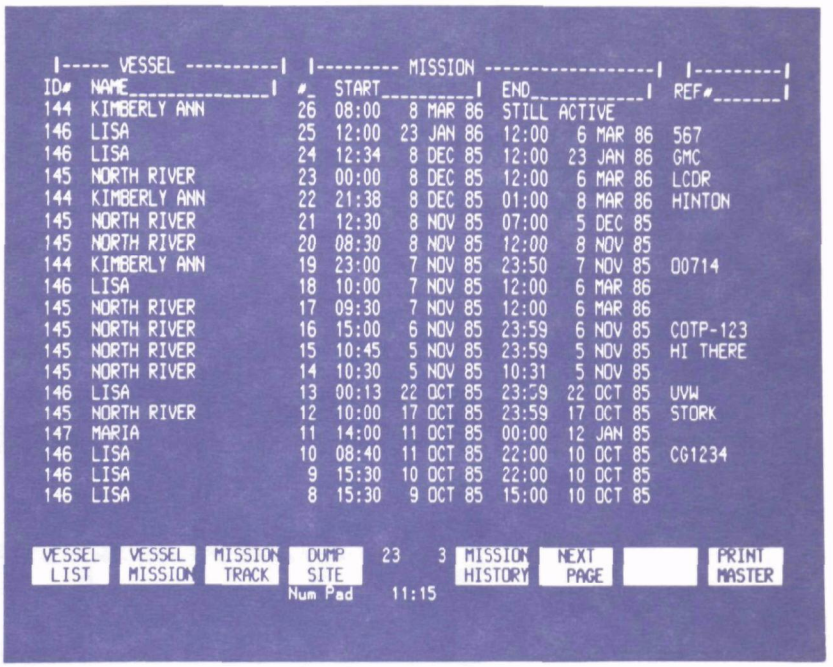
ODSS Screen Displays

The ODSS screen displays allow the watchstander to view information about the ocean dumping operations being monitored by the ODSS. The screens display information on each of the 16 vessels authorized by EPA to dump sludge at the 106-Mile Site. Some examples of the screens that are frequently used are shown below:



Vessel List and Compliance Screen.

The **Vessel List and Compliance Screen** displays all 16 vessels in the database and the current vessel status and black box status of each. If a vessel status changes, it shows brighter than normal until the watchstander acknowledges it by touching the vessel square. If the new status is a violation or a fault (BAD DUMP, NO AC POWER, TAMPERING), the whole square shows brighter and blinks. Touching the blinking violation square will call the Vessel Status screen, which contains additional information, for that particular vessel. The watchstander is able to have a copy of the Vessel Status screen printed by touching PRINT SCREEN.



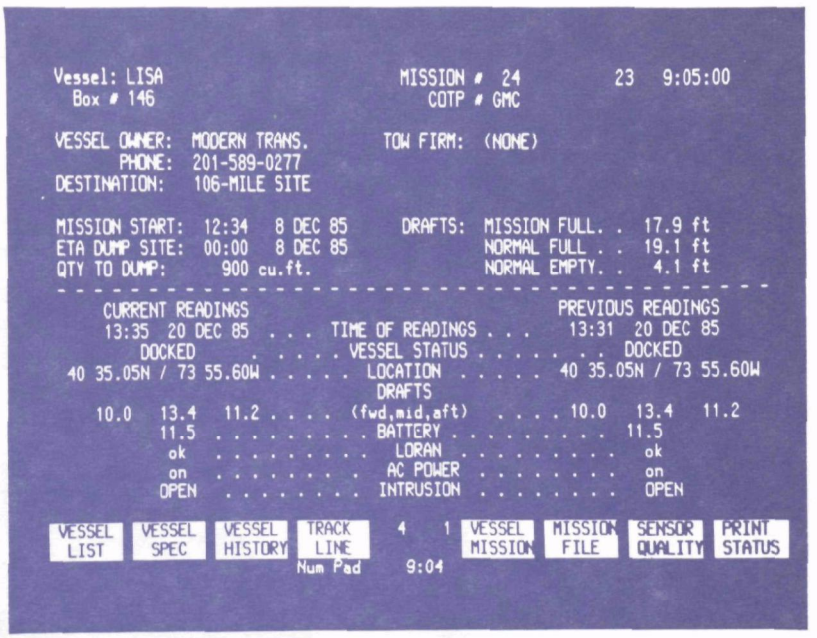
VESSEL		MISSION			
ID#	NAME	#	START	END	REF#
144	KIMBERLY ANN	26	08:00 8 MAR 86	STILL ACTIVE	
146	LISA	25	12:00 23 JAN 86	12:00 6 MAR 86	567
146	LISA	24	12:34 8 DEC 85	12:00 23 JAN 86	GMC
145	NORTH RIVER	23	00:00 8 DEC 85	12:00 6 MAR 86	LCDR
144	KIMBERLY ANN	22	21:38 8 DEC 85	01:00 8 MAR 86	HINTON
145	NORTH RIVER	21	12:30 8 NOV 85	07:00 5 DEC 85	
145	NORTH RIVER	20	08:30 8 NOV 85	12:00 8 NOV 85	
144	KIMBERLY ANN	19	23:00 7 NOV 85	23:50 7 NOV 85	00714
146	LISA	18	10:00 7 NOV 85	12:00 6 MAR 86	
145	NORTH RIVER	17	09:30 7 NOV 85	12:00 6 MAR 86	
145	NORTH RIVER	16	15:00 6 NOV 85	23:59 6 NOV 85	COTP-123
145	NORTH RIVER	15	10:45 5 NOV 85	23:59 5 NOV 85	HI THERE
145	NORTH RIVER	14	10:30 5 NOV 85	10:31 5 NOV 85	
146	LISA	13	00:13 22 OCT 85	23:59 22 OCT 85	UVW
145	NORTH RIVER	12	10:00 17 OCT 85	23:59 17 OCT 85	STORK
147	MARIA	11	14:00 11 OCT 85	00:00 12 JAN 85	
146	LISA	10	08:40 11 OCT 85	22:00 10 OCT 85	CG1234
146	LISA	9	15:30 10 OCT 85	22:00 10 OCT 85	
146	LISA	8	15:30 9 OCT 85	15:00 10 OCT 85	

VESSEL LIST | VESSEL MISSION | MISSION TRACK | DUMP SITE | 23 3 | MISSION HISTORY | NEXT PAGE | | PRINT MASTER

Num Pad 11:15

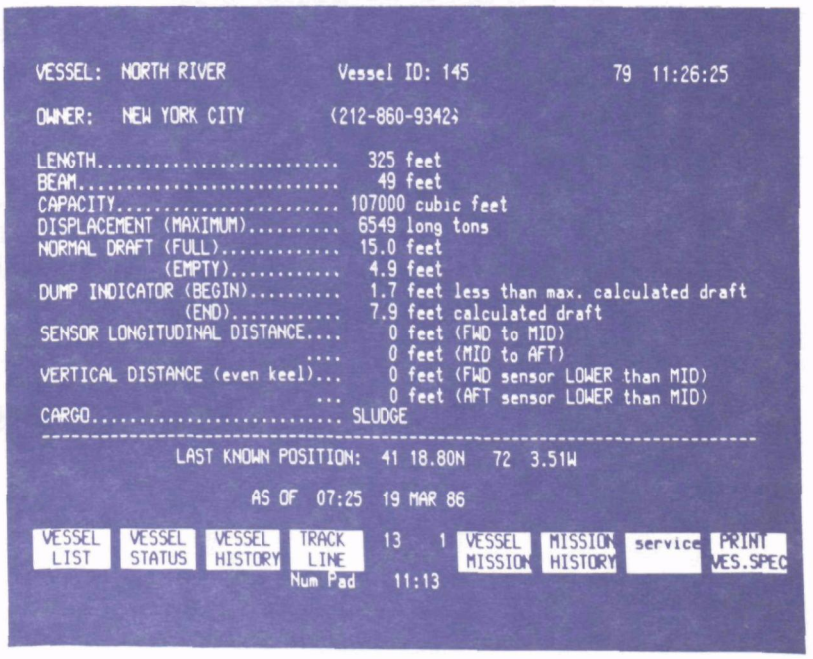
Mission Master File Screen.

