TO EXTEND THE MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

HEARING

BEFORE THE

SUBCOMMITTEE ON OCEANS AND ATMOSPHERE

OF THE

COMMITTEE ON COMMERCE

UNITED STATES SENATE

NINETY-FOURTH CONGRESS

SECOND SESSION

ON

S. 3147

TO EXTEND THE MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT FOR 2 YEARS

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TO EXTEND THE MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

MONDAY, APRIL 12, 1976

U.S. SENATE,
COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON OCEANS AND ATMOSPHERE,
Washington, D.C.

The subcommittee met at 10:05 a.m., in room 6202, Dirksen Senate Office Building, Hon. J. Glenn Beall presiding.

OPENING STATEMENT BY SENATOR BEALL

Senator BEALL. The hearing will come to order.

It has been over 3 years since the Marine Protection, Research and Sanctuaries Act, better known as the Dumping Act, was enacted into law.

In that time, substantial steps have been taken by the various Federal agencies charged under Public Law 92-532 with the regulation of ocean dumping and with the comprehensive research to study the impact of ocean dumping and to develop alternatives to this dangerous practice which would minimize or end all ocean dumping by October of 1978.

Clearly, however, we are far behind in attaining our goals. In a larger sense, it is evident that we have failed to develop a national policy toward all waste disposal.

My concern over compliance with the mandates of the act was heightened by the circumstances surrounding the ocean dumping off the shores of Maryland and Delaware by the cities of Philadelphia and Camden. Not only do we see an ever-increasing insult to the living marine environment which could have a catastrophic impact on a significant portion of our Nation's recreational and fishing industries; but there also appears to be an unwillingness, or simply procrastination by responsible officials, to develop environmentally safe alternatives to ocean dumping.

These concerns are amplified at the national level, where there has been a failure by any of the four major Federal agencies charged with responsibility under the act to take the lead in developing the required scientific knowledge which would allow us to meet our 1978 goals. Unfortunately, it appears that present research attempts are totally fragmented and wrought with information gaps which could lead to serious consequences.

Moreover, without a lead agency there is no one to coordinate the efforts which are being made. Indeed, I commend regional offices such

Staff members assigned to this hearing: Steven H. Flajser and Gerald J. Kovach.

as region III of the EPA which have taken courageous steps to develop a comprehensive approach to the problem without the aid of adequate guidance from Washington.

Finally, as with any scientific regulatory endeavor, where attached priorities are low, we find insufficient funding which restricts the agencies' ability to take the lead, much less achieve established goals.

Hopefully, the information provided today by our distinguished witnesses will assist the Commerce Committee in recommending to Congress the ways and means to develop an environmentally sound national policy towards the entire problem.

We have a long list of witnesses to appear here this morning. Because the Senate is considering the Budget Act beginning at 1 o'clock, it is necessary that we do our utmost to conclude the hearings by that time. I ask the witnesses in advance to, if they would, be as brief as

Staff member assigned to this hearing: Steven H. Flajser.

they can without doing damage, without trying to curtail their opportunity of making the kind of presentation they want.

I ask you to be as brief as you can in telling your story. In some instances, perhaps the witnesses would like to put their entire statement in the record and summarize as best they can whatever they wish. Then we can get to questions and answers.

[The bill and agency comments follow:]

91TH CONGRESS
2D SESSION

S. 3147

IN THE SENATE OF THE UNITED STATES

MARCH 16, 1976

Mr. HOLLINGS (for himself, Mr. MAGNUSON, and Mr. PEARSON) (by request) introduced the following bill; which was read twice and referred to the Committee on Commerce

A BILL

To extend the Marine Protection, Research, and Sanctuaries Act for two years.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 That section 111 of the Marine Protection, Research, and
4 Sanctuaries Act (33 U.S.C. 1420) is amended by striking
5 "and not to exceed $1,550,000 for the transition period
6 (July 1, through September 30, 1976)," and inserting in
7 lieu thereof "not to exceed $1,550,000 for the transition
8 period (July 1, through September 30, 1976), not to exceed
9 $4,800,000 for fiscal year 1977, and not to exceed $4,800,-
10 000 for fiscal year 1978.".

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF MANAGEMENT AND BUDGET,
Washington, D.C., April 9, 1976.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce, U.S. Senate, New Senate Office Building, Washington, D.C.

DEAR SENATOR MAGNUSON: This is in response to your letter to the Director of April 2, 1976, requesting the views of the Office of Management and Budget on S. 3147, a bill "To extend the Marine Protection, Research, and Sanctuaries Act for two years."

As you know, this is legislation that was submitted by the Administration to provide the appropriation authorization necessary for the Environmental Protection Agency to continue its activities under the ocean dumping program through fiscal year 1978. We understand that the Commitee is interested in this Office's views on the appropriate division of responsibilities among the four agencies involved in this program—the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the Army Corps of Engineers and the Coast Guard. The existing roles of these agencies can briefly be described as follows.

EPA

Under Title I of the Act, the Administrator of EPA is authorized to strictly regulate ocean dumping of all materials except for dredged material, which is regulated by the Corps of Engineers. Title I strictly prohibits the dumping in ocean waters of chemical, biological ,and radiological warfare agents and high level radioactive materials. Since enactment of the Act, EPA has developed criteria for the evaluation of permit applications, approved on an interim basis some 110 disposal sites, and issued approximately 100 permits.

NOAA

Under Title II of the Act, NOAA carries out intensive research studies to determine the short-term effects of ocean dumping upon marine ecosystems. These studies are conducted in close cooperation with EPA and state and local officials. NOAA also is working with the Corps of Engineers to study the impact of the disposal of dredged materials.

NOAA ensures adequate research efforts to determine the long range effects of man's activities on ocean ecosystems. NOAA works closely with other agencies with responsibilities in this area, including EPA and Interior. Direct NOAA research programs include environmental assessment studies of the impact of OCS oil and gas development on the Alaskan shelf, in cooperation with Interior. NOAA also is conducting the Deep Ocean Mining Environmental Study to obtain baseline data necessary to determine the impact of deep ocean mining. In addition, NOAA is involved in several international efforts to obtain data on background levels of pollutants in the oceans.

Corps of Engineers

The Army Corps of Engineers performs several activities related to the Marine Protection, Research and Sanctuaries Act. We estimate that about 1.5 percent of its general regulatory funds in fiscal year 1977 will be used for ocean dumping related work. The Corps is conducting a five-year congressional authorized Dredged Material Research Program at its Waterway Experiment Station in Vicksburg, Mississippi. Finally, its operations and maintenance appropriations for specific channel and harbor projects will be used, as required, for sampling, laboratory testing, and monitoring dredged material at individual project locations.

Coast Guard

The Coast Guard has been delegated the responsibility to conduct surveillance and other appropriate enforcement activities to prevent unlawful ocean dumping. Specifically, the Coast Guard assures that ocean dumping is carried out in accordance with permits issued by EPA or the Corps. When violations are detected, the Coast Guard undertakes an investigation and refers the case to EPA for disposition.

Surveillance of ocean dumping for federal dredging projects is the primary responsibility of the Corps; however, the Coast Guard actively monitors dumping operations in the New York and San Francisco areas on a continuous basis and supplements Corps surveillance in other dumping areas.

In support of its surveillance and enforcement activity the Coast Guard has underway an effort to develop electronic means of assuring compliance with the dumping permit. These devices will augment current surveillance efforts by shipriders, aircraft and vessels.

We believe the existing assignment of ocean dumping related responsibilities works well. It takes advantage of each agency's relative strengths and particular expertise in our continuing effort to protect this important resource. Moreover, this is still a relatively new Federal program, and we are periodically monitoring and evaluating the agencies' performance to ensure that their resources, both individually and collectively, are being applied in a sound and coordinated manner.

Sincerely yours,

JAMES M. FREY,
Assistant Director for Legislative Reference.

GENERAL COUNSEL OF THE U.S. DEPARTMENT OF COMMERCE,
Washington, D.C., April 30, 1976.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This is in reply to your request for the views of this Department concerning S. 3147, a bill "To extend the Marine Protection, Research, and Sanctuaries Act for two years."

Inasmuch as Title I of the Marine Protection, Research, and Sanctuaries Act of 1972 is administered by the Environmental Protection Agency, we would defer to that Agency concerning the adequacy of the proposed authorizations for carrying out activities pursuant to that Title.

We have been advised by the Office of Management and Budget that there would be no objection to the submission of our letter to the Congress from the standpoint of the Administration's program.

Sincerely,

———,
General Counsel.

Senator BEALL. The first two witnesses were to have been Senator Roth from Delaware and Congressman Bauman from the Eastern Shore of Maryland, both of whom are on their way to Washington from their respective States and districts. They will testify when they arrive.

In the meantime, in order to set the stage, we might call another public official, the mayor of Ocean City, Md., Hon. Harry W. Kelley.

Mayor Kelley, would you like to come up and give your testimony to lead off the witnesses at this morning's hearing?

We are happy to have you with us this morning, Mayor. I had the opportunity and good fortune to be asked to make a speech in Ocean City Saturday night. I spent part of Saturday and yesterday in Ocean City. In spite of the frigid blasts chilling us this morning, when I left Ocean City yesterday, the temperature was 74, with a lot of people on the boardwalk, and the people seemed to be enjoying themselves.

I am happy to have you with us this morning.

STATEMENT OF HON. HARRY W. KELLEY, MAYOR, OCEAN CITY, MD.

Mayor KELLEY. Thank you, Senator Beall.

It is indeed a singular pleasure to have our own Senator chair this committee. I had anticipated that Senator Magnuson would Chair it. I do want to congratulate you; you are our Senator from Maryland.

I enjoyed your prefacing your remarks about how you feel about this sludge dumping. I think we are together.

Mr. Chairman, members of this committee, I want first to express our appreciation for receiving this opportunity to appear as representatives of the residents of, and millions of guests and vacationers in, Ocean City, Md.

In our communications in reference to our appearance, it was my distinct pleasure to have conversed with the honorable chairman of the Commerce Committee, Senator Magnuson. I was impressed with the willingness of the chairman to speak his mind, and mindful of the power of the office and positions he and you hold.

As a result of the chairman's willingness to express strongly his views, I respect him personally above and beyond the respect due him as a prominent member of this august body. As a further result of that conversation, I am of the opinion that this subcommittee believes in action, and that is what is needed, as tragedy comes from crisis because of inaction.

This hearing is on ocean dumping in general. Therefore, our remarks are hereafter addressed to the generalities first and then to our specific situation, by way of example.

Senator BEALL. Would you identify the man sitting with you, Mayor?

Mayor KELLEY. He is our city solicitor, Dale Chappell. He didn't want me to identify him. I usually do.

Thank you, sir.

In the area of ocean dumping, the people of coastal America have no complaint with this committee. The House of Representatives, or the Senate. It is our belief that the Congress of the United States has met its responsibility by the enactments of the various sanctuaries acts. You and your colleagues are to be commended.

The adverse problems in the ocean dumping area are, in their entirety, a result of the abdication of responsibility, if not outright misfeasance or malfeasance or dereliction of duty, by a Government Agency of the executive branch of the Federal Government, to wit, the Environmental Protection Agency.

Why do we say abdication of responsibility, Mr. Chairman?

We say it because this Congress stated in 33 United States Code annotated section 1401G that:

> The Congress declares that it is the policy of the United States to regulate the dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any materials which would adversely affect the human health, welfare or amenities of the marine environment, ecological systems or economic potentialities.

One would think that the language used by Congress in the enactments is clear. Words such as "prevent," "strictly limit," "materials," "adversely affecting," "human health," welfare," amenities" have never been considered to be particularly confusing words.

However, under the banner of the sanctuary acts, the EPA has, as far as we can determine, increased ocean dumping of sewage sludge by 190 million percent in the waters offshore of the State of Maryland. Sludge dumping in Maryland's ocean waters increased from zero gallons prior to the acts to 190 million gallons subsequent.

The very fact that the EPA and Philadelphia chose to incur the expense of water transportation of the matter rather than disposing of it on their city parks, et cetera, should clearly indicate that they believe that such matter would adversely affect human health, welfare or amenities. In addition, however, in litigation currently in progress, there is indisputable scientific indicia of potential adverse effect.

Why do we refer to misfeasance, malfeasance, and dereliction of duty?

We say it, Mr. Chairman, because it is our firm belief that the EPA deliberately and intentionally attempted to conceal adverse reports in possession of the Agency during hearings on ocean dumping permits. I have here a copy of a notice of a public hearing that was held in January 1976 in Rehoboth, Del. It contains a listing of the contents of the matter to be dumped.

It talks of such items as arsenic, mercury, ammonia, cyanide, et cetera. But it omitted the single most important finding by the Agency. It omitted any reference to the discovery by the EPA itself at the dump site of a man-induced virus potentially dangerous to man.

We have just received a notice on a new hearing on another application in which the substances are listed and issues framed. Now EPA raises the issue of the presence of the virus, but only after they were forced to do so by the Department of Natural Resources of the State of Maryland.

When an Agency charged by Congress in the language before stated, with knowledge of the presence of such a virus, intentionally fails to disclose it to the people most affected, and must be forced to disclose it by a competent State agency, then we believe such words as misfeasance, malfeasance, and dereliction of duty are most appropriate.

In this same regard on the subject of viruses, an assistant attorney general of the State of Maryland, Mr. Warren Rich, has characterized a thought of EPA's director as scientifically improbable Mr. Rich is probably among the very highest qualified attorneys in the country in environmental matters. He is also a gentleman's gentleman, and his use of the term "scientifically improbable" reflects that characteristic.

In the use of that term, Mr. Rich was reacting to Mr. Train's suggestion that the virus found in the area where hundreds of millions of gallons and pounds of sewage sludge is dumped had come from a passing ship.

While we also believe in many of the virtues of gentlemanly conduct, we do not consider the action of EPA in permitting the dump site in our backyard a gentlemanly act, and we consider Mr. Train's suggestion as scientifically asinine and an insult to the intelligence of the American people and a strong indication of his insensitivity to the welfare of the people of Maryland.

Now, in respect to our specific situation, this hearing today is another opportunity graciously extended by congressional committees to local government for people input. This is the third time we have appeared before such committees. Unlike our appearances in EPA hearings, now approaching 9 or 10 in number, these Congressional hearings are immensely beneficial, because you listen to the people and the EPA does not.

EPA's own laboratories indicate a sludge blanket off the coast of Maryland from 2 to 4 miles wide and 10 miles long. It is composed exclusively of waste matter generated by the people of Pennsylvania and New Jersey. It is an area now contaminated that was not contaminated prior to the passage of the sanctuaries acts.

At almost every hearing we have attended, officials of the city of Philadelphia have themselves, or have had their surrogates question Ocean City's sludge disposal methods. For the record, our disposal is conducted by the Worcester County Sanitary Commission and they—at great expense—incinerate every pound of sewage sludge generated by the town of Ocean City.

And not 1 pound, 1 ounce, 1 gallon of any byproduct of the human system, whether sludge or highly treated waste water, is transported beyond the city limits of Ocean City. We do not ship our stuff to the waters adjacent to the city of Philadelphia, at least not yet, though it is an interesting thought in this Bicentennial year to consider the effect a reversal of the process would have on the city who is claiming that—to borrow their expression—"In 1976 Philadelphia is where it's at."

Mr. Chairman, members of the committee, in closing I have a very simple point to make with the aid of very simple props.

This gallon jug or jar contains a sample of one of coastal America's greatest assets. It is clean beach sand, and this sample comes from Ocean City.

This gallon jar, Mr. Chairman, contains one of urban America's greatest problems. It is sewage sludge, and this particular sample was obtained at Ocean City's plant.

This third jar, Mr. Chairman, contains in part one of coastal America's greatest assets and in part one of urban America's greatest problems. The result is apparent, the impactful implication clear. Urban America's sludge is completely and absolutely incompatible with coastal America's greatest asset.

EPA, in spite of clear congressional intent, has chosen a course of trading the health, welfare and safety of coastal America for the comfort, convenience and pocketbook of urban America. As well as being dangerous, unhealthy, resource-destructive and unsafe, it is inherently unfair, wrong and immoral to transfer Philadelphia's, and others', problems to Maryland's offshore waters.

Thank you for your time.

Senator, I would just like to say that the contempt of EPA—here is a newspaper article. It says here, "Emotional protesting won't do any good at the EPA hearings. They will continue to dump the sludge." That is what EPA says. It is in the newspaper.

I don't think we need to know that the Sea of Japan is dead, the Mediterranean is dead, the North Sea is partially dead, all from sludge dumping. We don't want to take God's greatest asset, that Atlantic Ocean, and do that.

It is ridiculous to think that the city of Philadelphia, Camden, New Jersey, or anywhere else, can pollute it to the point of no shellfish, no swimming, no nothing in it.

Senator, I say to you and this committee, I respect you all. But if you were sitting around your swimming pools and your next door

neighbor brought a bucket of this stuff and dumped it in your pool every day, I guarantee you would put a fist in his mouth.

Senator BEALL. Thank you for your testimony.

The recently published committee on Commerce report on ocean dumping regulation's appraisal of implementation makes some of the same points with regard to the situation that you do. They express some of your concerns in this committee report, the same concerns you have expressed in your testimony today. You are corroborating what the committee has been able to learn from our sources, too.

I was interested to note that you say Ocean City disposes of all of its wastes through the incineration process onshore.

Mayor KELLEY. Yes, sir.

Senator BEALL. You are doing this, I presume, as a result of your own natural desire to protect your air but also to stay within the regulations prescribed by the State of Maryland and the EPA; is that the case?

Mayor KELLEY. Yes, sir.

Senator BEALL. It is your contention that the same requirements ought to be imposed on others that are being imposed on you?

Mayor KELLEY. There are alternatives, Senator, such as burning. They have got all of those open mine pits they could put it in. If you make fertilizer out of it, you can landfill it. I don't want to see them jeopardize the Atlantic Ocean.

Senator BEALL. What kind of testimony and indications have you been receiving from those in the fishing industry around Ocean City?

Mayor KELLEY. They claim sludge doesn't move on the bottom, but it does. Nobody knows—it is not monitored. Half of it goes out there at night. Nobody knows whether they go 10 miles or the 35 miles.

But those fishermen know where they are going, and they know where the fish are and, sir, their nets are getting caught in this sludge. You put a buoy on them, and it is so heavy you can't get a net up because it is so heavy. You cannot get your net up once it goes into the sludge.

The fishermen are smart enough to know not to go into the areas where the sludge is, so the sludge is moving.

I would like you to encourage your colleagues to put a restraining order on the EPA, or cut their funds, and we will get rid of it.

Senator BEALL. Thank you, Mayor.

Our next witness is Mr. Henry Eschwege, Director of the Resources and Economic Development Division of the General Accounting Office.

Mr. Eschwege, you may proceed as you wish with your testimony. Also identify those accompanying you today.

STATEMENT OF HENRY ESCHWEGE, DIRECTOR, RESOURCES AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE; ACCOMPANIED BY WILBUR D. CAMPBELL, ASSOCIATE DIRECTOR; BRIAN P. CROWLEY, ASSISTANT DIRECTOR; AND PHILIP A. OLSON, SUPERVISORY AUDITOR

Mr. ESCHWEGE. In the interest of time I will read portions of my statement. I will now introduce my colleagues.

Mr. Brian Crowley, Assistant Director of my Division is on my far right. On my immediate right is Wilbur Campbell. On my left is Phil Olson, Supervisory Auditor in charge of our review of the ocean dumping activities.

We appreciate coming here today. My testimony will summarize the results of our recently completed review on the ocean dumping of sewage sludge and industrial wastes. We had not finalized our report to Congress when we learned of your interest to have us discuss our observations at these hearings. Accordingly, the responsible agencies have not been given an opportunity to formally comment on our tentative conclusions and proposals for improvement. My testimony will also include some comment on our ongoing review of the dumping of dredged material by the Corps of Engineers.

EPA, the Corps of Engineers, USCG, and the Department of Commerce, through NOAA, have major responsibilities for implementing the act.

The volume of sewage sludge and industrial wastes dumped in ocean waters off the coasts of the United States increased from 9.2 million tons in 1968, to 10.8 million tons in 1973 and 11.4 million tons in 1974. Preliminary EPA figures for 1975 show that the volume decreased to 9.4 million tons. More than 98 percent of the 1975 volume was dumped in the Atlantic Ocean. There is no dumping of these materials in the Pacific Ocean although sewage sludge is discharged to the ocean through outfalls in southern California.

Ocean dumping, especially of sewage sludge, is expected to increase. The Federal Water Pollution Control Act Amendments of 1972 require municipal sewage treatment plants to provide a minimum of secondary treatment of their wastewater by July 1, 1977. As more and more municipalities upgrade their sewage treatment facilities, additional sludge will be generated. EPA estimates that this upgrading of plants will triple the volume of sludge to be disposed of in the ocean by existing dumpers in New York and New Jersey.

Furthermore, additional municipalities in other locations are considering the ocean dumping of their sewage sludge.

Our review showed that a number of problems in EPA's administration of the permit program are resulting in the dumping of wastes which may be harmful to the marine environment.

EPA has established levels of mercury and cadmium, both of which are highly toxic, which it believes, if exceeded, will degrade the marine environment. The municipal permit holders in New York, northern New Jersey, and the Philadelphia area were dumping sewage sludge containing cadmium or mercury that exceeded from one to more than 100 times the safety levels. This practice is occurring because EPA's regulations allow the dumping of mercury or cadmium in excess of safety levels under certain permits if the materials are present in sewage sludge.

However, EPA officials informed us that EPA has no choice but to allow the ocean dumping of municipal sludge until alternative disposal methods are found.

Much concern has been expressed that mercury and cadmium are accumulating in the tissues of fish and shellfish. For example, less than 1 year after the Philadelphia dump site was moved in 1973, clams and scallops taken from the areas surrounding the new site had accumulated high levels of cadmium.

Another problem is that wastes are being dumped at too rapid a rate which may be causing harm to the environment. To prevent short-term harm to the environment, EPA utilizes a test—commonly referred to as a bioassay—to establish the rate at which wastes can be dumped, without unduly increasing the toxicity level at the dumping location. A number of marine scientists have questioned the validity of the tests because brine shrimp is used. This organism is not considered appropriate because (1) it is not a marine organism native to the dump sites, (2) it is too hardy, and (3) most marine plants and animals would be dead before the brine shrimp showed ill effects. The thought is that a slower rate of dumping should be prescribed.

EPA officials agreed that the brine shrimp was not an appropriate organism, but stated that dumpers may not be able to fully comply with the extended disposal times if appropriate marine organisms were used.

We also found problems in the USCG's surveillance of ocean dumping operations at dump sites off the northeastern Atlantic coast of the United States. These sites accounted for 100 percent of the sewage sludge and about 90 percent of the industrial wastes dumped in the Atlantic.

Our review showed that USCG did not meet its established surveillance goals for fiscal year 1975 in that: (1) Contrary to a goal of boarding 10 percent of ocean dumping vessels prior to departure, no vessels were boarded, (2) Although shipriders were to be assigned to 60 to 100 percent of the vessels going to the toxic chemical waste site, they were only assigned to 7 percent, (3) Only 42, or 1 percent of the dumpings for substances other than toxic chemicals were observed compared to a goal of 10 percent.

USCG officials stated that goals were not being met because of a shortage of personnel and other resources and other missions were considered to have higher priority. They noted also that bad weather sometimes forced the cancellation of surveillance missions. Also, because its surveillance depends on visual observation, the Coast Guard does not monitor night dumping which accounts for about one-half of all dumping operations.

When USCG detects ocean dumping violations, it forwards the cases to EPA for enforcement action. From the beginning of the program through June 30, 1975, USCG referred 24 cases involving apparent violations to EPA. Penalties were assessed in two cases, two other cases are still pending, and the remaining 20 cases were closed without assessing penalties because EPA considered that violations were minor or did not occur.

EPA has made suggestions to USCG for improving its surveillance methods; such as, obtaining photographs and taking samples of dumped material. To supplement current methods of surveillance USCG is testing an electronic ocean dumping surveillance system that is to be installed on ocean dumping vessels by 1978. This time frame may be somewhat optimistic, however. Testing of a prototype of the system, completed in January 1976, identified various equipment problems which have to be corrected.

The last point I would like to address concerns alternatives to ocean dumping.

EPA requires the dumpers of sewage sludge and industrial wastes to look for alternatives. Some industrial dumpers have been phased

out, others have established dates by which they plan to phase out, and still others are searching for alternatives. Various methods which would allow the discontinuation of ocean dumping are being examined, including the modification of manufacturing processes to reduce the volume of waste produced and the recovery of salable byproducts from the wastes.

We noted two situations that indicate that the alternative selected to ocean dumping of industrial wastes may not be environmentally sound. The examples are in my statement. I will not read them at this time.

Sewage sludge dumpers are also searching for alternatives although no major sludge dumper has yet phased out. Camden, N.J., has selected incineration as an alternative and Philadelphia has undertaken a pilot project to demonstrate the operational feasibility of the wet oxidation process. Communities in the New York-northern New Jersey area which account for more than 80 percent of sludge dumped in the Atlantic are participating in an EPA funded sludge management study administered by the Interstate Sanitation Commission of New York, New Jersey, and Connecticut. The Commission's report on phase I of the study, issued in June 1975, recommended that pyrolysis, a form of combustion, be adopted as the method of processing sewage sludge and proposed that a pilot project be undertaken.

In summary, we believe that a number of steps can be taken by EPA and USCG to improve the administration of the ocean dumping program. EPA should use appropriate marine organisms to establish waste discharge rates which will adequately protect the marine environment and permit only those alternatives to ocean dumping which are environmentally sound.

The USCG should increase the overall level of ocean dumping surveillance. In this regard, shipriders should be used to monitor night dumping operations. The USCG should also continue to develop new methods such as electronic surveillance whereby compliance with permit conditions may be more effectively monitored.

We are current conducting a review of the environmental effects of the corps' dredging activties.

The primary objective of our review is to determine the environmental and economic considerations and problems in disposing of material dredged from the Nation's waterways and the actions being taken to resolve or mitigate such problems.

The long-term environmental effects of dredging are still not fully known. The corps is conducting a major research program on dredging but the program will not be completed until fiscal year 1978 and may not provide all the answers. Changes in the method and location of dredged material disposal to meet environmntal objections can greatly increase the costs of keeping harbors and rivers open to navigation—as much as 5 to 10 times current costs. Such increases could result in costs exceeding benefits for maintaining parts of the waterway system.

In connection with the corps' research program on dredging effects, we believe that EPA and the corps need to work more closely together in evaluating the environmental effects of dredging.

We plan to address these issues more fully in a report to the Congress.

Mr. Chairman, this completes my prepared statement; we will be glad to respond to your questions.

I hope my full statement can be made part of the record.

Senator BEALL. Your full statement will be printed in the record.

I notice you were talking about the USCG and their problems in monitoring the dumping activities. You said USCG has referred 24 cases involving violations to EPA. Penalties were assessed in two cases.

What kind of cases were these?

Mr. ESCHWEGE. As I recall, Mr. Chairman, these were cases where the dumping did not take place within the approved dumping area, but I would have to check on that to be sure.

A you know, the time frame used in our testimony is only through June 30, 1975. I understand there have been additional cases since then.

Sentaor BEALL. What kind of penalties were imposed?

Mr. OLSON. Two civil penalties of $25,000 and $40,000 were imposed. In one case in Puerto Rico pharmaceutical wastes were dumped outside the authorized site. In the other case, acid wastes were dumped outside the authorized site.

Senator BEALL. Your study did find that the USCG is not meeting its goals of monitoring?

Mr. ESCHWEGE. No; they were not meeting their goals of monitoring. The USCG has considerable problems meeting their goals as we pointed out in my statement. The USCG attributes this to a lack of resources. It says it has other higher priority work such as checking the transportation of hazardous materials.

Senator BEALL. Did your study of the USCG indicate what has been done to develop technology which would enable you to better monitor?

Mr. ESCHWEGE. Yes; the USCG is trying to implement an electronic surveillance system, the loran-C system, which would give it some electronic monitoring capability. The loran-C system, however, has run into equipment problems. I don't think we can look to full implementation of this system within the next few years. We are a number of years away from implementation, if it can be done at all.

Senator BEALL. There has been indication that NASA has technology that might be transferable to the USCG.

Are you aware of that?

Mr. ESCHWEGE. We are not sure that NASA's technology can be used for surveillance of ocean dumping operations.

Senator BEALL. When will your report on the dredge spoil ocean dumping activity be available?

Mr. ESCHWEGE. I think we will have it available to the Congress late this summer, around August.

Senator BEALL. I note in your testimony you talked about the fact that figures for 1975 showed a decrease in the volume of sewage sludge and industrial waste being dumped. To what do you attribute the decrease? Later on you indicate there will be an increase.

Mr. ESCHWEGE. These figures are preliminary. The decrease is attributed to the industrial wastes and not to the municipal wastes. We expect an increase in municipal wastes and EPA does, too, because of the requirements of the 1972 act. Because the act requires upgrading

to secondary sewage treatment, a lot more sludge will be produced in the next few years.

Senator BEALL. You also indicate, I believe, that this problem generally has a low priority in the agencies that have some responsibility for it. That is all of the agencies. USCG gives a low priority to the monitoring and NOAA gives low priority to research activities.

EPA may not give it as high a priority as some people think it should. Is that your analysis?

Mr. ESCHWEGE. I would say it is basically correct. For instance, NOAA has deferred to EPA for carrying out research on alternative methods of disposal because NOAA feels it doesn't have that capability. NOAA has no funds of its own specifically designated for this work. It has to reprogram funds. The same was basically true for the USCG until fiscal year 1975. The only agency that has had funds authorized and appropriated for this specific purpose since passage of the ocean-dumping act has been EPA.

EPA in its 1977 budget is asking for more funds.

Senator BEALL. For research into ocean dumping?

Mr. ESCHWEGE. For research and for the entire program.

Senator BEALL. For the ocean dumping permit program and research?

Mr. ESCHWEGE. Right.

Senator BEALL. For the ocean dumping permit program and research?

Mr. ESCHWEGE. Yes; it has not identified the alternatives that are viable. I have to agree with the recent report from the congressional research service which indicates that some decisions will have to be made as to whether the Federal Government is going to completely eliminate all ocean dumping in favor of some other disposal method or whether it will continue in future years to let people dump some of their materials into the ocean. This is a crucial question which I am not sure the legislation has fully answered.

Senator BEALL. Do you think this program suffers because of a lack of lead agency among all of the agencies?

Do you think there should be someone designated in the law as the lead agency to handle this problem?

Mr. CAMPBELL. It depends on which aspect of the problem we are addressing.

For example, there is a lack of data with regard to the impact that ocean dumping is going to have on the environment particularly in the long term. There is also a lack of research with regard to alternative solutions, particularly land solutions in lieu of ocean dumping. The basic question is whether or not EPA is going to primarily control and regulate the extent and degree of ocean dumping or try to ultimately phase out all ocean dumping and require some alternative. If you are talking about a lead agency, I think EPA has taken the lead in issuing the permits and attempting to regulate the dumping and in conducting whatever research is being done in terms of searching for alternatives.

Whether it is given to EPA by legislation or not, I think EPA has, in effect, taken the lead.

Senator BEALL. Your study indicates that obviously the dumping has a harmful effect on the marine life in the area of the dumping.

Does your study indicate that there have been hazards, potential hazards for onshore life as a result of the dumping taking place at the present time?

Mr. CROWLEY. No; it hasn't. One potential problem came to our attention when we started reviewing the dumping in the New York Bight area. There is a lot of controversy as to whether sludge dumped in the New York Bight was moving closer to the beaches in New York. Apparently, EPA has taken the position that the sludge found near the beach areas may have come from onshore disposal facilities. The situation is hazy and we haven't made a determination on that.

Senator BEALL. You haven't determined whether there is a threat to the health and safety of individuals along the shore.

Mr. CROWLEY. Right.

Senator BEALL. You have made the determination that there is a serious undesirable effect on the marine life in the area of the dumping.

Mr. CROWLEY. Yes.

Senator BEALL. Is it possible that dumping is taking place too close to shore? Is one of the alternatives as someone proceeds to develop a total alternative to ocean dumping, that we should go further out to sea.

Mr. ESCHWEGE. It would seem that it would help our shores if it were a little further out but I'm only conjecturing on this. Some of the sites are further out. Some are as close as 12 miles while one is 106 miles out. I think the act, if I remember correctly, says that sites beyond the edge of the Continental Shelf shall be considered.

How far out is not specified.

Mr. CAMPBELL. Once you talk in terms of how far out, the question of economics comes into play. You get involved in a cost-benefit analysis. Dumping further out may force greater consideration to alternatives because it may be more economical to pursue some other alternative.

Senator BEALL. Maybe it is desirable that that be done.

Mr. CAMPBELL. Could be.

Senator BEALL. Is it ever too expensive to protect the health and safety of the individuals on shore?

Mr. CAMPBELL. It is tough to put a price on something like that.

Senator BEALL. What recommendations, if any, do you have as to changes in the Ocean Dumping Act.

Mr. CAMPBELL. We have no recommendations at this time for amending the legislation. We have directed our efforts toward what needs to be done to effectively implement the act as we see it today.

Mr. ESCHWEGE. Mr. Campbell is right, we have not developed recommendations for amending the act. However, there is the question that the Congressional Research Service brought up and which we talked about this morning; that is, whether we want to stop all ocean dumping or whether we want to continue, but mitigate it, and only let certain materials be dumped.

I'm not sure that the Congress would want to make that decision at this time, but you could mandate that the agencies direct their efforts in one of two ways. One would be to do most of their research on alternatives. The other way would be to do a lot of their research on the effects of dumping, such as the base line studies that NOAA has

been doing for EPA to find out what happens to marine life when you dump in certain areas.

Senator BEALL. Under title II of the act, NOAA has the basic responsibility for R. & D. endeavors.

Mr. ESCHWEGE. They do.

Senator BEALL. Why do you feel NOAA hasn't taken the lead as required under the law in research?

Mr. ESCHWEGE. NOAA has done some research in these areas, such as baseline studies. NOAA has told us and others that it doesn't feel it has the expertise to do the R. & R. work on alternatives for disposal of materials such as landfill and pyrolysis. We tend to agree that EPA would be more suitable to do this kind of research since it has a broader interest not only with respect to the sludge that is ocean dumped, but also the increased volume of sludge that is to be generated nationwide aas a result of Federal requirements for upgrading to secondary sewage treatment.

Senator BEALL. It would seem that the law might be changed to give EPA a clear mandate to do research on the subject rather than giving it to NOAA.

Mr. ESCHWEGE. In this area of alternatives, yes, I think it would be.

Senator BEALL. Thank you very much, gentlemen. I appreciate your testimony this morning.

[The statement follows:]

STATEMENT OF HENRY ESCHWEGE, DIRECTOR, RESOURCES AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE

Mr. Chairman and members of the subcommittee, we welcome the invitation of your subcommittee to discuss the effectiveness of the administration of the Marine Protection and Sanctuaries Act of 1972 commonly referred to as the "ocean dumping" act. With me today are Messrs. Wilbur D. Campbell, associate director; Brian P. Crowley, assistant director; and Philip A. Olson, supervisory auditor, of our Resources and Economic Development Division.

My testimony will summarize the results of our recently completed review on the ocean dumping of sewage sludge and industrial wastes. We had not finalized our report to Congress when we learned of our interest to have us discuss our observations at these hearings. Accordingly, the responsible agencies have not been given an opportunity to formally comment on our tentative conclusions and proposals for improvement. My testimony will also include some comment on our ongoing review of the dumping of dredged material by the Corps of Engineers.

As you know, a major objective of the act was to prevent or strictly limit the dumping of any material which would adversely affect human health and the marine environment.

The Environmental Protection Agency (EPA), the Corps of Engineers, the Coast Guard, and the Department of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), have major responsibilities for implementing the act.

EPA sets criteria to govern the disposal of wastes to the marine environment and issues permits for the discharge, transportation, and dumping of waste materials except dredged material, for which the Corps of Engineers issues permits on the basis of EPA criteria.

The Coast Guard is responsible for conducting surveillance and enforcement activities to prevent unlawful transportation of waste and unlawful dumping. The Coast Guard refers apparent violations to EPA for further enforcement action.

NOAA is required to perform research related to the effects of ocean dumping and alternative disposal methods.

From the effective date of the act, April 23, 1973, through June 30, 1975, EPA, Coast Guard, and NOAA have expended about $3 million, $500,000, and $300,000,

respectively, for activities carried out under the act. Additional indeterminable amounts of expenditures are incurred for numerous related activities.

OCEAN DUMPLING OF SEWAGE SLUDGE AND INDUSTRIAL WASTE

The volume of sewage sludge and industrial wastes dumped in ocean waters off the coasts of the U.S. increased from 9.2 million tons in 1968, to 10.8 million tons in 1973 and 11.4 million tons in 1974. Preliminary EPA figures for 1975 show that the volume decreased to 9.4 million tons. More than 98 percent of the 1975 volume was dumped in the Atlantic Ocean. There is no dumping of these materials in the Pacific Ocean although sewage sludge is discharged to the ocean through outfalls in southern California.

Ocean dumping, especially of sewage sludge, is expected to increase. The Federal Water Pollution Control Act Amendments of 1972 require municipal seawage treatment plants to provide a minimum of secondary treatment of their wastewater by July 1, 1977. As more and more municipalities upgrade their sewage treatment facilities, additional sludge will be generated. EPA estimates that this upgrading of plants will triple the volume of sludge to be disposed of in the ocean by existing dumpers in New York and New Jersey. Furthermore, additional municipalities in other locations are considering the ocean dumping of their sewage sludge.

EPA has promulgated criteria and established a permit program to regulate and control the types and concentrations of wastes dumped into ocean waters. In establishing criteria for assessing permit applications, EPA is to consider the (1) need for the dumping, (2) effects on health and welfare, shorelines and beaches, and the marine ecosystem and its resources, (3) persistence and permanence of the effects, (4) appropriate locations and methods of disposal, and (5) effects on alternate uses of the ocean.

Our review showed that a number of problems in EPA's administration of the permit program are resulting in the dumping of wastes which may be harmful to the marine enviornment.

WASTES EXCEEDING MERCURY AND CADMIUM SAFETY LEVELS ARE BEING DUMPED

EPA has established levels of mercury and cadmium, both of which are highly toxic, which it believes, if exceeded, will degrade the marine environment. The municipal permit holders in New York, Northern New Jersey, and the Philadelphia area were dumping sewage sludge containing cadmium of mercury that exceeded from one to more than 100 times the safety levels. This practice is occurring because EPA's regulations allow the dumping of mercury or cadmium in excess of safety levels under certain permits if the materials are present in sewage sludge.

Because of this practice, large amounts of mercury and cadmium are being dumped into the ocean. For example, in 1974, EPA estimated that the sewage sludge dumped into the Atlantic contained about 24 tons of cadmium. Ideally, EPA should not allow the dumping of cadmium and mercury which exceed the safety levels. However, EPA officials informed us that EPA has no choice but to allow the ocean dumping of municipal sludge until alternative disposal methods are found.

Much concern has been expressed that mercury and cadmium are accumulating in the tissues of fish and shellfish. For example, less than 1 year after the Philadelphia dump site was moved in 1973, clams and scallops taken from the areas surrounding the new site had accumulated high levels of cadmium.