The **Mission Master File Screen** lists the mission numbers in order, most recent at the top, along with the vessel name and I.D. number, the date and time that each mission started and ended, and the Captain of the Port (COTP) Reference Number for each mission. The COTP Reference Number is assigned to each vessel by the Coast Guard contact person at the start of each dump mission and is unique for each dump mission. The mission numbers are assigned chronologically by the computer (1-99) but are not unique for each dump mission--after counting to 99, the mission numbers are repeated. Each of the 16 vessels in the fleet has a unique, three-digit vessel identification number. A copy of the mission master file can be printed by touching PRINT MASTER.



Vessel Status Screen.

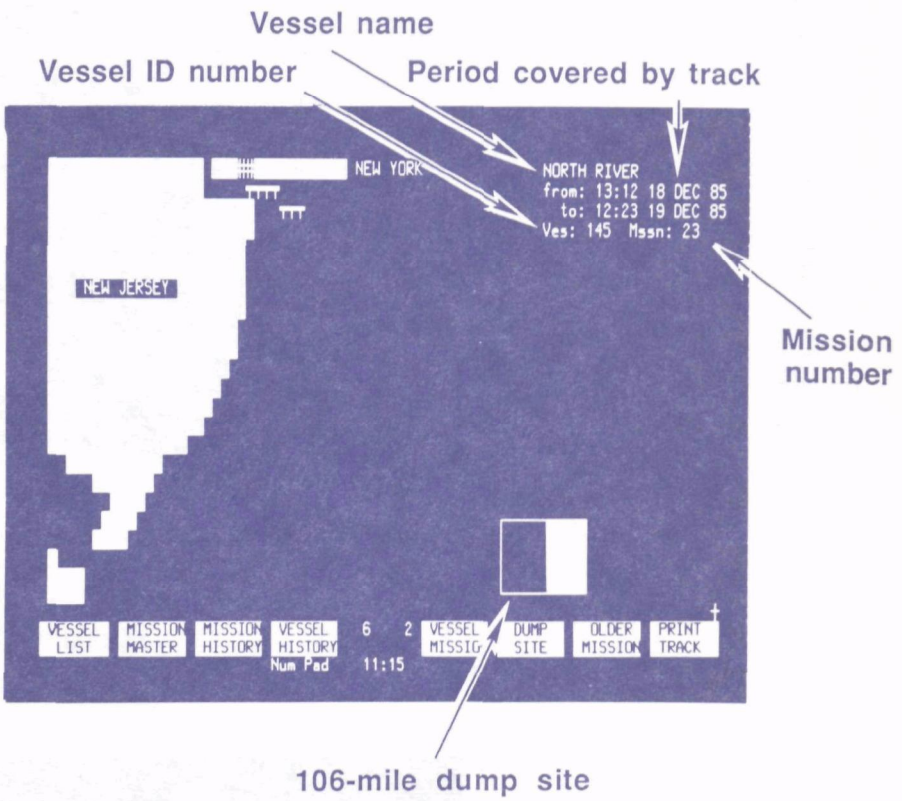
The **Vessel Status Screen** displays the current status information for a specific vessel. If the vessel is outside of the range of the ODSS (60 nautical miles from Sandy Hook, NJ) the screen will show the status of the vessel at the time of the last communication.



Vessel Specification Screen.

The **Vessel Specification Screen** displays information describing the vessel. This information (e.g,, length, beam, capacity,

displacement etc.) generally does not change. It is entered into the system through the System Manager's Program and can only be modified by using this program.



Vessel Position Screen.

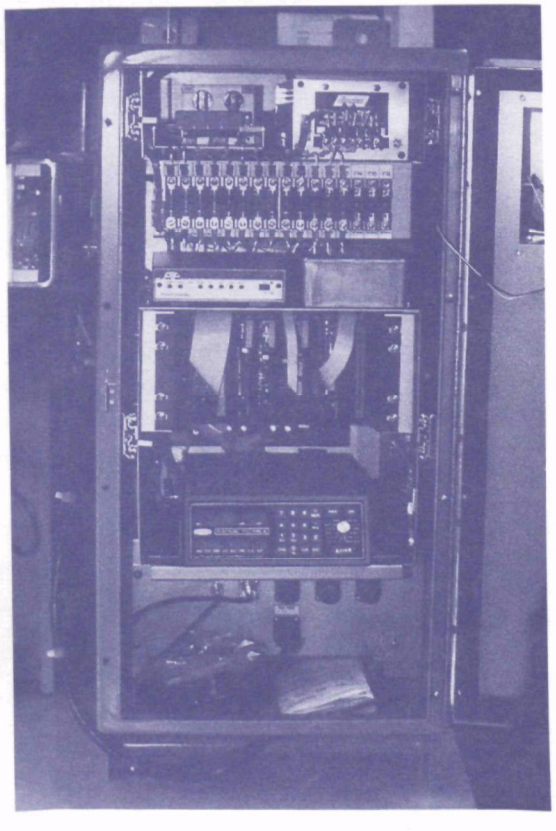
The **Vessel Position Screen** displays a representation of the New Jersey coast and offshore area. This display shows the vessel path to and from the 106-Mile Site and the vessel position when dumping inside the site. A copy of the screen can be printed by touching PRINT SCREEN.

Advantages of the ODSS as a Surveillance Tool

The ODSS was designed to be easy to learn and easy to use, and to minimize the workload of the personnel necessary to operate the system. The watchstanders and the system manager have multi-mission responsibilities and can not devote their full time to operation of the system. Therefore, the Coast Guard developed a

simple touch-screen interface for the watchstanders and a software program that automatically generates information on dumping activity.

The Coast Guard initially estimated that between the watchstanders and system manager, operation of the ODSS will require about one resource-year to operate the system for an entire year. More recent estimates by the Coast Guard indicate that about five resource-years will be required. In comparison, it would require approximately 26 resource-years to maintain shipriders on the vessels going to and from the dump site during the same time period.



The "black box", opened to show its components.

Accuracy of the ODSS

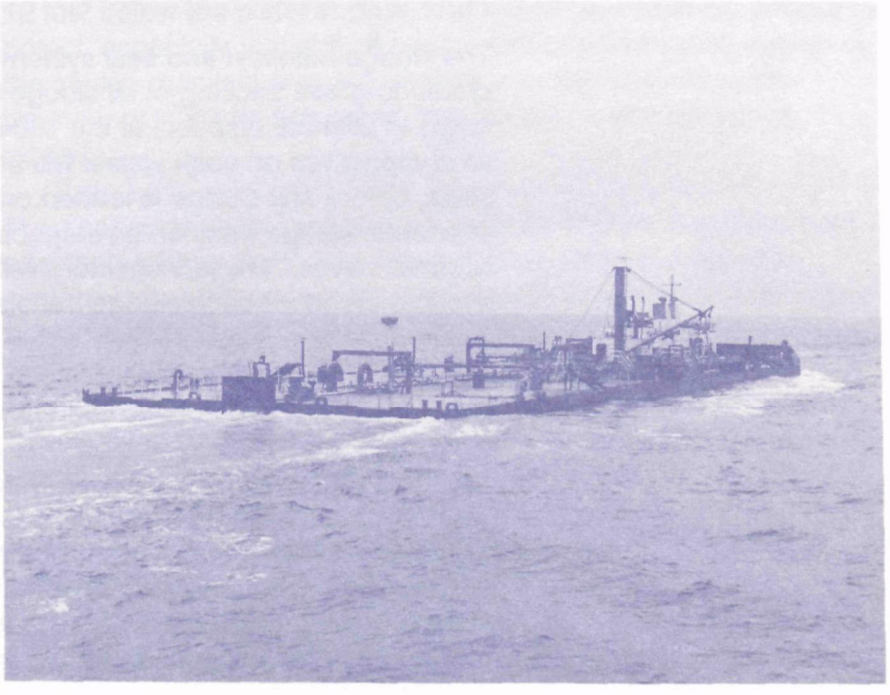
The key piece of equipment in each vessel's black box is the Loran receiver. This component receives signals from the Coast Guard's land-based Loran-C Navigation System to determine its precise location. The Loran receiver inside the black box is similar to the Loran receiver that the master of the vessel uses to navigate to the 106-Mile Site. Both Loran receivers will display the same coordinates at the same time. Therefore, the question of ODSS accuracy really has to do with how efficient the rest of the ODSS system is at accurately relaying the information contained in the Loran receiver to the base station. In an attempt to answer this question, EPA compared two independent sources of information; the ODSS printouts and the Ocean Dumping Notification Forms (ODNF) that EPA, through a permit condition, requires vessel masters to submit after each dump mission. The critical points and times (i.e., enter and exit dump site, start and end dump) from the two sources were shown to match. Because a vessel is permitted to enter and exit the dump site at any coordinates it chooses, the chances of a match being mere coincidence are almost nonexistent. Additionally, the coordinates of the sludge generator's docking facilities were checked against the coordinates shown on the ODSS printouts when the vessels were at the docking facilities. The two sets of coordinates were found to be the same, confirming that complete ODSS printouts accurately identify the location of the vessel.

The transducers, which measure changes in water pressure, are connected through circuitry to the computer inside the black box. This computer, after discounting for the effects of wave action, uses the pressure readings from the transducers to determine the draft of the vessel. Although the transducers measure the draft of the vessel accurately when they are functioning, the number of incidents when the transducers are not working properly is unacceptably high. The Coast Guard is working on a way to improve the durability of the transducers.

INSTALLATION OF THE ODSS

On November 24, 1987, at a meeting of the ocean dumpers, the Coast Guard, and EPA, held at Coast Guard headquarters on Governors Island, New York, the Coast Guard requested that the waste transporters furnish them with the mechanical, electrical, and structural drawings for each of the vessels authorized by EPA to dump sewage sludge at the 106-Mile Site. The Coast Guard supplied and installed the black box, hull transducers, hull inserts, antennas, and all necessary cables and connections, at an estimated cost of $25,000 per unit. The waste transporter was responsible for supplying and mounting brackets for cables and antennas, making all necessary waterproof bulkhead holes for the cables, mounting the hull inserts into which the transducers are installed, routing the cable from the transducers and antenna to the black box, and providing the black box with an AC power source.

In May 1988, the Coast Guard completed installation of 11 ODSS units on oceangoing vessels that dump sludge at the 106-Mile Site. Since then, five of the smaller oceangoing vessels have also been equipped with the ODSS units. This provides position coverage of the entire fleet of 16 vessels and the dump status of 14 of the vessels that are authorized by EPA to dump sewage sludge at the 106-Mile Site.



All barges authorized to dump sewage sludge now have ODSS units installed on board.

SLUDGE MANIFEST AND SEAL SYSTEM

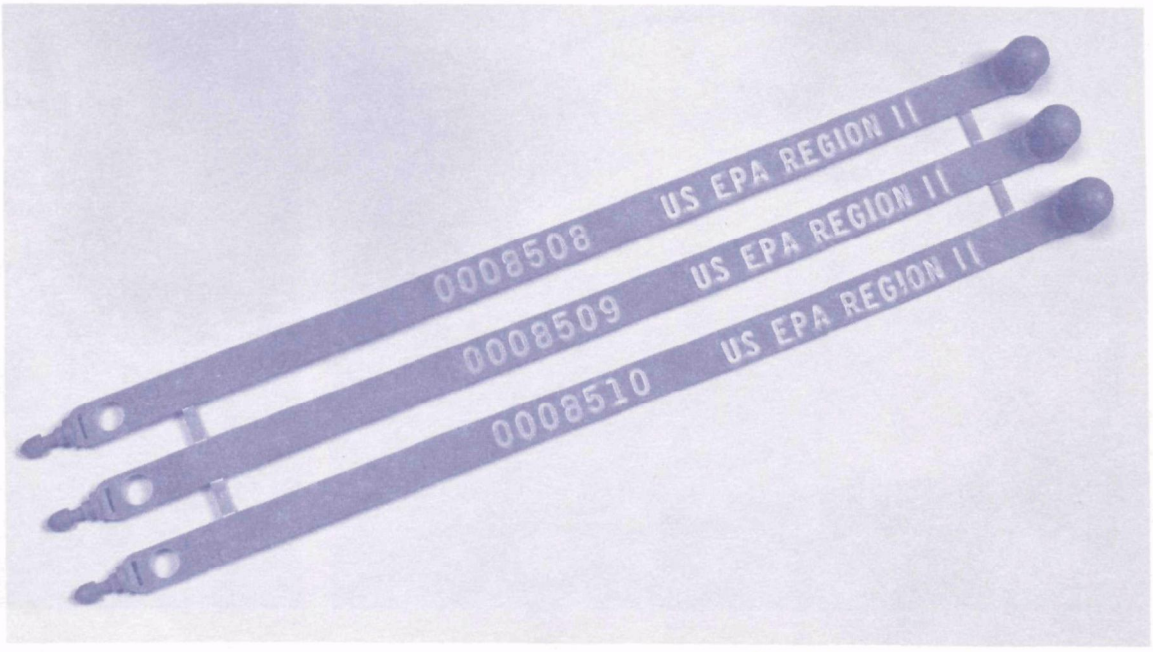
There are at least 10 feeder vessels that are used to transport sludge from the sludge storage tanks on land to the larger, oceangoing vessels. Navigation to some treatment plants is restricted because of shallow waters or narrow access and the feeder or shallow draft vessels are used to service these treatment plants.

ODSS units have not been installed on the feeder vessels and there are no plans to do so in the future. The ODSS was designed to provide surveillance of dumping operations and vessel movements to and from a specific designated site. Therefore, the ODSS units as now configured are not practicable for monitoring the feeder vessels, which are frequently loading and unloading sludge at different locations.

EPA has closed this surveillance and enforcement gap in the ODSS through its sludge manifest and seal system. Implementation of the plan began in February 1989. The purpose of this system is to prevent illegal short dumping of sludge and to prevent any prohibited or banned substances from being surreptitiously loaded onto the dump vessels along with the sewage sludge. This system has been operating as a pilot program; however, now that the special ocean dumping permits have become effective as of August 14, 1989, the manifest and seal system is a permit condition.

The sludge manifest and seal system was designed to provide cradle-to-grave tracking of all sludge transfers, from their point of origin to ultimate disposal at the 106-Mile Site. Under this system all dump valves on each vessel will be sealed, with EPA-supplied seals, before any sludge is loaded onto the vessel. Immediately after each sludge transfer, an inspector approved by EPA will seal all other valves. These inspectors will also record pertinent information about each sludge transfer on sludge manifest forms.