WASTES ARE BEING DUMPED AT A RATE WHICH MAY BE CAUSING HARM TO THE ENVIRONMENT

Another problem is that wastes are being dumped at too rapid a rate which may be causing harm to the environment. To prevent short-term harm to the environment, EPA utilizes a test (commonly referred to as a bioassay) to establish the rate at which wastes can be dumped, without unduly increasing the toxicity level at the dumping location. A number of marine scientists have questioned the validity of the tests because brine shrimp is used. This organism is not considered appropriate because (1) it is not a marine organism native to the dump sites, (2) it is too hardy, and (3) most marine plants and animals

would be dead before the brine shrimp showed ill effects. The thought is that a slower rate of dumping should be prescribed.

The high concentration of wastes dumped has caused environmental problems. For example, one study of the New York Bight showed that sizeable areas of the sea floor near the sewage dump site were nearly devoid of marine life. Another study of the bight concluded that abnormally high concentrations of heavy metals, microorganisms, and organic materials had resulted in the death of migrating crabs and lobsters.

Preliminary tests by EPA indicate that if appropriate organisms are used, the length of time dumpers would have to remain out at the dumping site would be extended, thereby increasing cost and the risk of collision. An EPA region III official estimated that disposal times would double under the revised bioassay procedure. EPA officials agreed that the brine shrimp was not an appropriate organism, but stated that dumpers may not be able to fully comply with the extended disposal times if appropriate marine organisms were used.

COAST GUARD SURVEILLANCE OF OCEAN DUMPING OPERATIONS HAS BEEN INADEQUATE

We also found problems in the Coast Guard's surveillance of ocean dumping operations at dump sites off the northeastern Atlantic coast of the U.S. These sites accounted for 100 percent of the sewage sludge and about 90 percent of the industrial wastes dumped in the Atlantic.

Our review showed that the Coast Guard did not meet its established surveillance goals for fiscal year 1975 in that:

1. Contrary to a goal of boarding 10 percent of ocean dumping vessels prior to departure, no vessels were boarded.
2. Although shipriders were to be assigned to 60 to 100 percent of the vessels going to the toxic chemical waste site, they were only assigned to 7 percent.
3. Only 42, or 1 percent of the dumping for substances other than toxic chemicals were observed compared to a goal of 10 percent.

Coast Guard officials stated that goals were not being met because of a shortage of personnel and other resources and other missions were considered to have higher priority. They noted also that bad weather sometimes forced the cancellation of surveillance missions.

About one-half of all dumping operations occurred at night. The Coast Guard does not monitor night activities because its surveillance efforts depend primarily on visual observaiton. Initially EPA did not permit night dumping. In December 1973 the Coast Guard requested that EPA permit night dumping because the prohibition was severely restricting ocean dumping operations.

When the Coast Guard detects ocean dumping violations, it forwards the cases to EPA for enforcement action. From the beginning of the program through June 30, 1975, the Coast Guard referred 24 cases involving apparent violations to EPA. Penalties were assessed in two cases, two other cases are still pending, and the remaining 20 cases were closed without assessing penalties because EPA considered that violations were minor or did not occur.

Several factors adversely affect the Cost Guard's ability to detect violations when it observes dumping operations. Each ocean dumping permit specifies the area in which the sewage sludge or industrial wastes are to be dumped and the allowable rate of dump. However, most barges discharge waste through outlets that are underneath the water and the actual discharge is not always observable. In addition, for safety reasons, it is not possible for Coast Guard vessels to get close enough to a barge to determine when the discharge begins and ends. In this regard, our staff accompanied the Coast Guard on one of its missions and confirmed that it was difficult to determine the precise starting and ending times of the discharges, the types and concentrations of wastes being dumped, and the rate of the discharge.

EPA has made suggestions to the Coast Guard for improving its surveillance methods; such as, obtaining photographs and taking samples of dumped material. To supplement current methods of surveillance the Coast Guard is testing an electronic ocean dumping surveillance system that is to be installed on ocean dumping vessels by 1978. This time frame may be somewhat optimistic, however. Testing of a prototype of the system, completed in January 1976, identified various equipment problems which have to be corrected.

ALTERNATIVES TO OCEAN DUMPING

The last point I would like to address concerns alternatives to ocean dumping. NOAA is responsible for conducting and coordinating research under the act. However, the bulk of the research effort currently underway in the area of alternatives, exclusive of dredged material, is being conducted by EPA.

EPA requires the dumpers of sewage sludge and industrial wastes to look for alternatives. Some industrial dumpers have been phased out, others have established dates by which they plan to phase out, and still others are searching for alternatives. Various methods which would allow the discontinuation of ocean dumping are being examined, including the modification of manufacturing processes to reduce the volume of wastes produced and the recovery of saleable byproducts from the wastes.

We noted two situations that indicate that the alternatives selected to ocean dumping of industrial wastes may not be environmentally sound. In one case, several industrial dumpers in Puerto Rico have advised EPA that they plan to discontinue ocean dumping and begin discharging their wastes into a municipal treatment facility when in opens in 1976. This facility, however, will provide only primary treatment and will not change the nature of these liquid industrial wastes. Thus, wastes currently dumped 42 miles offshore could be discharged only 3,300 feet from shore.

The other case demonstrates that landfill alternatives may also pose environmental prolems. An ERA survey of 45 former ocean dumpers disclosed that 29 were landfilling their wastes; 21 of these were using the same landfill. The survey indicated that this landfill was of questionable adequacy. It is located on a river bank and during periods of high rainfall, parts of the landfill are submerged. At times, wastes can be seen running down the banks, into the river. The survey also suggested that harmful materials were moving into the river by means of the groundwater.

Sewage sludge dumpers are also searching for alternatives although no major sludge dumper has yet phased out. Camden, New Jersey, has selected incineration as an alternative and Philadelphia has undertaken a pilot project to demonstrate the operational feasibility of the wet oxidation process. Communities in the New York-Northern New Jersey area which account for more than 80 percent of sludge dumped in the Atlantic are participating in an EPA funded sludge management study administered by the Interstate Sanitation Commission of New York, New Jersey, and Connecticut. The Commission's report on phase I of the study, issued in June 1975, recommended that pyrolysis, a form of combustion, be adopted as the method of processing sewage sludge and proposed that a pilot project be undertaken.

In summary, we believe that a number of steps can be taken by EPA and the Coast Guard to improve the administration of the ocean dumping program. EPA should:

Use appropriate marine organisms to establish waste discharge rates which will adequately protect the marine environment and

Permit only those alternatives to ocean dumping which are environmentally sound.

The Coast Guard should increase the overall level of ocean dumping surveillance. In this regard, shipriders should be used to monitor night dumping operations. The Coast Guard should also continue to develop new methods such as electronic surveillance whereby compliance with permit conditions may be more effectively monitored.

OCEAN DUMPING OF DREDGED MATERIAL

We are currently conducting a review of the environmental effects of the Corps of Engineers' dredging activities.

In fiscal year 1975 the Corps of Engineers dredged about 318 million cubic yards of material from our navigable channels and harbors at a cost of about $230 million. Of this total, about 93 million cubic yards were disposed of in ocean waters. Under the Marine Protection, Research, and Sanctuaries Act of 1972 the Corps of Engineers administers a permit program over the transportation of dredged material for dumpng in ocean waters. The Secretary of the Army determines whether dredged material is acceptable for disposal in ocean waters under criteria developed by EPA in October 1973.

The primary objective of our review is to determine the environmental and economic considerations and problems in disposing of material dredged from the Nation's waterways and the actions being taken to resolve or mitigate such problems. We reviewed the Corps' disposal in the New York Bight of most of the material dredged from the New York harbor. The Bight has been used for the disposal of dredged material for over 30 years.

Because of concerns that the materials dumped in the Bight might jeopardize the quality of the water near the beach areas of New York and New Jersey, EPA asked the Corps to plan for relocating its disposal site to an area about 65 nautical miles from the harbor. The Corps has taken the position that in view of the substantial costs involved the disposal site should not be moved unless it can be shown that dumping at the present site results in major adverse effects.

Our tentative conclusions on this review have not yet been furnished to the responsible agencies for their comments but I would like to briefly summarize them here.

The long-term environmental effects of dredging are still not fully known. The Corps is conducting a major research program on dredging but the program will not be completed until fiscal year 1978 and may not provide all the answers. Changes in the method and location of dredged material disposal to meet environmental objections can greatly increase the costs of keeping harbors and rivers open to navigation—as much as 5 to 10 times current costs. Such increases could result in costs exceeding benefits for maintaining parts of the waterway system. We believe the Corps should compile and make available to the Congress more complete information on the economic effects of such changes, when they are proposed, so that more informed decisions can be made regarding the tradeoffs between economics and environmental protection.

In connection with the corps' research program on dredging effects, we believe that EPA and the corps needs to work more closely together in evaluating the environmental effects of dredging.

We plan to address these issues more fully in a report to the Congress.

Mr. Chairman, this completes my prepared statement; we will be glad to respond to your questions.

Mr. BEALL. Our next witness is Mr. David H. Wallace, Associate Administrator for Marine Resources, National Oceanic and Atmospheric Administration.

Please identify for the record those with you as you give your testimony.

STATEMENT OF DAVID H. WALLACE, ASSOCIATE ADMINISTRATOR FOR MARINE RESOURCES, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE, ROCKVILLE MD.; ACCOMPANIED BY DR. SWANSON, PROJECT MANAGER, MARINE ECOSYSTEMS ANALYSIS; AND WILLIAM BREWER, GENERAL COUNSEL

Mr. WALLACE. Thank you, Mr. Chairman. I am David Wallace and I am the Associate Administrator for Marine Resources of NOAA. With me on my right is Dr. Swanson, who is project manager of NOAA's Marine Ecosystems Analysis [MESA] project for the New York Bight. On my left is Wr. William Brewer, the general counsel for NOAA.

Mr. Chairman, I would like to request that my statement be included in the record in its entirety and then in the interest of time I will try to summarize some of the key points as we go along.

Senator BEALL. Thank you. Your statement will be included in the record.

Mr. WALLACE. I would like to hit on several points involved in this legislation. Title II authorizes and provides funding for investigations

in three separate, yet related areas. These are programs under section 201 to investigate the short-term effects of ocean dumping upon marine ecosystems, programs under section 202 to assess the long-range effects of ocean pollution, overfishing, and other man-induced stresses on marine ecosystems, and assistance under section 203 to research activities exploring alternatives to disposal by dumping at sea.

I would like to briefly touch on these three items. Under section 201, NOAA has two basic roles to fulfill. First, to carry out ocean dumping monitoring and research activities in order to provide additional scientific support to the regulatory programs established pursuant to title I and, second, to conduct monitoring and research to strengthen our ability to assess the short-term and long-term ecological effects of dumping in our coastal waters and in the Great Lakes.

I mentioned the long-term effects deliberately because section 202 imposes on NOAA specific responsibilities for comprehensive research on the long-term effects of ocean dumping and other sources of marine pollution.

In the administration of ocean dumping permit programs under title I, it's essential to have an adequate description of dump sites and various other matters. NOAA has initiated a program of dump site characteristics to be followed by monitoring activities at dump site locations located off the Atlantic, Gulf, and Pacific Coasts.

This program is being coordinated to support regulatory programs carried out by EPA under title I. In March 1975 we concluded an agreement with EPA concerning baseline surveys and evaluations of ocean dumping sites.

The dump-site characteristic and monitoring program is designed to provide the concerned Federal, State, regional, and local decision-makers with information to assist their regulatory and management efforts.

I will summarize what we have done to date in our ocean dump-site characteristics monitoring program.

The most significant efforts by NOAA on the effects of ocean dumping to date have been as part of the MESA/New York Bight project initiated in 1974.

Although the principal focus of MESA is on large-scale ecosystem studies and the development of the research and monitoring techniques, the initial MESA effort in the New York Bight was directed toward the immediate problem of ocean dumping. This work involved a detailed characterization of the sewage sludge dump site in order to help meet the pressing need of EPA for information on that site.

The MESA project scientists were also called on by EPA to carry out a detailed evaluation of two alternative dumpsite areas at the edge of the continental shelf in the bight area to determine the environmental trade offs involved in the event EPA felt it necessary to remove the sewage dump site to an alternate location. The MESA project transmitted its recommendations to EPA last October and EPA Region II subsequently announced its decision not to relocate the sewage sludge dump site in March of this year.

At the conclusion of our ocean dumping investigations, we will have completed major objectives in establishing the information and the basis for sound management decisions in the New York Bight concerning ocean dumping problems. Also, we will have provided the

scientific rationale for EPA decisions affecting the existing sewage sludge site. Finally, we will have developed a comprehensive stategy for the monitoring of future changes to environmental quality due to dumping and will have established preliminary relationships of dumped materials to other pollutants entering the bight from diverse sources in terms of overall pollution load and pressures.

In addition to the MESA studies, we have been engaged since 1974 in a series of investigations at deepwater dump site 106, which is located 90 miles east of Cape Henlopen, Dela. This site is used by more than 25 dumpers who dispose of acid wastes and industrial chemicals. It's of high priority to EPA for assessing the environmental impact of industrial waste dumping in deep water.

The third and final seasonal survey of this dump site was conducted this past winter and NOAA will provide its final recommendations to EPA concerning the impact of the continued use of this site next year.

We are seeking from the Congress funds in fiscal year 1977 to expand the NOAA dump site characteristic and monitoring efforts beyond the three dump site locations in the New York Bight and deepwater dump site 106. We have developed a program to study three additional dump sites, two in the Gulf of Mexico, and one off Puerto Rico, which will be the subject of seasonal investigations beginning in fiscal year 1977, assuming that funding will be provided.

Within NOAA there also are other ongoing research efforts which, although developed in response to other legislation, have direct applicability to ocean dumping research needs. The sea grant program is, in particular, a sponsor of closely related projects. One, for example, is the Texas A. & M. study of the history of ocean dumping in the Gulf of Mexico which concludes that with the advent of ocean incineration and the development of more efficient waste disposal alternatives, ocean disposal could conceivably be significantly reduced in the Gulf of Mexico. Such work done within the sea grant program has enlarged the scope of the NOAA effort geographically and topically. The section 202 mandate for initiating research programs on the long-range effects of man's activities on ocean ecosystems is a broad one. From the legislative history of the provision we believe it was not the intent of Congress that the Department of Commerce or NOAA should mount new research programs which could be duplicative of ongoing efforts by other Federal agencies. We see our role as the agency responsible for insuring that the Federal research efforts are adequate as well as being coordinated in order to minimize duplication.

Our initial efforts have been aimed at taking inventory of the various research programs now underway by NOAA and by other agencies which are responsive to the concerns of section 202.

Our series of reports to the Congress on section 202 describe the many federally sponsored research activities underway. NOAA itself has been involved in the study of petroleum and heavy metals in the marine environment, assessment of our fishery resources and international negotiations to reduce overfishing, and the assessment of OCS oil and gas development and deep-ocean mining. EPA is doing important work on the effect of synthetic hydrocarbons, for example, pesticides and PCB's. NOAA has had input to comparable studies. Details of these programs are contained in the annual report and I won't attempt to describe them here. However, I would like to mention

some of the programs in which NOAA is involved in assessing the potential long-term effect of man's activities in the ocean environment.

Through a joint agreement with the Bureau of Land Management, NOAA has assumed a major role in the management of environmental assessment studies in the waters adjacent to Alaska. These studies, focused initially in the northeast Gulf of Alaska, are directed primarily toward the establishment of the assessment of the potential environmental impacts of OCS oil and gas development on the marine ecosystems of the Alaskan shelf.

With U.S. industry considering the initiation of mining operations in the deep ocean for manganese nodules, NOAA initated the deep ocean mining environmental study (DOMES). The initial phase of the DOMES project centers on the establishment of baseline environmental data in the general area of likely industrial mining interest and the establishment of preliminary environmental guidelines for control of this kind of activity.

This initial study will be followed by a second phase which will consist of monitoring the effects of actual test mining operations by industry.

In the area of overfishing, we have continued to work with various international commissions to provide protection for resources off our coasts. In particular, the recent negotiations of the International Commission for the Northwest Atlantic Fisheries has met with some measure of success in imposing quotas on certain stocks of fish inhabiting waters adjacent to New England and the Middle Atlantic States. These new quotas should permit recovery of the depleted stocks. It will require about 7 years at the established quota levels. Nevertheless, it does represent one example of major efforts that have been made toward protecting overfishing stocks in the international arena.

We have also taken an active role in international marine environmental research programs, such as the integrated global ocean station system (IGOSS) and the global investigation of pollution in the marine environment (GIPME), both of which are programs of the International Oceanographic Commission, of which the United States is a member and which is a part of UNESCO.

The final area of responsibility for the Department of Commerce under title II provides for supporting research on alternative methods of ocean waste disposal.

With the exception of at-sea incineration, the major possibilities in this area involve land-based waste treatment technologies. The development of these technologies is presently outside NOAA's background, mission, and technical competence. A large number of research efforts on waste disposal alternatives are being sponsored by other Federal agencies. Still, in order to be able to take responsible positions with respect to ocean dumping policies and alternatives, NOAA has maintained a continued awareness of the research and technology of alternative waste disposal mothods.

For the Department of Commerce to build a capability for developing alternative land-based waste disposal methods to ocean dumping would clearly involve duplication of existing scientific and technical resources and programs of other agencies. Consequently, we have placed priority on the earlier described dumpsite studies and have

deferred to EPA and the corps for the primary responsibility for the development of alternatives to ocean dumping.

Overall, Mr. Chairman, I believe substantial progress has been made since 1972, considering the magnitude of the problem, the complexity of the ecological systems involved, and the geographic diversity of the coastal areas. As the Federal agency responsible for our Nation's living marine resources, we are particularly cognizant of the need to protect the quality of the habitat of these resources. Consequently, it is our desire that all harfmul dumping be terminated as soon as possible.

Recognizing that alternative methods of waste disposal must be available before dumping can be terminated, we support the continuation of title II for the purposes of assessing the effects of dumping. Such assessment will provide the information base for the management decisions that will be necessary for the reduction or termination of dumping.

Regarding section 202, we believe it is extremely important for our Nation to develop a capability for assessing the long-range effects of man's activities on the marine environment. This need will be with us for a long time to come. With the remarkable growth of activities which can impact the marine environment, it is essential that each be systematically assessed.

Mr. Chairman, this completes my statement. I would be happy to answer any questions you have.

Senator BEALL. Thank you, Mr. Wallace. We appreciate your testimony this morning. What were those funding requests in 1975, 1976, and 1977 and perhaps more important, how much of your request was provided?

Mr. WALLACE. Mr. Chairman, I have to talk about this in two parts. One is the funding for the MESA New York Bight work and then I would like to talk more specifically about the special funding for other ocean dumping activities.

As I said in my testimony, we have worked to a large degree in the activities we are carrying on in the New York Bight toward analysis of ocean dumping even though the original concept of the study was on a very broad base, to understand the oceanographic processes and the effects of contaminants on the overall bight environment.

We estimate that approximately $6 million per year through fiscal year 1976 has been spent in the New York Bight on ocean dumping research activities. One of the activities we have been carrying on has been the evaluation of alternative dump sites which have been suggested for the one that is currently being used in the New York Bight by New York City, New Jersey, and adjacent New York State areas for dumping of sewage sludge. We have made this evaluation of these two sites and have made recommendations to EPA.

Most of this $6 million has been directed toward that kind of activity. As far as actual appropriations for this purpose, up to this moment we have had no funds specifically appropriated for ocean dumping research.

Senator BEALL. Have you requested it?

Mr. WALLACE. Yes; and I will get to that in a minute. We reprogramed $300,000 in our own funds in NOAA for fiscal year 1974, and this amount, more or less, has been available since that time.

We have in the budget request before the Congress a request by the administration for $1,070,000 for fiscal year 1977. It's now up before the Budget Committee of the Congress. As regards the request for funding, we proposed the full amount of the authorization be funded to carry out these studies. This was done, I believe, in fiscal 1976. For various budgetary and priority reasons these funds were not made available. As a consequence, we have had no additional funding for this purpose.

Senator BEALL. Is it your feeling that greater levels of funding would better enable NOAA to move ahead and get on schedule with regard to determining the short- and long-range effects of ocean dumping?

Mr. WALLACE. It's perfectly obvious that this is a big job and funding is one of the problems that we are facing.

We can continue to rely upon MESA to provide certain useful information on the ocean dumping problem, but certainly funding is a critical problem if we are to develop a research program directly responsive to section 201.

Senator BEALL. Funding request for MESA in fiscal 1977 is $500,000 less than it was. Does that indicate you have made substantial progress and you don't need the amount of moneys you had in the past?

Mr. WALLACE. It really means we have lengthened out the MESA program for an additional year rather than trying to complete it within the original time-frame that we had selected.

I believe that our original plan was to complete the MESA project in the New York Bight in fiscal 1980 and this probably will require us to slide it over into 1981.

Senator BEALL. What research, if any, has NOAA done on the health and environmental effects of the dumping activities off the coast of Delaware and Maryland?

Mr. WALLACE. We have done some work on looking at the offshore, deep-water dump site, but I believe that our total efforts on other sites in this region have been limited. I would like to consult with Dr. Swanson, if I may, to be sure about this.

Senator BEALL. Go right ahead.

Mr. WALLACE. Dr. Swanson verifies what I thought and that is that our efforts on these sites, except for the deep-water dump site, have been quite limited, but EPA has done considerable work here. We have supplied a data buoy and other things, such as submersibles, for EPA.

Senator BEALL. Limited because of lack of resources?

Mr. WALLACE. Yes, sir.

Senator BEALL. Or as a matter of priority?

Mr. WALLACE. No; I think we consider this an important matter. I must say there are so many dump sites that need to be considered. Many of them are very critical. We have laid out a program in 1977 to look at three additional sites.

Senator BEALL. What has NOAA found to be the effect of dumping on the coastal fishing activities?

Mr. WALLACE. In the New York Bight particularly where the greatest amount of dumping by far has taken place, there are areas adjacent to the sewage sludge dump site which have been adversely affected. There are areas that have been closed to the taking of shellfish because of the bacteriological increases as a result of the ocean

dumping itself. There are some indications that a certain kind of disease of fish which affects their fins has increased in that area. To be really precise, though, it's difficult to determine the extent at which our fisheries resources have been damaged by this particular condition. It's a very complex matter because fishing, particularly foreign fishing off our east coast, has had a dramatic adverse effect and oftentimes has overshadowed the things that may be occurring as a result of ocean dumping itself.

Senator BEALL. Do your studies show there has been specific damage to the marine life in the dumping areas?

Mr. WALLACE. Yes; definitely. In the local site there is no question about it. It has deteriorated the quality of the environment and made it less desirable for marine users.

Senator BEALL. What, if anything, in the study is shown with regard to the hazards presented to people onshore as a result of the areas you have studied to date?

Mr. WALLACE. This has been a matter of great concern in the New York Bight area, as you know, Senator. People are very concerned that this might present a health hazard to people bathing and using the beaches along the south shore of Long Island. Our studies indicate this has not been the case, that the health hazard does not exist there at this time as a result of the dump site activities. And this has been a matter of rather intensive investigation by our people.

Senator BEALL. Is the potential there for health hazard?

Mr. WALLACE. It's our opinion that we should continue to use the current dump site off the New York Bight. At this moment it does not pose a potential health hazard. The environmental effects of moving the dump site further offshore to other areas would have an even greater adverse impact.

Senator BEALL. You haven't done similar studies with regard to the area where Philadelphia and Camden are dumping their sewage sludge?

Mr. WALLACE. We have not. I am sure you are aware that the current dump site being used was moved further offshore in 1974. We have not at this point made similar kinds of studies.

Senator BEALL. Do you plan to make those kinds of studies?

Mr. WALLACE. We had not planned to make them in fiscal 1977 because of the other dump sites, the dump site off Puerto Rico, for example, where there has been serious concern. And there are two in the Gulf of Mexico. But obviously it would be one of the areas that should ultimately be looked at.

Senator BEALL. You have a cooperative agreement with EPA. Why don't you have a similar cooperative agreement with the corps in regard to the dumping of sludge?

Mr. WALLACE. We have had conversations with the corps and we hope to have more. It's desirable to pursue this matter and that we have a comparable arrangement with them.

Senator BEALL. Has your memorandum of understanding with EPA been satisfactory? Have you been able to receive funding from EPA to get the kind of things you need from them to carry out the work you think should be done?

Mr. WALLACE. I think our relationship with EPA in terms of ocean dumping and the kinds of things that we are capable of doing

has been really good. I believe that they have been very anxious to get the kinds of studies that we have been able to do, to get the results.

Senator BEALL. Have they given you funds?

Mr. WALLACE. Under certain circumstances, they have.

Senator BEALL. How much? Could you supply that for the record if you don't have it readily available?

Mr. WALLACE. Dr. Swanson tells me we have had $130,000 in New York Bight. But we have had some other funds from EPA too, and I must say, Mr. Chairman, I can't give you the exact numbers. I would be happy to submit them for the record.

[The following information was subsequently received for the record:]

In fiscal year 1974, $50,000 was provided to support contract studies at Florida State University on east coast dumpsite regions. In fiscal year 1975, $130,000 was provided for studies on the alternative sewage sludge dumping areas in the New York Bight. In fiscal year 1976, an amount of $235,000 was provided to support experimental studies on dumping effects in the deepwater dumpsite (DWD-106) off Delaware.

Senator BEALL. Are you satisfied with the overall level and the quality of the Federal research on ocean dumping alternatives?

Mr. WALLACE. Mr. Chairman, I think this is one of the critical issues we are facing here. We are anxious to have this effort pursued and moved along as fast as possible. It should be attacked at full speed as much as we can. We don't want to see continued dumping of noxious and dangerous materials in the ocean. I would have to say we would hope to see this accelerated if at all possible.

Senator BEALL. How can we make it more effective and responsive to our needs?

Mr. WALLACE. Again, it's a question of the funds that are available to be devoted to these kinds of studies. I would certainly hope that these are appropriate and adequate. I must say I don't know the actual amounts available to EPA for this.

Senator BEALL. How much money would you need to fully and adequately monitor all of the U.S. ocean dumping sites?

Mr. WALLACE. That's sort of bad to ask a bureaucrat that question.

Senator BEALL. Well, we would like to get the answer.

Mr. WALLACE. It would seem to me that the amount that has been authorized in the original legislation would have enabled us to do the kind of job we were hoping to do and that was a total of $6 million.

Senator BEALL. I'm on the Budget Committee and it's refreshing to hear millions instead of billions. I gather the law seems to say that first research should focus on the effects and on monitoring. Second, the law seems to say it should focus on alternatives. I gather from your testimony you have suggested to me that you considered NOAA's responsibility primarily to focus on the effects by monitoring rather than alternatives?

Mr. WALLACE. Yes and no. I think we have two responsibilities. One is to carry on short-term and long-term research, to define the basic problem and the characteristics of the problem and the kinds of things that are taking place in the environment which are deteriorating. And then we must make this available to the appropriate control agency. I also think we have the responsibility down the road to provide the kind of monitoring that will enable us to see what is

happening as a result of these control measures and what is taking place. I guess we have said, Mr. Chairman, that in the investigation of alternatives to dumping, we have taken the position that we really weren't qualified or capable of doing this because we haven't had the kind of experts available in our organization to carry out these kinds of studies. Obviously, we could build those if it were a pressing need which was not able to be met by anybody else.

But it appeared to us that EPA already had considerable expertise in this area and it would be more logical for them to carry out this effort.

Senator BEALL. You consider EPA to be the lead agency in this total effort?

Mr. WALLACE. That's difficult to say. We are the lead agency as far as research and the coordination of research is concerned. That is our game and we understand this and we have the capability to do it in the oceans. I won't say we would want to relinquish that responsibility.

Senator BEALL. Well, thank you very much. We will be checking with you from time to time as we will the other agencies.

It seems that generally the activity hasn't been as accelerated as it might have been in this regard and the committee staff has been requested to monitor the activities and develop questions of you and the other witnesses here today.

We appreciate your testimony, Mr. Wallace. Thank you for coming today.

[The statement follows:]

STATEMENT OF DAVID H. WALLACE, ASSOCIATE ADMINISTRATOR FOR MARINE RESOURCES, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. Chairman and members of the subcommittee, I am pleased to appear today before this subcommittee to discuss the activities of my agency under the Marine Protection, Research, and Sanctuaries Act. I shall direct my remarks primarily to implementation of the research provisions of Title II of the Act.

Title II authorizes and provides funding for investigations in three separate yet related areas. Briefly stated these are: (1) programs under Section 201 to investigate the short-term effects of ocean dumping upon marine ecosystems; (2) programs under Section 202 to assess the possible long-range effects of ocean pollution, overfishing, and other man-induced stresses on marine ecosystems; and (3) assistance under Section 208 to research activities exploring alternatives to disposal by dumping at sea. I would like now to briefly summarize for you the major activities carried out by NOAA in response to each of these areas.

Under Section 201 of Title II NOAA has two basic roles to fulfill. The first is that NOAA carry out ocean dumping monitoring and research activities in order to provide additional scientific support to the regulatory programs established pursuant to Title I. The second is that NOAA conduct monitoring and research, not necessarily related to the regulatory programs, so that we can strengthen our ability to assess the short-term and long-term ecological effects of dumping of wastes into our coastal waters and into the Great Lakes. I mention long-term effects deliberately because Section 202 imposes on NOAA specific responsibility for comprehensive research on the long-range effects of ocean dumping and other sources of marine pollution.

In the administration of ocean dumping permit programs under Title I it is essential to have an adequate description of the dumpsites, the material dumped, the affected biota, and fate and effects of the material dumped. It is also necessary to monitor the environmental effects of the dumping. To this end, NOAA has initiated a program of dumpsite characterizations to be followed by monitoring activities at individual dumpsites located on the Atlantic, Gulf, and Pacific coasts. This program is being closely coordinated to also support the regulatory programs carried out by EPA under Title I.

In March 1975 we concluded with EPA an interagency agreement concerning baseline surveys and evaluations of ocean disposal sites, under the Marine Protection, Research, and Sanctuaries Act. The dumpsite characterization and and monitoring programs we are carrying out are designed to provide the concerned Federal, State, regional and local decision makers with information to assist in their regulatory and management efforts. Specifically we hope that the program will contribute information for decisions relative to designation, relocation, and termination of dumpsites, and will assist in the evaluation of the environmental consequences and effectiveness of ocean dumping controls.

I would like to summarize what NOAA has accomplished to date in its ocean dumpsite characterization and monitoring program.

The most significant efforts by NOAA on the effects of ocean dumping have been part of the MESA New York Bight Project, initiated in fiscal year 1974. As we have noted previously to the Subcommittee, the New York Bight is the area of the Nation's most intensive municipal and industrial waste dumping. Although the principal focus of MESA is on large-scale ecosystem studies and the development of research and monitoring techniques, the initial MESA effort in the New York Bight was directed toward the immediate problem of ocean dumping.

This work involved a detailed characterization of the sewage sludge dumpsite, in order to help meet the then pressing need of EPA for information on that site. The MESA Project was also called upon by EPA to carry out a detailed evaluation of two alternative dumpsite areas at the edge of the Continental Shelf in the New York Bight area to determine the environmental tradeoffs involved in the event EPA must move the existing sewage sludge dumpsite in the area to one of two alternative locations. The MESA Project transmitted its recommendations to EPA last October and EPA Region II announced its decision not to relocate the sewage sludge dumpsite in March of this year.

The MESA research on ocean dumping in the New York Bight is nearing an end. At the conclusion of the ocean dumping investigations by the New York Bight MESA Project Office, we will have completed major objectives in (A) establishing the information and the basis for sound management decisions in the New York Bight considering ocean dumping problems, (B) providing the scientific rationale for EPA decisions affecting the existing sewage sludge site, as well as alternatives for possible relocation, (C) developing a comprehensive strategy for the monitoring of future changes to environmental quality due to dumping, and (D) establishing preliminary relationships of dumped material to other pollutants entering the Bight from diverse sources in terms of overall pollution load and pressures.

In addition to the MESA studies, NOAA has been engaged since 1974 in a series of seasonal investigations at Deepwater Dumpsite 106 which is located 90 nautical miles east of Cape Henlopen, Delaware. This site is used by more than 25 dumpers in the New York-New Jersey area to dispose of acid waste and industrial chemicals and is therefore of high priority to EPA for assessing the environmental impact of industrial waste dumping in deep water. The third and final seasonal survey at this dumpsite was conducted this past winter and, after evaluation of the data, NOAA will provide its recommendations to EPA concerning the impact of continued use of this site.

Funds are being sought from the Congress in fiscal year 1977 to expand the NOAA dumpsite characterization and monitoring efforts beyond the three dumpsite locations in the New York Bight and Deepwater Dumpsite 106. We have developed, in coordination with EPA, a list of three additional dumpsites, two in the Gulf of Mexico and one off Puerto Rico, which will be the subject of seasonal investigations beginning in fiscal year 1977. If resources permit, additional dumpsites will be added in subsequent fiscal years.

I would like to point out that while NOAA does not now have a major cooperative Section 201 effort with the Corps of Engineers, the Marine Ecosystems Analysis (MESA) Project for New York Bight has developed information regarding conditions at the dredge spoil dumpsite off New York. In addition, other individual activities within NOAA are being conducted in support of the scientific objectives of the Corps of Engineers' Dredged Material Research Program. We plan to hold discussions with the Corps in the immediate future with a view to ascertaining how best to combine our respective research capabilities on the problem of dredging and disposal of dredged material in our coastal waters and in the Great Lakes.

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Within NOAA there also are other ongoing research efforts which, although developed in response to other legislation, have direct applicability to ocean dumping research needs under Public Law 92-532. The Sea Grant Program in particular has been sponsoring several closely related projects. One example of the Sea Grant effort is the Texas A&M study of the history of ocean dumping in the Gulf of Mexico which concludes that with the advent of ocean incineration and the development of more efficient waste disposal alternatives, ocean disposal could conceivably be significantly reduced in the Gulf of Mexico. Such work done within the Sea Grant Program has enlarged the scope of the NOAA effort both geographically and topically.

The Section 202 mandate for initiating research programs on the long-range effects of man's activities on ocean ecosystems is a broad one indeed. From the legislative history of this provision, we believe that it was not the intent of Congress that the Department of Commerce or NOAA should mount new research programs which could be duplicative of ongoing efforts by other Federal agencies. We see our role as the agency responsible for ensuring that the Federal research efforts are adequate as well as being coordinated in order to minimize duplication.

Therefore, our initial efforts are aimed at taking inventory of the various research programs now underway by NOAA and by other agencies which are responsive to the concerns of Section 202. Our series of annual reports to the Congress on Section 202 describes in summary fashion the many federally sponsored research activities now underway. NOAA has been specifically involved in the study of petroleum and heavy metals in the marine environment, the assessment of our fisheries resources and international negotiations to reduce overfishing, and the assessment of OCS oil and gas development and deep-ocean mining. EPA is doing important work on the effects of synthetic hydrocarbons (pesticides, PCBs) on marine organisms. While details of these programs are contained in the second annual Report to the Congress on Ocean Pollution, Overfishing, and Offshore Development, I would like to mention briefly for you some of the programs in which NOAA is actively involved in assessing the potential long-term effects of man's activities on the ocean environment.

Through a joint agreement with the Bureau of Land Management of the Department of the Interior, NOAA has assumed a major role in the management of environmental assessment studies in Alaska. These studies, initially focused in the Northeast Gulf of Alaska, are directed primarily toward the establishment of an assessment of the potential environmental impacts of OCS oil and gas development on the marine ecosystems of the Alaskan shelf. As a result of our studies to date, we have provided BLM with environmental data and information for use in the Interior Department's leasing decisions for the Northeast Gulf of Alaska and the Beaufort Sea. In fiscal year 1976, field investigations are being initiated in the Lower Cook Inlet, Western Gulf of Alaska, Southeastern Bering Sea, Norton Sound, and the Chukchi Sea.

With U.S. industry actively considering the initiation of mining operations in the deep ocean for managanese nodules, NOAA initiated in 1974 the Deep Ocean Mining Environmental Study (DOMES). The initial phase of the DOMES Project centers on the establishment of baseline environmental data in the general area of likely industrial mining interest and the establishment of preliminary environmental guidelines for control of this activity. This initial study may be followed by a second phase which will consist of monitoring the effects of actual test mining operations by industry. During Phase II, changes in the environment will be documented and predictive models of environmental changes developed during the first phase will be tested and refined. This program is a necessary first step that must be taken for U.S. industry to proceed with deepsea mining operations in an environmentally safe manner.

In the area of overfishing, we have continued to work with various international commissions to provide protection for resources off our coasts. In particular, the recent negotiations in the International Commission for the Northwest Atlantic Fisheries (ICNAF) have been successful with respect to stocks inhabiting water adjacent to New England and the Middle Atlantic States. The new ICNAF overall agreed-upon quota will allow recovery of Northwest Atlantic depleted stocks; however, it will require about seven years at the established quota levels. Other negotiations in 1975 with Japan and the U.S.S.R.

also will facilitate stock conservation of halibut, and to a lesser extent, pollock in the East Bering Sea and Pacific Ocean as well as perch in the Northeast Pacific.

In addition, at the 1974 International Commission for the Conservation of Atlantic Tunas (ICCAT) meeting, two U.S. proposals to regulate Atlantic bluefin tuna were adopted and in 1975 the United States enacted the Atlantic Tunas Conservation Act, thereby implementing the ICCAT convention.

These are but some of the major efforts that have been made towards protecting overfished stocks in the international arena. The results from these efforts, however, will require several years to evaluate and to determine the rapidity with which the stocks are being restored. Furthermore, we must develop methods for evaluating the effects that a severely depleted stock may have on a given ocean ecosystem.

We also have taken an active role in international marine environmental research programs which are designed to gather data on the background levels of pollutants in the oceans. The programs of particular interest to us include: the Integrated Global Ocean Station System (IGOSS) and Global Investigation of Pollution in the Marine Environment (GIPME), both programs of the International Oceanographic Commission (IOC). We are also following with interest the contaminant baselines surveys in the North Atlantic being coordinated by the International Council for the Exploration of the Sea (ICES).

The final area of responsibility for the Department of Commerce under Title II provides for supporting research on alternative methods of waste disposal. With the exception of at-sea incineration, the major possibilities in this area involve land-based waste treatment technologies. The development of these technologies is presently outside of NOAA's background, mission, and technical competence. A larger number of research efforts, however, are being sponsored by other Federal agencies. Still, in order to be able to take responsible positions with respect to ocean disposal policies and alternatives, NOAA has maintained a continued awareness of the research and technology of alternative waste disposal methods. For the Department of Commerce to build a capability for developing alternative waste disposal methods to ocean dumping would clearly involve duplication of existing scientific and technical resources and programs of other Federal agencies. Consequently, we have placed priority on the earlier described ocean dumpsite studies and have deferred to EPA and the Corps of Engineers for the primary responsibility for the development of alternatives to ocean dumping.

Overall, Mr. Chairman, progress has been made since the enactment of Public Law 92-532 in 1972, considering the magnitude of the problem, the complexity of the ecological systems involved, and the geographic diversity of the coastal areas. As the Federal agency responsible for our Nation's living marine resources, we are particularly cognizant of the need to protect the quality of the habitat of these resources. Consequently, it is our desire that all harmful dumping be terminated as soon as possible.

Recognizing that alternative methods of waste disposal must be available before dumping can be terminated, we support the continuation of Title II for the purpose of assessing the effects of dumping. From such assessments can be derived the management decisions that will be necessary for the reduction or termination of dumping.

Regarding Section 202, of Title II, we believe that it is extremely important for our Nation to develop a capability for assessing the long-range effects of man's activities on the marine environment. This need will be with us for a long time to come. With the remarkable growth of activities which potentially can impact the marine environment, it is increasingly essential that each one be systematically assessed.