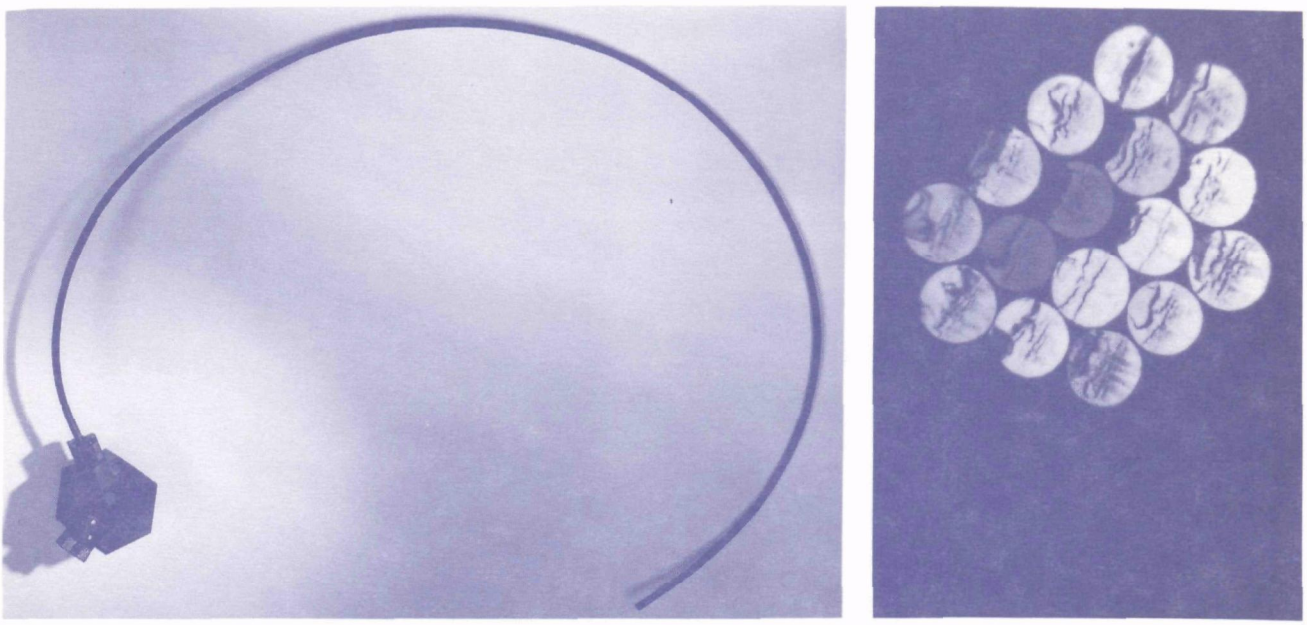
Two distinct types of seals are used. One type of seal is required on valves that are frequently used to load or unload sludge, or to dump sludge at the 106-Mile Site. Another type of seal is required on valves that must be permanently sealed. Ten-inch plastic Poly-Lok Seals have been selected for use on valves that do not require a permanent seal. Each of these seals has the words "US EPA Region II" and a seven-digit serial number embossed in white for easy identification. These seals will show whitish blush marks if any attempt is made to tamper with them.



Poly-Lok seals used to seal the barge's dump valves.

Fiber optic seals have been selected to permanently seal the dump valves on the feeder vessels. Many of these vessels were previously used to dump sludge at the 12-Mile Site and thus have discharge pipes that can dump sludge out of the bottom of the vessel. Any illegal dumping through these pipes would occur 4 to 12 feet below the water surface and would be extremely difficult to detect, especially at night. A paramount concern in the design of the sludge manifest and seal system was the integrity of the permanent seals for the valves that operate these discharge pipes.

The fiber optic seal was selected because it uses state-of-the-art seal technology. Each fiber optic seal consists of a durable protective polyethylene jacket that covers randomly positioned acrylic optical fibers. Once the seal is fastened, the optical fibers form a unique fiber optic "fingerprint." A special camera is used to photograph the fingerprint. Fiber optic seals have been used to seal diplomatic pouches, secure various components inside of missile silos, and for other purposes that require a high degree of seal integrity. There are no known cases of fiber optic seals having been circumvented, through either seal substitution or tampering.



A fiber optic seal (left) and its "fingerprint" (right).

No transfer of sludge is permitted if any seal is broken or missing, unless broken by the approved inspector. EPA and the Coast Guard will conduct spot checks at the loading facilities. The Coast Guard will also spot check the vessels in the process of transporting sludge. If any of the seals are found to be broken or missing, or show signs of tampering, the vessel may be required to immediately return to port, where a full investigation can be conducted.

EFFECTIVENESS OF THE ODSS

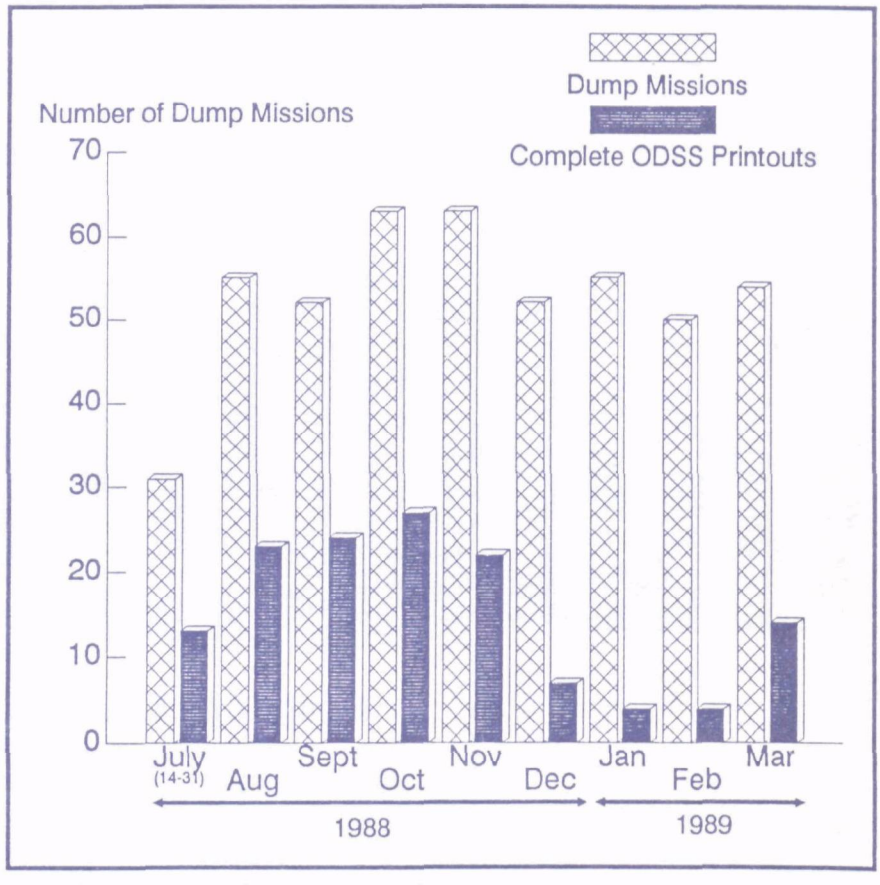
Completeness of ODSS Coverage

The Coast Guard defines a "complete" printout as any printout that shows the time, date, and coordinates of the vessel during the dumping operation and shows draft readings from at least one transducer. This information is sufficient to indicate position during dumping and dumping rate. Between July 14, 1988, and March 31, 1989, 475 dump missions were conducted to the 106-Mile Site. The table below shows the number of dump missions conducted during each month of the reporting period, and the complete printouts obtained, and the percentage of complete ODSS printouts.

NUMBER OF COMPLETE ODSS PRINTOUTS vs. DUMP MISSIONS

MONTH	DUMP MISSIONS	COMPLETE PRINTOUTS	PERCENT
July 14-31, 1988	31	13	42
August 1988	55	23	42
September 1988	52	24	46
October 1988	63	27	43
November 1988	63	22	35
December 1988	52	7	13
January 1989	55	4	7
February 1989	50	4	8
March 1989	54	14	26
TOTAL	475	138	29

During this reporting period, 138 ODSS printouts were complete, an average value of 29 percent completeness. Because of component failures and other system engineering problems, there were several weeks during the months of January and February when no data were collected, resulting in a very low performance rating for these months. The figure below shows a graphic representation of complete printouts vs. dump missions.