Mr. Chairman, this completes my statement. I would be pleased to answer any questions you or your colleagues may have.

Senator BEALL. Our next witness is Dr. Andrew Breidenbach, Assistant Administrator for Water and Hazardous Materials of the Environmental Protection Agency.

Mr. Breidenbach, you may proceed. Identify those with you and proceed with your testimony.

STATEMENT OF DR. ANDREW W. BREIDENBACH, ASSISTANT ADMINISTRATOR FOR WATER AND HAZARDOUS MATERIALS, ENVIRONMENTAL PROTECTION AGENCY; ACCOMPANIED BY JOHN RHETT, DEPUTY ASSISTANT ADMINISTRATOR FOR WATER PROGRAM OPERATIONS; AND KEN BIGLANE, DIRECTOR OF OIL AND SPECIAL MATERIALS CONTROL DIVISION

Dr. BREIDENBACH. This is my first appearance before your committee. It has been almost 3 years since the act went into effect.

I welcome this opportunity to discuss with you the progress that has been made under title I.

I am accompanied by John Rhett, Deputy Assistant Administrator for Water Program Operations; and Mr. Ken Biglane, Director of Oil and Special Materials Control Division of EPA.

The act was enacted in response to a national concern that the dumping of waste into the ocean was affecting the marine environment in an adverse manner. It is the policy of the MPRSA to regulate all ocean dumping and to prevent or strictly limit the ocean dumping of any material which would affect the marine environment adversely. To implement this policy, title I of the act establishes a system of permits to be administered by EPA and the Corps of Engineers to control dumping in ocean waters. The transportation from the United States of any radiological, chemical, or biological warfare agent, or high-level radioactive wastes for dumping in ocean waters, the territorial seas, or the contiguous zone is prohibited. Transportation for the purpose of dumping of other materials, except dredged materials, is prohibited unless the Administrator of EPA has issued a permit.

The Administrator is empowered to issue a permit after a determination by him that the dumping will not unreasonably degrade or endanger human health or the marine environment. The dumping of dredged material is regulated by the corps in consultation with EPA.

Title I also requires the Administrator to promulgate criteria for reviewing and evaluating permit applications, which must include an examination of the need of the proposed dumping and the alternatives available to the proposed dumping.

Because of time constraints, interim criteria were developed in April and May, 1973, based on the state of the knowledge at that time of the impact of waste materials on the marine environment. Final regulations and criteria, published in October of 1973, were based on initial operating experience with the program and on public comment on the interim documents. The criteria, which have been established largely from laboratory experimentation, are the basis upon which permits are issued or denied. They contain detailed quantitative test requirements and test procedures which are intended to estimate probable environmental effects of disposed materials.

Surveillance of dumping activities is assigned to the USCG by the act. The USCG's enforcement program is keyed to close surveillance of the disposal of toxic materials with spot checks of nontoxic material dumps. EPA has the authority to assess civil penalties for violation of permit conditions and there is also provision for

criminal action against persons who knowingly violate the act. The status of enforcement actions that EPA has taken under the MPRSA are shown in table I attached hereto.

In exercising its regulatory authority over ocean dumping, EPA has taken a strict, highly restrictive approach by requiring all dumpers to seek environmentally acceptable alternatives to ocean dumping even when their wastes have met the published EPA criteria for issuing permits. EPA has taken this approach because, while the criteria are adequate to base a short range determination of the impacts of waste materials on marine ecosystems, there is a general lack of specific knowledge concerning their long-range impacts.

Since 1972, EPA has brought all ocean dumping in the United States under full regulatory control and has required many dumpers either to stop dumping immediately or to phase out their dumping activities within the next few years. On the Atlantic coast alone, 75 former dumpers have ceased ocean dumping.

An additional eight dumpers are scheduled to be phased out of ocean dumping by June, 1976, and of the 24 industrial permittees now dumping in the Atlantic under permit from EPA region II, only six will not be phased out by December, 1977. Table II attached hereto shows all industrial dumpers already phased out. Table III attached hereto shows the phase-out schedule for remaining industrial dumpers.

Moreover, the cities of Philadelphia and Camden are required to end ocean dumping of sewage sludge by or before 1981. To meet the 1981 deadline, Philadelphia has a multifaceted program underway to select and implement alternatives. Land application of sludge to pasture land and strip mines is being instituted on a pilot basis and composting is being studied.

In addition, the city has begun a sludge giveaway program and is expending considerable effort in exploring various sophisticated technologies such as the wet oxidation of sludge.

The construction of a regional incinerator in 1980 should solve Camden's sludge disposal problem. In the interim, land application is being examined as an alternative to ocean dumping.

All other dumping of sewage sludge is by municipalities located in EPA region II and these municipalities are listed in table IV attached hereto. To meet the goal of ending dumping by 1981, EPA region II, in conjunction with the States of New York and New Jersey, has initiated a comprehensive program for development of land-based alternatives to ocean dumping for these municipalities. The first phase of the study, a technical examination of applicable alternative methods, was completed in June 1975. The report recommended that the most desirable alternative for the urban metropolitan area was dewatering of the sludge with filter presses followed by pyrolysis.

Current estimates indicate that the implementation of this process would cost one-half billion dollars.

The report also recommended that a small scale, pilot study be started immediately to develop engineering design parameters needed prior to full-scale demonstration. EPA will fund the pilot study during this fiscal year, using Federal Water Pollution Control Act funds.

Phase II, which is scheduled for completion in June 1976, will develop in specific terms a recommended technical plan for sludge management on a regional basis for the New York-New Jersey metropolitan area. This plan will include site locations, capital and operating costs, energy recovery, and an environmental impact assessment for the processes recommended in phase I.

The third phase, also under way and scheduled for completion in July 1976, will develop the legal and institutional arrangements for authorization and administration of the operating program identified in phases I and II.

The completion of this three-phase comprehensive study will provide the framework for implementation of a sound program of land-based alternatives to ocean dumping of sludge in the New York metropolitan area.

In the Gulf of Mexico, ocean dumping has decreased considerably as industries have been required to implement alternative methods of disposal. By the end of 1976, the volume of waste dumped in the gulf is anticipated to be 10 percent of the volume dumped in 1973.

In addition to a decrease in the number of dumpers, in 1975 the volume of wastes being dumped was decreased by almost 10 percent. Table V attached hereto shows the volumes of wastes dumped during the past 3 years.

Two recent decisions of Administrator Train—one in October of 1974 and one in September of 1975—have reflected our commitment toward phasing out the dumping of toxic pollutants.

In the 1974 decision, Mr. Train denied a permit to the Du Point Co. in Belle, W. Va., because there were inadequate scientific data upon which to make an informed judgment of the probable environmental effects of the proposed dumping. Since that time, Du Pont has conducted additional studies on the effects of dumping to support a new permit application. However, its application is being held in abeyance until further investigation can be made into alternatives to ocean disposal.

In the 1975 decision, Mr. Train upheld the decision of EPA Region III requiring the city of Philadelphia to phase out the ocean dumping of sewage sludge by 1981. The Administrator felt that the evidence presented had not demonstrated that there would be no endangerment to the environment if Philadelphia were allowed to continue dumping.

In addition, Mr. Train stated that methods of onland disposal of sewage sludge could be successfully implemented by Philadelphia.

Since 1972 studies and research on the marine environment have increased our scientific knowledge significantly. EPA is now on the verge of promulgating new criteria which will permit a more effective evaluation of permit applications.

We also have improved our techniques for conducting bioassays. Originally the brine shrimp, an organism not typical of the marine environment, was used as the test species. Now, marine organisms representative of sensitive biological groupings are being used including algae, copepods, clams, oysters, shrimp and various fish. As the state-of-the-art advances, it is anticipated that the use of additional species and the mixture of species to represent specific dump site ecologies will be possible.

Our state-of-the-art knowledge allows us to evaluate the immediate effects of pollutants on specific marine organisms but the long-range ecological effects of continued ocean dumping cannot be determined at the present time.

While our scientific and technical capabilities undoubtedly will continue to improve, we must recognize that regulating the ocean dumping of wastes is a small part of the problem of protecting the marine environment. Enormous volumes of wastes enter the ocean from a variety of other sources—directly from rivers and estuaries, from land runoffs and through ocean outfalls.

We also must recognize that the marine environment is a part of the total environment. Problems which affect the marine environment and solutions to these problems must be viewed in terms of their interrelation with the total environment. For example, EPA, under the mandate of the MPRSA, is in the process of phasing out ocean dumping, but this creates other environmental problems.

Some alternative form of disposal must be developed for each waste that is phased out of ocean dumping. Considerable research is going into the development of alternative methods of disposal, which will reduce the environmental effects of the ultimate disposal of the unavoidable residue—be it solid, liquid or gas—either on the land, in the water or in the air. We are concerned particularly about the problem of the ultimate disposal of sewage sludge, which will be produced in ever-increasing quantities as municipalities install more advanced forms of sewage treatment.

EPA, continuing the work of its predecessor agencies, has been developing environmentally acceptable methods for the disposal and management of municipal sludge since the enactment of the first Federal water pollution control laws. The study of alternatives for ocean dumping of municipal sludge normally has not been funded through the ocean dumping program, but under the Water Pollution Control Act since municipal sludge is an integral part of the sewage treatment process.

The initial phases of the research program were concerned with the characteristics and dewatering properties of primary and secondary sludge because of the need to dewater sludge before its ultimate disposal.

The current research and demonstration program emphasis has shifted toward development of improved technology for returning sludge to the environment in an ecologically acceptable manner. In fiscal year 1976, nearly $3 million were allocated on such programs, including secondary health and ecological effects of the alternatives to ocean disposal. The emphasis of these projects was on beneficial utilization, that is, land application for soil enhancement, crop production and reclamation of disturbed lands, the production of energy, and resource recovery.

EPA plans to continue its comprehensive program for municipal watsewater sludge management. This program will concentrate on demonstration of new technologies which will recycle or reuse sludges, or recover residuals contained in the sludges. For example, new technologies are being examined to determine if there are cost-effective methods for producing or recovering marketable products in the

processing of sludge. These products include metals recovery, organic acids, fertilizer bases, soil conditioner, methane, and the recovery of process heat.

Health effects research will include investigations into land application, disinfection, and composting. The health effects of airborne contaminants from incinerators and the improved technology for reducing or eliminating pollution emissions will be evaluated. It is also EPA's intent to continue cooperative agreements with other Federal, State and local agencies.

In addition to our research and demonstration programs, we are undertaking pilot studies for the design of new and innovative technologies for sludge, as well as studies of regional solutions to sludge issues. Presently over $11 million have either been obligated or are in the process of being committed for such studies. This work is being done under the Federal Water Pollution Control Act.

One alternative showing particular promise is the composting of sludge with various bulking agents such as wood chips, bark or solid waste. EPA has a joint project with the Department of Agriculture in Beltsville, Md., and is conducting an experimental program for composting in Bangor, Maine. Composting stabilizes the sludge and kills pathogens in the process.

The land area required for composting as a means of stabilizing sludges is small and in some cases an energy savings can be realized by using this method. The product resulting from composting has been shown to be an excellent soil conditioner while providing substantial fertilizer value.

Another alternative being used by many cities is the direct application of liquid or dried sludge to farmland or forests. We estimate that about 25 percent of the municipal sludges are currently being disposed of in this manner. This method has been frequently used to provide all or part of the fertilizer requirements for growing forage crops and grain. Such direct applications of sludge have also been used to reclaim strip mined or otherwise disturbed lands [shifting sand dunes, mine spoils, et certera].

EPA has initiated studies to survey the results of such city programs to better document current nationwide practices in land application of a series of manuals and bulletins explaining this method of sludge management and setting forth the steps necessary for its implementation.

Composting and direct application of sludge are examples of alternative methods of sludge management where the nutrient value of the sludge is being used. One firm is working with adding nitrogen to the sludge so that it becomes a high grade fertilizer.

Another option for this beneficial use of sludges that has been an accepted practice in several areas of the country for many years is the commercial operator who simply bags dried sludge and sells it as a soil conditioner.

However, any disposal/management alternative which results in sludge being applied to the land creates the potential for pollutants, particularly trace metals and nitrates, to reach into ground water or enter the food chain. To date, no link to adverse health effects from land application has been demonstrated by our research efforts, but work is continuing in this area.

In urban areas where the scarcity of open land inhibits the employment of any alternatives using land application, pyrolysis may be the answer. Pyrolysis is the thermal decomposition of materials into gases, liquids, and char in the absence or near absence of oxygen. The gases and liquids can be used as a fuel and the char is amenable to landfill disposal. A pilot study at Orange County, Calif., is being designed to convert the sludge pyrolysis char into activated carbon. This carbon will then be used to treat the sewage. In this way it may be possible to eliminate the conventional activated sludge system with a substantial savings in energy.

A pilot pyrolysis plant converting solid waste has been built by EPA in conjunction with the city of Baltimore, Md. At present, the operation of the plant is pending the correction of technological problems encountered during the plant's trial run.

A pyrolysis system using solid waste, sludge and coal is being developed in South Charleston, W.Va., with the aid of an EPA grant.

In addition, EPA is in the process of granting $186,000 to New York City for the conversion of an incinerator into a pyrolysis plant for sewage sludge. Once constructed, it is expected that the plant will consume more energy to operate than a traditional sludge incineration plant but air pollution problems should be significantly reduced and the residue will be of better quality for landfill disposal. However, until pyrolysis is perfected, traditional sludge incineration may be the best sludge disposal alternative for many urban areas.

At present, the elimination of ocean dumping is a laudable goal. We must continue to pursue alternative methods of waste disposal. However, there are many remaining unanswered questions regarding the overall problem of the pollution of the marine environment, what we know about it, and what are the impact of alternative methods of disposal. There may be circumstances where ocean dumping of certain wastes may cause no harm to the ocean or may be the most overall environmentally acceptable solution.

Thus, while we are continuing to scrutinize carefully all applications for ocean disposal permits to insure that harmful dumping is eliminated as rapidly as possible, we are investigating the broader issue of sludge utilization or disposal to develop the most environmentally acceptable waste management program.

This concludes my prepared remarks. I will be happy to answer any questions.

[The tables follow:]

TABLE I.—ENFOFCEMENT ACTIONS

Order No. and respondent's name	Referral from	Type of violation	Notice of violation	Disposition	Disposal site
REGION I					
Safety Projects & Engineering Co	EPA	Failed to containarize wastes as specified in permit.	February 20, 1975	$1,500 penalty paid agreed to meet specs.	Region industrial dump site.
REGION II					
73-1—General Marine Transportation Corp	EPA	Permit condition. Dumping without a permit.	November 21, 1973	Final order, May 15, 1974, hearing officer upheld General Marine on both counts.	Sewage sludge.
74-1—Moran Towing & Transport Co	USCG	Dumped outside authorized dump site	January 23, 1974	Final order, May 27, 1975, $25,000 penalty payment. Appealed U.S. district court.	Acid wastes.
74-2—Modern Transportation Co	USCG	do	April 2, 1974	Final order, Jan. 22, 1975, charges withdrawn.	Sewage sludge.
74-3 and 74-5—Pollution Control Industrial	USCG	do	April 16, 1974	Final orders, September 13, 1974, $40,000 penalty and install additional equipment on towing vessel and barges.	Chemical wastes—PR.
74-4—Spentonbush Transport Service, Inc	USCG	do	June 6, 1975	Pending	Chemical wastes.
75-1—Clerical error—No investigation necessary.					
75-2—Modern Transportation Co	EPA	Higher concentration of several parameters than that reported in the permit application.	March 5, 1975	do	Do.
75-3—Chemical Recovery, EPL Industrial	EPA	do	do	do	Do.
75-4—Nassau County	EPA	Failed to segregate waste	May 6, 1975	Final order, June 16, 1975, no penalty; ordered to terminate dumping of industrial wastes.	Sewage sludge.
75-5—Moran Towing & Transport Co	NASA EPA	Dumped outside authorized dump site	August 14, 1975	Pending	Acid wastes.
75-6—Pfizer Pharmaceutical, Inc	EPA	Exceeded volume limit	do	Final order, August 28, 1975, $5,000 penalty payment.	Chemical wastes—PR.
75-7—PCI International, Inc	EPA	do	do	Final order, December 3, 1975, $3,000 penalty payment.	Do.
75-8—P.R. Olefins Co	EPA	do	September 4, 1975	Final order, September 19, 1975, $4,000 penalty payment.	Do.
75-9—PCI & McAllister Bros	USCG	Dumped outside authorized dump site	December 11, 1975	Pending	Do.
REGION VI					
VI-OD-01—Ethyl Corp	USCG	Violated reporting and dumping conditions.	December 9, 1975	$1,500 penalty payment	Mississippi River site.
REGION IX					
H-10 Water Taxi Service	EPA	Dumping outside authorized dump site	October 1974	Permit not reviewed, $1,500 penalty payment.	Garbage site.

TABLE II.—OCEAN DUMPING PERMITS NOT GRANTED OR BEING PHASED OUT

Region and company	Location	Date phased out or denied
1. II—Benjamin Moore & Co	Newark, N.J. 07105	Before April 1973.
2. II—Chester Packing Co., Inc	Chester, N.Y. 10918	Do.
3. II—Childers Products Co	Bristol, Pa. 19007	Do.
4. II—Clairol, Inc	Stamford, Conn. 06904	Do.
5. II—Debell & Richardson	Enfield, Conn. 06802	Do.
6. II—Dow Chemical Service	Stoneham, Mass. 02180	Do.
7. II—Drake Bakeries	Wayne, N.J. 07470	Do.
8. II—Drew Chemical	Boonton, N.J. 07005	Do.
9. II—Electro-Nucleonics, Inc	Fairfield, N.J. 07006	Do.
10. II—Engelhard Industries	Newark, N.J. 07015	Do.
11. II—Fedders Corp	Edison, N.J. 08817	Do.
12. II—Ford Motor Co	Mahwah, N.J. 07430	Do.
13. II—Gamlen Chemical Co	Elmwood Park, N.J. 07407	Do.
14. II—Heinzelmen & Sons	Carlstadt, N.J. 07072	Do.
15. II—B. Horstmann Co	East Hanover, N.J. 07936	Do.
16. II—I.C.I. America, Inc	Bayonne, N.J. 07002	Do.
17. II—International Paper	Whippany, N.J. 07981	Do.
18. II—Ivers-Lee Co	West Caldwell, N.J. 07008	Do.
19. II—Koppers Co., Inc	Kearny, N.J. 07032	Do.
20. II—Lehn & Fink, Co	Belle Mead, N.J. 08502	Do.
21. II—L. & M. Trucking Corp	Kenilworth, N.J. 07033	Do.
22. II—Makar Trucking Co	Mendham, N.J. 07945	Do.
23. II—National Can Corp	Piscataway, N.J. 08854	Do.
24. II—NL Industries, Inc	Pedricktown, N.J. 08067	Do.
25. II—Norton & Sons, Inc	Bayonne, N.J. 07002	Do.
26. II—New York Twist Drill Manufacturing Corp	Ramsey, N.J. 07446	Do.
27. II—The Parker Co	Wayne, N.J. 07470	Do.
28. II—G. Redner, Inc	Wanaque, N.J. 07465	Do.
29. II—Sandoz-Wander, Inc	East Hanover, N.J. 07936	Do.
30. II—Three Star Anodizing Corp	Beacon, N.Y. 12508	Do.
31. II—Universal Oil Products	East Rutherford, N.J. 07073	Do.
32. VI—E. I. duPont de Nemours	La Place, La. 70068	November 1973.
33. I—Pratt & Whitney	East Hartford, Conn. 06108	Do.
34. II—Biocraft Corp	Waldwick, N.J. 07463	Do.
35. II—Alcholac, Inc	Ossing, N.Y. 10562	Do.
36. II—Everlon Fabrics Corp	Closter, N.J. 07624	Do.
37. II—The Ansul Co	Marinette, Wis. 54143	January 1974.
38. II—Consolidated Edison Co	New York, N.Y. 10003	Do.
39. II—BASF Wyandotte Corp	South Kearny, N.J. 07032	Do.
40. II—The Clorox Co	Jersey City, N.J. 07305	Do.
41. II—Gaess Environmental Services Corp	Passaic, N.J. 07055	Do.
42. II—Bell Telephone Laboratories	Whippany, N.J. 07981	Do.
43. II—Amerada Hess Corp	Woodbridge, N.J. 07095	Do.
44. II—Riegel Products Corp	Milford, N.J. 08848	Do.
45. II—General color Co	Newark, N.J. 07114	April 1974.
46. II—J. M. Huber Corp	Edison, N.J. 08817	Do.
47. II—Lily-Tulip	Holmdel, N.J. 07733	Do.
48. II—The National Lockwasher Co	North Branch, N.J. 08876	Do.
49. II—Howmedica, Inc	Rutherford, N.J. 07070	Do.
50. II—Celanese Coatings Co	Belvidere, N.J. 07823	Do.
51. II—American Cyanamid Co	Pearl River, N.Y. 10965	Do.
52. II—Green Village Packing Co	Green Village, N.J. 07960	Do.
53. II—The Mennen Co	Morristown, N.J. 07960	Do.
54. II—Weyerhaeuser Co	Closter, N.J. 07624	Do.
55. II—Wilson Products Co	Neshanic, N.J. 08853	Do.
56. II—American Cyanamid Co	Bound Brook, N.J. 08805	Do.
57. II—Kimberly-Clark Corp	Spotswood, N.J. 08884	Do.
58. II—St. Regis Paper Co	West Nyack, N.Y. 10994	Do.
59. II—Hercules, Inc	Kenvil, N.J. 07847	Do.
60. II—Dow Chemical	Mount Holly, N.J. 08060	Do.
61. IX—H-10 Water Taxi	San Pedro, Calif. 90733	September 1974.
62. VI—E. I. duPont de Nemours	Belle, W. Va. 25015	October 1974.
63. II—A. & S. Transport Co	South Kearny, N.J. 07032	December 1974.
64. VI—GAF Corp	Texas City, Tex. 77590	Do.
65. I—Pine State By-Products, Inc	S. Portland, Maine 04106	January 1975.
66. VI—E. I. du Pont de Nemours	LaPorte, Tex. 77571	Do.
67. VI—E. I. du Pont de Nemours	Beaumont, Tex. 77704	February 1975.
68. II—Blue Ridge-Winkler Textiles	Bangor, Pa. 18102	June 1975.
69. II—The Nestle Co., Inc	Freehold, N.J. 07728	Do.
70. II—U.S. Radium Corp	Hackettstown, N.J. 07840	Do.
71. II—Tenco Division of the Coca-Cola Co	Morris Plains, N.J. 07950	Do.
72. II—Warner-Lambert Co	do	Do.
73. II—Mycalex Corp	Clifton, N.J. 07011	Do.
74. II—Worthington Biochemical Corp	Freehold, N.J. 07728	Do.
75. II—Howmet Corp	Dover, N.J. 07801	Do.
76. II—Sherwin Williams Co	Newark, N.J. 07101	Do.
77. II—William Schaeffer Septic	Pequannock, N.J. 07101	Do.
78. III—Sun Oil Co	Marcus Hook, Pa. 19061	July 1975.
79. II—Solvents Recovery Services	Linden, N.J. 07036	Do.
80. II—Eagle Extrusion Corp	Dover, N.J. 07801	Do.
81. II—Chevron Oil Co	Perth Amboy, N.J. 08861	October 1975.

TABLE III.—PERMITTEES ON IMPLEMENTATION PLANS TO PHASE OUT OCEAN DUMPING

Company	Location	Phaseout date
Region II:		
American Cyanamid Co	Linden, N.J	1979
Middleton Sewer Authority	Belford, N.J	1981
Passaic Valley sewerage commissioners	Newark, N.J	1981
Allied Chemical Corp	Morristown, N.J	1981
The Upjohn Manufacturing Co	Barceloneta, P.R	1978
E. I. duPont de Nemours	Linden, N.J	1981
City of Long Beach	Long Beach, N.Y	1981
Middlesex Co. Sewerage Authority	Sayreville, N.J	1981
New York City	New York, N.Y	1981
Merck & Co., Inc	Rahway, N.J	1981
Abbott Chemicals, Inc	Barceloneta, P.R	1978
NL Industries, Inc	South Amboy, N.J	1981
Modern Transportation Co	South Kearny, N.J	1981
Bergen Co. Sewerage Authority	Little Ferry, N.J	1981
Linden Roselle Sewerage Authority	Linden, N.J	1981
Elizabeth Joint Meeting	Irvington, N.J	1981
Pfizer Pharmaceuticals, Inc	Barceloneta, P.R	1978
Merck Sharp & Dohme	do	1978
County of Nassau	Mineola, N.Y	1981
County of Westchester	White Plains, N.Y	1981
West Long Beach Sewerage District	Atlantic Beach, N.Y	1981
Oxochem Enterprises	Ponce, P.R	1978
Puerto Rico Olefins Co	do	1978
Whippany Paper Board Co	Whippany, N.J	1977
Sobin Chemicals Co	Newark, N.J	1977
International Wire Products	Wyckoff, N.J	1977
City of Glen Cove	Glen Cove, N.Y	1981
Arrow Group Industries	Haskell, N.J	1976
Reheis Chemical Co	Berekley Heights, N.J	1977
Bristol Alpha Corp	Barceloneta, P.R	1978
M/M Mars	Hackettstown, N.J	1977
The Coca-Cola Co	Highstown, N.J	1976
Curtiss-Wright Corp	Fairfield, N.J	1976
Norda, Inc	East Hanover, N.J	1976
S. B. Penick & Co	Montville, N.J	1977
Pfizer, Inc	Parsippany, N.J	1977
J. T. Baker Chemical Co	Phillipsburg, N.J	1977
Fritzsche Dodge & Olcott	Clifton, N.J	1976
Mallinckrodt & Baker	Morristown, N.J	1977
Caldwell Trucking Co., Inc	Fairfield, N.J	1981
Schering Corp	Manati, P.R	1978
American Cyanamid Co	Wayne, N.J	1976
S. B. Thomas, Inc	Totawa, N.J	1976
General Marine	Bayonne, N.J	1981
Crompton Knowles	Reading, Pa	1981
Region III:		
City of Camden	Camden, N.J	1981
City of Philadelphia	Philadelphia, Pa	1981
E. I. duPont de Nemours	Edge Moor, Del	1978

TABLE IV.—MUNICIPAL OCEAN DUMPERS IN EPA REGION II
SEWAGE SLUDGE—NEW YORK BIGHT

[Weight, in dry tons]

	1973	1974	1975 (estimate)
Bergen County Sewer Authority	285,000	237,000	293,000
Joint Mtg. of Essex and Union Counties	121,000	138,000	145,000
Linden Roselle Sewerage Authority	63,000	82,000	77,000
Middlesex County Sewerage Authority	402,000	427,000	383,000
Middletown Sewerage Authority	22,000	13,000	23,000
Passaic Valley sewerage commissioners	702,000	750,000	600,000
City of Glen Cove			4,128
City of Long Beach	24,000	24,000	24,000
Nassau County	293,000	295,000	410,000
Westchester County	100,000	100,000	133,000
West Long Beach Sewer District	4,000	4,000	4,000
New York City	3,230,000	2,372,000	2,370,000
Modern Transportation Co	308,000	383,000	242,000
General Marine Transport Corp	37,000	41,000	65,544
Total	5,600,000	4,860,000	4,771,000

TABLE V.—OCEAN DISPOSAL: TYPES AND AMOUNTS, 1975,[1] 1974,[2] AND 1973[3]

[In tons, approximate]

Waste type	Atlantic			Gulf			Pacific			Total		
	1975	1974	1973	1975	1974	1973	1975	1974	1973	1975	1974	1973
Industrial waste	3,322,300	3,642,000	3,642,800	123,700	950,000	1,408,000	0	0	0	3,446,000	4,592,000	5,050,800
Sewage sludge	5,039,600	5,010,000	4,898,900	0	0	0	0	0	0	5,039,600	5,010,000	4,898,900
Construction and demolition debris	395,900	770,400	973,700	0	0	0	0	0	0	395,900	776,400	973,700
Solid waste	0	0	0	0	0	0	0	200	240	0	200	240
Explosives	0	0	0	0	0	0	0	0	0	0	0	0
Total	8,757,800	9,422,400	9,515,400	123,700	950,000	1,408,000	0	200	240	8,881,500	10,372,600	10,923,640

[1] 1975 source: EPA regional offices. Preliminary figures from unpublished reports, 1975 (12 mo of dumping activity).

[2] 1974 source: EPA regional offices. Unpublished reports, updated information, 1974 (12 mo of dumping activity).

[3] 1973 source: EPA regional offices. Unpublished reports, 1973 (8 mo of dumping activity, May to December 1973 under permits issued by ocean disposal program extrapolated for 12 mo to provide an annual rate).

Senator BEALL. Thank you, Dr. Breidenbach.

Of course, your supplementary tables have been included in the record, along with your remarks.

You supplied us a list of enforcement actions. Are they the same enforcement actions that we have heard about earlier from GAO?

Dr. BREIDENBACH. Yes; but I believe this list includes the enforcement actions in all of the regions.

Senator BEALL. It is all of them?

Dr. BREIDENBACH. Yes.

Senator BEALL. What you have supplied here is a record of the disposition of all of the alleged violations?

Dr. BREIDENBACH. The USCG refers all alleged violations to us which we then investigate. If a violation has occurred, we issue a notice of violation. The attached table on enforcement actions shows all notices of violation that we have issued. To facilitate prosecution of violators, one notice of violation may encompass several violations which the dumper had allegedly committed.

Senator BEALL. You spoke about the alternatives and mentioned things that are going on. Is this all inclusive, the listing of alternatives or are there other things going on not listed in your testimony?

Dr. BREIDENBACH. I have listed the major ones.

Senator BEALL. How many dollars is EPA spending each year or has EPA spent each year since the passage of the act on the examination of alternatives to ocean dumping?

Dr. BREIDENBACH. EPA has spent almost $3 million per year in the research and development of alternative methods of sludge disposal.

Senator BEALL. Per year?

Dr. BREIDENBACH. There has been a total of $11 million spent in demonstration programs for the management of sludge in a variety of different modes which would include the alternatives that are applicable for ocean dumping. This work is being done under the Water Pollution Control Act.

Senator BEALL. Are you satisfied with the level and quality of the research on alternatives?

Dr. BREIDENBACH. The sooner we move toward creating prototype demonstrations which actually create the design factors on which plants can be built for various sludge disposal problems, the quicker the problem will be eliminated.

Senator BEALL. How do you feel about your relationship with NOAA?

Dr. BREIDENBACH. I think the relationship has been very good. NOAA made their case in the testimony just preceding. The expertise required to develop ocean disposal alternatives is not particularly a part of NOAA's compliment. Our staff is more capable in that area, both in headquarters and in the regions. We have worked out agreements with NOAA and we feel that the information coming from them has a great value.

Senator BEALL. Dr. Eschwege in his testimony talked about the level of mercury and cadmium being dumped by the permit holders in New York, northern New Jersey and Philadelphia area. He indicated this practice was occurring because EPA regulations allow the dumping of mercury or cadmium in excess of the safety levels in certain permits.

Because of this, mercury and cadmium is being dumped into the ocean. Much concern has been expressed that mercury and cadmium are accumulating in the fish and shellfish. For example, in 1973 clams and scallops taken from the areas surrounding the dump site contained high levels of mercury and cadmium.

Dr. BREIDENBACH. I can make a general comment and perhaps Mr. Rhett or Mr. Biglane would like to add to it. Sludge is generated day after day, week after week, and month after month. The first requirement is that one must have a manner to dispose of it. In the least-populated areas of the country, land disposal is a viable method of disposal. In the heavily populated New York and Philadelphia areas, land disposal, while it may prove to be viable with some of the alternatives we are developing, is still a tenuous and difficult operation.

The permits are interim permits. They are provided for a short time period, in no case exceeding 1 year. For example, the Philadelphia permit will come up for public hearing in Georgetown, Del., on April 28 and 29. At that time a full public hearing process will be gone through in order that all concerned may hear what the alternatives are.

It is true that in some cases, the amounts of cadmium and mercury exceed the deadlines or standards. They are not regulations in the true sense.

We are moving on as rapid a schedule as we consider possible to phase out ocean dumping of toxic substances.

Senator BEALL. Well, Baltimore, for instance, has resolved their sludge problem.

Dr. BREIDENBACH. Yes, sir.

Senator BEALL. Part of this, I guess, is because of the pyrolysis

Mr. RHETT. It is primarily incineration.

more has done this, why can't Philadelphia do the same thing?

Senator BEALL. It is others generally. I can't understand if Balti-

experiment.

Mr. RHETT. Sir, I believe Philadelphia can. The question is strictly a matter of timing.

Senator BEALL. A matter of what?

Mr. RHETT. A matter of timing, how long it takes to move to the other alternatives—be it the procurement of land or the construction of pyrolysis plants or items of this nature. There are a number of encouraging factors particularly in the Philadelphia situation. The composting in Beltsville is an example. The various alternatives available to Philadelphia will be examined at the hearings on the 28th and 29th of April. Philadelphia will display its schedule for phasing out ocean dumping and the implementation date for each different method that they plan to use. So, I think it is strictly a matter of timing.

Some municipalities have been involved in ocean dumping for a considerable period of time—as an example, Philadelphia started in 1961.

Baltimore started much earlier than Philadelphia to use methods of sludge disposal other than ocean dumping.

Senator BEALL. There is no question in EPA's mind that ocean dumping is an undersirable alternative and must be phased out.

Dr. BREIDENBACH. The ocean dumping of toxic substances must be phased out.

Senator BEALL. Do you think your present budget request of fiscal 1977, does that represent a figure that you think is optimal in the resolving of the problem of ocean dumping?

Dr. BREIDENBACH. We would have difficulty commiting additional funds beyond that amount in an effective manner. I think that is an optimal sum.

Senator BEALL. How many ocean dumping permits recommended by the corps have been denied by EPA? If you don't have that statistic, maybe you can supply it for the record.

Dr. BREIDENBACH. I do not have that information but perhaps Mr. Rhett does.

Mr. RHETT. In answer to your question, I do not believe there have been any denials of corps permits primarily because of the extremely close working relationship between the corps and each one of our regional offices. As a permit is being developed the corps and our regional officers work jointly.

Senator BEALL. Any difficulties are worked out prior to that time?

Mr. RHETT. Yes, sir.

Senator BEALL. What is the relationship within EPA of its activities under the Ocean Dumping Act on the one hand and the Clean Water Act on the other?

Dr. BREIDENBACH. The relationship is a good one. Within my office and particularly Mr. Rhett and Mr. Biglane's activities, we are in constant communication with the activities of the regional offices of EPA who administer the ocean dumping permit program. Also under Dr. Talley, the Assistant Administrator for Research and Development, there is a group of research laboratory scientists located mainly in Corvallis, who are working on the ecological effects and human health effects issue as related to ocean dumping.

The communication within the Agency on this is very good at present. However, Mr. Rhett and I have agreed that improvements can still be made. We plan before the beginning of the next fiscal year to take steps to make some improvements.

Senator BEALL. We appreciate your coming this morning.

Thank you.

Our next witness is Col. Robert Hughes, Assistant Chief of Construction-Operations Division, Office of the Chief of Engineers, Department of the Army.

Colonel Hughes?

STATEMENT OF COL. ROBERT B. HUGHES, ASSISTANT CHIEF, CONSTRUCTION-OPERATIONS DIVISION, OFFICE OF CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY; ACCOMPANIED BY RONALD ALLEN, OFFICE OF THE CHIEF OF ENGINEERS' CHIEF COUNSEL; AND LT. DICK FRANKS, U.S. COAST GUARD

Colonel HUGHES. Mr. Chairman and members of the committee, I am Col. Robert B. Hughes, Assistant Chief of the Construction-Operations Division, Office of the Chief of Engineers, Department of the Army.

I am accompanied this morning by members of the OCE staff.

On my right is Mr. Ronald Allen, Office of the Chief of Engineers' Chief Counsel.

On my left I have Lt. Dick Franks, U.S. Coast Guard. He is working with the corps in an officer exchange program, and working very closely with the subject at hand.

I shall restrict my remarks to the Department of the Army's views on S. 3147 as requested by the committee. However, I'm prepared to present a short summary of the corps' regulatory program, regarding the transportation of dredged material for the purposes of dumping in the ocean; or if it would please the committee, I'm prepared to supply such information for the record, as you may request.

I appreciate the opportunity to testify on behalf of Chief of Engineers and the Army, regarding S. 3147, a bill to amend the Marine Protection, Research, and Sanctuaries Act to authorize appropriations to carry out the provisions of the act during the transition period—July 1, through September 30, 1976—and in fiscal year 1977.

The corps is not directly affected by this bill. S. 3147 provides authorizations for appropriations to EPA; it does not provide any authorizations for appropriations to the corps. Thus, the corps defers to the views of EPA regarding the merits of the bill.

Though the corps is not funded through this committee, we do perform considerable activities related to the Marine Protection, Research and Sanctuaries Act.

Collectively, the corps is seeking approximately $4 million in fiscal year 1977 to carry out responsibilities under the act. These funds are being budgeted for under the following three areas of our civil works operations and maintenance general appropriation:

First: We estimate that about 1.5 percent of our general regulatory funds in fiscal year 1977 will be used for ocean dumping related work. This will amount to over $0.5 million.

Second: The corps is conducting a 5-year congressionally authorized dredged material research program at our Waterways Experiment Station in Vicksburg, Miss. Regarding funds, we are seeking a total of $6 million in fiscal year 1977, of which we estimate that approximately $3 million will be of direct benefit to ocean dumping research.

Our third source of ocean dumping related funding is from our operations and maintenance appropriations for specific channel and harbor projects. Some of the project funds will be used, as required, for sampling, laboratory testing, and monitoring dredged material at individual project locations. I cannot give you an exact figure; however, we estimate that not more than $0.5 million will be spent on these activities.

Mr. Chairman, this completes my statement. I will, of course, be pleased to answer any questions that you may have.

Senator BEALL. Thank you, Colonel.

I understand that about 90 percent of all of the dumping in the oceans of our shore is the responsibility of the corps, in that it represents dredged material, generally.

Colonel HUGHES. Generally, 80 to 85 percent is the figure I have heard, and consider generally valid.

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Senator BEALL. With regard to permits, of course, non-Federal dumpers have to get permits from the corps; is that right?

Colonel HUGHES. That is correct.

Senator BEALL. Are the same standards applied to the Federal and non-Federal dumpers?

Colonel HUGHES. Yes, sir, the act requires that we issue ourselves permits or that we issue regulations that we must apply to ourselves.

In this case, we have issued ourselves regulations.

Senator BEALL. The regulations are the same as those applied to the non-Federal groups?

Colonel HUGHES. That is correct.

Senator BEALL. Who reviews those?

Colonel HUGHES. With our corps projects, they are reviewed by the district engineer; and in and during the evaluation, planning process and review process of the project itself.

The manner in which the disposal operations take place, the location, the timing of the year, these factors are all considered in the environmental impact statement and these factors are coordinated with all Federal agencies to include EPA, and inland and ocean fishery services.

Senator BEALL. EPA has an input?

Colonel HUGHES. Definitely they do. In the ultimate, they have a veto over our issuance. Let's say, of a statement of findings, in the case of a Federal project which we use instead of a permit.

Senator BEALL. For a project basis?

Colonel HUGHES. For a project basis; that's right.

Senator BEALL. Under the Dumping Act NOAA and EPA are required to submit annual reports to the Congress on the act itself under the act.

The corps doesn't have that responsibility.

What would your remarks be to mandating that the corps submit annual reports to the Congress of their activities?

Colonel HUGHES. We have been asked that question many times.

We feel that we supply input both to EPA and NOAA in our reports. We are working jointly with them. So, the information we supply to them would be our report and, personally, we feel that eliminating a number of reports is much better than adding additional administrative burden on us.

We work with the reporting agencies and provide the information they desire.

Senator BEALL. Thank you for your testimony.

Our next witness is Capt. E. P. Schubert, Chief, Environmental Protection Division, U.S. Coast Guard.

You may proceed as you wish.

STATEMENT OF CAPT. FREDERICK P. SCHUBERT, CHIEF, MARINE ENVIRONMENTAL PROTECTION DIVISION, U.S. COAST GUARD; ACCOMPANIED BY COMDR. JAMES H. COSTICH, CHIEF, SURVEILLANCE AND MONITORING BRANCH

Captain SCHUBERT. Good morning, Mr. Chairman.

I am Capt. Frederick P. Schubert, Chief of the Marine Environ-

mental Protection Division, USCG. With me is Comdr. James H. Costich, who is Chief of the Surveillance and Monitoring Branch in my division.

With your permission, I would like to read our entire statement which is realtively short. It summarizes the USCG's activities in this program area.

Under title I of the act, the USCG has been delegated the responsibility to conduct surveillance and other appropriate enforcement activity to prevent unlawful ocean dumping. More specifically, we see our role as that of insuring that ocean dumping is conducted under an effective EPA or corps permit, or COE statement of findings, that the material is dumped at the location and in the manner specified within the permit, and that the material meets the criteria outlined in the permit.

Our enforcement program objective is close surveillance of the transportation and dumping of toxic materials [those materials dumped at EPA's toxic waste sites] and spot checks of all other disposal activities. Surveillance methods operationally available include the escort or interception of dumping vessels by USCG vessels or aircraft, the comparing of dumper's logs with permits and USCG notification and sighting logs, the use of shipriders to ascertain position and dumping rate, and in the San Francisco area, the use of vessel traffic services [VTS] radar.

From April 1973 through December 1975, 720 toxic and 19,568 nontoxic dumps were reported to the USCG during that period 1,511 disposal surveillance missions were conducted, 41 cases have been referred to EPA for penalty action, encompassing 163 apparent violations. The majority of these violations wree failures by the dumpers to notify the USCG properly of their intended departure and estimated time of arrival at the prescribed site. Almost all of these failure to notify violations occurred in the early states a new effort such as this. Only two failure to notify violations have occurred since 1973.

The USCG has continued to emphasize that proper notification is vital to an effective surveillance program, both from an operational and a deterrent standpoint. Of the remaining violations, 10 involved dumping outside of the prescribed dump site. We have provided for the record a breakdown of the various violations investigated and referred to EPA through December 1975.

We fell our surveillance of nontoxic disposal activity has been generally effective. Efforts are currently underway to fill billets specifically identified for our ocean dumping activities, with officers at selected district offices and with enlisted personnel having the navigation experience required of shipriders at the appropriate field units. When this has been accomplished, we believe our program will become even more effective.

Dedicated ocean dumping surveillance and enforcement personnel at our field units will allow us to provide increased attention to toxic surveillance primarily through shipriding. At present, use of shipriders is the most cost-effective method of insuring compliance with provisions of a permit. However, it is a personnel intensive method of enforcement and must be supplemented by vessel or aircraft patrols as sole reliance upon shipriders provides no lasting deterrent. Our on-

going research and development effort to provide an electronic "ocean dumping surveillance system" [ODSS] will eliminate the requirement for shipriders on all vessels carrying such a black box. We do not anticipate requiring the ODSS on board vessels engaged in one-time, or very infrequent dumping, and may exempt from the requirement vessels operating in areas covered by radar or other continuous surveillance.

EPA presently requires dumpers to submit samples for chemical analysis. There is little or no assurance, however, that the sample submitted was properly drawn, that it was not altered, or that it was even drawn from the load to be dumped. We have not encouraged sample taking by USCG personnel due to the training and indoctrination that would be required in sampling methods and hazards associated with the various types of vessels and materials. As the dump vessel personnel already have the necessary expertise, we feel that the most cost-effective method of discouraging submission of nonrepresentative samples is the utilization of USCG personnel to randomly oversee the sample taking, and certify the samples as having been taken in accordance with EPA instructions.

The USCG's ocean dumping surveillance efforts have been directed primarily toward activity by dumpers holding EPA or COE permits. Approximately 85 percent of the U.S. ocean dumping is associated with COE Federal dredging projects, which are authorized under statements of findings rather than by permits. The great majority of this activity is conducted by COE vessels. We are presently involved in discussions with the corps to determine the extent of their supervision of their contract vessels. If this supervision does not extend to insuring that their contract vessels dispose of dredged material at the approved sites, we will, of course, have to expand our present surveillance to randomly monitor these activities as well.

Work on the previously mentioned ocean dumping surveillance system is processing well. Two prototype systems were installed last summer on two dumping vessels operating out of New York. One system was installed on board the New York City sewage sludge tanker *North River;* the other system was installed on board the commercial tug *Stamford* which periodically transports wastes to the toxic waste site approximately 120 miles southeast of New York. The system consists of an automatic Loran-C receiver, a clock, and a recorder which records time versus position. The recorder tape can be read by computers at our district offices and, when desired, the computer can provide a graphic display of the vessel's voyage. Through this data, we can ascertain that the dumper traveled to the proper site and remained for a period of time consistent with his volume and required discharge rate. We anticipate the addition of a dump valve or dump door sensor to the next generation prototype or first operational system so that the actuation of the dumping mechanism will also be recorded. The Loran-C receivers continuously display two Loran-C time delay signals in digital form, so that the vessel's navigator has only to apply these readings to his Loran-C chart to obtain a rapid and accurate two-line fix.

If and when the ODSS is adopted, our ability to conduct surveillance at night will be greatly enhanced, as we presently are limited primarily

to search and rescue-related resources for night surveillance. The system will similarly enhance our effectiveness during other periods of reduced visibility when, as at night, unlawful dumping is most likely to occur. Two factors cause us to view this "black box" surveillance method as only supplemental to present means of surveillance. First, it is not "real time" surveillance. The recorded data must be retrieved and analyzed after the dumper has completed his mission and returned to port. The second, and related, factor is the question of the acceptability and sufficiency of the system's tapes as sole evidence. At worst, however, this source of information should alert USCG to the few dumpers who may warrant closer attention, thereby permitting the most effective utilization of operational resources. Obviously, too, it should provide a significant degree of deterrent to intentional violations. We believe that the cost per system can be kept below $10,000. We expect that the transporter will be required, via conditions within his permit, to purchase and maintain a system. Tapes would be furnished by USCG.

Ocean dumping surveillance is part of the marine environmental protection program. The associated costs or expenditures for ocean dumping surveillance are included in the budget for the parent program, and therefore can only be approximated. The estimated operational expenses appropriation and expenditure data for surveillance activities from fiscal year 1973 through 1976 have been submitted for the record. In this regard it should be noted that the $41,000 provided in the fiscal year 1975 budget represents the first opportunity for the Coast Guard to request funds to meet this new requirement and that until these funds were appropriated, we funded our efforts by temporarily reducing the scope of other activities. The fiscal year 1976 budget has $275,000 for this program. This brings the total directly appropriated funds for this effort to $316,000. We expect our research and development activities in support of this effort to total approximately $190,000 in fiscal year 1976.

You have under consideration S. 3147, a bill to authorize appropriations to carry out the provisions of the Marine Protection, Research, and Sanctuaries Act for fiscal year 1977. USCG does not receive authorization for appropriations under the act being amended and defers to the views of the Environmental Protection Agency and the Department of Commerce regarding the specific funding of these programs. Funding for USCG activities is appropriated as part of our overall budget in any particular year.

Under title II authority, USCG continues to cooperate with other agencies—EPA and NOAA—in their research on the effects of ocean dumping and other man-induced changes to ocean ecosystems. Interagency agreements provide for USCG support in these joint activities. Under title III, providing for designation of marine sanctuaries, USCG is working with NOAA toward effective enforcement of present and proposed sanctuary regulations.

Thank you, Mr. Chairman, for this opportunity to briefly address you regarding USCG involvement under the Marine Protection, Research and Sanctuaries Act. If there are any specific questions, I will be pleased to answer them now or provide you with answers for the record.

[The tables follow:]

TABLE I.—OCEAN DUMPING ENFORCEMENT CASES REFERRED TO EPA, APRIL 1973 TO DECEMBER 1975

Violation	Coast Guard district	Number of case referrals	Number of alleged violations
Dumping short	3	5	5
	7	3	3
	12	1	1
Dumping long	7	1	1
Dumping without permit	HQ	1	1
	1	1	1
Attempted dumping without permit	1	1	1
Violating permit conditions [1]	1	2	2
	3	1	1
	7	1	1
	8	1	5
	11	4	4
Failure to notify COTP	3	15	133
Liquid wastes spilled enroute	3	3	3
No permit on board	3	1	1
Total		41	163

[1] Dumping at night, trash garbage blowing over enroute, not sinking on site, etc.

TABLE II

[In thousands of dollars]

	Fiscal year—			
	1973	1974	1975	1976
Operating expenses:				
Direct appropriated funds	0	0	41	316
Fund reprogramed from other activities	15	227	323	86
Total estimated expenditures	15	227	364	402
Research, development, testing, and evaluation: Expenditures	0	0	121.4	[1] 190

[1] Estimate.

Senator BEALL. Thank you, Captain, for being here today.

You said that the cases are being properly disposed of by EPA once they are sent there?

Captain SCHUBERT. We would have to address that on a case-by-case basis, sir.

Senator BEALL. In general.

Captain SCHUBERT. I have no reason to believe that they are not disposed of properly.

Senator BEALL. The CRS report that we referred to says USCG surveillance and performance activities have suffered from a lack of resources submitted to the program. Has this low priority given by USCG had an effect on the program?

Captain SCHUBERT. You are talking about the GAO report?

Senator BEALL. Congressional Research Service.

Captain SCHUBERT. That is correct for the time addressed. As we mention in our statement the resources we have requested were not authorized until the end of fiscal year 1975. We have them in the 1976 budget. We feel that these resources are, in fact, adequate to do the job. I might also add that we are reorienting our priorities and have stepped up our enforcement activities in the areas where we feel we have not met our goals in the past.

Senator BEALL. You give the ocean dumping enforcement a higher priority today than you did last year or the year before?

Captain SCHUBERT. Yes, sir, we have raw figures which indicate a substantial improvement and we hope this improvement will continue.

Senator BEALL. And obviously that is in response to what you consider to be a need for improvement.

Captain SCHUBERT. Yes, sir.

Senator BEALL. In your statement you also talk about the electronic surveillance system that you are working on at the present time and doing some experimenting with. This is obviously going to be expensive. Does your budget request include sufficient funds to move toward the implementation of this surveillance system if it is indeed successful as you think it will be.

Captain SCHUBERT. Yes, sir, it does. I'm not as pessimistic as Mr. Eschwege was as to when the system will be operational. We have completed the first operational prototype testing. The concept is proven to be effective but we had some technical problems with the hardware. We hope to have a second generation prototype available some time this fall.

If everything goes well, we should have an operational system by the end of next year.

Senator BEALL. How much is this going to cost?

Captain SCHUBERT. We have $190,000 in the current research and development budget. It's for the development of this device. We feel that the cost of the device is going to be in the neighborhood of $10,000. We hope to keep it under $10,000 per copy. We feel that the cost of that is going to be the responsibility of the dumper. It will be part of his price of doing business.

Senator BEALL. You indicated that you do not routinely sample materials being dumped at the dump site. You thought the analysis of these wastes was the responsibility of EPA. Are you satisfied that EPA is making the proper effort in analyzing the content of the waste being disposed of?

Captain SCHUBERT. I don't believe I am competent to answer that, sir. Our responsibility is to insure that the material that is supposed to be in the barge in accordance with the permit is there. Our efforts are directed to ensuring that that sample is representative of what is in the barge.

The conditions of the permit, the materials that are permitted in that barge are EPA's responsibility and we forward that sample to EPA. Our specific responsibility as we see it is to assure that sample is untampered and is representative of what is in the barge.

Senator BEALL. You are taking the sample?

Captain SCHUBERT. We monitor the sample taken because of the peculiarities of the dumping vessels and hazards involved——

Senator BEALL. Once the sample is taken it is out of your hands?

Captain SCHUBERT. Yes, sir, it goes to the EPA for analysis.

Senator BEALL. But the USCG isn't taking the sample. The dumper is taking the sample.

Captain SCHUBERT. Yes, sir, under USCG random spot supervision.

Senator BEAL. You are satisfied that the random spot supervision is sufficiently frequent?

Captain SCHUBERT. We think that it will be when the program is fully implemented—I don't want you to believe that it is fully imple-

mented. We are implementing that at the present time but it's not yet totally in effect.

Senator BEALL. We appreciate your being here today.

Our next witness is Mr. Kenneth Kamlet, National Wildlife Federation.

STATEMENT OF KENNETH S. KAMLET, COUNSEL, NATIONAL WILDLIFE FEDERATION

Mr. KAMLET. I will not attempt to read my entire prepared statement.

The Federal ocean dumping program now consists of 2¾ billion pounds of waste material barged out to sea and dumped each year off U.S. shores. That's 1,250 pounds for every man, woman, and child in this country. It consists of an area of ocean off the New York and New Jersey coasts, the New York Bight, that is so polluted it is a national disgrace. One could call it the New York "blight." It consists of fish and shellfish contaminated with poisons and pathogens. It consists of ever-increasing quantities of ocean-dumped sewage sludge. And it consists of an approach toward the dumping of dredge spoil that has yet to see a single ocean dumping permit denied.

At the present time, 3 years after the effective date of the ocean dumping law, the ocean dumping box score consists of over 120 million tons a year of ocean-dumped dredge spoil and nearly 9 million tons a year of ocean-dumped sewage sludge and industrial wastes—according to EPA's most recent figures. A third or more of the dredge spoil is contaminated with chemical, municipal and/or agricultural wastes.

Although EPA has generally succeeded in phasing down, if not out, the ocean dumping of industrial wastes, EPA and the corp have not not been living up to their statutory and treaty obligations with respect to the dumping of sewage sludge and dredge spoil. I will address these two waste categories in turn.

In terms of sewage sludge ocean dumping, 18 of 20 permit holders are located in the New York-New Jersey metropolitan area and are under the regulatory jurisdiction of EPA region II. A much larger share than eighteen-twentieths of the legal defects in EPA's sludge-dumping program can be laid at region II's doorstep, however.

Contrary to the requirements of the ocean dumping law and treaty, to EPA's own regulations, to commitments made to Congress by two EPA administrators, to the approach being taken by a neighboring EPA region, and to the approach it is itself taking toward the ocean dumping of industrial wastes, EPA region II refuses to take an active role in phasing out the ocean dumping of sewage sludge. Instead of placing its sludge dumpers on firm timetables for getting out of the ocean, all EPA region II does is commission studies to look into the problem, while announcing its nonbinding desire to see sludge dumping ended by 1981. Meanwhile, the New York Bight continues to deteriorate, and EPA region II, like the Emperor Nero, continues to fiddle around.

My prepared statement spells out eight specific inadequacies in region II's approach. I will mention only three at this point.

One, it is unrealistic to expect municipalities to gear up for a phase-out of their dumping on the basis of no more than vague EPA expressions of intention.

Two, EPA region II's sludge dumping program also violates commitments made to Congress at the time of the ocean dumping law's passage.

For example, it is inconsistent with the pledge made to this very committee by former EPA Administrator Ruckelshaus that communities already dumping at sea would not be allowed to increase the volume of such dumping over current levels; that no new sources of sewage sludge would be permitted; and that EPA would require existing sludge dumping to be phased out entirely within a reasonable period of time.

And finally, not only is this approach illegal and unwise, it is unnecessary. The engineering firm of Camp Dresser & McKee, which recently filed progress report No. 7 for phase 2 of a three-phase EPA-funded study of sludge management alternatives, now believes that pyrolysis facilities could be constructed by 1981 to handle the region II sewage sludge which is presently ocean-dumped.

The point is that environmentally sound, economically feasible alternatives to the ocean dumping of sewage sludge are close at hand, if not immediately available. EPA region II has but to lead its sludge dumpers out of the sea and into the 20th century.

Turning now to dredged material, I will discuss the blatant inadequacy of the dredged material ocean dumping program.

The MPRSA attempted to strike a balance between navigational interests and environmental protection. Unfortunately, this arrangement has not worked. The Corps of Engineers, with the passive acquiescence and sometimes willing complicity of EPA, has sharply tilted the scales in favor of dumping, dumping, and more dumping.

The dredged material ocean dumping criteria set by EPA are grossly inadequate. Even where it goes through the motions of applying these criteria, no corps district has ever denied a dredged material ocean dumping permit. Nor has EPA ever exercised its veto power. It is, therefore, not surprising that more dredged material is disposed of by ocean dumping today than ever before.

For example, U.S. dumping levels in 1974 exceeded 120 million tons. This was triple the level reported for 1968, and accounted for 90 percent of all U.S. ocean dumping and at least a quarter of all dredged material disposed of in the United States in 1974.

Although dredged material consists basically of natural sediment dredged up from river and harbor bottoms, it can be and often is contaminated with pollution from industrial, municipal and agricultural discharges. When one considers that the polluted category of dredged material alone amounts to more than 3 times the quantity of all ocean-dumped municipal and industrial wastes combined, and that this dredged material is often contaminated with the very same kinds of pollutants, it becomes clear that this material is capable of doing a lot of damage, and that unless the ocean dumping of dredged material is properly regulated, all the regulation in the world of non-dredged wastes will be of limited usefulness.

Even leaving totally aside impacts associated with chemical and microbial contaminants of dredged material, it is not difficult to see that the effects of such vast volumes of material on the marine environment could be enormous unless extraordinary care were taken to keep it out of biologically productive coastal areas. The trend, unfortunately, appears to be otherwise, with dumping pressure on nearshore disposal sites being dramatically on the increase.

Apart from the turbidity, smothering, and substrate modification effects associated with duping of unpolluted dredged material, there are even more serious concerns, including contamination of human seafood, at least potentially associated with the at least one-third of all ocean-dumped dredge material that is polluted.

Although the corps' impressive $30 million dredged material research program has demonstrated that few dredged material contaminants are readily released into the water column, the DMRP until very recently did virtually nothing to investigate the ability of these contaminants to poison or accumulate in bottom-dwelling and other marine organisms which may come into direct contact with settled or suspended dredge material. Indeed, the dredged material ocean dumping criteria continue to measure the pollutional status of dredged material solely on the basis of the ability of contaminants to leach into the water, despite the fact that the corps' own studies have already shown that contamination of the water is less likely to be of environmental significance than direct contamination of organisms.

Notwithstanding the magnitude of dredged material dumping activities and the potential risks they pose to health and the environment, the EPA dredged material criteria and related Corps of Engineer policies and procedures simply fail to meet the minimum environmental protection requirements laid down by law.

For example, in direct contravention of the MPRSA's requirement that no dumping approvals be given without a clear showing of harmlessness, the dredged material criteria specify that all dumping will be permitted absent evidence of harm. At the same time, Corps of Engineer regulations impermissibly weight the balance against denial of ocean dumping proposals by requiring such denials to be concurred in the division level, whereas dumping approvals may be routinely granted by the district offices without the need for higher level clearances. In light of this overall bias in favor of ocean dumping, it is easy to see why district office employees might conclude, as some have, that dredged material found to be pollutant ought to be ocean-dumped precisely because it was polluted.

In addition to stacking the deck against the possibility of ever turning down an ocean dumping proposal, the dredged material criteria unlawfully fail to apply the mandatory environmental evaluation factors of both the ocean dumping law and treaty; allow dumping outlawed by the treaty, such as the dumping of spoil with more than trace amounts of the toxic heavy metal cadmium; and fail to safeguard the environment against dredged material to the same degree as for nondredged wastes.

There is no need to worry that strict enforcement of the law will close down our ports and harbors. For one thing, the MPRSA

expressly authorizes dumping which exceeds ocean dumping criteria where the Secretary of the Army certifies that there is no economically feasible alternative disposal method or location. And, for another, a field survey conducted by the corps itself indicates that alternatives to ocean dumping do, in fact, exist at least 40 percent of the time.

After trying repeatedly but without success for 2 years to persuade EPA and the corps to obey the law voluntarily, the National Wildlife Federation went to court last November to get these agencies to do what Congress had directed them to do more than 3 years earlier. The case is still pending, but our lawsuit has had the effect of stimulating EPA to draft another set of ocean dumping regulations and criteria, the publication date of which always seems to be 2 more months away. Unfortunately, we cannot say whether the new dumping criteria will be any more acceptable than the present ones, because the Government has so far refused to let us see them.

That is the status of the Federal ocean dumping program, as we see it. Definite strides have been made in some areas, but in others, potentially harmful ocean dumping proceeds unabated.

Among other things, we would hope that this committee would take the occasion of these oversight hearings to express its displeasure at agency foot-dragging and subversion of the act's requirements.

We would also recommend that the committee consider requiring, either through formal amendment of the act or through a less formal expression of the committee's wishes, both the corps and USCG to file with the Congress annual reports on the discharge of their respective ocean dumping responsibilities, as the statute presently requires of both EPA and NOAA. In addition to being a useful source of information, such a reporting requirement would serve the salutary purpose of making these agencies, at least once a year, assess the strengths and weaknesses of their programs in light of the law's requirements.

This need is reinforced by the present absence of meaningful interagency coordination. I have been privately advised by representatives of all three of the other Federal Agencies with ocean dumping responsibilities that these agencies have had great difficulty in obtaining from the Corps of Engineers information concerning corps ocean dumping activities and research.

In view of all these considerations, and especially since the corps does not object to preparing such annual reports—I am referring to General McIntire's recent testimony before the House Oversight Committee—we especially urge that such a reporting requirement be imposed on at least the Corps of Engineers.

Finally, for the further background information of the committee, I have submitted four exhibits to the committee staff for inclusion in the hearing records.*

Senator BEALL. They will be included as well as your entire statement.

Does the National Wildlife Federation agree with NOAA that dumping in the New York Bight does not present today environmental and health harzards?

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*See pp. 61–95.

Mr. KAMLET. Yes and no.

We agree, based on presently available information, that the sewage sludge dump site as presently constituted should not be moved in favor of one of the two or more remote areas that have been studied.

We disagree with any assessment that all is well in the New York Bight in terms of effect on the environment or effect on human health. We think some of the more critical inquiries, such as the extent of uptake of heavy metals and poisons into the food chain, into the seafood that winds up on the human dinner table, have not been made. There is an indaquacy of data in that area. No one has been making the effort to gather data of that kind, and include the evaluation of these data in the assessment of environmental impacts.

Senator BEALL. You indicate that the quality may be all right of the efforts but the level is sufficiently high. That is in research?

Mr. KAMLET. NOAA concedes they want to expand their research in the future. Thus far, the vast majority of NOAA's research effort has been focused on the New York Bight as part of the MESA program. That is where most dumping goes on. In some respects that is a poor place to do research because the dumping has been going on for so long. There is no baseline before dumping against which to measure the effects of dumping as it proceeds. We would like to see heavy emphasis continue in the New York Bight, but we would like to see that effort expanded to other areas.

Senator Beall. How about the R. & D. effort in regard to alternatives to ocean dumping?

Mr. KAMLET. NOAA keeps saying it doen't have the expertise to study alternatives. That is perhaps true. I don't think the intent of Congress in establishing that section of title II was that NOAA duplicate the investigations being carried out by other Agencies. I think there is something to be said for having an impartial Agency that does not have direct permit-issuing responsibilities take a coordinating role in making sure that adequate alternatives research is going on.

I think there is a great deal more that NOAA could be doing that it does not have to keep tabs on what the other Agencies are doing in the day of studying alternatives.

Senator BEALL. Thank you, Mr. Kamlet. We appreciate your testimony. We may have other questions which we will send you.

[The statement follows:]

STATEMENT OF KENNETH S. KAMLET ON BEHALF OF THE NATIONAL WILDLIFE FEDERATION

I appear here as an attorney and biologist for the National Wildlife Federation and on behalf of the Federation's 3.5 million members and supporters. As the Nation's largest private conservation-education organization, we vigorously oppose all potentially harmful ocean dumping. We view the continuation of such dumping practices as not only unwise, but also as generally unnecessary.

Three years have now passed since the Marine Protection, Research, and Sanctuaries Act ("MPRSA") came into effect, and it has been more than seven months since the international "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter" ("Convention") became fully binding on the United States. Yet the federal agencies charged with carrying out the ocean dumping law and treaty still have not lived up to their obligations under either the law or the treaty. We think it entirely appropriate for this Committee to find out why not!

Before discussing a few examples of what is wrong with the federal ocean dumping program, it would perhaps be well to describe what this program now consists of.

What the program now consists of is two-and-three-quarter billion pounds of waste material (1250 pounds for every man, woman, and child in this country) barged out to sea and dumped off U.S. shores each year. It consists of an area of ocean off the New York and New Jersey coasts—the New York Bight—that is so polluted it is a national disgrace. It consists of fish and shellfish contaminated with poisons and pathogens. It consists of ever-increasing quantities of ocean-dumped sewaeg sludge. And it consists of an approach toward the dumping of dredge spoil that has yet to see a single ocean dumping permit denied.

The box score at the moment shows somewhere between 118 and 167 million tons of ocean-dumped dredge spoil—a third or more of which is polluted with chemical, municipal and/or agricultural wastes; and about 13.6 million tons of ocean-dumped sewage sludge and industrial wastes—carried out under 20 sludge dumping and 38 industrial waste dumping permits.

In terms of numbers of permits and quantities of non-dredged wastes ocean-dumped, EPA Region II and the New York-New Jersey Metropolitan Area is where this Committee's attention should be most directly focused. Of a total of 58 permits for the ocean dumping of wastes under EPA jurisdiction, Region II accounts for 52.

EPA REGION II'S INADEQUATE APPROACH TO OCEAN DUMPING REGULATION

Contrary to the requirements of the ocean dumping law and treaty, to EPA's own regulations, to commitments made to Congress by two EPA Administrators, to the approach being taken by a neighboring EPA Region (Region III), and to the approach it is itself taking toward the ocean dumping of industrial wastes, EPA Region II refuses to take an active role in phasing-out the ocean dumping of sewage sludge. Instead of placing its sludge-dumpers on firm timetables for getting out of the ocean, all ERA Region II does is commission studies to look into the problem, while announcing its non-binding desire to see sludge dumping ended by 1981. Meanwhile, the New York Bight continues to deteriorate, and EPA Region II—like the Emperor Nero—continues to fiddle around.

From the standpoint of practicality, legality, and policy, Region II's approach to sludge dumping simply does not hold water. Specifically:

(1) It is unrealistic, from a practical standpoint, to expect municipalities to gear up for a phase-out of their dumping on the basis of no more than vague EPA expressions of intention.

(2) From a legal standpoint, Region II's approach violates the MPRSA's prohibition against allowing ocean dumping not shown to be safe.

(3) It likewise violates the Convention's prohibition against dumping more than "trace" amounts of wastes containing the toxic heavy metal cadmium and certain other substances.

(4) And it violates EPA's own regulations which require all dumpers unable to qualify for "special" ocean dumping permits to develop and actively implement a plan to eliminate or reduce their ocean dumping. Region II adhers to this requirement for its industrial dumpers; why can't it do the same for its municipal dumpers?

(5) EPA Region II's slude dumping "program" also violates commitments made to Congress at the time of the ocean dumping law's passage. For example, it is inconsistent with the pledge made to this Committee by former EPA Administrator Ruckelshaus that "communities already dumping at sea would not be allowed to increase the volume of such dumping over current levels"; that "no new source of sewage sludge would be permitted"; and that EPA would require existing sludge dumping "to be phased out entirely within a reasonable period of time."

(6) This approach, similarly, contravenes present EPA Administrator Train's September 25, 1975 adjudicatory hearing decision, which affirmed Region III's authority and duty to phase-out sludge-dumping by the City of Philadelphia.

(7) It conflicts with the regulatory approach of neighboring EPA Region III, which, to its credit, has placed both of *its* sludge dumpers—including one of the country's largest cities—on explicit schedules for phasing out their ocean dumping by 1980 and 1981, respectively.

And, finally, (8) not only is this approach illegal and unwise, it is unnecessary. The engineering firm of Camp Dresser & McKee, which recently filed "Progress Report No. 7" for "Phase 2" of a 3-phase EPA-funded study of sludge management alternatives, now believes that "pyrolysis facilities could be constructed by . . . 1981" to handle the Region II sewage sludge which is presently ocean-dumped. Pyrolysis, which is the high-temperature treatment of organic matter, under conditions which minimize air pollution and emphasize the recovery of useful thermal energy and organic and inorganic materials, is certainly far less damaging to the environment than ocean dumping. And although it does entail the utilization of some fuel oil, and does not yield all the benefits of using sludge to reclaim depleted soils, it is certainly preferable to outright landfill or incineration. The important point, however, is that environmentally sound, economically feasible alternatives to the ocean dumping of sewage sludge are within easy reach, if not immediately available. EPA Region II has but to carry out its duty to lead its sludge dumpers out of the sea and into the twentieth century.

With respect to industrial chemical dumpers, Region II's record is a bit better. Many such dumpers are already out of the ocean. And most of the rest are on the way, although some of Region II's biggest and baddest dumpers are being given as much as five years to phase out their dumping. In general, the National Wildlife Federation supports the phase-out approach toward industrial ocean dumping of EPA Regions I, II, III, and VI.

However, we are forced to part company with EPA Region II in its handling of one group of industrial ocean-dumpers: a group of six pharmaceutical and chemical companies which presently dispose of their wastes in deep ocean water (several miles deep), 40-odd miles off the coast of Puerto Rico. EPA Region II is allowing and encouraging these six companies to shift from ocean dumping to an alternative that promises to be even more damaging to the environment: namely, the discharge of the same wastes, together with various other wastes, through an ocean outfall pipe. This will place these wastes much closer to shore and in much shallower water, where the possibility of interfering with biologically productive and ecologically sensitive nearshore communities is substantially greater. We regard this as an inappropriate alternative and one which EPA should not have authorized in light of its statutory duty (MPRSA, section 102 (a)(G)) to evaluate the "appropriateness", of alternative locations and methods of disposal or recycling. We have requested a General Counsel's Opinion from EPA headquarters on the scope of EPA's responsibilities under section 102(a)(G) of the MPRSA. We are still awaiting a reply to this request, which was filed nearly three months ago.

THE BLATANT INADEQUACY OF THE DREDGED MATERIAL OCEAN DUMPING PROGRAM

The MPRSA gave the Corps of Engineers, as the federal agency concerned with dredging activities, the authority and responsibility to regulate the ocean dumping of dredged materials. Mindful, however, of the Corps' active sponsorship of numerous dredging and dumping projects, the MPRSA made Corps decisions on spoil-dumping proposals subject to environmental impact criteria and disposal site locations established by EPA. EPA was also given the power to veto Corps dumping approvals where the proposed dumping threatens unacceptable adverse environmental impacts.

This arrangement, although sound in theory, has not worked in practice.

The dredged material ocean dumping criteria set by EPA are blantantly inadequate. Applying these criteria, no Corps district has ever denied a dredged material ocean dumping permit. And EPA, for its part, has never exercised its veto power. Consequently, it is not surprising that more dredged material is disposed of by ocean dumping today than ever before. For example, dumping levels off U.S. coasts in 1974 exceeded 120 million tons. This was triple the level reported for 1968 and accounted for 90 percent of all U.S. ocean dumping and more than one-quarter (perhaps as much as a third) of all dredged material disposed of in the U.S. in 1974.

By way of comparison with natural processes, the 120 million tons of ocean-dumped dredge spoil represents more than 4 times the total annual discharge of suspended sediment by all U.S. Atlantic coast rivers. (The comparison with riverine discharges to the Atlantic is appropriate in view of the large quantities of dredged material ocean-dumped in the Atlantic.)

Although dredged material consists basically of natural sediment—dredged up from river and harbor bottoms—it can be and often is contaminated with pollution from industrial, municipal, and agricultural discharges. According to conservative Corps of Engineer estimates made in the late 1960's more than a third of all ocean-dumped dredge material may be deemed "polluted," with the figure being closer to one-half along the Atlantic seaboard. When one considers that the "polluted" category of dredged material alone amounts to three times the quantity of all ocean-dumped municipal and industrial wastes combined, and that this dredged material is often contaminated with the same kinds of municipal and industrial pollutants the direct dumping of which is being closely regulated or phased-out, it becomes clear (1) that this material is capable of doing a lot of damage, and (2) that, unless the ocean dumping of dredged material is properly regulated, all the regulation in the world of non-dredged wastes will be of limited usefulness.

Even leaving totally aside impacts associated with chemical and microbial contaminants, it is not difficult to see that the effects of such vast volumes of material on the marine environment could be enormous unless extraordinary care were taken to keep it out of biologically productive coastal areas. The trend, unfortunately, appears to be otherwise, with a greatly increased quantity of dredged material being deposited at a decreasing number of dump sites—most of which sites tend to be concentrated at relatively nearshore locations on the biologically productive and ecologically sensitive continental shelf. A comparison of the quantities of dredged material dumped and the number of dumping sites in active use for 1968 and 1974, for example, indicates that the average dumping "pressure" per disposal site has increased more than 8-fold during the six-year period.

Apart from the purely physical effects of smothering and substrate modification associated with dumping of unpolluted dredged material, there are even more serious concerns—including contamination of human seafood—at least potentially associated with the at least one-third of all ocean-dumped dredged material that is polluted.

Although the Corps' impressive $30 million Dredged Material Research Program has demonstrated that few dredged material contaminants are readily released upon mixing with water, the DMRP, until very recently, did virtually nothing to investigate the ability of these contaminants to poison or accumulate in bottom-dwelling and other marine organisms which may come into direct contact with settled or suspended dredged material. Indeed, the dredged material ocean dumping criteria continue to measure the pollutional status of dredged material solely on the basis of the ability of contaminants to leach into the water—despite the fact that studies have already shown that contamination of the water is less likely to be of environmental significance than direct contamination of organisms.

In short, despite the magnitude of dredged material dumping activities and the potential risks they pose to health and the environment, the EPA dredged material criteria and related Corps of Engineer policies and procedures fail to meet the minimum environmental protection requirements laid down by law.

For example, contrary to the MPRSA's requirement that no dumping approvals be given without a clear showing of harmlessness, the dredged material criteria specify that all dumping "will be permitted" absent evidence of harm. Similarly, Corps regulations, issued under a 1905 statute continue to provide that dredgings from certain New York harbor and river bottoms "are required" to be dumped at sea—despite the MPRSA's (Section 106(a)) supression of this authority three years ago (when the MPRSA became effective), and despite Brigadier-General McIntyre's assurance to a House oversight committee a month-and-a-half ago that steps would be taken "in the near future" to purge provisions of this kind from the regulations. At the same time, other Corps regulations (which the Corps intends to retain) weight the balance against denial of ocean dumping proposals, by requiring concurrence in such denials to be obtained at the division level, whereas dumping approvals may be routinely granted by the district offices without the need for higher-level clearances. In light of the overall bias in favor of ocean dumping, it is easy to see why district office employees might conclude—as did one from the New York district in a recent public notice—that dredged material found to be polluted ought to be ocean-dumped precisely because it was polluted.

In addition to "stacking the deck" against the possibility of turning down an ocean dumping proposal, the dredged material criteria unlawfully: fail to apply the mandatory environmental impact evaluation factors of both the ocean dumping law and the ocean dumping treaty; allow dumping practices outlawed by the treaty (e.g., the dumping of spoil containing more than trace amounts of the toxic heavy metal cadmium); and fail to safeguard the environment against the ocean dumping of dredged material to at least the same degree as for the dumping of nondredged wastes.

Strict enforcement of the law, it should be noted, will not close down our ports and harbors. For one thing, the MPRSA (section 103(d)) allows for dumping which would result in noncompliance with the ocean dumping criteria where the Secretary of the Army certifies that there is "no economically feasible" alternative disposal method or location. And, for another, a field survey conducted by the Corps indicates that alternatives to ocean dumping do, in fact, exist at least 40 percent of the time.

On November 19, 1975, after trying unsuccessfully for two years to persuade EPA and the Corps to carry out their legal responsibilities voluntarily, the National Wildlife Federation went to court to secure a court ruling ordering these agencies to do what Congress had directed them to do more than three years earlier. The case is still pending before U.S. District Court Judge Aubrey Robinson. Our lawsuit has already had the effect, however, of stimulating EPA (in close collaboration with the Corps) to draft a new set of ocean dumping regulations and criteria, the publication date of which always seems to be two more months away. Unfortunately, we cannot say whether the new dumping criteria will be any more acceptable than the present ones, because the Government has so far refused to let us see them.

CONCLUSIONS AND RECOMMENDATIONS

That is the status of the federal ocean dumping program, as we see it. Definite strides have been made in some areas, but in others, ocean dumping proceeds in a business-as-usual fashion.

We would hope that this Committee would take the occasion of these oversight hearings to reaffirm the lofty purposes of the Marine Protection, Research, and Sanctuaries Act, and to express its displeasure at agency foot-dragging and subversion of the Act's requirements. Beyond this, we would urge the Committee to call upon EPA and the Corps to respond to the issues we have raised in this testimony and to do so substantively and in detail. We would also recommend that the Committee consider requiring (either through formal amendment of the Act, or through an informal expression of the Committee's wishes) both the Corps of Engineers and the Coast Guard to file with the Congress annual reports on the discharge of their respective ocean dumping responsibilities—as the statute presently requires of both EPA and NOAA. In addition to being a useful source of information for Congress, other concerned federal agencies, and the public, such a reporting requirement would serve the salutary purpose of making these agencies, at least once a year, assess the strengths and weaknesses of their programs in light of the law's requirements.

This need is reinforced by the present absence of meaningful inter-agency coordination. I have been privately advised by representatives of all three of the other federal agencies with ocean dumping responsibilities—EPA, NOAA, and the Coast Guard—that these agencies have had difficulty in obtaining from the Corps of Engineers information concerning Corps ocean dumping activities and research. In view of all these considerations, and especially since the Corps does not object to preparing such annual reports, we especially urge that such a reporting requirement be imposed on at least the Corps of Engineers.

Finally, for the further background information of the Committee, I have sumitted the following Exhibits to the Committee staff for inclusion in the hearing record:

Exhibit I

Paper presented at the April 7, 1976, Federal Water Quality Association Conference on Environmental Impacts on Coastal and Marine Waters (places ocean dumping in the context of the cumulative impact on the marine environment of pollution from all sources).

Exhibit II

Statement on sludge dumping in the New York Bight (presented at a public hearing held by EPA Region II on a draft environmental impact statement on the same subject).

Exhibit III

Paper presented at the January 26 28, 1976, ASCE Speciality Conference on Dredging and its Environmental effects (discusses the dredged material ocean dumping program and NWF's lawsuit in greater detail).

Exhibit IV

NWF's January 19, 1976 request to EPA for a General Counsel's Opinion on the Scope of the obligations imposed by Section 102(a)(G) of the Ocean Dumping Law (discusses EPA's duty to ensure that disposal methods proposed as alternatives to ocean dumping not have an even more damaging impact on the environment).