Number of complete ODSS printouts vs. number of dump missions.

EPA can also glean valuable information from some ODSS printouts even though the printouts are not complete. For example, EPA can compare the amount of time a vessel remains inside the 106-Mile Site with the amount of time it would take the same vessel to dump its sludge at the permitted discharge rate. If the printout shows that the amount of time the vessel remained inside the 106-Mile Site is less than the time required to dump at the permitted rate, then the vessel must have exceeded its maximum permitted dumping rate, dumped outside the 106-Mile Site, or both. Therefore, even if none of the transducers are functioning, an enforcement action may be possible.

Violations of Ocean Dumping Permits

Violations detected by the ODSS between July 14, 1988, and March 31, 1989, have been tabulated and are shown in the table below. One dump, suspected to have occurred more than 20 nautical miles outside the site in January 1989, is currently under investigation. Instances in which vessels strayed outside of the site during dumping operations are also under investigation.

VIOLATIONS SHOWN ON COMPLETE PRINTOUTS

MONTH	SHORT DUMPS	STRAYED OUTSIDE SITE	EXCEEDED DUMPING RATE
July 1988	0	1	0
August 1988	0	2	0
September 1988	0	1	0
November 1988	0	0	0
December 1988	0	0	0
January 1989	1	0	0
February 1989	0	0	0
March 1989	0	0	0
TOTAL	**1**	**4**	**0**

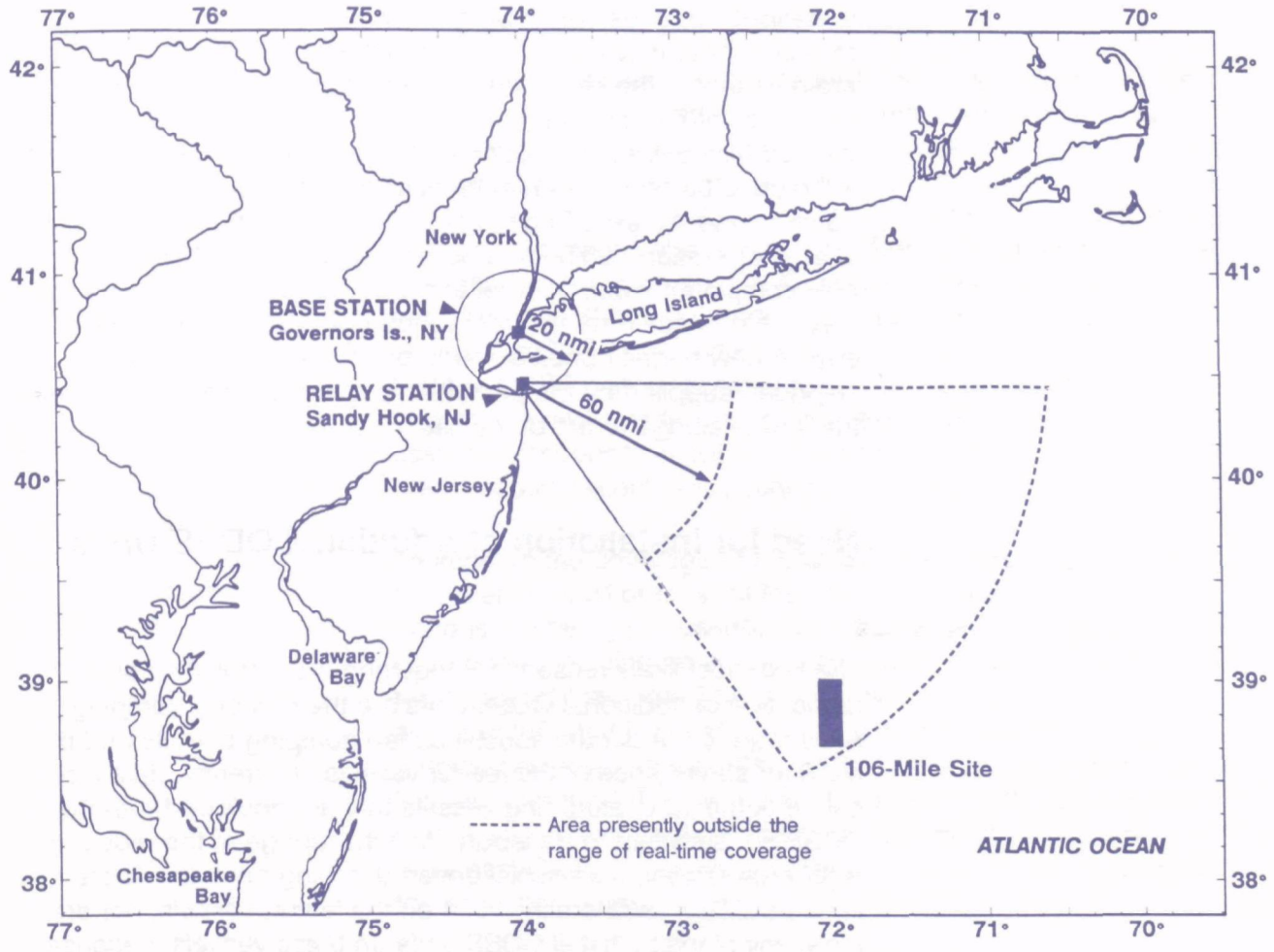
In July of 1988, EPA issued Administrative Complaints against all three waste transporters and all nine sewerage agencies for permit violations. Most of the complaints contained penalties for exceeding the maximum allowable discharge rate prior to July 1988. The complaints were a result of EPA's examination of Ocean Dumping Notification Forms (ODNFs). An ODNF contains information on a vessel's start and end dump times and the quantity of sludge dumped. Permit conditions require the master of each vessel to submit an ODNF after each dump mission. Since the July complaints were issued, no discharge rate violations have been detected, during the time period covered by this report, either by an examination of the ODNFs or by examination of complete ODSS printouts.

Limitations to the ODSS

The ODSS is not effective in detecting illegal discharges of sludge in the harbor areas or during vessel transfer (loading and unloading) operations. Tall structures or bridges in the harbor area interfere with or block line-of-sight radio transmissions, creating "dead zones". Even when transmissions are not blocked, the effectiveness of the system is limited during transfer operations. The ODSS determines vessel dump status by measuring changes in vessel draft. Before the system can accomplish this, it must determine a maximum draft for the vessel. A maximum draft for any given vessel can only be determined after the vessel has been loaded and has departed port. If a vessel were to illegally dump sludge out of its bottom discharge pipes at the same time that it was being loaded with sludge, the ODSS would not be able to detect a violation. In addition, vessels can hit bottom during loading, which further impedes the determination of vessel draft by the ODSS. Therefore, EPA will monitor all sludge transfers through its sludge manifest and seal system, as described in this report.

As designed, the ODSS communications link does not provide continuous contact between the base station and the vessels. Therefore, real-time detection of violations cannot be made. When vessels are more than 20 nautical miles from the Coast Guard base station located on Governors Island, New York, or 60 nautical miles from the relay station at Sandy Hook, New Jersey, communication is lost. Data on the trackline and dump information must be stored in the vessel's black box computer until the vessel again enters communications range on its return to port.

To detect ocean dumping violations, EPA and the Coast Guard use printouts that are generated after the dumping has occurred. Initially, it was expected that the ODSS would be able to obtain complete printouts on 80 percent of all dump missions. During the first five months of its operation, the performance of the ODSS averaged almost 42 percent. Overall, during the first 9 months of operation, the ODSS obtained complete printouts on only 29 percent of the dump missions. The Coast Guard is reevaluating the ODSS to determine possible measures to improve its performance while considering other surveillance techniques.