[The exhibits follow:]

EXHIBIT I

Discharge of Pollutants Into the Marine Environment

(By Kenneth S. Kamlet)

ABSTRACT

Pollutants enter the ocean through a variety of routes. In some, but by no means all cases, riverine and atmospheric inputs outweigh direct transfer by dumping, outfall discharge, and spillage. Overall quantities are not the whole story, however. As is amply demonstrated by parts of the New York Bight and the Southern California Bight, the entire ocean need not be degraded in order for safe levels to be exceeded locally. Point sources of direct pollutant discharge to the ocean can also be more readily regulated and controlled to the immediate benefit of the marine environment than can diffuse and indirect sources. It is imperative that legislation adopted to protect the ocean against direct pollutant discharges be vigorously enforced at the same time that the implementation of air and freshwater pollution controls serves to cut down on the more diffuse sources marine pollution. Only if the ocean is closed to all direct dischargers of potentially harmful wastes, can we avoid overwhelming it with the combined excreta of all who, if allowed to do so, would flock to use it as an inexpensive dumping ground.

Discharge of Pollutants Into the Marine Environment*

(By Kenneth S. Kamlet)**

INTRODUCTION

Virtually every waste product discarded by man sooner or later ends up in the ocean. If he burns it, it enters the air where rain may carry it into the sea. If he flushes it, puts it down the drain, or pours it through an outfall, it may also wind up in the ocean either directly (by way of ocean outfalls or ocean dumping of barged wastes), or indirectly (by way of rivers draining into the sea). Even wastes which are placed in or on the land may find their way to the ocean unless care is taken to avoid surface runoff to nearby waterways and seepage to the underlying groundwater.

In short, the ocean is being assaulted on many fronts.

This is not to say that efforts to reduce or eliminate marine pollution are doomed to failure, or that attempts to limit direct pollutant inputs to the ocean will be offset by more massive indirect inputs. The form, manner, and location of pollution inputs may have a great bearing on their toxicity to marine organisms and on their potential impacts on man. And the manner of pollutant intro-

*Presented at the April 7, 1976, Federal Water Quality Association Conference on Environmental Impacts on Coastal and Marine Waters, held at Washington, D.C.

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duction certainly has some bearing on man's ability to control or prevent their entry into the marine environment. From both these standpoints, direct point source pollution of the ocean deserves and requires priority attention.

This paper rests on two assumptions: First, that a healthy, unpolluted ocean is of more value to mankind than a polluted ocean full of poisons and disease. And second, that without strict controls on its use as a free dumping ground, the ocean's assimilative capacity will be quickly overtaxed—at least in critical coastal areas of high biological productivity.

MAGNITUDE AND TRENDS OF OCEAN POLLUTION

If the past two or three years can be taken as a guide, some two-and-three-quarter billion pounds of unwanted material will be barged from U.S. ports out to sea and dumped in 1976.[1,2] Based on a 1975 U.S. population estimate of 212.8 million, this represents 1,250 pounds of ocean-dumped wastes for every man, woman, and child in the United States. Types and amounts of waste materials ocean-dumped during 1973 and 1974 are given in Tables I and II.

TABLE I.—OCEAN DISPOSAL: TYPES AND AMOUNTS, 1974[1] AND 1973[2]

[In tons, approximate]

Waste type	Atlantic 1974	Atlantic 1973	Gulf 1974	Gulf 1973	Pacific 1974	Pacific 1973	Total 1974	Total 1973
Industrial waste	4,767,000	3,997,100	950,000	1,408,000	0	0	5,717,000	5,405,100
Sewage sludge	5,676,000	5,429,400	0	0	0	0	5,676,000	5,429,400
Construction and demolition debris	2,242,000	1,161,000	0	0	0	0	2,242,000	1,161,000
Solid waste	0	0	0	0	200	240	200	240
Explosives	0	0	0	0	0	0	0	0
Total	12,685,000	10,587,500	950,000	1,408,000	200	240	13,635,200	11,995,740

[1] 1974 source: EPA regional offices. Unpublished reports, updated information, 1974 (12 mo of dumping activity).
[2] 1973 source: EPA regional offices. Unpublished reports 1973 (8 mo of dumping activity—May to December 1973 under permits issued by ocean disposal program extrapolated for 12 mo to provide an annual rate).

TABLE II.—DREDGED MATERIAL DUMPED IN OCEAN, 1974

[In cubic yards]

	Corps of Engineers	Permits	Total
New England division	1,340,400	921,800	2,262,200
North Atlantic division	8,234,543	3,475,849	11,710,392
South Atlantic division	2,931,748	2,979,500	5,911,248
Lower Mississippi Valley division	54,600,000	.....	54,600,000
Southwestern division	9,743,982	.....	9,743,982
South Pacific division	7,163,918	1,292,500	8,455,418
North Pacific division	5,982,280	.....	5,982,280
Total	89,995,871	8,669,649	98,665,520

In addition to the ocean dumping of barge-transported wastes, enormous volumes of wastewater are discharged to U.S. coastal waters by way of outfall pipes. A 1975 National Wildlife Federation ("NWF") survey of coastal Environmental Protection Agency ("EPA") regional offices revealed that there are some 438 permitted ocean outfalls accounting for well over twelve-and-a-third billion gallons a day of discharged wastewater. The results of this survey are tabulated in Table III.

[1] U.S. Environmental Protection Agency, "Ocean Dumping in the United States—1975: Third Annual Report of the Environmental Protection Agency on Administration of Title I, Marine Protection, Research, and Sanctuaries Act of 1972, as Amended." Office of Water and Hazardous Materials, EPA, Washington, D.C. (June 1975).
[2] Kamlet, K. S., "Deep Sixing Wastes: Disaster at Sea." *Environmental Action*, 6, 4 (1975).

TABLE III.—OCEAN OUTFALLS IN THE UNITED STATES [1]

EPA region	Number of outfall permits issued				Quantity of outfall discharges (Mgal/d)			
	Municipal	Industrial	Other	Total	Municipal	Industrial	Other	Total
I	16	10	36	62	9.9	[2] 1,118.7	1.7	1,199.3
II	17	31	53	109	[3] 156.0	[4] 447.0	Unknown	Unknown
III	1	0	0	[5] 1	Unknown			
IV	17	18	22	57	258.0	5,675.0	12.0	5,945.0
VI	0	0	1	[7] 1	0	0	.092	.092
IX	43	53	112	205	1,703.0	2,950.0	503.0	[8] 5,153.0
X	0	3	0	3	0	35.0	0	35.0
Total	91	118	229	433	2,123.9	10,294.7	516.792	12,332.39

[1] This table was prepared by W. M. Jeffress, Jr., based upon information provided to NWF by the respective EPA regions. The table is probably an underestimate of the number of permits and discharge quantities in view of gaps in the data provided by EPA.

[2] Quantities are expressed in million gallons per day (Mgal/d).

[3] The Seabrook nuclear generating station is responsible for 1,135 Mgal/d of this amount.

[4] This figure is based upon approximations in our printout sheets from region II. It is probably an underestimate.

[5] This figure represents discharge quantities for only the 3 sources (Toms River Chemical of New Jersey, Union Carbide of Puerto Rico, and Commonwealth Oil Refining Co. of Puerto Rico) for which NWF has quantitative data.

[6] Permit for the sewage treatment plant of Ocean City, Md., Sussex County, Del., plans to discharge 1 Mgal/d beginning on Nov. 1, 1976.

[7] This permit expired on Dec. 31, 1975.

[8] The quantity figures for region IX represent only California discharges due to lack of data for discharge sources in Hawaii.

Marine pollution associated with oil spillage also requires mention. The National Academy of Sciences estimates that slightly more than 6.1 million metric tons per annum of petroleum hydrocarbons are introduced into the ocean.[3,4] Of this amount, one-third (2.133 million tons) is caused by "marine transportation" activities, with tankers being the largest single contributor of such pollution. Nearly another million tons is attributable to coastal municipal and industrial wastes (0.3 million tons each), coastal refineries (0.2 million tons), and offshore oil production (0.08 million tons). Less than half the total (2.5 million tons) is accounted for by non-point sources, such as river runoff (1.6 million tons), atmospheric fallout (0.6 million tons), and urban runoff (0.3 million tons). A mere 0.6 million tons is associated with natural oil seeps.[3,5] In the five-year period, 1969–73, alone there were an estimated 452 tanker accidents causing pollution worldwide, with a total oil spillage of nearly a million tons (951,317 tons). More than sixty-three thousand tons (63,147 tons) of oil were spilled during this period in tanker accidents in U.S. waters within 50 miles from shore.[4]

Clear trends are not easy to establish. In the case of ocean dumping, the 1974 dumping total of 133 million tons[1] represents, on paper, nearly a tripling of levels reported for 1968.[6,7] However, it is likely, given the absence of a comprehensive regulatory or record-keeping program in 1968, that the figures for that year are incomplete and understate true dumping levels. Nevertheless, it seems probable that ocean dumping has been generally on the increase over the past several decades.

With respect to the future, the ocean dumping of at least municipal sewage sludge will continue to increase through at least 1981. This is so in view of the increased generation of sewage sludge by the East Coast municipal treatment plants now engaged in ocean dumping that will accompany the upgrading of many of these plants from primary to secondary treatment. This is so also in view of EPA Region II's announced intention not to phase-out ocean dumping

[3] National Academy of Sciences, "Petroleum in the Marine Environment." Ocean Affairs Board, NAS, Washington, D.C. (1975).

[4] Congress of the United States, Office of Technology Assessment, "Oil Transportation by Tankers. An Analysis of Marine Pollution and Safety Measures." U.S. Government Printing Office, Washington, D.C. (1975).

[5] Wilson, R. D., et al., "Natural Marine Oil Seepage." *Science* 184, 857 (1974).

[6] Council on Environmental Quality, "Ocean Dumping: A National Policy." U.S. Government Printing Office, Washington, D.C. (Oct. 1970).

[7] Smith, D. D. and Brown, R. P., "Ocean Disposal of Barge-Delivered Liquid and Solid Wastes from U.S. Coastal Cities." EPA Solid Waste Management Office, Washington, D.C. (1971).

of sewage sludge in the New York Bight until 1981, and then only if "environmentally acceptable, technically feasible, and economically viable land-based alternatives can be developed." [8] EPA Region III has placed the cities of Camden and Philadelphia on firm phase-out schedules which require ocean dumping to be terminated by mid-1980 and 1981, respectively.

Future patterns of ocean dumping for industrial wastes and dredge spoil are less clear.

In the case of industrial wastes, for example, EPA Regions III and VI have made major inroads in quantities dumped. Region II, however, although it has greatly reduced the number of industrial permits it issues (i.e., from 87 in 1973 to 45 in 1975), has not achieved a comparable reduction in the quantities of industrial wastes ocean-dumped. Excluding "cellar dirt," ocean dumping levels in 1975 for acid and chemical wastes in Region II were 2,863,000 tons (wet weight), as compared with 2,958,000 tons for 1974, and 3,129,000 tons for 1973.[9] Region II's six major industrial dumpers are not expected to phase-out their dumping (or bring their wastes "within ocean dumping criteria") until 1981.

In the case of dredged material, one would anticipate a further dumping increase based upon tightened restrictions on inland dredge disposal, particularly in wetland areas, and upon the potential future need to deepen harbor and channel areas to accommodate "supertankers" of increasing size. On the other hand, the New York District of the Corps of Engineers, which has been producing 8 to 13 million cubic yards a year of dredge spoil for the past 3 years (compared with a nationwide total for 1974 of 98.67 cubic yards), has projected "no increase in these quantities, except for "new work -which is essentially virgin material." [10,11] It is possible that both these expectations are accurate. The New York District, which disposes of virtually all dredge spoil at sea, has no wetland dumping to reduce at the expense of the ocean. This is decidedly not the case for other Corps districts.

As to trends in ocean pollution via outfalls and oil spills, one can only assume that oil pollution of the ocean will keep pace (i.e., grow) with our exploration of marine sources of petroleum and with the number and size of marine oil tankers. The outfall question is more complex. On the one hand, sewage generation will increase with population growth and the pressure to discharge to the ocean will heighten as laws to protect rivers and groundwater are more strictly enforced. On the other hand, the upgrading of sewage treatment plants from primary to secondary (and in some cases, beyond) will improve the quality of any sewage effluent that is discharged to sea. And, it is at least possible that the combined effect of strict enforcement of both laws to protect the rivers and laws to protect the ocean will be to encourage land application of sewage wastewaters and associated groundwater recharge.

In any event, whatever the precise patterns of ocean pollution the future holds in store, two things are certain: ocean pollution is a serious present problem, and it widl continue to be a serious problem on into the indefinite future.

ENVIRONMENTAL IMPACT OF MARINE POLLUTION

The environmental impact potential of marine pollutants depends on four key characteristics."

1. Rate of release or mobilization into the environment.
2. Residence times in places accessible to biological systems.
3. Concentration factors in parts of the system (e.g., surface films or estuaries) or in organisms (i.e., bio-accumulation).
4. Levels of toxicity.

Based on their estimated mobilization rates and toxicities, Ketchum [12] has

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[8] Dames & Moore, "Draft Environmental Impact Statement on the Ocean Dumping of Sewage Sludge in the New York Bight." EPA Region II, New York, N.Y. (Feb. 1976).

[9] Hansler, G. M., "Statement Before Subcommittee on Oceanography and the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Committee on Merchant Marine and Fisheries, United States House of Representatives." EPA Region II, New York, N.Y. (Mar. 5, 1976).

[10] Hunter, T. C., "Statement Before Subcommittee on Oceanography and the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Subject—'Ocean Dumping in the New York Bight.'" U.S. Army Corps of Engineers, N.Y. District, New York, N.Y. (Mar. 5, 1976).

[11] National Academy of Sciences, "Assessing Potential Ocean Pollutants." NAS Ocean Affairs Board, Washington, D.C. (1975).

[12] Ketchum, B. H., "Biological Implications of Global Marine Pollution." In: "The Changing Global Environment." S. F. Singer, (Ed.), D. Reidel Publishing Co., Dordrecht-Holland (1975).

rated the relative hazards to the marine environment or 11 heavy metals (which may also be assumed to be persistent and subject to bioconcentration). The "relative critical index" computed by this technique provides a measure of the volume of ocean water which would receive an annual increment of the element equal to its toxicity level at the indicated rate of mobilization. The three metals with the highest criticality indices are mercury, cadmium, and nickel.

The M.I.T. "Study of Critical Environmental Problems,"[13] listed the following, among others, in addition to toxic heavy metals, as problems of critical global concern:

Ecological effects of DDT and other persistent chlorinated hydrocarbons.

Ecological effects of petroleum oil in the oceans.

A later National Academy of Sciences report[14] identified the heavy metals and halogenated hydrocarbons (particularly, polychlorinated biphenyls) as appearing to "offer the greatest dangers through promiscuous release to the environment. . . ." The report also recommended further study of the problem of virus pollution of coastal waters and of the properties of petroleum films at the ocean-atmosphere interface in the uptake and transfer to marine organisms of atmosphere-borne pollutants.

In response to the SCEP and NAS reports, the National Science Foundation, through its participation in the International Decade of Ocean Exploration ("IDOE"), initiated a "Baseline Data Acquisition Program" and a "Pollutant Transfer Program," aimed at further evaluating the problems posed by: (1) the synthetic halogenated hydrocarbons, (2) petroleum, and (3) heavy metals.

The 1972 IDOE Baseline Conference made some interesting findings:[15]

Lead concentrations per unit mass decrease with increasing trophic levels. The external surface of fish skin and scales frequently show lead values an order of magnitude higher than the amounts found in fish muscle. The largest lead concentrations appear to be associated with phytoplankton.

Mercury levels are very low offshore and mercury pollution appears to be confined to the coastal areas, especially estuaries. Except for tuna and swordfish, which can contain relatively high levels of mercury, and a few individual fish from localized hot spots, mercury levels were not found by the IDOE baseline program to exceed the FDA limit of 0.5 ppm (wet weight) in the other common marine food species surveyed. Levels in marine mammals, however, which are used for human consumption, especially in the Arctic, are "often" in excess of the FDA limits.

Cadmium appears to be highly concentrated in zoo- and phytoplankton in nearshore areas along the California coast. Inshore levels of cadmium may be a factor of 10 higher than soluble cadmium values for open-ocean waters. Large concentrations of cadmium have been found in the internal organs of fish, shellfish and marine mammals. In particular, up to 500 ppm cadmium occur in certain sea otter kidney samples, suggesting a possible food chain link from shellfish.

Anomalously high concentrations of copper occur in coastal areas within a few kilometers of known sources such as sewage outfalls and industrial waste disposal sites.

High concentrations of zinc, attributable to man's influence, have been found in coastal waters and their biota and in rivers and estuaries. As was the case for lead, the zinc concentration measured in a limited number of organisms decreases going up the food chain.

High levels (100 ng/g, ppb, dry weight) of selenium have been found in Antarctic seal and penguin livers.

Evidence of marine pollution by arsenic and antimony appears to be confined to coastal areas where known inputs occur. High arsenic levels have been reported for the clam, *Mercenaria mercenaria*. Shrimp have been found to contain 15–40 ppm arsenic and 0.05–0.8 ppm antimony; long-fin cod and rat tail fish contained 200–500 ppm arsenic and 0.019–0.13 ppm antimony dry weight).

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[13] Massachusetts Institute of Technology, "Man's Impact on the Global Environment: Assessment and Recommendations for Action." Report of the Study of Critical Environmental Problems, The MIT Press, Cambridge, Massachusetts (1970).

[14] National Academy of Sciences, "Marine Environmental Quality: Suggested Research Programs for Understanding Man's Effects on the Oceans." NAS–NRC Ocean Affairs Board, Washington, D.C. (Aug. 9-13, 1971).

[15] National Science Foundation, "Baseline Studies of Pollutants in the Marine Environment and Research Recommendations." The IDOE Baseline Conference, May 24–26, 1972, New York. NSF Office for the IDOE, Washington, D.C. (1972).

Nickel concentrations in zoo- and phytoplankton along the California coast appear to be lower than in open Pacific Ocean plankton samples. However, nickel is higher in Narragansett Bay water samples than in open-ocean water, and there is a 5- to 10-fold increase in the nickel content of nearshore waters relative to offshore areas of the eastern U.S. coast.

Turning to the halogenated hydrocarbons, the 1972 conference found polychlorinated biphenyls (PCB) and pesticides (primarily DDT and its metabolites) to be ubiquitous in the Atlantic and Pacific Oceans, continental seas and the Gulf of Mexico:

Seawater PCB measurements show levels ranging from a part per trillion in the nearshore Pacific to over 4 parts per billion in northeast U.S. coastal waters. Little relationship can be seen between seawater levels and proximity to land. In the case of DDT, however, a reduction in water levels has been found near-land to offshore.

Analysis of DDT and PCBs in marine plankton show a range for zooplankton of from 0.2 to 207 ppb for DDT, and 0.7 to 1300 ppb for PCB, with the highest values in each case from areas known to be locally polluted. These and other available figures must be used with caution, however, because of the ubiquitous presence of oil or tar droplets or films, potentially capable of extracting organochlorines from water or air.

With few exceptions, both DDT and PCBs were found in every individual of every species of fish and shellfish examined from the North and South Atlantic, Denmark Strait, Gulf of Mexico, Caribbean Sea, Northeast Pacific, Scottish west coast and the Baltic Sea. Although the concentrations of these chlorinated hydrocarbons in open-Atlantic fish are somewhat below those from coastal waters and enclosed or sheltered seas where the contributions from continental runoff and industrial inputs are significant, open ocean values overlap those from coastal and shelf environments. PCB and DDT contamination of marine fish is truly an oceanic, and not mainly a coastal, problem. In general, PCB concentrations are greater than DDT levels in open ocean fish, but become more equal in coastal areas where extensive DDT use has occurred. Analyses reported by IDOE investigators show that accumulations of PCB and DDT do not increase going up the food chain in marine organisms when their lipid concentrations are compared.

Levels of organochlorines of approximately 100 ppm have been reported for seals, porpoises, and whales in the Baltic Sea, southern North Sea, Irish Sea, and Gulf of St. Lawrence. Concentrations around 1000 ppm occur in marine mammals along the coast of California. A high incidence of premature births has been observed among California sea lions.

Finally, the IDOE conference addressed the problem of petroleum hydrocarbons but was unable to reach any clearcut conclusions.

One thing is clear. Petroleum has entered the marine food chain at locations both in coastal waters and in the open ocean. For example, marine biota in Chedabueto Bay, Canada showed petroleum hydrocarbon contamination of up to 545 ppm (dry weight), while open ocean seston samples in the North Atlantic contained as much as 20 ppm. In terms of biological impacts, the long-term persistence of certain petroleum fractions in the area of the spill may drastically alter benthic communities long afterwards. Sublethal effects may be even more serious than direct lethality. For example, certain petroleum fractions can block organs of chemireception in marine crustaceans and place them at a competitive disadvantage in locating food or in escaping predation. Moreover, petroleum fractions have been shown to interfere with reproduction of certain species, like the lobster, which depend on chemical signals to stimulate proper copulation.

A follow-up IDOE workshop, held in 1974, made some further important findings.[16]

Results of atmospheric trace metal studies indicate that zinc, copper, antimony, lead, selenium, and cadmium (over the North Atlantic) occur in the atmosphere at concentrations far in excess of that predicted from normal crustal weathering. All particulate heavy metals investigated in the surface microlayer (lead, aluminum, iron, vanadium, copper, cadmium, chromium and manganese) are significantly enriched compared to water 20 to 30

[16] National Science Foundation, "Pollutant Transfer to the Marine Environment: Deliberations and Recommendations of the NSF/IDOE Pollutant Transfer Workshop held in Port Aransas, Texas, January 11-12, 1974." R. A. Duce and P. L. Parker (Eds.), University of Rhode Island, Kingston, Rhode Island (1974).

centimeters below the surface. No enrichment has been found of total or dissolved mercury in the oceanic surface microlayer. In the Southern California Bight, atmospheric particle input has been found to be a major source of industrial lead, comparable in magnitude to the input of lead from storm runoff, rain, and sewage.

Estuarine processes influence the amount, and possibly the form, of metals entering continental shelf waters. A large portion of the dissolved iron and manganese precipitates and accumulates in estuarine sediments along with particulate forms of these metals. Most dissolved cadmium and copper are transported through salt marsh estuaries while the particulate fractions are apparently lost to the sediments. All dissolved mercury and, apparently, a desorbable fraction of that in particulate form are transported through the salt marsh system. For southeastern Atlantic salt marsh estuaries, sediments appear to trap 100% of the inflowing iron, 64% of the manganese, 22% of the copper, 17% of the cadmium, and 11% of the mercury.

Copper, zinc, nickel, lead, iron, manganese, chromium, cadimum, and vanadium present on particles in the water column are transported to the water surface in significant quantities by bubbles. In most open ocean areas, the upward flux of many of these trace metals to the sea surface on particles associated with bubbles is at least of the same magnitude as the downward flux of the same metals to the sea surface from the atmosphere.

As much as 50 to 60% of the mercury present in North Atlantic coastal and river waters may exist as organic compounds or in association with organic matter. Total mercury in open ocean waters was a factor of 5 to 8 less than that for coastal waters.

Much of the lead in seawater may be adsorbed on the mucilage of algae and large amounts of lead collect on the epidermal mucus of fish.

With respect to chlorinated and petroleum hydrocarbons, the following were among the workshop's findings:

PCB and DDT compounds are universally present in Arctic wildlife, both terrestrial and marine. Among marine birds, highest DDT residues occur in the Southern California Bight, the result of input from a single terrestrial point source, the White's Point outfall of the Los Angeles County Sanitation Districts. In the vicinity of Amchitka in the Aleutians, PCB concentrations are relatively high in birds (probably carried there by westerly winds from Japan), and PCB exceeds DDT. South of the equator, both DDT and PCB residues in birds drop by an order of magnitude, with DDE/PCB ratios near unity. PCB is found in some, but not all, specimens of Antarctic marine birds, whereas DDT is present in all samples.

Studies of chlorinated hydrocarbons entering the Southern California Bight indicate that surface runoff from rivers has contributed only a relatively small amount of PCB and DDT compounds to the total. The White's Point outfall has been the major source of DDT residues and has also been, with other waste water treatment plants, the major source of PCB. The highest concentrations of DDT in Southern California Bight fish and plankton have occurred around Los Angeles (i.e., derived from the L.A. sewer system) over the past 25 years, although input of DDT and PCB compounds into the Bight from sewage has been declining since 1971.

Municipal wastes discharged to U.S. coastal waters contribute an estimated 28,000 to 140,000 metric tons per year of petroleum hydrocarbons—a level in the same range as the reported amount spilled in coastal areas.

Low-molecular-weight chlorinated hydrocarbons detected at stations in the North Atlantic, the Barents Sea and the North Sea are believed to derive in part from the dumping of waste products of vinyl chloride manufacture in the North Sea. (Until relatively recently, the Shell Chemical Company had been dumping similar wastes into the Gulf of Mexico at the rate of millions of kilograms per month).

Measurements in 1972 of open North Atlantic ocean water levels of PCBs, showed an average surface concentration of 35 ppb and 10 ppb at 200 meters. On this basis, it was estimated that the mixed layer of the North Atlantic contained about 20,000 tons of PCB. A year later, surface water concentrations dropped tenfold, perhaps as a result of use and containment controls instituted in the U.S. in 1970–71. Mussels obtained at Royal Palma on the Palos Verdes Peninsula also showed a downward trend in both DDT and PCB concentrations from 1971 to 1973.

The degradation of ubiquitous tar balls (probably derived from tanker wastes) may be extremely slow because of the low concentrations of nutrient and hydrocarbon-oxidizing bacteria in the open ocean.

The ultimate resting place for a significant fraction of petroleum and chlorinated hydrocarbons is marine sediments. One survey of several locations on a transect from Bermuda to the New York Bight to Woods Hole, Mass., showed the highest sediment hydrocarbon concentrations at stations in the New York Bight region, with the highest levels (2900 and 560 micrograms per gram dry weight) at the sludge/spoil dumpsites and in the Hudson Shelf trough into which dumpsite sediments are believed to be transported.

The mean concentration of PCBs in both North and South Atlantic plankton was 200 ppb (wet weight), with phytoplankton samples containing more than 100 ppb. Commercial groundfish, e.g., cod, haddock, pollock, etc., caught on the New England fishing grounds contain about ten times more PCB and DDT than similar fish caught in the Denmark strait. Evidence from laboratory food chain studies suggests that unicellular algae, scavenge part-per-trillion levels of PCBs and DDT by as much as ten-thousandfold, but that animals feeding on these algae, and fish larvae feeding in turn on these herbivores, accumulate them only two- to fivefold.

A May 1973 National Academy of Sciences workshop gave specific attention to the problem of "petroleum in the Marine Environment."[8] Among its findings were:

> The measured level of petroleum hydrocarbons in a variety of marine organisms ranges over three orders of magnitude (e.g., from 0.3 ppm in flying fish to 535 ppm in herring gull muscle and 429 ppm in the macroalga, *Enteromorpha*).
>
> Although some fish and crustaceans metabolize petroleum hydrocarbons within 2 weeks, metabolism is slow in plankton and benthic invertebrates.
>
> There is no evidence for food web magnification of petroleum hydrocarbons in the marine environment; on the contrary, direct uptake from the water or sediments seems to be more important than from the food chain, except in special cases.
>
> Petroleum hydrocarbon concentrations in polluted coastal sediments can range from 1,500 to 5,700 ppm compared to a range of from 26 to 130 ppm in nearby unpolluted areas.
>
> Different oils have different biological effects, with toxicity being most pronounced for refined distillates (e.g., refined No. 2 fuel oil) and physical smothering most severe with viscous crude oils or Bunker C crude oil.
>
> Very low concentrations of the soluble fractions of kerosene interfere with searching behavior of a marine snail.
>
> The photosynthesis of marine phytoplankton was reported to be reduced by 100 ppb of No 2. fuel oil.
>
> The time required for recovery of polluted areas may vary from a few months to several years. In general, the initial stages of recovery are characterized by opportunistic species that are often very productive, with a much longer time required to restore the community to one that supports more long-lived species.
>
> Animals with very slow reproductive rates, such as marine birds like the auk and penguin, are highly vulnerable to damage from oil or other pollution. Even if oilings were widely spaced in time, they would be chronic catastrophes to auks, which might never recover from a series of spills.
>
> The ecological communities of coastal marshes and estuaries are particularly vulnerable to pollution. Because of their isolation from one another, almost all of the recruitment of resident species is from the offspring of the resident population. If this population were completely destroyed by pollution, recolonization by chance immigration from a distant estuary would probably take a very long time.
>
> With our present scanty evidence, there is no reason to treat the possible concentration of carcinogens from spilled oil as a significant threat. However, there might be other dangerous materials present in petroleum that have not yet been identified.

Another NAS report,[11] resulting from deliberations at a Fall 1973 Woods Hole workshop, selected six groups of potential marine pollutants for study and evaluation: transuranic elements, synthetic organic chemicals, ocean-discharged wastes, metallic wastes, medicinal wastes, and marine litter. Of the materials studied, transuranic elements and hexachlorobenzene were identified as "clear potential problems." Low molecular weight chlorinated hydrocarbons ("LMCH's"), acrylonitrile, iron and copper wastes, open ocean litter, tetracy-

cline, and technetium, were felt to present "no demonstrable hazard to open ocean ecosystems at present or foreseeable levels of release." Possible effects of LMCH's and tetracycline in inshore waters and "some local adverse effects" of aromatic hydrocarbons, certain dumped chemicals, an inshore litter could not be ruled out.

Among this report's significant findings were the following:

Predictions of the effects of transuranic elements on the marine environment cannot be formulated until more extensive knowledge of their modes of transport and their biogeochemical and radiobiological behavior is available. On this basis, conservative approaches should be taken to any releases of transuranic elements to the environment. Both accidental and planned releases should be kept to an absolute minimum.

Present evidence indicates that transuranic elements introduced to marine waters are rapidly transferred to the sediments. If this holds true, then any input from waste treatment or reprocessing will mainly affect the coastal zone near the point of introduction, and would not be expected to contribute significantly to open ocean pollution which would be largely due to atmospheric fallout.

The uses and atmospheric release of the LMCH's studied (perchloroethylene, 1,2-dichloroethane, 1,1,1-trichloroethane, and 1,2-dichloropropane) do not appear to be a hazard to the marine environment. Ocean dumping and perhaps also disposal into rivers of LMCH's and their waste products appear to be of greater concern.

(NOTE: The American Cyanamid Company of Linden, New Jersey, presently ocean-dumps 40 million gallons a year of waste from the manufacture of rubber, paper, mining, and water treating chemicals, organophosphate insecticides, sulfuric acid, and surfactants. Three to five percent of the waste mixture is organic and is predominantly toluene. The material is being dumped at the 106-mile, "toxic chemical" dump site at the edge of the New York Bight, under an EPA permit which does not require a phase-out of this dumping until 1979.)

Hexachlorobenzene ("HCB") is a hazard to man and to the environment. It is highly resistant to chemical, biological, and physical degradation; it is readily dispersed through the atmosphere; and it is accumulated in food webs. Although there are few data on the single dose acute toxicity of HCB, its subacute or chronic toxicity can be significant. The principal response to the long-term daily consumptoin of low levels of HCB by vertebrates is porphyria, a dysfunction of the liver which results in a disturbance of the metabolic pathway in heme synthesis—an important blood pigment. HCB is a by-product in the manufacture of many chlorinated hydrocarbons and in the production of chlorine gas. It is also a significant contaminant in certain pesticides, and is itself used as a grain fungicide. It may be released to the environment and enter the ocean from all of these sources.

Acrylonitrile, which is used as an intermediate in the production of polymers, has a high chemical reactivity and a relatively high biodegradability. This suggests that upon release to the environment it would degrade and have a short residence time. So, acrylonitrile should not have any significant impact on marine organisms, except "acute effects of direct high level discharges . . . to the marine environment, especially estuaries."

The dumping of dredge spoil and sewage sludge in the New York Bight have degraded the environmental quality of the area. This degradation is of local but not regional impact.

The impact of the higher volume of sewage sludge resulting from the achievement of higher levels of sewage treatment will be substantial if disposed of at sea, unless sludge digestion reduces substantially the organic fraction and microorganism levels and care is taken to reduce to a minimum the heavy metal and chlorinated hydrocarbon content of the sludge.

The discharge of industrial waste chemicals to designated disposal areas using presently specified discharge methods can neither be demonstrated to be harmful or not harmful to local ecosystems. The characteristics of the materials involved and the disposal sites indicate that disposal at the Puerto Rico, Gulf of Mexico, and Atlantic deep-water chemical dumpsites may have regional as opposed to local effects.

Wastes disposed by ocean outfalls in Southern California have had a harmful impact in the local ecosystem, but no widespread impact is evident.

Natural inputs of iron and copper to the marine environment, primarily from rivers, dominate the human sources. The disposal of these metallic elements in

ocean areas at present levels will probably result in small overall concentration changes. There may, however, be significant impacts when relatively large injections of toxic metals to small zones such as estuaries are involved.

Tetracyclines as a medicinal waste are not likely to be found in biologically active forms in the marine environment because of dilution and inactivation. There does exist a possibility, however, that tetracycline-resistant bacteria may be shed into and disseminated in the marine environment. To the extent that such bacteri aare increased by tetracycline use, they may be taken up by mollusks, and lead to increased risk of infection by humans who ingest such mollusks.

Technetium-99m is an example of a group of artificially produced radioisotopes, the uses of which are expanding. Although the present usage of this isotope does not seem to pose any threats to the marine environment, the lack of knowledge about leakages from hospitals and industrial sites suggests that occasional monitoring of 99Tc in the coastal marine environment is warranted in areas close to major population and use centers.

Estimates of litter generation and the data on effects suggest that existing concentrations of marine litter do not cause widespread significan alterations in the marine system. However, there may be deleterious effects in regions of litter accumulation. The primary overall impact of marine litter at this time appears to be aesthetic. The flux of liter to the world oceans is about 6.4 million tons per year, with the U.S. the likely source of about a third of this total.

Floating debris can transport organisms into different ocean areas. Floating materials such as styrofoam cups, six-pack retainers, and plastic bags may physically trap organisms, killing them or hindering their movement and feeding. Floating fragments of fishing nets and trawling webs can trap and drown marine organisms. Elastic bands can be caught around the necks of small fish and damage the gills, flesh, and fins of the fish as they grow. Smaller particles may be ingested by small organisms. Suspended material can also clog the gills of fish and crustaceans beyond their capacity to clean them.

A word or two of comment about some of the conclusions of this report may be in order. One must be cautious in extrapolating information about degradation rates in freshwater and in the atmosphere to marine conditions. For example, whereas toluene is 53% biodegrated after 5 days in a freshwater situation, under salt water conditions it will be only 3% biodegraded in the same period of time.[17] Conclusions concerning hazard potential which are based on degredation rates under other than saltwater conditions must, therefore, be taken with a grain of salt. In addition to this salt water effect, account must also be taken of the fact that rates of microbial degradation may be 10 to 100 times slower in the deep sea than closer to shore.[18 19]

On a related point, the pathways of marine litter may provide a useful lesson in assessing the impacts of pollution by materials which occur naturally in seawater. A National Marine Fisheries Service cruise during the summer of 1972 as part of the MARMAP program, observed a widespread occurrence of plastic particles throughout the North Atlantic ocean. Fifty percent of the neuston (surface) samples collected in the Caribbean Sea, 57% in the Antilles Current area, and 69% in coastal, Slope, and Gulf Stream waters between Florida and Cape Cod contained plastics.[20] The investigators concluded that "the accumulation of compounded plastics (wrapping material, containers, toys, etc.) results from routine at-sea solid waste disposal by individual vessels." Other types of plastics (e.g., clear and opaque polystyrene spherules and cylinders) were believed to be derived from outfall waste discharges. In view of the fact that heavy metals and other waste constituents are subject to potentially extensive transport by suspended particulates in seawater,[21 22] and may have an ubiquity similar to that of plastics introduced to the ocean by the same routes, one must be careful to not assume too quickly that simply because a pollutant occurs

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[17] Price, K. S. *et al.*, "Brine Shrimp Bioassay and Seawater BOD of Petrochemicals." *Jour. Water Poll. Control Fed.*, *46*, 63 (Jan. 1974).

[18] Jannasch, H. W., et al., "Microbial Degradation of Organic Matter in the Deep Sea." *Science*, *171*, 672, (Feb. 19, 1971).

[19] Jannasch, H. W., and Wirsen, C. O., "Deep-Sea Microorganisms: In Situ Response to Nutrient Enrichment." *Science*, *180*, 641 (May 11, 1973).

[20] Colton, J. B., *et al.*, "Plastic Particles in Surface Waters of the Northwestern Atlantic." *Science 185*, 491, (Aug. 9, 1974).

[21] Rohagi, N. and Chen, K.Y., "Transport of Trace Metals by Suspended Particulates on Mixing With Seawater." *Jour. Water Poll. Control Fed.*, *47*, 2298 (Sept. 1975).

[22] Chen, K.Y., *et al.*, "Trace Metals in Wastewater Effluents," *Jour. Water, Poll. Control Fed.*, *46*, 2663 (Dec. 1974).

naturally in ocean water, dilution and dispersion will take care of any potential toxicity.

One final NAS report deserves brief mention. This is the 1976 report on "Disposal in the Marine Environment,"[23] which was based on a workshop held in Woods Hole in September 1974. The following were among this report's findings and recommendations:

> Every possible effort must be made to limit or to prevent the entry into the ocean of known or suspected dangerously toxic materials, such as certain halogenated hydro-carbons, plutonium, carcinogens, teratogens, mutagens, and materials in certain reactive states.
>
> Exotic and persistent synthetic organic materials present a serious potential hazard to the environment.
>
> Existing ocean dumping criteria assume that environmental damage will be (1) reversible and (2) not catastrophic. There is no assurance that these assumptions are correct.
>
> An ocean dumping waste management strategy should: confine disposal; exclude wastes with unknown effects; avoid an irreversible dependence on the ocean; exclude wastes that concentrate in food webs; control the rate of disposal in order to avoid overloading site capacity; —continually re-evaluate effectiveness of management, and develop new knowledge as necessary.
>
> Dumpsite monitoring strategies should not ignore the potential for broad-scale chronic pollution of the coastal ocean which could become, if undetected, a far more serious threat than the degradation of restricted areas.

The discussion to this point has been largely limited to chemical pollutants. However, pathogenic microorganisms introduced to the marine environment through dumping and discharge of sewage sludges and effluents, may also pose a very substantial threat to marine organisms and to human health. One particularly ominous recent revelation is that bacteria may remain viable for long periods in ocean sediments, coliform organisms associated with ocean-dumped sewage sludge and dumpsite sediments display a marked resistance to antibiotics, and this resistance to chemotherapeutic agents can be rather freely transferred from otherwise harmless coliform bacteria to the most virulent pathogenic bacteria. "The danger of continued dissemination, through . . . ingestion . . . by marine fauna, of antibiotic . . . resistant strains of bacteria which could colonize man and other animals, is obvious."[24] At least one group of scientists has pressed for a shift away from current water quality standards which regard coliforms purely as indicators of fecal pollution. Now that "plasmid-infected coliforms have joined forces with bacteria which may cause disease" to confer on them antibiotic resistance, they can "no longer be regarded as harmless."[25]

Greater attention also needs to be focused on the problem of the survival of disease-producing viruses in seawater, particularly in association with suspended and settled particles.[26] Not only is better monitoring needed to detect such viruses, but we must come up with far better techniques than are now being employed to inactivate viruses present in sewage discharged to the ocean.[27]

SIGNIFICANCE OF MARINE POLLUTION IMPACTS

Of course, it is difficult to evaluate the overall hazard associated with the addition of dangerous materials to the ocean. For one thing, in the case of naturally occurring substances, such as heavy metals, it is hard to predict how much input is necessary to produce localized water or sediment levels in the toxic range. Obviously, the oceans are not uniformly mixed, and relatively large injections of toxic materials to relatively confined or restricted ocean areas may have pronounced effects.[11 12] But how large an injection is too large cannot readily be determined.

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[23] National Academy of Sciences, "Disposal in the Marine Environment: An Oceanographic Assessment." Report of the Ocean Affairs Board's Ocean Science Committee, NAS, Washington, D.C. (1976)

[24] Koditschek, L. K. and Guyre, P., "Antimicrobial-Resistant Coliforms in New York Bight." *Marine Poll. Bull.*, 5, 71 (May 1974).

[25] Prozesky-O. W. and Smith, L. S., "Drug Resistant Coliforms Call for Review of Water Quality Standards." *Water Research*, 8, 1 (1974).

[26] Gerba, C. P. and Schaiberger, G. E., "Effect of Particulates on Virus Survival in Seawater." *Jour. Water Poll. Control Fed.*, 47, 93 (Jan. 1975).

[27] Cramer, W. N., *et al.*, "Chlorination and Iodination of Pellovirus and f2." *Jour. Water Poll. Control Fed.*, 48, 61 (Jan. 1976).

For another thing, it is difficult to evaluate the significance of localized environmental changes. How much degradation of the ocean can be tolerated as reasonable or acceptable?

The National Marine Fisheries Service, for example, has reported[28] preliminary results from its survey of 9 (ultimately, 15) microconstituents present in 2,415 edible fish and shellfish samples, representing 106 species captured in the coastal waters of the United States, including Alaska and Hawaii. These results indicate that 150 of the 2,415 fish samples analyzed (6.2%), representing 23 species, had mercury levels exceeding the FDA 0.5 ppm mercury guidelines, including 100% of the blue marlin samples tested. Similarly, the results indicate that the calico scallops and North Atlantic oysters tested had mean cadmium levels in excess of 3 ppm; octopus, green abalone, and North Atlantic oysters had silver levels above 0.5 ppm; all species of oysters had mean zinc levels in excess of 175 ppm; and four molluscan and two finfish species contained more than 1 ppm of nickel.

Are these results cause for concern? The Department of Commerce concluded, in a September 11, 1975 news release:

> There do not appear to be any problems with fish and shellfish in regard to the elements analyzed.

Some might plausibly take issue with that conclusion.

Another example of differences of opinion in interpreting marine pollution data comes from the rather intensive studies of the New York Bight over the last decade.

Gross has reported[29, 30] substantial enrichments in surficial sediment heavy metal levels in the Bight, particularly in and around the sewage sludge and dredge spoil disposal sites. Lead concentrations in dump site deposits were twenty times higher than in normal shales; silver was "easily detected" in deposits from waste disposal area; copper was "easily detected" in all sediment samples, with median harbor levels about 5 times those in shale, and concentrations in the dredged waste and sewage sludge disposal areas "distinctly higher" than in continental shelf sediments; and chromium was "easily detected" in all sediment samples, with the highest inner harbor concentrations about 5 times those in shale.

Based on a mass of waste solids from New York City of 8.6 million tons per year dumped in the ocean during the period 1964–1968, Gross concluded[31, 32] that ocean-dumped solids from the New York area exceeded the sediment discharge of all rivers emptying into the Atlantic Ocean between the U.S.-Canadian border and Chesapeake Bay, and that, excluding the Amazon River which flows into the equatorial Atlantic Ocean and the Mississippi River which discharges into the Gulf of Mexico, "the New York metropolitan region may well be the largest source of sediment entering the North Atlantic Ocean." Ocean dumping into the Atlantic has nearly doubled between 1968 and 1974.[1, 6]

The Sandy Hook laboratory of NMFS concluded[33] from its extensive field and laboratory investigations of the New York Bight that sludges and spoils have affected "an area of over 20 square miles"; that the presence of these wastes "have significantly reduced" the standing crops, or biomass, and diversity of marine benthic communities; that elevated heavy metal levels are present in Hudson Canyon sediments 25 nautical miles south of the sludge dumpsite; and that coliform bacteria have a distribution similar to that observed for heavy metals. A group of Woods Hole scientists, who reviewed data on the oxygen content of bottom waters at New York Bight disposal sites, concluded that: "sometime between 1949 and 1969 dumping activities in the New York Bight

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[28] National Marine Fisheries Service, "First Interim Report on Microconstituent Resource Survey." NMFS Southeast Utilization Research Center, College Park, Maryland (Feb. 19, 1975).

[29] Gross, M. G., *et al.*, "Survey of Marine Waste Deposits, New York Metropolitan Region." Marine Sciences Research Center, Technical Report No. 8, State University of New York, Stony Brook, New York (April 1971).

[30] Gross, M. G., "Geologic Aspects of Waste Solids and Marine Waste Deposits, New York Metropolitan Region." *Geological Society of America Bulletin*, 83, 3163 (Nov. 1972).

[31] Gross, M. G., "New York City—A Major Source of Marine Sediment." Marine Sciences Research Center, Technical Report Series No. 2, State University of New York, Stony Brook, New York (Sept. 1969).

[32] Gross, M. G., "Sediment and Waste Deposition in New York Harbor." *Annals New York Academy of Sciences*, 250, 112 (1974).

[33] National Marine Fisheries Service, "The Effects of Waste Disposal in the New York Bight—Summary Final Report." NMFS Middle Atlantic Coastal Fisheries Center, Sandy Hook Laboratory, Highlands, New Jersey (April 1972).

exceeded a critical level and became so excessive that the water system could no longer recover from the contaminating perturbation.[34]

Data on the adverse effects of ocean dumping in the New York Bight could be presented almost indefinitely.

What is the significance of these effects? A National Oceanic and Atmospheric Administration ("NOAA") report[35] on "Ocean Dumping in the New York Bight," prepared under its Marine Ecosystems Analysis ("MESA") rogram, concluded that, "The hazards of dumping sewage sludge and dredge spoils containing trace metals and other toxic wastes into the New York Bight are not known. . . ." and that "there is no evidence of an imminent hazard to [Long Island] beaches." NOAA reached this conclusion despite the following findings of its own report:

> During the passage of major storms, dumped material has been observed to move as much as 1,200 feet over periods of several days.
>
> A mound of material some 30 feet high has accumulated at the dredge spoil dump site over about a generation of dumping.
>
> Concentrations of coliform bacteria in Bight shellfish beds appear to be increasing, and the FDA in 1974 expanded the area closed to shellfishing near the sludge dumpsite.
>
> Fish taken from the Bight apex have a higher incidence of fin rot that specimens taken elsewhere in the Bight.
>
> Crabs and other crustacea in the dump areas show some shell deformities that could be pollution-related.
>
> Antibiotic-resistant strains of coliform bacteria have been found in the Bight, suggesting that this acquired resistance, or "R-factor," is transmitted via harmless as well as harmful bacterial species.

A June 15, 1975 NOAA news release quotes the Manager of MESA's New York Bight project as recommending that "the present dumping sites be kept active until alternatives can be developed," because "there appears to be no evidence of an immediate health problem or threat to Long Island beaches from dumping. . . ."

Another group of scientists assessing the biological effects of waste dumping into the waters of the New York Bight expressed the following rather different view: "All of us who eat anything from the ocean or who go swimming in the surf are having something chopped off of our life expectancy, as a consequence of ocean dumping."[36]

In short, the harm associated with marine pollution, like beauty, depends on the eye of the beholder.

DISCUSSION AND CONCLUSIONS

The ocean has an importance to man and to the future of life on this planet that goes far beyond its use or potential use as a waste repository. Among other things to remember is that four-fifths of the world's animals call the ocean their home, and marine plants account for 50 to 80 percent of the earth's annual plant productivity. And the 10% of ocean area represented by the coastal zone—the region which has borne the brunt of man's polluting activities—is responsible for 90 percent of the world's marine fish production.[14]

A little bit of pollution in the wrong place can do an awful lot of damage.

Nor is man's input of pollution necessarily minor in comparison to natural processes. We have already seen that waste solids from the New York metropolitan region are probably the largest source of sediment entering the North Atlantic. Estimates of specific pollutant loadings to the New York Bight,[3] confirm the importance of direct contaminant inputs to localized areas of the ocean. Thus, barging along contributes 63% of the suspended solids, 50% of the total phosphorus, 82% of the total cadmium, 50% of the chromium, 51% of the copper, 79% of the iron, and 44% of the lead entering the Bight. Municipal and industrial wastewater discharges account for 50% of the biochemical oxygen demand, 36% of the chemical oxygen demand, 58% of the ammonia nitrogen, 53% of the total Kjeldahl nitrogen, 72% of the orthophosphate, 73% of the mercury, and from 84 to 91% of the fecal and total coliform reaching

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[34] Morne, R. A., *et al.*, "The Marine Disposal of Sewage Sludge and Dredge Spoil in the Waters of the New York Bight." Woods Hole Oceanographic Institution. Report to U.S. Army Coastal Engineering Research Center, Fort Belvoir, Virginia (Jan. 29, 1971).

[35] National Oceanic and Atmospheric Administration, "Ocean Dumping in the New York Bight." NOAA Technical Report ERL 321-MESA 2. Environmental Research Laboratories, Boulder, Colorado (Mar. 1975).

the Bight. Wastewater discharges and barging together contribute 55% of the total organic carbon and 60.7% of the oil and grease input.

When one adds to these considerations the facts that (1) the annual loss of hydrocarbons to the ocean is of the same order of magnitude as the annual synthesis of hydrocarbons by marine plants,[36] and (2) no part of the ocean or of its resident flora and fauna is free of chlorinated hydrocarbons traceable to man, it is enough to make even the most placid ecologist uneasy.

One must bear in mind, too, that man's assaults on the ocean both direct and indirect, have a cumulative if not synergistic impact. It matters little to the harassed sea creature whether the oil, BOD, or cadmium tormenting it travelled down an outfall pipe, a river or a raindrop.

Dr. James H. Carpenter of the University of Miami has estimated that inputs of sludge and other solids to the waters of the North-Atlantic continental shelf from Boston to Norfolk will exceed the assimilative capacity of this system with respect to water transparency, nutrients, dissolved oxygen, viruses and heavy metals by the year 2000. "If all liquid and solids that are presently being produced were transmitted to the Shelf, the capacity would be exceeded today."[37]

Indeed, it is precisely the matter of cumulative effects that makes strict regulation of ocean dumping and discharge so important. Any given dumper or discharger may have a pretty convincing argument that his dumping activity will not unreasonably degrade the ocean. But every other would-be dumper could say the same thing. Once you open the door, there is no closing it until it is too late.

EXHIBIT II

STATEMENT OF KENNETH S. KAMLET ON BEHALF OF THE NATIONAL WILDLIFE FEDERATION ON DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE OCEAN DUMPING OF SEWAGE SLUDGE IN THE NEW YORK BIGHT, BEFORE THE U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION II, MARCH 24, 1976

This statement is presented on behalf of the 3.5 million members and supporters of the National Wildlife Federation, including our 70,000 associate members in New York and New Jersey.

The ocean dumping of sewage sludge and other wastes has helped make the New York Bight one of the most degraded areas of the ocean in the world. It is a good example of how not to manage our ocean resources. It is a national disgrace.

In part because of such dumping practices:

Surficial bottom sediments in and around the sludge and spoil dump sites have greatly elevated heavy metal levels.[1]

Suspended sludge particles affect over 200 square miles of ocean surface (DEIS, p. 208).

Water column levels of toxic heavy metals remain elevated seven hours after a sludge dump.

A 15-square mile area of ocean bottom around the sludge and spoil sites show evidence of reduced biomass and a shift in the composition and diversity of benthic organisms (DEIS, p. 229).

Breeding and habitat areas of the commercially important red crab and American lobster in the Hudson Shelf Valley have been contaminated (DEIS, p. 231).

Concentrations of coliform bacteria in Bight shellfish beds appear to be increasing, and the FDA had to expand in 1974 the area closed to shellfishing near the sludge dumpsite.[2]

Crabs and other crustacea in the dump areas show shell deformities[3] (See also, DEIS, p. 236).

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[36] Barber, R. T., "The Threat to Ocean Ecology." In: "The Fate of the Oceans." J. J. Logue, (Ed.), Villanova University Press, Villanova, Pennsylvania (1971).

[37] Carpenter, J. H., letter to William Frich, Deputy General Counsel, Environmental Protection Agency, Washington, D.C. (May 16, 1975).

[1] Gross, M. G., et al., "Survey of Marine Waste Deposits, New York Metropolitan Region." Marine Sciences Research Center, Technical Report No. 8, State University of New York, Stony Brook.

Gross M. G. "Geologic Aspects of Waste Solids and Marine Waste Deposits, New York Meropolitan Region." Geological Society of American Bulletin, 83, 3163 (November 1972).

[2] National Oceanic and Atmospheric Administration, "Ocean Dumping in the New York Bight." NOAA Technical Report ERL 321–MESA 2, Environmental Research Laboratories, Boulder, Colo. (March 1975).

Antibiotic-resistant strains of coliform bacteria have been found in the Bight, suggesting that this acquired resistance is transmitted via harmless as well as harmful bacterial species.[2]

My remarks today fall into two categories: (1) Deficiencies in the Draft Environmental Impact Statement, and (2) Deficiencies in EPA's regulation of sewage sludge ocean dumping, as reflected in the impact statement.

The defects in the first category are many.

The Impact Statement depends excessively on EPA and NOAA studies and does not adequately reflect inputs from knowledgeable outside experts.

For example, the Impact Statement repeatedly implies or expressly states (see, e.g., DEIS, pp. 208, 209) that dispersion of ocean-dumped sewage sludge is an objective devoutly to be pursued. Yet, despite the fact that many respected marine scientists believe there is a virtue in containing rather than dispersing troublesome materials of this kind so that an eye can be kept on it, the Impact Statement contains no discussion whatever of the existence of an issue in this regard or of the arguments supportive of a containment approach. See, e.g., Testimony of Dr. Gilbert Rowe, at EPA Adjudicatory Hearing on the Ocean Dumping of Sewage Sludge by Philadelphia, May 19–28, 1975, Washington, D.C.

Similarly, not only does the Impact Statement give short shrift in general to the problem of seafood contamination (see below), but it reflects no effort whatever to solicit and consider the views of outside public health experts and toxicologists on the significance of potential seafood contamination.

Instead, the Impact Statement tacitly assumes that FDA closure of certain areas to commercial shellfishing will solve any and all possible problems. Indeed, although the Impact Statement does make brief reference (DEIS, p. 256) to the potential for a sludge dumping impact (through bacterial contamination) on sport fishing within 25 nautical miles of the New Jersey coast if the dump site is moved to the Southern Area, it is totally silent as to the similar potential for sludge dumping at the present disposal site.

Least defensible of all, perhaps, is the Impact Statement's total failure to consider the very important and valuable results of the two-week long adjudicatory hearing on sludge dumping held by EPA Headquarters from May 19 to May 28 of last year. At this hearing, EPA received testimony from dozens of marine scientists and experts on sludge management alternatives. The comprehensive record of these hearings must be regarded as "must" reading in any conscientious review of sludge dumping, its consequences, and its alternatives. The Impact Statement's failure to consider this body of knowledge is simply inexcusable.

The Impact Statement fails to consider or discuss several important alternatives to the present practice of sludge dumping.

For example, the Impact Statement notes on page 200 that shifting sludge dumping to a site 85 nautical miles offshore "would be preferable * * * in terms of minimizing the potential for environmental impacts" to either of the alternative areas considered in the Statement. The Impact Statement also notes that, if the large reserve capacity of the present barge fleet is exceeded at some future time, "additional barges could be brought in from other geographic areas, as required" (DEIS, p. 243), and that there would be no increase in transportation costs for commercial barges hauling sludge to a site 85 miles versus 65 miles offshore (DEIS, p. 245, Figure 41). Yet the Impact Statement gives no attention to the possibility of moving at least some sewage sludge from the present site to the indicated 85-mile area. Although the Impact Statement refers in several places (see, e.g., DEIS, pp. 95, 200) to the maximum range of the existing barge fleet being 65 nautical miles, the nature of the impediments to venturing further offshore are nowhere enumerated. And, despite the diversity of the barges in the present fleet, and the fact that several barges currently haul toxic chemicals some 50 miles further offshore than the stated 65-mile limit, the Impact Statement does not even admit of the possibility that at least some sludge could be hauled beyond 65 miles without having to construct brand-new barges.

This narrowing of the Impact Statement's focus in turn gives rise to other significant deficiencies.

Except for a brief reference (DEIS, p. 200) to the "prohibitive" cost of transporting sludge to an alternate dump site off the continental shelf (nowhere is it explained why it is prohibitive for sludge dumpers and not for the industrial waste dumpers who now use the "106" site), there is no discussion at all of the environmental pros and cons associated with such a move (cf., DEIS, p. 95).

This is one of several places in the Statement where the DEIS more closely resembles an economic than an environmental impact statement.

And, although information presented in the Impact Statement (DEIS, pp. 34–35, Table 4) indicates that ocean-dumped sludges vary greatly in their chemical characteristics (e.g., the worst sludges in terms of heavy metal content are those associated with Passaic Valley, Bergen County, and Westchester County sources), no consideration is given to the possibility of treating some sludges differently than others. For example, high heavy metal containing sludges might appropriately be moved to an 85-mile dump site, while less severely contaminated sludges might be retained at the present site. Not only might this approach minimize the potential impacts associated with the more toxic sludges, and relieve some of the growing pressure on the present sludge dump site, but it would provide an added incentive on the dumpers selected to move further out to sea (which presumably, would cost them more money) to either phase-out their dumping altogether or accelerate their efforts to reduce the heavy metal content of their sludges.

Similarly, the Impact Statement fails to discuss the feasibility and impact of reducing the rates of sludge discharge at the present disposal site as a means of promoting dispersion and minimizing at least short-term toxicological effects. Although the Impact Statement states (p. 202) that "[t]he rate of discharge is based on bioassay analyses of representative waste samples," it fails to address the criticism, levelled by the General Accounting Office among others, that this discharge rate is unjustifiably based on bioassays using the inappropriately hardy brine shrimp, and that if more suitable test organisms were used, very much slower rates of discharge would be required to protect marine organisms.[3] It also fails to consider that discharge rates at the sludge dump site often in practice fail to conform to even a brine shrimp-related rate of discharge, but rather are dictated by the high density of ship and barge traffic passing through the present dump site (DEIS, p. 82). Thus, it is quite possible, for example, that the environmental impact of sludge dumping could be minimized by reducing the discharge rates of sludge dumpers to levels designed to safeguard appropriate sensitive marine organisms, with any dumping that could no longer be accommodated at the present site under such a regime being moved to an alternative site. The Impact Statement, with characteristic unimaginativeness, fails to so much as consider this possibility.

Likewise, and in the same vein, the Impact Statement does not analyze the possibility of employing clean dredged sediment as a bottom coating in the vicinity of the sludge dump site as a means of stabilizing the sludge and minimizing its impact. If this approach were determined to exceed the present site's capacity to receive both sludge and dredged material (it could, in fact, increase the present site's capacity to receive sludge) partial use of an alternative site could again be considered. Again, the Impact Statement confines itself to simplistic generalizations in noting (DEIS, p. 201) that: "It would be difficult, if not impossible, to determine the cause of adverse environmental effects at a dump site where two or more different types of waste were being dumped." Of course, the present sludge and spoil sites are so close together now that, for all intents and purposes, they could be considered a single site (as the FDA has for purposes of establishing prohibited zones).

The Draft Environmental Impact Statement fails to consider alternative regulatory approaches as possible means of accelerating the termination of ocean dumping or otherwise minimizing the environmental impact of continued ocean dumping.

For example, the Impact Statement repeatedly refers (see, e.g., DEIS, pp. 43, 266) to EPA's "intention" to phase-out all ocean dumping of sewage sludge by 1981 ("where environmentally, technically, and economically feasible"). The Impact Statement also notes (DEIS, p. 92), however, that municipal and sewerage authorities indicated, in connection with the announcement in April 1974 of EPA's "intention" of shifting sludge dumping operations to an alternate site by July 1976, that "they could not commit the necessary resources to effect such a move on the basis of a notification of 'intention' alone." Despite the reason-

[3] Statement of Henry Eschwege, Director, Resources and Economic Development Division, General Accounting Office, before the Subcommittee on Oceanography and the Subcommittee on Fisheries and Wildlife Conservation and the Environment, House Merchant Marine and Fisheries Committee, on Administration of the Marine Protection, Research, and Sanctuaries Act of 1972, Jan. 23, 1976.

ableness of supposing that the announcement by EPA of vague "intentions" or "goals" in connection with a 1981 dumping phase-out will be no more effective in spurring municipal sludge dumpers into effective action than similar announcements concerning the 1976 dump site shift, the Impact Statement nowhere addresses the alternative of EPA's placing New York and New Jersey sludge dumpers on firm phase-out schedules as has been done by EPA Region III in the Philadelphia and Camden situations.

Indeed, nowhere does the Impact Statement even address the impact of continued sludge dumping in the New York Bight beyond 1981—a possibility which approaches absolute certainty unless EPA modifies its regulatory policies.

Similarly, the Impact Statement (DEIS, p. 44) assumes that the heavy metal levels in ocean-dumped sludge will remain "about the same" through at least 1981, despite the fact that pretreatment requirements will go into effect by 1977, and despite the fact that as many as 5 treatment plants (including that producing the heavily contaminated Westchester County sludge) have plans to switch to sludge incineration between now and 1981 (DEIS, p. 49). The Impact Statement, in fact, does not address at all the Regional Administrator's ability (through the application of appropriate permit conditions) to affect the content and composition of ocean-dumped sewage sludge. (Another example is the reference on page 46 to possible increases in the solids content of ocean-dumped sludge between now and 1981; despite the potential for increased environmental impact associated with the dumping of more concentrated wastes, the Impact Statement does not discuss this question or the Regional Administrator's ability to influence this process).

The Draft Environmental Impact Statement fails to adequately consider and evaluate the potential public health impact of sludge contamination of edible fish and shellfish.

The Impact Statement concludes that continued use of the present sewage sludge dump site poses no "present threat to public health" (DEIS, pp. 7, 89). But, as is made clear throughout the Impact Statement, the Statement's whole focus is on managing sludge dumping "without affecting the recreational quality of Long Island and New Jersey coastal waters" (DEIS, p. 89).

Thus, although there is a brief discussion near the end of the Impact Statement of the "significant potential" for bacterial contamination of edible commercial and sport shellfish taken from the New York Bight (DEIS, pp. 224–225), it is tacitly assumed (see, e.g., DEIS, p. 259) that closure by the Food and Drug Administration of commercial shellfishing areas will eliminate any possible public health hazard, and the Statement's summary sections (DEIS, pp. 5–6, 272–274) do not even include seafood contamination among the potential impacts of continued sewage sludge ocean dumping.

The Impact Statement's failure to properly consider the public health hazard associated with human ingestion of sludge-contaminated seafood, makes it not only seriously deficient, but dangerously misleading. The seafood eaters of the Metropolitan area and of other places that rely on fish and shellfish from the New York Bight have a right to a candid assessment of the risk of illness and poisoning imposed on them by continued sludge dumping.

As noted in the Impact Statement (DEIS, p. 224), "The health hazards implicit in the consumption of contaminated shellfish is much greater than that from direct contact (swimming) because shellfish have the capacity to concentrate microorganisms in their tissues." The same could be said for toxic heavy metals, for polychlorinated biphenyls (PCBs), for DDT and its metabolites, and for other halogenated organics. And, although fish are generally less efficient bio-accumulators than shellfish, the risk of consuming contaminated fish is a very real one. (E.g., some fish feed on shellfish and can accumulate high levels of pathogens and toxicants by this route).

A recent National Marine Fisheries Service survey[4] of thousands of fish and shellfish taken from U.S. coastal waters, for example, found that 6.2 percent of the fish samples analyzed, including 100 percent of the blue marlin samples tested, had mercury levels exceeding the 0.5 ppm FDA mercury guidelines. The survey also found that the calico scallops and North Atlantic oysters tested all had cadmium levels in excess of 3 ppm, with other shellfish having very high levels of silver, zinc and nickel.

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[4] National Marine Fisheries Service, "First Interim Report on Microconstituent Resource Survey." NMFS Southeast Utilization Research Center, College Park, Md. (Feb. 19, 1975).

The Impact Statement makes no effort to assemble data on chemical or microbial contamination of New York Bight fish and shellfish.

And although the Impact Statement does suggest (DEIS, p. 256) that sport fishing within 25 nautical miles of the New Jersey coast could be impacted by sludge dumping at one of the proposed alternative sites, it refuses to acknowledge the possibility that there may be considerable sport fishing impacts associated with continuation of present sludge-dumping practices. Indeed, the Statement nowhere discusses the state and FDA roles in the "Shellfish Sanitation Program," and the limitations of this program. For example, the program is directed only at commercial shellfish sanitation; it does not regulate or monitor either sport or commercial fishing, recreational shellfishing, or chemical contaminated (with the partial exception of mercury) of either fish or shellfish. Moreover, the program's performance, even within its limited scope, has been criticized as largely ineffective.[5]

The Nation's seafood-eaters deserve to be informed of the risk they run, because of EPA's permissive ocean dumping policies, in eating fish or shellfish taken from the New York Bight.

Finally, although the Impact Statement discusses (DEIS, pp. 128–139) the numbers and distribution of fish and shellfish in the proposed alternative areas and possible economic impacts on these resources of a shift in dump sites (DEIS, pp. 246–248), the foodchain and public health aspects are nowhere considered. Nor is consideration given to present commercial losses due to the FDA's establishment of prohibited zones; or to public health dangers associated with present dumping practices as a result of "illegal harvesting of contaminated shellfish" (DEIS, p. 233); or to the effects of short dumping inshore of the present dump site—an eventuality which must be regarded as "likely" (DEIS, p. 237) if not inevitable; or to the potential for water column or bottom transport of present on-target and short-dumped sludge into productive fishing and shellfishing areas.

In short, the Impact Statement ignores what it should be emphasizing.

The Draft Environmental Impact Statement fails to consider the public health significance of the ocean dumping of sewage sludge containing antibiotic-resistant microorganisms.

The Impact Statement devotes two short paragraphs to antibiotic-resistant bacteria (DEIS, pp. 144–145). After noting the suggestion that "the dump site is a potential 'breeding ground' for antibiotic resistant bacteria," the Statement observes that "antibiotic resistant bacteria are an indicator of wastewater contamination." One searches the Impact Statement in vain for the slightest expression of concern over potential public health significance. Again, this reflects badly on the Statement's value as either a decision-making tool or a means of properly informing the public.

Outside scientists have no trouble seeing a danger in the spread of antibiotic resistance from harmless coliforms to virulent pathogens which may find their way into the food chain: "The danger of continued dissemination, through * * * ingestion * * * by marine fauna, of antibiotic * * * resistant strains of bacteria which could colonize man and other animals is obvious."[6] And, now that "plasmid-infected coliforms have joined forces with bacteria which may cause disease" to confer on them antibiotic-resistance, they can "no longer be regarded as harmless."[7] Antibiotic-resistant coliforms are far more than "an indicator of wastewater contamination."

The Impact Statement notes the apparent persistence of bacteria in the vicinity of the present sludge dump site, especially in bottom sediments (DEIS, p. 198), but is unable or unwilling to put two and two together to get four.

The Draft Environmental Impact Statement, although it recommends continued use of the present dump site along with a "comprehensive monitoring program" to detect "imminent public health hazards" and "damage to recreational water quality," does not discuss what an adequate or comprehensive monitoring program should consist of or the practical feasibility of putting such a program into effect.

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[5] General Accounting Office, "Protecting the Consumer from Potentially Harmful Shellfish (Clams, Mussels, and Oysters)." Report to the Congress by the Comptroller General of the United States, GAO Report No. B-164031(2) (Mar. 29, 1973).

[6] Koditschek, L. K. and Guyre, P., "Antimicrobial-Resistant Coliforms in New York Bight." Marine Pollution Bulletin, 5, 71 (May 1974).

[7] Prozesky, O. W. and Smith, L. S., "Drug Resistant Coliforms Call for Review of Water Quality Standards." Water Research, 8, 1 (1974).

The National Wildlife Federation, on the basis of the available, limited, information, supports retention of the present sludge dump site in preference to an immediate, total shift to either of the two alternative areas addressed by NOAA and by the Impact Statement. (This is not to say that NWF's position might not change based on the results of more thorough study, or on the basis of the consideration of an expanded range of options). The validity of such a position depends, however, on the active implementation of an effective and comprehensive monitoring program (DEIS, p. 201).

The Impact Statement is totally silent as to what the contemplated monitoring program will or should consist of. We regard the nature of the monitoring program to be of crucial significance in assessing EPA's ability to safeguard the quality of the New York Bight environment or the health of its constituency. We would very much like to be reassured that EPA has more in mind than simply taking coliform counts at Long Island and New Jersey beaches. In our view, no monitoring program can begin to be effective or comprehensive unless it includes careful monitoring for heavy metals, organohalogens, and pathogens (including viruses), of a variety of New York Bight fish and shellfish in, around, and away from the present sewage sludge dump site. We trust that the present Draft statement will be revised to incorporate a commitment from EPA to carry out a monitoring program of this kind.

The Draft Environmental Impact Statement inadequately discusses the requirements of the ocean dumping law and treaty.

The Impact Statement discusses applicable legal requirements on pages 63 through 77. However, in almost every instance, the Statement fails to describe the strict environmental protection requirements of the ocean dumping law and treaty.

For example, in its discussion (DEIS, pp. 63–64) of the Marine Protection, Research, and Sanctuaries Act (the Ocean Dumping Law), the Statement fails to point out any of the following:

1. The MPRSA's policy (§ 2(b)) "to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentfalities."

2. The MPRSA's prohibition (§ 102(a)) against permitting any ocean dumping unless the Administrator is able to determine that the proposed dumping is safe (i.e., that it will not "unreasonably" degrade or endanger the marine environment or human health).

3. The MPRSA's encouragement (§ 102(a)(I)) of dump site designations, "wherever feasible," at locations "beyond the edge of the Continental Shelf."

4. The MPRSA's desire (§ 203) that means be found for "minimizing or ending all dumping of materials within five years of the effective date of this Act" (i.e., by April 23, 1978).

Similarly, in its brief discussion (DEIS, pp. 75–76) of the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter" (the ocean dumping treaty), the Statement neglects to mention any of the following:

1. The pledge by parties to the Convention (Art. I) to "promote the effective control of all sources of pollution of the marine environment and . . . to take all practicable steps to prevent the pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea."

2. The Convention's prohibition (Art. IV (1)(a)) Annex I) *against the ocean* dumping of wastes containing (more than "trace" amounts of) *mercury*, cadmium, organohalogens, and oil and grease.

3. The Convention's prohibition (Art. IV(1)(b), IV(2)) against the ocean dumping of Annex II materials without strict adherence to the 21 evaluation factors of Annex III, "including prior studies of the characteristics of the dumping site."

Indeed, the discussion of Annex II which appear at the top of page 76 gives the erroneous implication that Annex I has no application at all to sewage sludge and dredged material—a conclusion not warranted by the Convention's language or its history.

The effect of the Statement's incomplete and misleading exposition of the law is to make it appear that EPA has come a lot closer to complying with legal requirements than it in fact really has.

The Impact Statement has many other deficiencies which we will not take the time to discuss in detail.

I will reiterate, on behalf of the National Wildlife Federation, however, our hope and expectation that, despite EPA's decision not to proceed with an immediate shift in sludge dump sites, the present Draft Impact Statement will be revised to correct the deficiencies we and others have raised, and be reissued as a Final Environmental Impact Statement. We hope, too, that EPA's role in the process of revision and reconsideration will be more extensive than the "editing and abridging" that went into the present draft.

Let us now turn briefly to a discussion of the more fundamental question of the propriety and legal sufficiency of EPA Region II's approach to the regulation of sewage sludge ocean dumping.

EPA Region II's refusal, contrary to the policy laid down by two EPA Administrators and to the practice of the neighboring EPA Region III, to place its sludge dumpers (in whole or in part) on firm timetables for phasing out their dumping activities.

Despite an oft-expressed "goal" or "intention" to phase-out ocean sludge dumping by 1981, Region II steadfastly refuses to place its sludge dumpers on firm phase-out schedules. Or, as Regional Administrator Hansler prefers to put it: "Regional policy is to determine an environmentally acceptable land-based disposal method for municipal sludge, rather than to first set impractical to achieve deadlines for the establishment of alternatives which may, in the long run, prove to be more environmentally damaging." [8]

Unfortunately, as previously noted, to expect municipalities to gear up for a phase-out of their dumping on the basis of no more than vague expressions of intention is unrealistic. If any alternative is to be implemented by 1981, sludge dumpers must forcefully and immediately be directed to proceed toward achieving that objective.

Region II's policy of gentle encouragement is not only slow and ineffective, however, it also violates the law and EPA policy in the following respects:

1. It violates the MPRSA's bar against allowing ocean dumping not shown to be safe.

2. It violates the Convention's prohibition against dumping more than "trace" amounts of cadmium-containing wastes.

3. It violates EPA's own regulations (40 C.F.R. §§ 220.3(d), 227.4) which require all interim ocean dumping permittees to develop and "actively implement" a plan to eliminate their dumping or bring it into compliance with the ocean dumping criteria.

4. It violates former Administrator Ruckelshaus's pledge to the congressional committees responsible for the MPRSA that "communities already dumping at sea would not be allowed to increase the volume of such dumping over current levels"; that "no new sources of sewage sludge would be permitted"; and that EPA would require existing sludge dumping "to be phased out entirely within a reasonable period of time." [9]

5. It violates present Administrator Train's testimony (in his then capacity as Chairman of the Council on Environmental Quality) to the same congressional committees that "the policy . . . is to end all harmful dumping as rapidly as possible," and, in the case of existing sludge dumpers, "the policy is definitely to phase these out." [10]

6. It contravenes Administrator Train's September 25, 1975 adjudicatory hearing decision, acknowledging EPA's responsibility under the MPRSA and the Convention not only to prevent "unnecessary ocean dumping" but to develop "alternatives for use and disposal of waste materials." 5 ELR 30003. In that

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[8] Statement of Mr. Gerald M. Hansler, P. E., Regional Administrator, Environmental Protection Agency, Region II Before the Subcommittee on Oceanography and the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Committee on Merchant Marine and Fisheries, United States House of Representatives, New York, N.Y., Mar. 5, 1976.

[9] Hearings on Ocean Waste Disposal Before the Subcommittee on Oceans and Atmosphere of the Senate Committee on Commerce, 92nd Cong., 1st Sess., Ser. 11, at 265 (1971); see also

Hearings on Ocean Dumping of Waste Materials Before the Subcommittee on Fisheries and Wildlife Conservation and the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries, 92nd Cong., 1st Sess., Ser. 2, at 395, 453 (1971).

[10] Hearings on Water Pollution Control Legislation, Ocean Dumping Before the Subcommittee on Air and Water Pollution of the Senate Committee on Public Works, 92nd Cong., 1st Sess., Ser. H10, Pt. 5, at 2018 (1971).

decision, the EPA Administrator affirmed Region III's authority and responsibility to phase-out sludge dumping by the City of Philadelphia.

7. It conflicts with the regulatory approach of neighboring EPA Region III, which has placed both of its sludge dumpers on explicit schedules for phasing out their ocean dumping by 1980 and 1981, respectively.

Among the other policy-related problems highlighted (although not discussed as such) by the Impact Statement are the following:

—Although the Impact Statement speaks in terms of there being 23 treatment plants engaged in sludge dumping by 1981 (DEIS, p. 44), as compared to the present 28 (DEIS, p. 34), and Regional Administrator Hansler recently emphasized that Region II has issued no dumping permits to municipalities not engaged in ocean dumping prior to 1973, the Impact Statement also signifies an EPA intention (DEIS, p. 44) to allow brand-new treatment plants (e.g., N.Y.C.'s proposed North River Plant) of presently permitted municipalities to begin ocean dumping for the first time. Based on the Impact Statement's reference (p. 44) to 3 commercial sludge haulers and 3 to 5 small municipal dumpers (p. 49) expected to phase-out their dumping by 1981, the projection of 23 sludge dumpers by 1981 implies that there will be from 1 to 3 new treatment plants that will begin ocean dumping between now and then.

—Although the Impact Statement speaks (DEIS, pp. 56–57) of the "phasing out" of all industrial chemical dumping by 1981, Regional Administrator Hansler indicated at recent congressional oversight hearings that several major industrial dumpers may be allowed, instead of phasing out their dumping, simply to bring their wastes into compliance with the criteria.

Even with respect to the five municipal and three commercial sludge dumpers (DEIS, pp. 49, 44) which have plans to terminate their ocean dumping, EPA has thus far been unwilling to incorporate phase-out requirements in their ocean dumping permits.

The Impact Statement's reference (DEIS, p. 51) to an expectation by the Corps of Engineers of a "future annual increment of 46 to 54 thousand cu. m. (60 to 70 thousand cu. yd.)" of dredged material ocean-dumped in the New York Bight, appears to conflict with Colonel Hunter's testimony [11] that he sees "no increase" in present levels of dredged material ocean dumping.

In view of the Interstate Sanitation Commission's expressed preference for pyrolysis—an alternative not capable of implementation for approximately 10 years (DEIS, p. 193)—why does EPA continue to speak of its intention to phase-out sludge dumping within five years?

The Impact Statement (DEIS, pp. 71–72) describes the Coast Guard's prototype sealed recording navigation equipment which is capable of verifying that a dumping vessel reaches the designated dump site. The Statement also notes, however, that the prototype does not have a "dump sensor," although this is "electronically possible," to ensure that no dumping occurs enroute to the dump site. EPA should encourage incorporation of the dump sensor feature in future models.

In conclusion, the National Wildlife Federation finds many deficiencies in the Draft EIS on sludge dumping, many of them no doubt the result of defective "marching orders" given by EPA to the contractors who wrote the EIS. In some respects, however, the limitations of the EIS are most likely attributable to the narrow policy approaches adopted by EPA Region II. Such a narrowing of policy approaches could only have resulted in an equally narrow and unimaginative EIS discussion of impacts and alternatives.

We find it difficult to escape the conclusion that part of Region II's problem in finding short-term alternatives to ocean dumping of sludge, in addition to its misapplication or misconstruction of legal and policy dictates, has to do with its quest for a single sludge management methodology capable of handling all of the Metropolitan area's ocean-dumped sludge. This approach just complicates the task and delays the implementation of alternatives. Region II must adopt a regulatory approach with the flexibility, for example, to require sludge-dumpers in outlying areas (or otherwise having access to land) to apply all or some of their sludge to land as a soil amendment or fertilizer. Perhaps one of the major

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[11] Statement of Colonel Thomas C. Hunter Before Subcommittee on Oceanography and the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Subject—"Ocean Dumping in the New York Bight."—Mar. 5, 1976.

reasons Region III was able to place both of its sludge dumpers on phase-out schedules is that it has just 2 (and not 2 dozen) dumpers. If Region II, likewise, treated its dumpers on a two-by-two basis, rather than en masse, it might make more progress, more quickly.