ODSS Coverage Area. Line-of site radio transmission is possible for 20 nautical miles from the base station and for 60 nautical miles from the relay station. The communications range would have to extend to the 106-Mile Site to provide near real-time detection.

Shipriders

Shipriders are independent observers that remain on board the tugboat or self-propelled vessel for the duration of the dump mission. Until the ODSS improves, EPA will need to supplement the system by requiring that shipriders accompany the ocean-going vessels. The shiprider's job is to ensure that the vessel operators dump the sludge in the designated dump site and at the permitted discharge rates. However, shipriders also have limitations. Because most barges are towed at a distance of up to one-quarter mile behind the tugboat and some of the barges are unmanned, the shipriders will not be able to observe when dumping actually starts and ends. Also the average dump time at the 106-Mile Site at the reduced rates is 18 hours. Some vessels will require 38 hours or more to discharge their sludge. The ship-riders cannot be expected to remain awake for the entire dis-charge operation. Shipriders do not replace the ODSS, they can only complement operation of the ODSS. Cost estimates for the services of a qualified shiprider range from $700 a day to $1200 a day. A new permit condition requires that an EPA-approved shiprider, supplied by the permittee, accompany each vessel that transports sludge to the dump site.

Need for Installation of Additional ODSS Units

The two most likely reasons for requiring the installation and fabrication of additional ODSS units are the reduced dumping rates required under the special ocean dumping permits and the need for surveillance of the feeder vessels. Currently, data indi-cate that the 16 oceangoing vessels that are equipped with the ODSS are sufficient to transport all of the sludge at the reduced discharge rates in the special ocean dumping permits. At pre-sent, no ODSS units are installed on the feeder vessels, nor are there any plans to install ODSS units on these vessels, because the ODSS is not an effective surveillance tool on feeder vessels. EPA will monitor the feeder vessels through its sludge manifest and seal system.

In conclusion, the installation of additional ODSS units at this time is unnecessary. However, should unforeseen exigencies require that additional vessels be equipped with ODSS units, the Coast Guard could install two units on short notice if the need arises, provided that the waste transporter arranges for expeditious dry docking of the vessel. If there is an emergency that requires an immediate response, EPA may, upon receipt of a written request

from a waste transporter, authorize a vessel not equipped with an ODSS unit to dump sewage sludge at the 106-Mile Site. EPA will require the vessel to be accompanied by an EPA-approved shiprider each time the vessel departs for the 106-Mile Site.

Improvements to the ODSS

Some of the problems associated with the ODSS during this reporting period can be attributed to normal start-up and initial operation of the system. However, there are other problems that are persistent and have undermined the consistency of the entire system. In October 1989, the Coast Guard hired an independent contractor to troubleshoot the ODSS Software. After problems in the software are resolved, the Coast Guard will complete contracting for another independent maintenance contractor who will service the ODSS units on each of the vessels. It is anticipated that the ODSS performance should improve once the contractor becomes a dedicated resource not tasked with other duties, and assumes responsibility for troubleshooting the system and developing a strict maintenance schedule.

To improve the coverage of the ODSS to include near real-time surveillance of all or most of the operational area, two possible options are being discussed: (1) increase the range of real-time coverage by placing an antenna on top of the World Trade Center, on top of the Loran Tower at Wildwood, New Jersey, or on any structure that is substantially higher than the 180-foot communications tower at the relay station; and (2) establish a satellite link for communicating with the base station. EPA also recommends improvement of the communications capability between the Coast Guard on Governors Island and the vessel operators in the operational area.

Antenna on the World Trade Center or Loran Tower

Because the ODSS is a line-of-site system, the quickest, most direct, and least expensive approach for upgrading the ODSS is to place an antenna on top of a structure that is substantially higher than the communications tower at the relay station, such as the World Trade Center. An antenna on top of the World Trade Center may allow for almost complete real-time coverage of the entire operational area. No changes to any of the ODSS remote units would be required. The antenna, at a height of 1,130 feet,

would take the place of the 180-foot line-of-sight (LOS) communications tower located at Sandy Hook, New Jersey. The Coast Guard would be almost instantly alerted of a violation almost anywhere in the operational area.

Another possible option for improving the range of the ODSS's real-time coverage is to place an antenna on top of an existing Loran tower. There is a 720-foot Loran tower in Wildwood, New Jersey. Although this tower is not as tall as the World Trade Center, it is located parallel to the 106-Mile Site and is completely under the control of the Coast Guard.

The costs to place these antennas is estimated to be about $16,000 for the World Trade Center and about $800 for the Loran tower in Wildwood.

Recently, EPA was informed by the Coast Guard that revised calculations indicate that an antenna on the World Trade Center or on the Loran tower at Wildwood, New Jersey, might not be effective because of background and other atmospheric interference problems. EPA is encouraging the Coast Guard to go beyond theoretical calculations and actually install and test one or both antennas, and also to examine other innovative approaches to increasing real-time coverage when they conduct their reevaluation of the ODSS.

Satellite Link

The Coast Guard has been investigating the feasibility and cost of retrofitting the present ODSS to accommodate the satellite link GEOSTAR. A rough estimate of the cost to complete this retrofitting is about $1 million. Adopting GEOSTAR would provide a near real-time data link to the barges by eliminating the electronic telemetry between the base station and the remote units. GEOSTAR was selected because of its reliability and its ability to meet data capture criteria without delays in transmission.

A satellite link would require that the Ray Nav Loran recievers that are incorporated into the ODSS remote unit on each of the authorized vessels be replaced with a satellite transceiver, which

uses an ANI 7000 Loran-C receiver. The satellite transceiver would be able to continuously transmit to a geosynchronous satellite. Therefore, complete real-time coverage of the operational area could be achieved. The satellite transceivers are commercially available from several manufacturers. The satellite transceiver uses a spread spectrum-type transmission, which would

minimize any possible interference. Frequencies in the 1610-1626.5 MH band have been allocated by the FCC for these new Radio Determination Satellite Services.

Communications Capability

Another aspect of the ODSS that needs improvement is the communications capability of the Coast Guard base station on Governors Island, New York. The base station is now using VHF-FM radio communications, which only allow the Coast Guard to communicate with the vessel operators approximately 35 nautical miles from shore. Although theCoast Guard can communicate with the vessel operators indirectly through their land-based dispatchers, EPA believes that the Coast Guard should have the ability to talk directly with the vessel operators anywhere within the operational area. At present, the vessel operators can communicate with their land-based dispatchers anywhere in the operational area via single-side band radio or by satellite communications. However, direct communications between the vessel operators and the Coast Guard on Governors Island are limited to those via VHF-FM radio.

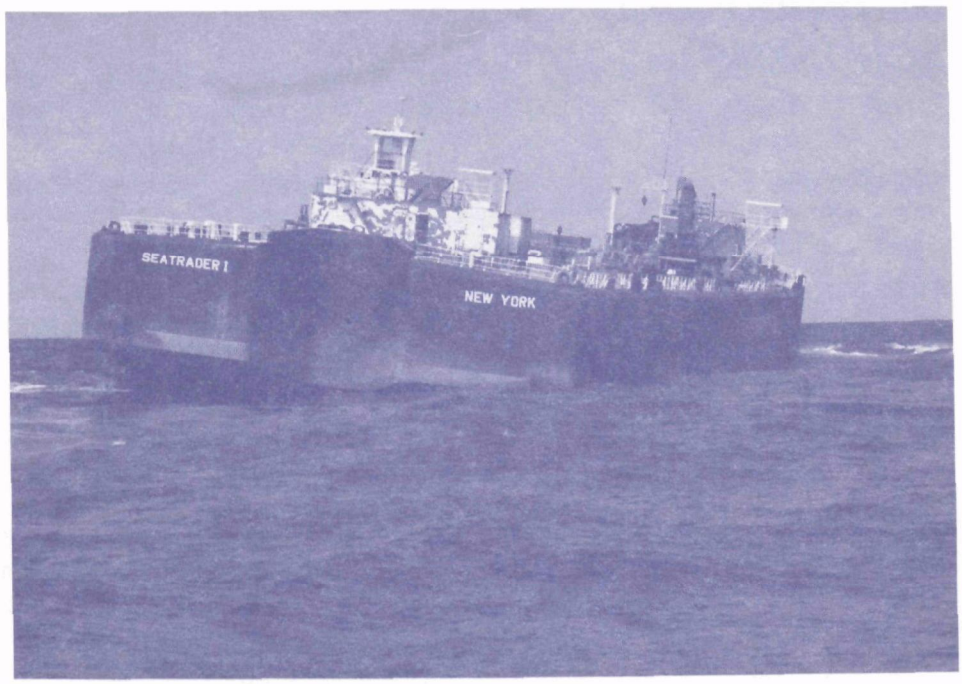
CONCLUSIONS AND RECOMMENDATIONS

Both EPA and the Coast Guard expected the ODSS to perform better than it has during its first 9 months of operation. Performance has been sporadic--some weeks it generated a high percentage of complete printouts, other weeks the percentage was low or zero. Although the ODSS provides some deterrent effect in that the dumpers cannot be certain whether or not it is functioning properly, EPA is concerned that the deterrent effect of the ODSS has been diminished by its inconsistent performance record.

Therefore, until the consistency of the ODSS improves, EPA will require shipriders on board the vessels that are authorized to dump sewage sludge at the 106-Mile Site. As consistency improves, the shiprider requirement may be partially or completely waived. EPA will monitor the progress of the overall system as well as the individual performance of units on each of the 16 vessels authorized to dump sewage sludge at the 106-Mile Site.

To improve the coverage of the ODSS, EPA encourages the Coast Guard to install and test antennas on the World Trade Center or on the Loran tower at Wildwood, New Jersey, or on any structure that is substantially higher than the 180-foot communications tower at the relay station. Although satellite coverage may appear to be an attractive option, EPA is concerned that by the time extensive modifications are completed on each of the ODSS units and the system is thoroughly tested and debugged, ocean dumping of sewage sludge will have ended. On the other hand, the antenna approach can be quickly implemented and should greatly enhance coverage.

Anyone who has watched the performance of the ODSS during the past months will be impressed by the fact that the ODSS unit on the *Sea Trader I*, the largest vessel in the fleet, is capable of communicating with the base station up to 80 nautical miles from the relay station. The other 15 vessels in the fleet are only capable of communicating with the base station up to 60 nautical miles from the relay station at Sandy Hook, New Jersey. The reason for this difference is that the communications antenna on the *Sea Trader I* is approximately 10 to 20 feet higher than the antennas on the other vessels. The ODSS is a line-of-sight system. Therefore, increasing the height of the land-based antenna and/or the antenna on board the vessel could increase the range of coverage.



The Sea Trader I

Now that the sludge manifest and seal system is a permit condition of the special ocean dumping permits, EPA and the Coast Guard will work together to ensure that this system protects the harbor, estuarine, and shore areas in New York and New Jersey from any potential illegal dumping by the feeder or oceangoing vessels. This system, backed by Coast Guard spot checks of the vessels while they are transporting sludge and by EPA and Coast Guard spot checks at the loading facilities, is expected to deter any violators.

EPA and the Coast Guard are confident that by employing the ODSS, the sludge manifest and seal system, and shipriders to complement operation of the ODSS, cradle-to-grave monitoring of sewage sludge from its point of origin to its ultimate disposal at the 106-Mile Site will be achieved.

GLOSSARY AND ACRONYMS

106-Mile Site	(Also known as **DMSDS**) 106-Mile Deepwater Municipal Sludge Dump Site.
At Sea	A vessel is considered at sea when it is not in port, but in the area of the outer New York Harbor, Long Island Sound or the Atlantic Ocean.
Bad Dump	(Also known as **Short Dump**) Any dump that is outside the designated dumpsite.
Black Box	(Also known as the electronics package or remote unit) The ODSS (see below) component installed on each dumping vessel that houses a Loran-C receiver, clock, circuitry, and communications package in a tamper-resistant box.
Complete ODSS Printout	A printout that shows the time, date, and coordinates of the vessel, and draft readings from at least one transducer during a dumping operation.
Docked	A vessel is considered docked if it is in port and has not moved for three polling periods. When in port, each polling period is 20 minutes.
DMSDS	(Also known as the **106-Mile Site**) 106-Mile Deepwater Municipal Sludge Dump Site.
Dumping	A vessel is considered dumping when its draft decreases by a specified amount below the maximum draft and triggers the ODSS.
Feeder Vessel/Shallow Draft Vessel	Any vessel used to transfer sludge from one location (or vessel) to another, primarily within the New York/New Jersey Harbors.
FCC	Federal Communications Commission.
Geosynchronous Satellite	A satellite that travels at an altitude of at least 35,000 kilometers, and at a speed matching that of the earth's rotation, thereby maintaining a constant relation to points on the earth.
In Port	A vessel is considered to be in port when it is within the area roughly encompassing the New York Harbor north of the Verrazano Narrows Bridge plus the west side of Staten Island and Rockaway inlet.

Line-of-Sight Transmissions	Radio transmissions that can only be made if the transmitting and the receiving antennas are within sight of each other.
Long-Range Hyperbolic Radio Navigation System (Loran C)	A land-based navigation system, operated by the Coast Guard, which transmits radio signals to vessels. Any vessels equipped with a Loran receiver can determine its location within 50 meters.
Loran Receiver	A receiver that receives signals from the Loran-C, interprets the signals, and visually displays the latitude and longitude of the vessel.
MPRSA	Marine Protection, Research, and Sanctuaries Act of 1972.
Nautical Mile	One nautical mile equals 6,076 feet or 1.15 statute miles.
NOAA	National Oceanic and Atmospheric Administration.
Oceangoing Vessel	Any vessel that is authorized to dispose of sludge at the 106-Mile Site.
ODBA	Ocean Dumping Ban Act.
ODNF	Ocean Dumping Notification Form.
ODSS	Ocean Dumping Surveillance System. The entire ODSS includes the base station, the relay station, and the vessel installation.
ODSS Unit	All ODSS equipment installed on a vessel--the "black box," transducers, connecting circuitry, communications equipment, and Loran antenna.
Real-Time Detection	The ability to detect dumping violations as they occur.
Resource-Year	The amount of work a person can be expected to perform in one year. One resource year equals 48 weeks x 40 hours/week or 1,920 hours/year.
Shipriders	Independent observers who remain on board the towing vessel or the oceangoing vessel for the duration of the dump mission.
Short Ton	2000 pounds, as opposed to a long ton, which is 2240 pounds.
Single Side Band Radio	High frequency radio transmissions that are not limited to line-of-site range, but can be sent and received over great distances.
Vessel Draft	Depth of a vessel between the water line and the deepest point of the hull.
VHF-FM Radio	Radio transmissions that are limited to line-of-sight range.

APPENDIX A

Vessels Authorized to Dump Sludge	
Authorized Vessels	**Capacity (Wet Tons)**
Sea Trader I	38,000
Eileen	18,000
Weeks 702	17,800
Lemon Creek	15,000
Spring Creek	15,000
Tibbets Brook	15,000
Udalls Cove	15,000
Morris J. Berman	12,000
Princess B[1]	12,000
Kimberly Ann	8,000
Lisa	8,000
Maria	7,900
Weeks 701	6,400
Leo Frank	5,500
OBI IV[2]	1,000
Sotoco II[2]	1,000
TOTAL	**196,100**

1 Princess B sank on or about October 6, 1989, inside or near the 106-Mile Site.

2 Authorization for these vessels to dump sewage sludge at the DMSDS was abrogated on August 14, 1989, at the request of the waste transporter.