We hope and trust that the process of revising the Draft EIS on sludge dumping will help Region II to "see the light" and reassess its policy approach.

Otherwise, we and others will be forced to continue to equate Region II's passive approach to the degradation of the New York Bight through continued dumping of sewage sludge with that of the Emperor Nero in dealing with a certain fire problem in Rome. We respectfully suggest that it is time to stop "fiddling" around.

EXHIBIT III

Impact of Public Law 92-532 on Dredging and Disposal[1]

(By Kenneth S. Kamlet)[2]

INTRODUCTION

The Ocean Dumping Act (Public Law 92-532) [*24*] established a national policy of strict regulation of the ocean disposal of wastes, including dredged material. Under this law, Corps of Engineer review of spoil dumping proposals must consider and apply environmental impact criteria set forth in dredge disposal regulations [*10*] developed by the Environmental Protection Agency ("EPA") on consultation with the Corps. An international treaty on ocean dumping [*3*] to which the U.S. is a party entered into force in mid-1975. It places additional environmental constraints on the disposal of dredged material at sea.

This paper discusses the environmental protection requirements of U.S. and international law as they relate to the ocean dumping of dredged material, the National Wildlife Federation's legal challenge to EPA's dredge disposal regulations, and approaches to obeying the law without closing down the nation's ports and harbors.

THE PRACTICE AND SIGNIFICANCE OF DREDGED MATERIAL OCEAN DUMPING

More dredged material is disposed of by ocean dumping today than ever before. In 1974, dumping off U.S. coasts exceeded 120 million tons (10.9×10^{10} kg) [*8*]. This was triple the level reported for 1968 and accounted for 90 percent of all U.S. ocean dumping and one-quarter of all dredged material disposed of in the U.S. in 1974 [*5, 8, 26*]. It also represented over 4 times the total annual discharge of suspended sediment (as estimated around 1900) of all U.S. Atlantic Coast rivers [*7, 14, 16*].

One need not indulge in flights of fancy to imagine that, with such massive quantities of material, even pure sediment could have a major disruptive effect on the marine environment unless great care were taken to keep it out of biologically productive areas. Among the purely physical effects of dredged material deposition in marine environments are the impairment of photosynthesis as a result of decreased light transmission, and the covering and resultant alteration of benthic (bottom-dwelling) communities. Benthic effects include not only gross damage, such as habitat destruction and smothering, but may encompass more subtle longer-term effects, such as inhibition of locomotion, alteration of feeding habits, disruption of prey-predator relationships (e.g., by modifying natural cover), and interference with reproduction by destroying bottom-laid eggs. Resettlement of affected areas may occur slowly even after dredged material disposal has ended.

Yet despite these potential impacts, most ocean-dumped dredged material continues to be disposed of in ecologically sensitive coastal waters. Indeed, there has been a distinct trend toward concentrating increasing amounts of dredged material in a greatly decreased number of dump sites. While this may lessen the impact on some areas of the ocean (and avoid stirring up the residents of the

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[1] Presented at the January 26-28, 1976, ASCE Specialty Conference on Dredging and its Environmental Effects, held at Mobile, Ala.

[2] Counsel, National Wildlife Federation, Washington, D.C.

corresponding coastal communities), the potential impact on the remaining disposal areas is clearly increased.

As an illustration of the magnitude of this effect, consider that fewer than 40 million tons (3.6 x 10^{10} kg) of dredged material were ocean-dumped at some 160 disposal areas in 1968, as against more than 120 million tons (10.9 x 10^{10} kg) at fewer than 60 disposal sites in 1974 (Parish, J. V., personal communication; 8, 31). The average dumping "pressure" per disposal site has, therefore, increased more than 8-fold during this six-year period. Although the 1968 disposal areas tended to be closer to shore and in shallower water than most of their 1974 counterparts—60 percent of the 1968 disposal sites were within 3 miles of the coast in water depths of less than 100 feet; 21 percent of the 58 permits issued to private dumpers in fiscal year 1974 were for sites within the territorial sea (statistics are not available for the five-sixths of all dredged material dumping carried out by the Corps itself)—dredged material dumping in 1974 continued to be largely limited to relatively near-shore areas of the biologically productive continental shelf (Parish, J. N., personal communication; 8, 28, 31).

In short, the potential adverse impact on the marine environment of the ocean dumping of even "unpolluted" dredged material is both large and growing larger.

Unfortunately, a substantial proportion of the dredged material disposed of at sea is "polluted" with contaminants derived from sewage and industrial wastes. These contaminants run the gamut from pathogens (e.g., bacteria, viruses, parasites) to toxic heavy metals (e.g., mercury, cadmium, lead, arsenic) to chlorinated organic chemicals (e.g., DDT, PCBs).

A 1968 Corps estimate put the quantity of "polluted" dredged material ocean-dumped at about 34 percent of the dredge dumping total, including 45 percent of the spoil dumped off the Atlantic Coast [5]. This estimate considered only chlorine demand, biochemical oxygen demand ("BOD"), chemical oxygen demand ("COD"), volatile solids, oil and grease, concentrations of phosphorus, nitrogen, and iron, silica content, and color and odor. It is possible, therefore, that a more extensive characterization effort (e.g., including heavy metal and organochlorine analyses) would have revealed an even greater frequency of pollution.

The environmental significance of ocean dumping of polluted dredged material may extend far beyond localized physical effects. In addition to oxygen-depleting effects on the water (resulting from microbial degradation of organic matter associated with sewage- and nutrient-laden sediment), which can reach the point that "certain fish and other aquatic populations cannot survive," toxic chemical contaminants can adversely affect both marine life and public health—even with substantial dilution [5]. In some cases, biological uptake, accumulation, and food-chain magnification may pose a far greater potential hazard than acute or chronic toxicity to marine life. From at least the public health and public policy standpoints, injury to human seafood eaters commands greater attention than the destruction of an occasional shellfish bed or fishery. It is far from easy, however, to trace a Long Island housewife's Thursday morning stomach ache to a barge load of dredge spoil dumped in the New York Bight the previous Monday. The ocean dumping of polluted dredged material can also reduce recreation opportunities and produce economic losses when seafood species are killed or rendered inedible, as well as generally damage aesthetic values through the creation of surface films (e.g., from the release of adsorbed oil and grease) and the release of floatable contaminants.

FEDERAL OCEAN DUMPING REGULATION

The Ocean Dumping Act, formally known as the Marine Protection, Research, and Sanctuaries Act ("MPRSA"), was passed on October 23, 1972 (and became effective six months later), largely in response to environmental concerns expressed by the Council on Environmental Quality ("CEQ") in its ocean dumping report to the President [5]. The CEQ report concluded that:

"If no action is taken and ocean dumping continues to increase, the long-term damage to the marine environment will be great."

With respect to dredged material, the report made the following recommendations:

"Ocean dumping of polluted dredge spoils should be phased out as soon as alternatives can be employed. In the interim, dumping should minimize ecological

damage. The current policy of the Corps of Engineers on dredging highly polluted areas only when absolutely necessary should be continued, and even then, navigational benefits should be weighed carefully against damages.

"Ocean dumping of unpolluted dredge spoils, construction and demolition debris, and similar wastes which are inert and nontoxic should be regulated to prevent damage to estuarine and coastal areas."

The MPRSA committed the United States, for the first time on a national basis, "to regulate the dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."

Title I of the MPRSA, which is the "marine protection" part of the statute, requires the EPA Administrator and the Secretary of the Army to establish permit programs designed to exclude from the ocean all waste materials (dredged materials in the latter case, non-dredged wastes in the former) which might result in "unreasonable" degradation or endangerment of the marine environment or human health. Project approvals (both private permit requests and Corps-initiated project proposals) for the ocean dumping of dredged material are made by the Secretary (this responsibility has been delegated to Corps District Engineers), in accordance with regulatory criteria required to be established by the Administrator (in consultation with the Secretary). If the Administrator and the Secretary disagree as to compliance with the dredged material criteria, the Administrator's determination prevails and the Secretary may not issue a permit which does not comply with the criteria. (The MPRSA authorizes the ocean dumping of non-conforming dredged material only if the Secretary certifies that there is no other economically feasible disposal site or method available and the Administrator grants a "waiver" based on the absence of certain "unacceptable adverse impact[s]").

The statute provides for the case-by-case evaluation of ocean dumping proposals, with dumping approvals to be granted only where there has been an affirmative showing of no unreasonable degregation. Such a showing must be based on the ocean dumping criteria which, in turn, must consider at minimum the nine evaluation factors specified in section 102(a) of the MPRSA. These factors are concerned with the short- and long-term effects of ocean dumping on marine life and human health and welfare, as well as with the need for, and availability of alternatives to, ocean dumping.

Complementing and, in some cases, supplementing the MPRSA is the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter ("Convention"). This international treaty was agreed upon November 13, 1972 by a conference of representatives of ninety-two nations meeting in London. The Convention, to which the U.S. is a party, became fully operational in the late Summer of 1975. As amended on March 22, 1974, the MPRSA requires the domestic ocean dumping criteria (except to the extent that this would relax pre-existing MPRSA requirements) to "apply the standards and criteria binding upon the United States under the Convention, including its Annexes."

The EPA regulations applicable to the ocean dumping of dredged material ("dredged material criteria"), first published in the Federal Register of October 15, 1973, emphasize the classification of dredged wastes into "polluted" and "unpolluted" categories. Once this has been done, however, regulatory guidance evaporates, and Corps officials are essentially left to their own devices in deciding when and under what conditions ocean dumping may proceed. As will be discussed, this has led to the conviction in some quarters that the dredged material criteria in their present form are incapable of being applied in conformity with applicable legal requirements.

DEFECTS IN THE PRESENT DREDGED MATERIAL CRITERIA

The dredged material criteria seem to violate the law in five major respects:

1. They fail to prohibit ocean dumping which may unreasonably degrade or endanger the marine environment or human health.
2. They allow ocean dumping without requiring full prior consideration of all evaluation factors required to be considered by the ocean dumping law.
3. They allow ocean dumping without requiring full prior consideration of all evaluation factors required to be considered by the ocean dumping treaty.

4. They allow the ocean dumping of substances the dumping of which is prohibited by the treaty.

5. They are impermissibly less protective of the environment than the criteria for non-dredged wastes.

FAILURE TO APPLY THE UNREASONABLE DEGRADATION STANDARD

The MPRSA authorizes the Secretary to issue an ocean dumping permit only where he is able to determine that the proposed dumping "will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."

The dredged material criteria violate this requirement in two separate respects. First, the criteria apply the wrong statutory standard. Second, the criteria do not properly allocate the burden of proof.

With respect to the statutory standard, the dredged material criteria impermissibly base ocean dumping decisions on the presence or absence of evidence that the proposed dumping "will have an unacceptable adverse impact on municipal water supplies, shellfish beds, wildlife, fisheries (including spawning and breeding areas), or recreational areas." The statute requires the more rigorous "unreasonable degradation" standard, with its associated minimum of nine mandatory evaluation factors, to be applied instead.

As far as the burden of proof is concerned, in contrast to the statutory presumption against ocean dumping absent an affirmative showing of safety, the dredged material criteria specify that "[t]he dumping of dredged material in the ocean will be permitted * * * unless there is evidence that the proposed disposal will have an unacceptable adverse impact * * *" and that "[m]aterial which is determined to be unpolluted may be dumped at any site which has been approved for the dumping of settleable solid wastes of natural origin." Incredibly, anachronistic Corps regulations [4], first published in 1950, continue to require:

"all material originating in New York Harbor, Hudson River south of Hastings, New York, and East River west of Throgs Neck * * * to be dumped at sea."

This philosophy was recently extended to the point of utter absurdity when an enterprising official of the New York Corps District office announced in Public Notice No. 7851 (Sept. 27, 1974) that, because a sample of dredged material was determined to be polluted (as indicated by a "Shaker Test analysis"): "The dredged material will, therefore, be disposed of at an approved ocean Government Dump site." If both polluted and unpolluted dredged material are pre-destined to be ocean-dumped, why even bother classifying them as "polluted" and "unpolluted"?

Finally, perhaps the clearest indication of the chilling effect the dredged material criteria have been having on the strict regulation of ocean dumping is the fact that, of the 159 private ocean dumping permit applicatiaons processed by the Corps in fiscal year 1974, not a single permit request was turned down.

In short, the dredged material criteria as presently constituted resolve all doubts as to the safety of ocean dumping against the ocean and against public health. Such an approach, if continued, can only lead to the unreasonable degradation and endangerment of the values which Congress, in enacting the MPRSA, sought to protect and safeguard.

FAILURE TO APPLY THE MPRSA'S MANDATORY EVALUATION FACTORS

As previously noted, section 103 of the MPRSA authorizes the Secretary of the Army to approve the ocean dumping of dredged material only upon a determination that the proposed dumping will not cause unreasonable degradation or endangerment. A determination that a dumping proposal is "reasonable" can be made only through the application of ocean dumping criteria which consider, at minimum, the nine evaluation factors specified in section 102(a). The nine statutory factors are as follows:

(a) The need for the proposed dumping.

(b) The effect of such dumping on human health and welfare, including economic, esthetic, and recreational values.

(c) The effect of such dumping on fisheries resources, plankton, fish, shellfish, wildlife, shore lines and beaches.

(d) The effect of such dumping on marine ecosystems, particularly with respect to—(1) the transfer, concentration, and dispersion of such material and

its byproducts through biological, physical, and chemical processes; (ii) potential changes in marine ecosystem diversity, productivity, and stability; and (iii) species and community population dynamics.

(e) The persistence and permanence of the effects of the dumping.

(f) The effect of dumping particular volumes and concentrations of such materials.

(g) Appropriate locations and methods of disposal or recycling, including land-based alternatives and the probable impact of requiring use of such alternate locations or methods upon considerations affecting the public interest.

(h) The effect on alternate uses of oceans, such as scientific study, fishing and other living resource exploitation, and nonliving resource exploitation.

(i) In designating recommended sites, the Administrator shall utilize wherever feasible locations beyond the edge of the Continental Shelf.

The dredged material criteria violate these provisions in that: (1) They do not fulfill the function of administrative rulemaking, which is to add specificity to and fill in the details of broad legislative commands, and (2) they fail to take account of all the evaluation factors which the statute requires to be considered.

As a decisionmaking aid, the dredged material criteria are less than useless. Not only to they not clarify and interpret the statute, but they condense twenty-nine lines of already broad statutory generalizaions into the following even broader and less helpful seven lines of regulation:

"Decisions concerning the disposal of dredged material in the ocean will be based on considerations of the actual need for such disposal, alternatives to ocean dumping, the nature and extent of the environmental impact, and the economic costs or benefits involved."

Quite apart from their lack of utility to decisionmakers, the dredged material criteria simply fail to address factors and concerns which the MPRSA gives them no discretion to ignore.

Three evaluation factors are totally unaddressed by the dredged material criteria: (1) The human health and welfare concerns of section 102(a)(B); (2) effects on alternate uses of the ocean, as dealt with in section 102(a)(H); and (3) the congressional preference, as expressed in section 102(a)(I), for disposal sites located beyond the edge of the Continental Shelf.

An additional four factors (those of sections 102(a) (C) through (F)) are all merged into the unilluminating catch-phrase, "nature and extent of the environmental impact."

FAILURE TO APPLY THE CONVENTION'S MANDATORY EVALUATION FACTORS

Among the "standards and criteria" of the Ocean Dumping Convention which MPRSA section 102(a) makes obligatory on the United States as a matter of domestic law is Paragraph 2 of Article IV, which states: "Any permit shall be issued only after careful consideration of all the factors set forth in Annex III, including prior studies of the characteristics of the dumping site, as set forth in Sections B and C of that Annex." Contrary to this requirement of the MPRSA and the Convention, the dredged material criteria fail to require "careful consideration of" all twenty-one Annex III factors.

Under Annex III, ocean dumping criteria must consider (at minimum): 8 factors relating to the "characteristics and composition" of the waste; 9 factors relating to the "characteristics of [the] dumping site and [the] method of deposit"; and 4 general factors relating to dumping effects and to the "practical availability" of land-based alternatives to dumping.

Notwithstanding limited provisions for characterizing dredged materials as "polluted" and "unpolluted", and for adjusting "the place, time, and conditions" for ocean dumping of polluted dredged material, the dredged material criteria totally fail to address or inadequately address twenty of the twenty-one mandatory Annex III considerations. These Annex III considerations (which have not been properly addressed) are:

(1) The "[t]otal amount and average composition of the [dredged material ocean-] dumped" in the course of a year (or any other sustained period of time) (Par. A(1)).

(2) The "physical," "chemical and biochemical," and "biological" properties of ocean-dumped dredged material (e.g., solubility, density, oxygen demand,

nutrient content, presence of viruses, bacteria, yeasts, and parasites) (Par. A(3)).

(3) The "[t]oxicity" of the ocean-dumped dredged material (Par. A(4)).

(4) The "physical," "chemical and biological" persistence of ocean-dumped dredged material and dredged material constituents (Par. A(5)).

(5) The "[a]ccumulation and biotransformation [of ocean-dumped dredged material and dredged material constituents] in [organisms] or sediments" (Par. A(6)).

(6) The "[s]usceptibility [of ocean-dumped dredged material] to physical, chemical and biochemical changes and interaction in the aquatic environment with other dissolved organic and inorganic materials" (Par. A(7)).

(7) The "[p]robability of production of taints or other changes reducing marketability [of fish, shellfish, and other marine resources]" (Par. A(8)).

(8) The "[l]ocation of dumping sites" in relation to amenity areas, exploitable resources, etc., and the requirement (Article IV(2)) of prior studies of dump site characteristics (Par. B(1)).

(9) The "[r]ate of [dredged material] disposal per specific period (e.g., quantity per day, per week, per month)" (Par. B(2)).

(10) Possible "[m]ethods of packaging and containment" (Par. B(3)).

(11) "Initial dilution achieved by [the] proposed method of release" (Par. B(4)).

(12) "Dispersal characteristics" (Par. B(5)).

(13) "Water characteristics" at the disposal site (Par. B(6).

(14) "Bottom characteristics [in and around the disposal site] (e.g., topography, geochemical and geological characteristics and biological productivity)" (Par. B(7)).

(15) "Existence and effects of other dumpings which have been made in the dumping area" (Par. B(8)).

(16) The adequacy of the "scientific basis for assessing the consequences of [ocean] dumping [of dredged material], taking into account seasonal variations" (Par. B(9)).

(17) "Possible effects [of dredged material ocean dumping] on amenities" (Par. C(1)).

(18) "Possible effects [of dredged material ocean dumping] on marine life, fish and shellfish culture, fish stocks and fisheries, seaweed harvesting and culture" (Par. C(2)).

(19) "Possible effects [of dredged material ocean dumping] on other uses of the sea" (Par. C(3)).

(20) "The practical availability of alternative land-based methods of treatment, disposal or elimination, or of treatment to render the dredged material less harmful for dumping at sea" (Par. C(4)).

ALLOWANCE OF DUMPING PROHIBITED BY THE CONVENTION

Section 102(a) of the MPRSA, as amended by Public Law 93-254, 88 Stat. 50, March 22, 1974, requires the Administrator, "[t]o the extent that he may do so without relaxing the requirements of this title . . ., in establishing or revising [ocean dumping] criteria, [to] apply the standards and criteria binding on the United States under the Convention [on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter], including its Annexes."

One of the most specific and significant provisions of the Convention is its prohibition in Article IV(1)(a) of "the dumping of wastes or other matter listed in Annex I . . ." Seven categories of substances appear on the Annex I list [the "black list" substances], including organohalogen compounds (e.g., DDT, PCBs), mercury and mercury compounds, cadmium and cadmium compounds, and oils "taken on board for the purpose of dumping." Compounds in each of these categories are often fond as contaminants in spoil dredged from river and harbor bottoms, and spoil containing these contaminants is often ocean-dumped.

The blanket prohibition against the ocean dumping of Annex I substances is relaxed in only two narrow situations:

(a) If the "substances . . . are rapidly rendered harmless" on contact with seawater (provided they do not render marine organisms unpalatable or endanger human or domestic animal health) (Paragraph 8); and

(b) If the "wastes or other materials (e.g., sewage sludges and dredged spoils) contain [ ] the matters referred to . . . as trace contaminants" (Paragraph 9).

The ocean dumping criteria applicable to dredged material, in direct disregard of the Convention's command, make no provision whatever for prohibiting the dumping of spoil containing the black list substances—regardless of amount or circumstances.

Thus, sections 227.6 through 227.65 of the ocean dumping criteria—the provisions dealing with dredged material—do not so much as mention the Annex I list or the Article IV (1)(a) prohibition against dumping these substances.

The one section of the ocean dumping criteria (i.e., 40 C.F.R. § 227.22) which does deal with the Annex I substances specifies that the listed substances "will be considered as trace contaminants" whenever "they are present in sewage sludge, dredged material, or in wastes from industries which do not use or produce the constituents identified in this section."

Under the ocean dumping criteria as presently constituted, therefore, one would not be barred from ocean dumping dredged material literally "dripping" with proscribed Annex I substances. Although the Convention does not explicitly define the phrase "trace contaminants," it would seem rather obvious that it did not mean to provide an across-the-board exemption for any and all wastes (with the sole exception of the limited class of industrial wastes to which Annex I substances are intentionally added). The "Technical Working Party," to which the conferees delegated the task of drafting the technical annexes, suggested that trace contaminants are, "substances (not deliberately added to otherwise acceptable wastes) which do not occur in such amounts, or forms, that the dumping of such wastes causes significant undesirable effects including the possibility of dangers associated with bioaccumulation in marine organisms and especially food species" [29]

Continuing approvals by the Corps of Engineers for the ocean dumping of dredged material containing high heavy metal, organohalogen, and oil and grease levels, in short, directly violate U.S. and international law.

FAILURE TO PROTECT THE ENVIRONMENT TO AT LEAST THE SAME DEGREE AS THE CRITERIA FOR NON-DREDGED WASTES

Under the MPRSA, not only must the dredged material criteria apply the statutory burden of proof allocation and the statutory permit evaluation factors, but they must also correspond to the environmental impact criteria established under section 102(a) for non-dredged wastes. Section 103(b) directs that decisions regarding the ocean dumping of dredged material be made on the basis of "those criteria, established pursuant to section 102(a), relating to the effects of the dumping." Contrary to this comparability requirement, EPA has established specialized dredged material criteria which bear no resemblance to and are less restrictive than the ocean dumping criteria applicable to non-dredged wastes.

Despite the assertion of section 227.6(b)—that "practical implementation of the criteria of §§ 227.22 and 227.31 [relating to black and gray list substances in non-dredged wastes] will be achieved through the procedures of the following sections [i.e., §§ 227.61 through 227.65] in differentiating unpolluted and polluted dredged material"—it is clear that the mere differentiation of polluted and unpolluted material is far from equivalent to prescribing specific, ascertainable discharge limits (based on toxicity and on natural background levels. The dredged material criteria, in sharp contrast to the section 102(a) criteria for other wastes, specify no objectively implementable standards for excluding damaging dredged material from the marine environment, or otherwise (as required by § 103(b)) "relating to the effects of the dumping." This failure to measure up even to the imperfect criteria for non-dredged wastes, places the dredged material criteria in violation of MPRSA § 103(b).

THE NATIONAL WILDLIFE FEDERATION LAWSUIT AGAINST EPA AND THE CORPS

On November 19, 1975, the National Wildlife Federation ("NWF"), the nation's largest private conservation education organization, filed suit (Civil Action No. 75-1927) in federal district court for the District of Columbia, seeking a court order requiring EPA to bring its dredged material criteria into conformity with legal requirements. Named as defendants were Russell E. Train, EPA Administrator; Martin R. Hoffman, Secretary of the Army; and William C. Gribble, Jr., Chief of Engineers, Army Corps of Engineers.

The NWF Complaint requested three supplementary forms of relief:

(1) A declaration that the existing dredged material criteria are legally deficient.

(2) An order directing EPA to issue new criteria remedying these legal defects.

(3) An injunction barring continued Department of the Army approval for the ocean dumping of dredged material until the dredged material criteria, and Corps policies and procedures, have been brought into full conformity with the requirements of the MPRSA and the Convention.

In a November 20 Press Release issued by NWF, the organization's Executive Vice President Thomas L. Kimball, explained the lawsuit's purpose:

"We are not seeking a complete ban on ocean dumping or trying to deny the Corps all options for disposing of dredged materials. We simply want the Corps to follow the law's criteria and consider a proper balance between environmental and economic values before approving dumping proposals."

Where the Secretary finds (and so certifies) that "there is no economically feasible method or site available" [for the disposition of dredged material] other than a dumping site the utilization of which would result in noncompliance with [the ocean dumping criteria], the MPRSA itself makes provision for a waiver by the EPA Administrator of the Act's strict environmental protection requirements. The effect, then, of an NWF victory in its lawsuit would be simply to make the ocean dumping of heavily polluted dredged material a recourse of last, rather than first, resort.

That this was the sort of balance intended by Congress is made clear by the Report (No. 92-361) of the House Committee which sponsored the bill (H.R. 9727) which was to become the Ocean Dumping law:

"H.R. 9727 will enable this country to restore a proper balance between its economic and environmental values, as these relate to ocean dumping. It is clear that ports and harbors cannot be allowed to silt up and that cities cannot be permitted to strangle in their own waste production, but neither can these problems be resolved at the cost of threatening a critical resource of life on this planet. In this bill we give to the agencies of Government tools with which they can balance these values."

APPROACHES TO CORRECTING DEFECTS IN THE DREDGED MATERIAL CRITERIA

The major shortcoming of the present dredged material criteria is that they contain no standards to aid Corps decisionmakers in rejecting ocean dumping proposals as posing too great a risk of unreasonable degradation. The much-maligned "bulk sediment" test, established in 1971 and discarded in 1973, was one not-too-well-received attempt to quantify the conditions that would render dredged material too polluted to justify open-water disposal. Its rejection may have been too hasty.

THE BULK SEDIMENT TEST

The approach, which was basically sound, of the bulk sediment test was that, when the concentrations of certain sediment parameters (volatile solids, chemical oxygen demand, total Kjeldahl nitrogen, oil-grease, mercury, lead, and zinc) exceeded indicated numerical limits, "the sediment [would] be considered polluted in all cases and, therefore, unacceptable for open water disposal."

The most pertinent criticisms levelled against the bulk sediment approach [2] included the following:

1. That the use of fixed numerical criteria (based, presumably, on natural sediment background levels) ignores the often great variability of background levels from place to place.

2. That the COD test is nonspecific and measures a variable undefined fraction of the organic and inorganic compounds present in sediment.

3. That total Kjeldahl nitrogen measures too much; only ammonia or oxidized forms of nitrogen in the sediment are significant.

4. That volatile solids content measures an undefined mixture of organic and inorganic compounds in sediment and, as such, provides little or no information on the pollutional tendencies of dredged material.

5. That essentially no information is available on the relationship between tar or oil residues in sediment and degradation of water quality.

6. That bulk chemical analysis alone will not tell you whether water quality problems exist in the overlying water.

7. That bulk chemical analysis alone ignores the very different impacts on receiving water of different volumes of dredge spoil and dilution water.

Although some of these criticisms seem justified, it would appear that many are rather easily resolved and that the bulk chemical analysis approach may well more than make up in ease of application and compatibility with legal requirements for what it may lack in sophistication. Among the readily resolvable criticisms are the following:

1. If fixed numerical criteria ignore natural variability from one type of sediment to another, separate criteria can be established for each major sediment type. If fixed criteria ignore natural variability even within a single sediment type, separate criteria can be established for each individual dredge disposal site based on background (i.e., pre-dumping) levels characteristic of sediment at each disposal site. What is important is that Corps decisionmakers have ready access to ascertainable (if not fixed) discharge standards that will tell them when polluted spoil is unsuited (at least if there are any alternatives available) for ocean disposal.

2. If the COD test is too nonspecific, substitute a BOD (biochemical oxygen demand) test, which may provide a better indication of the spoil's potential oxygen demand.

3. If "total Kjeldahl nitrogen" measures too much, substitute an "ammonia nitrogen" analysis.

4. If the "volatile solids content" is of little value, delete the requirement for such an analysis.

5. Although it may be difficult to relate oil and tar content to water quality, the direct impact of contact with such contaminants by benthic and other organisms amply justifies retention of a test for "oil-grease" content.

6. Although bulk chemical analysis alone may not take full account of dilution and mixing phenomena and may not permit direct prediction of water quality impacts, it does provide a measure of unnaturally high levels of potentially toxic and bioaccumulative pollutants with which aquatic organisms may come in contact. As such, it addresses itself to the major (if not exclusive) concerns of the MPRSA and the Convention.

7. Limits for organohalogen compounds should be added.

The strengths of the bulk chemical analysis (particularly when modified in the above indicated respects) are best appreciated however, when contrasted with the "elutriate" or "shaker" test which took its place. The elutriate test, as set forth in section 227.61(c) of the dredged material criteria, consists of comparing supernatant resulting from shaking dredged sediment in disposal site water with water taken from the proposed disposal site. If the resultant supernatant (or "elutriate") contains more than 1.5 times the concentration of any "major constituent" (i.e., water quality parameters "deemed critical") as compared with disposal site water, the dredged sediment is regarded as "polluted." As previously noted, and in sharp contrast to the bulk chemical analysis, a finding through the use of the elutriate test, that dredged sediment is "polluted," has little or no influence on Corps decisions regarding its acceptability for ocean disposal.

And although a more direct relationship to water quality effects can be claimed for elutriate test results than for bulk chemical analyses, the elutriate test is totally unable to detect * * * preffect of chemical contaminants in dredged sediment on * * * filter-feeding and deposit-feeding organisms. Bulk chemical analyses, on the other hand—at least to the extent that the reference standards accurately reflect natural background (or threshold toxic) levels—do provide a measure of potential biological availability of contaminants present in excess of natural environmental levels. (This assumes, not implausibly, that marine organisms will have adapted to naturally occurring levels of toxic chemicals—but to no more). In any case—and in keeping with legal dictates—the bulk chemical approach would be expected (depending on the specific numerical limits chosen, of course) to tend to over-estimate, rather than under-estimate as the elutriate test inevitably must, the potential risks to the marine environment of dredge spoil contaminants. The elutriate test unjustifiably assumes that the only important effects will be those that alter water quality and that dilution and dispersion phenomena will always be available to minimize these effects on the water column.

In short, although the elutriate test may be useful in certain situations (e.g., in monitoring the quality of supernatant in diked disposal areas), or as a sup-

plement to other biological or chemical tests, it is far less useful as a regulatory tool and in meeting legal requirements than a bulk chemical-type analysis.

OTHER ALTERNATIVE EVALUATION TECHNIQUES

In addition to modifications of the classical bulk chemical analysis as a means of assessing the chemical effects of spoil disposal, various investigators have suggested procedures to be used along with elutriate analyses for measuring availability to benthic organisms of undissolved sediment constituents. For example, Lee and Plumb [*21*] have suggested the use of "[a] laboratory test based on the chemical characteristics of the interstitial waters that would be formed at the disposal site." Indeed, since the interstitial water chemistry of the dredge spoil will largely determine the degree of alteration of disposal site interstitial water, Bricker [*2*] has recommended that elutriate test results be combined "with data on the interstitial water chemistry at the dredge site * * *."

An integrated test procedure for determining both the standard elutriate and the interstitial water composition of a sediment sample has been developed by Bricker for this purpose. Procedures developed by Engler, et al. (unpublished) can also be adapted to the same effect.

Once the results of such integrated test procedures are in hand, one is in a position to incorporate them in an environmental standard—a process which could well engender some controversy (e.g., the Corps has steadfastly resisted the use of the 1.5 elutriate factor as a basis for rejecting dredge material for disposal). Somewhat conservative interim standards might need to be developed pending the availability of sufficient empirical data to permit the setting of more precise standards.

Lee and Plumb have also suggested (21), as an alternative to the interstitial water approach to assessing effects on benthic organisms, the use of "relatively simple" bioassay tests, "in which the benthic organisms are placed in contact with a column of the dredged material where the organisms would have an opportunity to burrow into the sediment and swim above it."

While simplicity is a virtue not to be minimized, one problem with the approach suggested by Lee and Plumb is that, unless the bioassays were continued over relatively long periods of time, they would tend to underestimate the importance to aquatic organisms of long periods of contact (e.g., months to years). Nevertheless, successful results have been obtained with this type of bioassay (11, 12). Other bioassay approaches, including in situ tests, have also been employed successfully to measure directly the chemical effects on organisms of dredged material disposal [*12, 14, 19, 32*].

Two problems with using an elutriate test are that (a) it uses water to extract readily-releasable chemicals, although the residues may nevertheless be biologically available, and (b) it detects only short-term leaching even to the water column and does not duplicate the conditions of continuous sediment-water contact (and leaching) present in the environment.

One way of speeding up nature to get around these problems and allow significant changes which may take a long time to occur in the environment to occur quickly in the laboratory, is to use a stronger extractant than water for releasing leachable chemicals. Chemical extractants have long been used by agricultural chemists. For example, ammonium acetate, which is commonly used to estimate "exchangeable" materials in soils, could easily be used to do the same for sediment. Even Lee and Plumb [*17*] recognized "some potential for this approach in evaluating the potential environmental impact of the disposal of dredged material." Other scientists have also explored the use of cation exchange estimates for characterizing bottom sediments [*22, 23, 30*].

The use of a mild chemical extractant, such as ammonium acetate, it should be noted, would represent a compromise between the elutriate test which uses water (too weak) and the original bulk sediment test which used concentrated acid (arguably too strong).

One final approach deserves mention. This would be to compare levels of toxicant enrichment in selected dredge site organisms (preferably filter and deposit feeding benthic species, and other organisms which show visible evidence of pathohistological damage, such as fin rot and skin tumors), with the levels of the same constituents in control organisms taken from the proposed disposal site (or comparable unpolluted area). Statistically significant toxicant enrichment in dredge site organisms might then provide a basis for permit denial or

restriction. Such an approach would be especially useful in evaluating the potential risks of bioaccumulation and food-chain magnification of chemicals associated with dredged sediment—risks not addressed by the elutriate test. Some support was given to this sort of "critical pathways" approach by a recent EPA-sponsored workshop [7].

Other evaluation techniques described in the literature [*1, 27*] are either too complex or too limited in their application to be discussed here.

PROPOSED INTERIM APPROACH

The law requires EPA to establish and the Corps to apply dredged material screening criteria capable of fully assessing potential risks of ocean dumping to the marine environment and public health. As we have seen, existing procedures do not satisfy this requirement. The elutriate test, in particular, falls short in at least four respects: (1) In its present from at least, it does not provide an objective measure of how polluted is "too polluted"; (2) it is limited in its applicability solely to water quality considerations (i.e., it is of no use in assessing chemical-biological interactions between particle-phase contaminants and benthic, filter-feeding, or deposit-feeding organisms); (3) it is limited in its applicability solely to assessing the short-term leaching of readily-releasable contaminants to the water column (i.e., it is incapable of evaluating chronic, low-level effects even on the water column); and (4) it provides no indication of the potential for biological uptake, accumulation, and food-chain magnification (including possible contamination of human seafood) posed by the ocean dumping of polluted dredged material. Suitable revisions to the dredged material criteria are therefore necessary, and necessary immediately.' This may necessitate the development of best-guess interim standards which, to the extent that they will be less than foolproof, must err in favor of environmental protection. When, and if, the results of ongoing and future research, produce sufficient empirical data to permit the development of more precise standards, the standards can then be revised and refined.

Until the arrival of that great day when we have all the answers, a regulatory approach along the following lines is suggested:

1. As a first step, a relatively simple gross measure of pollution potential should be employed. Dredged material showing up as "unpolluted" by this procedure should be regarded as eligible for ocean dumping. If, but only if, less damaging land-based alternatives are available, and precautions are taken to dump the material under conditions and at a location designed to maximize dispersion of the material and minimize large build-ups of material in ecologically sensitive areas. Dredged material found to be "polluted" would then be subjected to further screening analysis to determine whether it must be barred entirely from oceandumping. An attractive candidate for this first-step role is the bulk chemical analysis (modified as indicated previously). Dredged sediment determined to contain more than two to three times the specified contaminant limits (which would be based either on ambient unpolluted sediment levels in the dump site vicinity or on estimated toxicity thresholds, including a safety factor), would be deemed "polluted." If ocean dumping were still regarded as desirable, dredged material so characterized would, with one exception, then be subjected to additional screening procedures. In the case of dredged material found to be polluted with respect to any of the substances listed in Annex I of the Ocean Dumping Convention (i.e., mercury, cadmium, organohalogens, oil and grease), ocean dumping would be barred under all but "emergency" conditions (and then, only following the required international notifications).

2. The ultimate determination of the acceptability of polluted dredged material for ocean dumping should be based on procedures capable of assessing effects both on water quality and on marine organisms (and, in some cases, the potential for foodchain uptake as well). For example the elutriate test (modified along the lines suggested by at least one Corps consultant) [*20*] could be combined with an interstitial water analysis of the sort developed by Bricker [*2*]. If parameter levels in either the elutriate or interstitial water associated with dredged sediment exceeded by more than a factor of two (for example), corresponding levels in (unpolluted) disposal site water, it would be deemed unacceptable for ocean disposal.

Alternatively, ammonium acetate extraction (with a comparison of leachates from dredged sediments with those from natural sediment in the disposal site

area) and/or bioassay procedures could be used for assessing the biological availability of dredged material contaminants. Bioassay procedures, if they are to be acceptable, must employ an array of representative, sensitive marine organisms which are reasonably typical of the disposal site environment. They must also be carried out over a sufficiently long period of time (certainly no less than 96 hours), and with attention to sublethal as well as lethal effects, to give some assurance that chronic, low-level impacts will not be substantial.

3. Blouptake studies should be carried out whenever there is a risk of contaminating seafood caught by either commercial or recreational fishermen.

CONCLUSIONS

The present dredged material criteria governing the ocean dumping of dredged material are legally deficient in the following five major respects:

1. They fail to prohibit ocean dumping which may unreasonably degrade or endanger the marine environment or human health.

2. They allow ocean dumping without requiring full prior consideration of all evaluation factors required to be considered by the ocean dumping law.

3. They allow ocean dumping without requiring full prior consideration of all evaluation factors required to be considered by the ocean dumping treaty.

4. They allow the ocean dumping of substances the dumping of which is prohibited by the treaty.

5. They are impermissibly less protective of the environment than the criteria for non-dredged wastes.

In practical terms, the major impediment to effective regulation of dredged material disposal at sea is probably the lack of clearcut regulatory standards capable of being used to assess potential impacts on water quality, marine organisms, and the human food chain. A regulatory approach incorporating the three following elements would substantially improve the situation:

1. A preliminary screening test capable of identifying "unpolluted" sediments suitable for ocean disposal (provided there are no less damaging alternatives and precautions are taken to minimize physical effects of large-volume disposal).

2. Supplemental screening procedures capable of assessing the availability to organisms and the water column of toxic contaminants associated with dredged material found preliminarily to be "polluted". Polluted dredged material exceeding specified criteria would be deemed unsuitable for ocean disposal except in "emergencies" or where acceptable alternatives were unavailable.

3. Studies of biological uptake potential in all cases posing a risk of human seafood contamination.

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EXHIBIT IV

NATIONAL WILDLIFE FEDERATION,
Washington, D.C., January 19, 1976.

Re Request for General Counsel's Opinion on Scope of Obligations Imposed by Section 102(a)(G) of the Ocean Dumping Law.