Permittees Authorized to Dump Sludge

Permittees	Wet Tons per Month *
New York City Dept. of Environmental Protection	379,891
Passaic Valley Sewerage Commissioners	116,667
Middlesex County Utilities Authority	83,417
Nassau County Dept. of Public Works	76,650
Westchester County Dept. of Environmental Facilities	42,803
Bergen County Utilities Authority	35,833
Joint Meeting of Essex and Union Authority	33,367
Rahway Valley Sewerage Authority	14,097
Linden Roselle Sewerage Authority	8,342
TOTAL	**791,067**

* Projected sewage sludge quantities for 1991.

APPENDIX B

ODSS Printout

OCEAN DUMPING SURVEILLANCE SYSTEM VESSEL HISTORY
VESSEL: NORTH RIVER VESSEL ID: 145

REPORTED DATE	REPORTED TIME	LOCATION LATITUDE	LOCATION LONGITUDE	DRAFT FWD	DRAFT MID	DRAFT AFT	BATT VOLT	STATUS VESSEL	STATUS BOX	MSN
20 DEC 85	1340	40 31.61N	74 0.26W	13.7	14.6	14.8	12.1	AT SEA	ok	25
20 DEC 85	:1338	40 31.87N	74 0.69W	13.7	14.6	14.8	12.1	AT SEA	ok	25
20 DEC 85	1240	40 38.72N	74 1.88W	13.7	14.1	14.8	12.1	DOCKED	ok	25
20 DEC 85	1140	40 38.71N	74 1.87W	12.8	13.3	13.7	12.2	DOCKED	ok	-23
20 DEC 85	1040	40 38.72N	74 1.88W	12.8	13.1	13.3	12.1	DOCKED	ok	-23
20 DEC 85	0940	40 38.72N	74 1.88W	8.8	9.0	9.0	12.0	DOCKED	ok	-23
20 DEC 85	0920	40 38.72N	74 1.88W	6.6	8.1	9.0	12.0	INPORT	ok	-23
20 DEC 85	0900	40 38.71N	74 1.92W	6.6	8.1	9.0	12.0	INPORT	ok	-23
20 DEC 85	0840	40 42.31N	73 59.67W	6.6	8.6	8.8	12.0	INPORT	ok	-23
20 DEC 85	:0834	40 47.33N	73 54.99W	6.9	8.1	8.8	12.0	INPORT	ok	-23
19 DEC 85	2241	40 47.35N	73 54.99W	15.8	15.2	15.4	12.1	INACTIVE	@	-23
19 DEC 85	2141	40 47.37N	73 54.97W	15.4	14.8	14.8	12.0	DOCKED	ok	-23
19 DEC 85	2121	40 47.35N	73 54.98W	13.3	13.3	13.7	12.0	INPORT	ok	-23
19 DEC 85	2059	40 47.34N	73 54.99W	11.8	11.3	11.3	12.0	INPORT	ok	-23
19 DEC 85	2019	0 0.00N	0 0.00W	6.4	7.9	8.8	12.0	NO LORAN	*	-23
19 DEC 85	1939	40 45.12N	73 57.56W	6.2	8.1	8.6	12.0	INPORT	ok	-23
19 DEC 85	1919	40 41.84N	74 0.03W	6.4	8.1	8.6	12.0	INPORT	ok	-23
19 DEC 85	1859	40 37.28N	74 2.54W	6.4	8.1	8.6	12.0	INPORT	ok	-23
19 DEC 85	1839	40 34.05N	74 1.43W	6.6	8.1	8.6	12.0	AT SEA	ok	23
19 DEC 85	1819	40 31.06N	73 58.70W	6.6	8.1	8.8	12.0	AT SEA	ok	23
19 DEC 85	1759	40 29.39N	73 54.13W	6.6	8.1	8.6	12.0	AT SEA	ok	23
19 DEC 85	1739	40 27.21N	73 49.47W	6.6	8.1	8.6	12.0	AT SEA	ok	23
19 DEC 85	1719	40 24.78N	73 44.78W	6.9	8.1	8.6	12.0	AT SEA	ok	23
19 DEC 85	1659	40 23.39N	73 42.59W	6.9	7.9	8.6	12.0	AT SEA	ok	23
19 DEC 85	1657	40 23.52N	73 42.57W	6.9	7.9	8.6	12.0	AT SEA	ok	23
19 DEC 85	1655	40 23.63N	73 42.71W	6.9	7.9	8.6	12.0	AT SEA	ok	23
19 DEC 85	1653	40 23.74N	73 42.90W	6.9	7.9	8.6	12.0	AT SEA	ok	23
19 DEC 85	1651	40 23.85N	73 43.09W	6.9	7.9	8.6	12.0	AT SEA	ok	23
19 DEC 85	:1651	40 23.85N	73 43.09W	6.9	7.9	8.6	12.0	AT SEA	ok	23
19 DEC 85	1649	40 23.97N	73 43.27W	8.7	8.9	9.2	12.0	DUMPING	ok	23
19 DEC 85	1647	40 24.17N	73 43.82W	10.6	9.8	9.6	12.0	DUMPING	ok	23
19 DEC 85	1645	40 24.82N	73 44.12W	14.7	11.3	10.1	12.0	DUMPING	ok	23
19 DEC 85	1643	40 24.87N	73 44.27W	15.9	13.9	12.6	12.0	DUMPING	ok	23
19 DEC 85	1641	40 24.97N	73 44.87W	16.3	15.6	15.2	12.0	AT SEA	ok	23
19 DEC 85	1627	40 26.24N	73 46.68W	16.3	15.6	15.2	12.0	AT SEA	ok	23
19 DEC 85	:1625	40 26.52N	73 47.16W	16.1	15.6	15.2	12.0	AT SEA	ok	23
19 DEC 85	1607	40 28.95N	73 51.34W	15.2	15.2	15.2	12.0	AT SEA	ok	23
19 DEC 85	1545	40 30.08N	73 53.24W	15.0	15.2	15.0	12.0	AT SEA	ok	23
19 DEC 85	1525	40 34.57N	73 52.62W	15.0	15.0	15.0	12.0	INPORT	ok	23
19 DEC 85	1505	40 38.23N	73 51.97W	15.0	15.0	15.2	12.0	INPORT	ok	23
19 DEC 85	1445	40 38.32N	73 51.89W	15.2	15.0	15.2	12.0	INPORT	ok	-22
19 DEC 85	1345	40 38.30N	73 51.77W	14.3	13.9	14.1	12.0	DOCKED	ok	-22
19 DEC 85	1245	40 38.30N	73 51.77W	11.1	11.1	11.1	12.0	DOCKED	ok	-22
19 DEC 85	1145	40 38.30N	73 51.77W	10.9	10.9	10.9	12.0	DOCKED	ok	-22
19 DEC 85	:1131	40 38.30N	73 51.77W	9.2	9.9	10.1	12.0	DOCKED	X	-22
19 DEC 85	1043	40 38.30N	73 51.77W	8.4	9.2	9.6	12.0	DOCKED	ok	-22
19 DEC 85	0943	40 38.30N	73 51.77W	8.1	9.0	9.6	12.0	DOCKED	ok	-22
19 DEC 85	0843	40 38.30N	73 51.77W	6.4	7.9	8.6	12.0	DOCKED	ok	-22
19 DEC 85	0823	40 38.30N	73 51.77W	6.4	7.9	8.6	12.1	INPORT	ok	-22
19 DEC 85	0803	40 38.30N	73 51.77W	6.4	7.9	8.6	12.1	INPORT	ok	-22

BOX STATUS: *LORAN DOWN #WRONG DOCK XINTRUSION @AC POWER LOST