ROBERT V. ZENER, Esq.,
General Counsel, Environmental Protection Agency,
Washington, D.C.

DEAR MR. ZENER: This request concerns what has become a recurring issue in EPA Region II's regulation of various ocean-dumpers off the northern coast of Puerto Rico. It also bears directly on the larger question of EPA's authority and duty to protect the environment as a whole while discharging its regulatory responsibilities under statutes concerned with one component of the environment or another.

By Public Notice No. 75–455, dated June 20, 1975, Region II announced its tentative determination to reissue interim ocean dumping permits to eight pharmaceutical companies. Proposed "Special Condition 7" stated that five of these applicants (Upjohn; Abbott Chemical; Pfizer; Merck, Sharp & Dohme; and Brischem) had "evidenced a firm commitment to enter into an agreement with the Puerto Rico Aqueduct and Sewer Authority to participate fully in the Barceloneta Regional Waste Treatment System." No other reference to any implementation plan, schedule, or alternative for any of these five companies was present in the proposed permit.

The Regional Administrator rendered his decision on ocean dumping permits for these companies on October 14, 1975. The only modification made to "Special Condition 7" was the addition of the following language:

"Should connection with the Barceloneta Regional Waste Treatment System not be achieved prior to the date of reapplication then such reapplication for a new ocean dumping permit shall not be considered complete unless the permittee —— either

a. Submits a Phase A/Phase B plan meeting all the requirements of 40 C.F.R. 227.4 (Supp. 1973) or

b. Submits a detailed engineering report outlining the alternatives to its current practice of ocean dumping. This report shall include a schedule for the complete implementation on or before April 23, 1978 of an alternative method of disposal."

The Regional Administrator chose this approach despite the Regional Hearing Officer's September 17 conclusion that it did not go far enough since it requires "compliance with the ocean dumping criteria * * * only if connection with the Barceloneta plant is not achieved." The Regional Administrator also rejected the suggestion of the Chief of Region II's Marine Protection Program that each permittee be required to "provide documentation 90 days prior to connection with the aforementioned treatment system demonstrating that such treatment is environmentally acceptable and complies with all appropriate provisions of Public Laws 92–500 and 92–532." Finally, the Region II Administrator rejected the National Wildlife Federation's view that the Marine Protection, Research, and Sanctuaries Act bars the switching by an ocean-dumper "to an alternative location and method of ocean disposal without close prior evaluation of both the 'appropriateness' of the shift (in light of its environmental and other 'public interest' impact) and the 'need' to continue ocean disposal, in whatever form (relative to other potential alternatives with less severe adverse impacts)."

On December 26, 1975, a further Public Notice (No. 75 859) was issued by EPA Region II, this time announcing a request by "Cyanamid Agricultural de

P.R., Inc." for a new interim ocean dumping permit. Proposed "Special Permit Condition 7" contains language identical to that in the permits issued to the five pharmaceutical companies subject to the Regional Administrator's Decision of October 14. The ocean dumping site in all six cases is some 42 miles from shore and some 12,000 to 24,000 feet deep.

The question presented for your decision is whether "Special Permit Condition 7," as adopted by Region II for five interim ocean dumping permits and as proposed for a sixth, comports with the requirement of Section 102(a) of the Marine Protection, Research, and Sanctuaries Act that EPA, in reviewing applications for ocean dumping permits, must evaluate interalia "[a]ppropriate locations and methods of disposal or recycling, including land-based alternatives and the probable impact of requiring use of such alternate locations or methods upon considerations affecting the public interest," and "[t]he need for the proposed dumping." A related, but secondary, issue is whether Special Permit Condition 7 satisfies the implementation plan requirements imposed on all interim ocean dumping permittees by 40 C.F.R. 227.4.

The tie-in with the so-called "Barceloneta Regional Waste Treatment System," proposed by the pharmaceutical companies and passively acquiesced in by EPA Region II, poses in our view real questions both of "appropriateness" and of conformity with the public interest. The "Treatment System," as presently constituted, will provide no more than conventional primary treatment. Since the pharmaceutical wastes in question contain no floating or suspended solids of the sort amendable to this mode of treatment, their passage through the system will in no way reduce their potency. Indeed, bioassay test results indicate that chlorination of the mixed wastes passing through the plant will enhance rather than reduce their toxicity to marine life. Since the disposition of "processed" wastewaters is to be to the Atlantic Ocean (in water a mere 90 feet deep and 3,000 feet from shore) via an ocean outfall pipe, the net result of a switch-over to this mode of waste management will be a drastic reduction in the depth of water and distance from shore at which ocean disposal is taking place. In view of the fact that negative impacts on the marine environment can, in general, be expected to grow as available dilution water dwindles and as proximity to productive coastal waters increases, the contemplated shift in ocean disposal methods must be regarded as a change for the worse. Even assuming that the system will eventually be upgraded to secondary treatment and that the microorganisms essential for such treatment, can be kept alive in the presence of antibiotics designed to kill microorganisms, it is by no means clear that the risk which will remain of unleashing antibiotic-resistant pathogens is an acceptable one. Nor, certainly, is it clear, that there do not exist for one or more of the pharmaceutical companies in question, one or more clearly acceptable alternatives to both ocean dumping and ocean discharge.

Our view, that the Ocean Dumping Law requires the exploration by EPA of such acceptable alternatives, is evidently shared by Administrator Train. In his September 25, 1975 decision in "*In Re Interim Ocean Disposal Permit No. PA-010 Granted to the City of Philadelphia*," 5 ELR 30003 (EPA, 1975), the Administrator stated:

Congress, of course, recognized that any decision regarding disposal of wastes cannot be made solely on the basis of the harm such disposal causes to one portion of the environment. The probable impact of alternative methods or locations of disposal, such as land based alterantives, must also be considered. Risks must be balanced to insure that the overall public interest is served. "The Ocean Dumping Act, as presented here, can provide a valuable impetus to developing these alternatives to their full potential."

The City of Philadelphia case, moreover, furnishes another important reason why the Region II approach must not be allowed to prevail. The main effects of this approach in the Pureto Rico situation are (1) to delay evaluation of the merits of outfall discharge until after the physical connection has been made, and (2) to limit regulatory control to the aggregate outfall discharge rather than to the facts and circumstances of each contributor. But the same approach, if followed in the Philadelphia case, would not only have restricted regulatory options, it would have eliminated the opportunity to regulate the dumping alternative selected altogether. This is so, because (with the exception of limited regulatory power in connection with the award of federal construction grants) EPA lacks regulatory jurisdiction over most types of land treatment and disposal. In other words, but for the fortuity of NPDES review over the outfall dis-

charge in the Puerto Rico case, Region II's approach to the Ocean Dumping Law may well have left it with no role at all in the selection and implementation of ocean dumping alternatives. The next case that comes before Region II might well turn out to be such a case. The Ocean Dumping Law was designed to avoid such "slipping-through-the-holes" situations—and we trust you will so find.

To assist you in your decision, I have taken the liberty of attaching copies of relevant Public Notices and other documents.

Your attention to this matter is appreciated.

Sincerely,

KENNETH S. KAMLET, *Counsel.*

ENVIRONMENTAL PROTECTION AGENCY

Before the Administrator

(In the matter of City of Philadelphia Ocean Disposal Permit No. PA 010)

BRIEF FOR THE NATIONAL WILDLIFE FEDERATION

(Kenneth S. Kamlet, Counsel, National Wildlife Federation, 1412 16th Street, N.W., Washington, D.C. 20036, Attorney for the National Wildlife Federation)

JUNE 27, 1975.

I. CONCLUSIONS OF LAW

1. It is up to the ocean permit applicant to demonstrate by a preponderance of the evidence, that ocean dumping will not unreasonably degrade or endanger human health or the marine environment. (1–12).

2. The standard of proof in a challenge to an ocean dumping phaseout requirement is no less than that for a challenge to permit denial. (2).

3. A determination by the Administrator that there will be no unreasonable degradation as a result of ocean dumping activities requires, at the very least, an informed judgment on the probable environmental effects of those activities. (7).

4. An informed judgment cannot be made without reasonable confidence in the sufficiency and reliability of the available scientific data; it cannot be arrived at, without such confidence, merely by weighing the evidence offered by proponents and opponents of dumping. (7).

5. Where doubts exist as to the sufficiency or reliability of the available scientific data, a dumping phase-out requirement must remain in effect until and unless further technical studies demonstrate that continued dumping will not cause unreasonable degradation or endangerment. (7–8).

6. The mere fact that a permit applicant has satisfied all of the specific requirements of the ocean dumping regulations and criteria does not narrow the Administrator's discretion to deny or restrict the permit. (8).

7. The failure to satisfy ocean dumping regulatory requirements, such as sufficient description of waste materials or the preparation and implementation of a phase-out plan, is tantamount to a showing of unreasonable degradation and endangerment. (11).

8. Dispersion enhancement techniques, when employed with conservative pollutants, are inconsistent with a policy of avoiding unreasonalbe degradation. (10).

9. A finding of human health endangerment may be made on the basis of suspected but not completely substantiated relationships between facts, of trends among facts, of theoretical projections from imperfect data, and of probaive preliminary data not yet certifiable as fact. (10).

10. No ocean dumping permit may issue for materials insufficiently described in terms of their physical, chemical, and biological properties to permit evaluation of their impact on marine ecosystems. (9).

11. The ocean disposal provisions of the MPRSA and the FWPCA should be construed in a way that makes them consistent. (9).

12. The determination to deny or restrict an ocean dumping permit is an agency action committed to agency discretion by the MPRSA. (11–12).

13. In contrast, the determination to issue an ocean dumping permit must be predicated on the satisfaction of numerous statutory and regulatory evaluation criteria. (11–12).

14. Inconclusive scientific evidence may not serve as the basis for U.S. approval of continued ocean dumping in international waters of toxic substances subject to strict regulation under the International Ocean Dumping Convention. (8).

15. A challenge to a Regional Administrator's ocean dumping permit action requiring a phase-out of ocean dumping, must overcome not only the statutory burden of demonstrating no unreasonable degradation but also the procedural burden of overcoming the presumptive correctness of the regional agency decision. (11).

16. The fact that a particular ocean dumping source is only one of a number of sources of pollutants entering the marine environment is no bar to strict regulation of the ocean dumping point source. (2).

17. The fact that one EPA Regional office may have chosen a slightly different approach to certain dumpers than has another Regional office to dumpers of a somewhat different character, does not make the approach of the stricter Region discriminatory or unfair. (2).

18. Congress intended that ocean dumping of digested sewage sludge be phased-out promptly, particularly on the part of cities like Philadelphia which do not have large investments in barging facilities and equipment. (3–4).

19. EPA may require ocean dumping permit applicants to investigate and report on specific waste disposal and recycling alternatives to ocean dumping. (13–14).

20. Pennsylvania law imposes reclamation and revegetation requirements on both present and former surface mine operators. (14–16).

21. The country commissioner approval provision of the Pennsylvania Solid Waste Management Act is not an impediment to the use of sewage sludge for surface mine reclamation purposes. (14–16).

Findings of Fact

II. IMPACTS OF OCEAN DUMPING

1. Barges carrying sewage sludge to the Philadelphia dump site pass right through the main band of the U.S. sea clam industry. (17).

2. The sea clam industry accounts for approximately 43 percent of all clams, oysters, and mussels harvested in the U.S. today. (17).

3. There is a potential for the commercial harvesting of the ocean quahog (mahogany clam) at the present Philadelphia dumping site. (17).

4. Short-dumping of wastes at sea is a continuing problem which has been documented since 1966. (23).

5. Scallops, lobster, crabs, hake, and flounder are among the seafood organisms that have been observed at the bottom of the present Philadelphia dump site. (18).

6. Virginia fishermen fish for scallops and lobster in the general vicinity of the Philadelphia dump site. (18).

7. Some 600 documented epidemics in the U.S. have been linked to sewage disposed of in water and the eating of contaminated shellfish. (18).

8. No epidemics have ever been related to sewage disposed of on land. (18).

9. The dumping or short-dumping of Philadelphia sewage sludge in commercial shellfish harvest areas is of grace concern to the FDA and a serious potential threat to public health. (19).

10. The adverse impact of short-dumping is the same whether done in bad faith or because of bad weather. (19).

11. Short-dumping safeguards are at best effective only in preventing dishonesty by tug captains, but are not foolproof even in this regard. (19).

12. Where "emergency" short-dumps are concerned, no amount of monitoring or deferrence can prevent the short-dumping from taking place. (20).

13. Although prompt radio notification following emergency short-dumps may somewhat reduce their adverse impacts, the FDA would still have serious control problems in attempting to prevent the harvesting and marketing of seafood from sewage-contaminated areas. (20–21).

14. Unless EPA acts to phase-out ocean dumping by Philadelphia, the FDA will have no recourse but to close to shellfish harvesting on ocean area of 150 to 200 square miles. (21–22).

15. Although the barge company president admits to only two short-dumps of Philadelphia sludge since late April of 1973, there are indications that there may have been two additional "known" short-dumps in that same time period. (22).

16. A wide range of recreationally as well as commercially important marine fin fishes, including fish that feed on bottom-dwelling shellfish, inhabit the mid-Atlantic Coast in the vicinity of the Philadelphia dump site. (23).

17. Sport fishing occurs in the vicinity of the Philadelphia dump site throughout the year. (23).

18. The Philadelphia dump site is one of the principal migratory pathways for many species of fish. (23).

19. The sport fisherman who fishes over a sludge dumping ground has no government agency to protect him from catching and eating contaminated marine animals. (23–24).

20. The direct value to the economy of the fishery resources potentially subject to the influence of Philadelphia sludge dumping may be $40 million or more. (24).

21. The economic impact of contamination of one type of seafood may quickly spread to other seafoods. (25.).

22. Metals present in the marine environment in an assimilable form usually undergo bioaccumulation through the food chain. (25).

23. Elements present in the water in low concentrations may be accumulated in this way many thousandfold in certain organisms. (25).

24. Metals are particularly susceptible to concentration by invertebrates, especially filter-feeders such as oysters and clams. (25).

25. Fish are also capable of high degrees of biological concentration. (25.

26. The extent of heavy metal uptake by an animal depends in part on how the metal is presented to the animal (i.e., whether it is in solution or suspension). (25–26).

27. Metals have a large biological half-life. (26).

28. Unnatural levels of metals are accumulated much more rapidly than they are excreted. (26).

29. Heavy metal pollution can have a profound effect on the biology and productivity of the sea. (26).

30. Heavy metal levels in Philadelphia sewage sludge far exceed the National Academy of Science's suggested "hazard" levels, as well as EPA's established safety thresholds. (27).

31. In addition to bioaccumulation through the food chain and direct lethality to marine organisms, heavy metals may induce subtle sublethal changes in marine organisms and communities. (26).

32. The fact that the ocean into which Philadelphia sludge is dumped contains a very large volume of water by no means ensures that the high heavy metal levels in the sludge will be rapidly diluted or dispersed to insignificance. (27).

33. Metals adsorbed to organic particles present in sludge may travel large distances through the ocean without being diluted or rendered any less biologically available. (27–28).

34. Organic sludge particles and adsorbed heavy metals will likely maintain a continuing association when dumped into seawater. (27–28).

35. Philadelphia is the predominant source of silver, cadmium, copper, nickel and lead in the vicinity of the Philadelphia dump site. (29).

36. After less than a year of sludge dumping at the present Philadelphia dump site clams and scallops had accumulated high levels of four of the five metals typical of sludge at one or more survey stations in the 1000-square mile study area surrounding the dump site. (30).

37. Heavy metal uptake by mobile scallops may understate the exposure of other, less mobile, shellfish to sludge heavy metals. (30).

38. During the several-month interval between the Fetch and Ides EPA cruises, there were statistically significant increases in shellfish uptake levels of at least 2 sludge-associated metals at survey stations common to the two cruises. (31).

39. Although sludge-dumping by Philadelphia may not be responsible for the entire metal uptake by nearby shellfish, it is logically a far more substantial source of sludge-associated metals than could be land-based sources 40 miles away or dumping of industrial wastes containing only minor amounts of these metals. (31).

40. Observed variability in the degree and distribution of shellfish uptakes of sludge-associated metals is not unusual and does not weaken the case for assignment of responsibility to Philadelphia sludge-dumping. (31).

41. The observed, statistically significant, reduced size of shellfish inside and near the Philadelphia sludge dump site may reflect growth suppression in a causal sense. (32).

42. Net surface and bottom current movements from the area of the Philadelphia dump site will be shoreward for some significant part of the year. (32–34).

43. Even if the currents move shoreward only 5% of the time, five percent of the time is too much. (34).

44. Philadelphia sewage sludge dumped in the marine environment has to go somewhere; the metals it contains are not going to disappear. (34).

45. Even if ocean-dumped sludge is doing no harm, we are wasting it. (34).

46. The cumulative impact of sludge and effluent dumping and discharge by Philadelphia and other coastal municipalities may be very severe damage to the ecosystem and probably before we realize it. (35).

47. Many metals will have a deleterious effect on marine life at the part per billion level. (36).

48. The loading of the ocean system by an increased number of pollution inputs may very well reach an irreversible level. (36).

49. For the geographical region of the Atlantic Shelf from Long Island to Cape Hatteras, present evidence for the capacity of the system to accept nutrients and heavy metals indicates that we are on the verge of unwise use of this portion of our environment. (36A).

50. Philadelphia has presented no creditable evidence in any way tending to show that continued ocean dumping of its sludge will not harm the marine environment and human health; it has, therefore, met neither its burden of proof nor its burden of going forward. (17–36A).

III. AVAILABILITY OF ALTERNATIVES

1. The Barber Colman PURETEC System may permit recovery of resource values from sludge, do so at a net operating cost of less than a third of the present cost of barging to sea, and do so on a full-scale basis within the phase-out period specified by EPA. (38–39).

2. A plant-scale unit, employing this process, will be in operation in Philadelphia this summer. (39).

3. Adoption of one of the four land-dispersal alternatives favored by Philadelphia's consultants would increase the charge to the City's average residential and commercial sewer customers by slightly over 3 cents a day. (40).

4. Adoption of one or more of these land-dispersal alternatives should be possible well within the phase-out period specified by EPA. (41).

5. The anhydrous and liquid ammonia resource recovery process proposed by Philadelphia's consultants could be implemented by Philadelphia within the phase-out period specified by EPA. (42–43).

6. Use of sludge for reclamation of surface-mined land is an ideal way to dispose of sludge, while benefiting the environment. (42–46).

7. This approach has been tested both in the field and under greenhouse conditions. (45).

8. Public rejection of a properly presented strip-mine reclamation proposal has never occurred in Pennsylvania (to the contrary, Pennsylvania citizens have even accepted some far less beneficial solid waste disposal projects), and it cannot be assumed. (46).

9. Digested, composted, and heat-dried sludge have many uses for ornamental improvements of land which pose minimal risk to the food chain. (46–50).

10. The specialty plant food market can readily absorb Philadelphia's entire sludge output. (49–50).

11. Composting, which works well with Philadelphia sludge can be accomplished for the City's entire sludge output on well under 100 acres of land. (50–51).

12. The composted product is a very acceptable, hygienic, odorless, fine granular material. (51).

13. The Beltsville composting method is cost effective and environmentally suitable for the City of Philadelphia. (51).

14. Trenching is an environmentally acceptable, cost-competitive, low lead-time, and highly feasible option for Philadelphia sludge. (51–53).

15. Application to pastureland to promote the growth of forage crops is an economically feasible, readily implemented, and environmentally advantageous use of Philadelphia sludge. (53–56).

16. The 10,000-acre King Ranch site, located just outside of Philadelphia is available immediately for pastureland application of Philadelphia sludge. (54).

17. PennDER approval for this activity has already been obtained, and soil and agricultural scientists say the King Ranch soil is ideal for receiving moderate sludge applications. (54).

18. Construction sites have already been identified which are capable of at least 25 years' worth of Philadelphia sludge processed by the IUCS landfilling process. (56).

19. There are land-based alternatives available to Philadelphia capable of accommodating nearly half of the City's sludge output by the expiration of the present ocean dumping permit. (54).

20. There are land-based alternatives available to Philadelphia capable of accommodating at least half and perhaps all of Philadelphia's sludge output by 1979. (37-56).

21. There are certainly land-based alternatives available to Philadelphia capable of accommodating all of the City's sludge output by 1981. (37-56).

IV. GENERAL PREFERABILITY OF LAND-APPLICATION

1. When sludges are applied to land, constituent chemical elements remain in place; since their location in the environment is known, there are soil and crop management practices which can be employed to contain, control, analyze, and remedy any problems which may arise. (57).

2. When sludge constituents are disposed of by ocean dumping, the ability to account for them, assess their impacts, and control them is lost. (57).

3. Changes in the ecosystem dynamics of terrestrial systems are more easily predicted and controlled than those of ocean systems. (57-58).

4. The economic and technical feasibility of an environmental monitoring strategy adequate to track the fate of potential environmental contaminants is considerably greater in a terrestrial system than in the ocean. (58).

5. Short-dumping, while a severe problem in the ocean, is not a problem at all on land. (58).

6. The high propensity of shellfish and other edible marine organisms to accumulate pathogenic microorganisms has no parallel on land. (58-59).

7. Pesticides and other organochlorine compounds, although persistent and highly toxic in the ocean, are rapidly decomposed in the soil. (59).

8. Potentially toxic sludge constituents introduced into the ocean present a far greater risk of exposure to man and the food chain than they would in terrestrial systems because of the operation in (land) plants and soils of multiple barriers to biological uptake that do not exist in ocean systems. (59-60).

9. This is as much the case for sludge constituents whose toxicity and carcinogenicity we do not yet appreciate as it is for those (such as cadmium) whose hazards we recognize. (60).

10. Terrestrial organisms have been better equipped by evolution to adapt to environmental stresses than marine organisms. (60).

11. Not only is sludge less hazardous on land than it is in the ocean, but it is also far more useful. (60).

V. REDUCTION OF HEAVY METAL LEVELS

1. Philadelphia has no ongoing heavy metal pretreatment or source reduction program. (61).

2. Its preliminary heavy metal source identification survey was conducted solely or largely in response to Federal requirements. (61).

3. Northeast Philadelphia sludge contains more than 500% of the cadmium, more than 250% of the zinc, more than 200% of the lead, and more than 150% of the nickel contained in a typical non-industrialized, "domestic" sludge. (62).

4. Northeast sludge also contains far more cadmium than even the worst New York City sludge. (62).

5. Tools are available for keeping cadmium and other heavy metals out of sewage. (63).

6. The metal source data thus far developed by Philadelphia are so incomplete and susceptible to error that no confidence can be placed in conclusions concerning the relative contributions of so-called "controllable" and so-called "uncontrollable" sources. (64-66).

7. Even if the metal source data were accurate, they would not justify the conclusion that the heavy metal sources of Philadelphia sludge cannot be controlled appreciably enough to be worth the bother. (66–68).

8. Nor is there any justification for Philadelphia's premise that the Water Department must itself go out and identify every source that might be regarded as "basically controllable" before any action can be taken. (68).

9. There are no legal constraints that stand in the way of Philadelphia's adoption of its own heavy metal control program, notwithstanding the Federal regulatory scheme. (68–69).

10. Estimates by consultants for the City of permissible application rates (with attendant land acquisition requirements and costs) are based on the unsupported premise that there will be no reduction in sludge heavy metal levels by 1990. (69).

11. The immediate imposition of pre-treatment or source reduction requirements on Philadelphia platers and other industries is no more discriminatory and unfair than the dual advantage these industries curently enjoy over their direct-discharging and non-coastally located competitors. (69).

12. EPA has clear regulatory authority to direct Philadelphia, as a condition on its interim ocean dumping permit, to require its industrial discharge sources to adopt control measures to reduce their metal discharges. (70).

VI. NEED FOR FIRM PHASE-OUT SCHEDULE

A. Bad faith and foot-dragging rationale

1. Despite their sponsorship of him as a witness, Philadelphia has never retained Dr. Kaplovsky to investigate land disposal of sludge for the City. (70–71).

2. Dr. Kaplovsky, who was hired by the City to testify about problems with land application, is a sanitary engineer, not a soil and crop person. (70).

3. Despite the extensive expertise of Pennsylvania State University on the subject of land- (including strip mine-) application of sewage sludges and wastewaters, Philadelphia has no ongoing relationship or program with them. (71).

4. Despite the great expertise of the USDA Agricultural Research Service's Biological Waste Management Laboratory at Beltsville, Maryland on the subject of land application of sewage sludge, Philadelphia has never requested their assistance in solving its sludge problem. (71).

5. An exclusively sanitary engineering-oriented consulting firm was retained by the City to identify sludge disposal alternatives. (72).

6. Considerations of cost, rather than feasibility, have figured prominently in Philadelphia's refusal to pursue a number of land application alternatives to ocean dumping of sludge. (72).

7. The Letterkenny land application proposal, for which no public education groundwork was laid until after word had leaked the press, and which started from an already hostile and already formed public opinion, has no bearing on the likely public reaction to a properly explained, mutually beneficial, surface mine reclamation project. (73–74).

8. The Snowshoe Township proposal to dump garbage in a strip mine, about the public education groundwork of which, if any, Water Department witnesses had no knowledge, has no bearing whatever on the likely public reaction to a mutually beneficial reclamation project. (72–73).

9. The fact that two Pennsylvania counties have agreed to allow strip mine deposition of Philadelphia *trash* makes likely an even warmer receptiveness to a mutually beneficial reclamation project employing sludge. (73).

10. The impressions of Philadelphia Water Department personnel as to adverse public reaction have all (with the exception of Letterkenny) been second-hand, and in no case involved use of sludge for reclamation purposes. (74–75).

11. The only survey by Philadelphia representatives of a strip mine site for possible sludge application was made of the deepest and least suitable type of surface mine in the State; no investigation whatever was made of sludge application feasibility at more suitable surface mines. (75–76).

12. Earthmoving costs even at deep surface mines are not so great as to be necessarily prohibitive. (76).

13. Philadelphia's sludge disposal coordinator has no expertise in any of the complex technical specialties from which the answers to sludge disposal problems must come. (75).

14. Philadelphia has not taken even the simple step of advertising a contract for purposals to handle the City's ongoing sludge output. (76–77).

15. The City has never independently explored the availability of the King Ranch site—which is virtually in its backyard—for application of Philadelphia sludge, despite its awareness that a specific proposal of this kind had been made to PennDOT. (76–77).

16. A low-key effort to apply small amounts of sludge on a field in Fairmount Park is the City's only actual experience with a demonstration-type sludge application project. (78).

17. This effort was abandoned because, although the grass got greener, it also got higher, and the Park Commission doesn't like to cut the grass. (78–79).

18. It is not at all clear that the residents of Philadelphia would object to a properly planned and presented land-application project in Fairmount Park. (79).

19. At least 50 Pennsylvania communities currently land-apply sewage sludge. (79).

20. Although the City plans another small-scale land application demonstration project this summer at the treatment plant sites, it does not intend to rely on the results of this project. (79–80).

21. Many questions to which a city conscientiously seeking land-based alternatives to ocean dumping of sewage sludge would desire answers, were never investigated by Philadelphia. (80–81).

22. Even if the Water Commissioner were presented proof satisfactory to him that the City's sludge dumping were harmful to the ocean, his reaction would be to do the same thing he has been doing for the last several years. (84–85).

23. Despite a steady stream of people who initiated contacts with the City offering land, contracts, and ideas, Philadelphia has undertaken no initiatives or investigations of its own. (81–83).

24. For the $4 million or so it would cost the City to buy its own barge and tug for hauling its wastes to sea—a course of action its consultant has strongly urged as more cost-effective than its present leasing arrangement—the City could purchase at least 130 sludge tank trucks equipped with flotation tires. (82).

25. The only inconsistency associated with shipping Philadelphia sewage sludge for use by other countries is the City's inability to find a beneficial use for it in the U.S. (83).

26. There is not sufficient information available to determine whether the quantity of sludge generated by the City during the term of its current ocean dumping permit will be closer to 195 or to 150 million gallons. (86–87).

27. The City has far from demonstrated a need to ocean-dump an additional 25 million gallons of sludge beyond the 150 million gallons authorized in its current permit. (86–87).

28. Much of the testimony by so-called "expert" witnesses for Philadelphia consisted of unsupported assertions by non-experts who, although in some cases were familiar with the results they were discussing, were unable to discuss their significance. (83–84).

29. Although the City took New Jersey to court when it felt aggrieved by a restrictive N.J. statute barring the transportation into N.J. of out-of-state solid waste for disposal, has taken no action to litigate the applicability and/or constitutionality of provisions of Pennsylvania law which it regards as similarly restrictive. (83).

B. Lack of incentive rationale

1. It is not hard to understand that efforts to identify and implement land application alternatives might be rather low-key and preliminary, with more emphasis on the identification and study aspects than on the implementation, at a time when ocean dumping activities are in full swing with no immediate end in prospect and with no immediate compulsion or necessity to find a suitable substitute. (88).

2. Prior to the EPA permit action in February of 1975, Philadelphia expected to be able to continue ocean dumping indefinitely. (88).

3. Philadelphia's efforts at finding alternatives to ocean dumping of its sludge have been virtually limited to identifying problems rather than attempting to find solutions. (89–91).

4. The type of disposal chosen by a community is a commitment not easily changed. (87).

5. Unless EPA directs Philadelphia to terminate its ocean dumping and adopt a land-based alternative in accordance with a set schedule, the City will continue to do what it has been doing. (91).

I. Legal Issues

A. THE BURDEN OF PROVING THE REASONABLENESS AND SAFETY OF CONTINUED OCEAN DUMPING OF PHILADELPHIA SEWAGE SLUDGE RESTS SQUARELY ON THE CITY

The Marine Protection, Research, and Sanctuaries Act (hereinafter, "MPRSA") gives the Administrator great discretion to deny an ocean dumping permit entirely, a decision to issue a permit being permissible only where he is able to determine that the proposed dumping "will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." § 102(a) [1]

However, a finding of reasonableness and/or lack of harm is only a necessary but not a sufficient prerequisite to award of a permit. Even where the Administrator has determined that the proposed dumping will not cause unreasonable degradation or endangerment, the plain words of the statute say that he merely "may", but not necessarily "must", issue the requested permit.

Indeed, section 104(e) of the MPRSA makes plain that it is up to the permit applicant to furnish all information needed by the Administrator in making his determination and that failure to supply such information (whether out of intransigency or because it does not exist) is grounds for permit denial. The Committee Reports of both the House and the Senate leave little doubt in this regard, interpreting section 104(e) as making it "clear that he burden of providing sufficient information lies on the permit applicant" and that the "Administrator is required to get from the applicant the information necessary for the necessary determination before a permit issues." S. Rep. No. 451, 92d Cong., 1st Sess. (1971); H.R. Rep. No. 361, 92d Cong., 1st Sess (1971). Both Reports likewise confirm that "[p]ermit issuance may come only after *the applicant has shown* that the proposed activity will not degrade or endanger human health, [etc.] . . ." (Emphasis added). (*Id.*). Moreover, in testimony before the sponsoring congressional committees, both EPA's present and its former Administrator expressed their understanding of the ocean dumping bill as clearly placing the burden of proof on the permit applicant. *Hearings on Ocean Dumping of Waste Materials Before the Subcomm. on Fisheries and Wildlife Conservation and the Subcomm. on Oceanography of the House Comm. on Merchant Marine and Fisheries*, 92d Cong., 1st Sess., Ser. 2, at 194, 450-51 (1971).

It is inconceivable that any lesser standard of proof might apply simply because the Administrator, rather than denying permit issuance altogether, took the more lenient course of allowing the dumping gradually to be phased out. As noted in the House Report, "[p]ermit 'rights' under this Act are in no sense 'vested rights'." H.R. Rep., *supra*, at 19. In short, the mere fact Philadelphia has gotten ocean dumping permits from EPA in the past in no way entitles Philadelphia to continue receiving them or obligates EPA to continue providing them indefinitely.[2]

This is particularly true in the case of ocean dumping of sewage sludge, a problem specifically discussed in the MPRSA's legislative history. Thus, among the policy recommendations of the Council on Environmental Quality's 1970 report on Ocean Dumping. A National Policy, which served as the basis for the MPRSA, were the following:

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[1] Whether potential degradation or endangerment is "reasonable" or not, presumably is to be tested against the 9 evaluation factors specified under Section 102(a) and any other criteria established by the Administrator. Considerations of "need" and "alternatives availability", as well as of environmental impact, would, therefore, have to be reviewed and evaluated before a potentially harmful dumping activity could be adjudged "reasonable" and a permit therefor issued.

[2] Similarly, the mere fact that sewage enters the ocean from a number of sources in addition to ocean dumping does not mean that EPA or the Congress lacks the right to strictly regulate ocean dumping. And the fact that EPA Region II may have chosen a slightly different approach than Region III in regulating dumping by its very different mix of municipalities, does not mean that EPA's treatment of Philadelphia is discriminatory or unfair. See, e.g. Salyer Land Co. v. Tulare Lake Basin Water Storage Dist., 93 S. Ct. 1224 (1973) (equal protection clause does not make every minor difference in application of laws to different groups a violation of our Constitution); Lehnhausen v. Lake Shore Auto Parts Co., 93 S. Ct. 1001 (1973) (line-drawing must amount to "invidious" discrimination before it is unconstitutional); McDonald v. Board of Election Com'rs of Chicago, 394 U.S. 802 (1969) (legislature is allowed to take reform one step at a time, addressing itself to that phase of the problem which seems most acute, and it need not run the risk of losing an entire remedial scheme simply because it failed to cover every evil that might conceivably have been attacked).

Ocean dumping of undigested sewage sludge should be stopped as soon as possible and no new sources allowed.

Ocean dumping of digested or other stabilized sludge should be phased out and no new sources allowed. In cases in which substantial facilities and/or significant commitments exist, continued ocean dumping may be necessary until alternatives can be developed and implemented. But continued dumping should be considered an interim measure.

Unlike the situation in New York City (which owns and operates a fleet of self-propelled ocean-going barges), Philadelphia does not have a capital investment in or other "significant commitments" to continued ocean dumping. The message of the CEQ report was clear: ocean dumping of sewage sludge by cities like Philadelphia was to be phased out promptly.

Both EPA's present and its former Administrator endorsed this policy in testimony on proposed ocean dumping legislation before the sponsoring congressional committees. William D. Ruckelshaus, EPA's first Administrator, pledged his Agency to the following approach:

Some communities have substantial financial investment in facilities and equipment for the barging of digested sludge to sea. To impose an immediate ban on ocean dumping by these communities would be uneconomic and possibly self-defeating where acceptable land-based disposal methods are not immediately available.

In such cases, EPA would temporarily allow the dumping to be continued but would require it to be phased out entirely within a reasonable period of time. No new sources of sewage sludge would be permitted.

This would mean that communities already dumping at sea would not be allowed to increase the volume of such dumping over current levels or what the existing barging facilities will accommodate. In the case of municipalities which do not currently dump sewage sludge at sea, they would not be allowed to start.

Hearings on Ocean Waste Disposal Before the Subcomm. on Oceans and Atmosphere of the Senate Comm. on Commerce, 92d Cong., 1st Sess., Ser. 11, at 265 (1971); *see also*, 1971 House Hearings, *supra*, at 395, 453.

The present EPA Administrator, Russell E. Train (at that time, Chairman of CEQ), made the following statement:

[T]he policy as set forth in our report is to end all harmful dumping as rapidly as possible, recognizing that in some cases, particularly disposal of sewage sludge by cities of New York, this can't be done overnight. But, the policy is definitely to phase these out.

Hearings on Water Pollution Control Legislation, Ocean Dumping Before the Subcomm. on Air and Water Pollution of the Senate Comm. on Public Works, 92d Cong., 1st Sess., Ser. H10, Pt. 5, at 2018 (1971).

In short, when it passed the MPRSA, Congress was well aware that EPA might—and indeed, expected and intended that EPA would—begin a prompt phase-out of the ocean dumping of all sewage sludge, particularly by cities like Philadelphia which have no large financial investment in ocean dumping facilities and equipment and which do have available a number of land-based alternatives.[3]

In discussing abstract legal principles such as burden of proof allocations, it is well to consider the following sentiments contained in the House Committee Report on the ocean dumping legislation, concerning FAO fisheries statistics which indicated that the world fisheries catch had declined in 1969 for the first

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[3] Although EPA has allowed the ocean dumping of sewage sludge to increase substantially in the last four years—contrary to previous pledges and congressional expectations—EPA's Deputy Administrator, John R. Quarles reaffirmed last spring the continuing need to live up to the policy commitment of phasing out ocean dumping of sewage sludge:

"In some instances one might make the argument theoretically that ocean dumping [of sewage sludge] is a good out. We have not adopted that approach.

"The sewage sludge contains large quantities of organic matter which perhaps might be disposed of in the ocean with no adverse effects, but it also contains a residue of everything else that happens to come through the municipal sewage collection system, including a good many industrial waste streams that are put into that system. There can be toxic materials, heavy metals, and other things which we feel should not be dumped in the ocean.

"We are putting more of our emphasis for the disposal of sludge in the direction of sanitary landfill and other mechanisms."

Hearings on Ocean Dumping Oversight Before the Subcomm. on Fisheries and Wildlife Conservation and the Environment and the Subcomm. on Oceanography of the House Comm. on Merchant Marine and Fisheries, 93d Cong., 2d Sess., Ser. 38, at 12 (1974).

time since World War II: "We do not have enough information to say whether this ominous decline should be attributed to pollution, to overfishing, or to other factors, alone, or in combination. We can, however, say that so long as the possibility exists that there is a relationship between pollution and the declining fish catch (and there clearly is), it seems to the Committee only a prudent exercise of environmental good manners to begin to cut back the rate of disposition of waste into the world's oceans.

H.R. Rep. No. 92-361, 92d Cong., 1st Sess. at 13 (1971). This is the only "standard of proof" the environment can stand.

No court decision[5] and only one agency decision is directly on point.

The controlling agency decision is the October 3, 1974, "Decision of the Administrator" in the case of *In Re Permit to Dump Materials into Ocean Waters, E. I. du Pont de Nemours & Co., Belle Works, Belle, West Virginia.* That case, like the present one, involved many uncertainties about the probable environmental effects of the proposed dumping activity. As in this case, "[t]he quality and quantity of data relating to circulation of water masses" and to "the transport of discharged materials" was deemed inadequate to estimate probable effect. (At 3, n. 3). As in this case, "[a]lthough the chemical nature of the . . . wastes is qualitatively and quantitatively known, many uncertainties exist about the behavior of the waste in the marine environment and its fate and transport . . ." (*Id.*). As in this case, "[w]hile many of the waste constituents are considered to be of minor environmental consequence . . ., others . . . occur in large amounts and must be presumed to be environmentally harmful until definitive data are developed." (*Id.*). And finally, "[a]vailable biological data [at least in the *DuPont* case] [suggest[ed]] that the . . . waste may be of low relative toxicity with respect to acute (short-term) bioassays," but, in both cases, "the information base is inadequate to estimate chronic (long-term) effects of possible accumulation of materials in [marine] species or in the food chain." [Id.].[6]

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[5] In Society of the Plastics Industry, Inc. v. Occupational Safety and Health Administration, 509 F.2d 1301 (2d Cir. 1975), the Second Circuit Court of Appeals upheld strict new OSHA standards governing exposure of workers to vinyl chloride gas, taking the position that once the danger to the workers was indicated a rigid standard could be imposed without a showing that the standard was technologically feasible. In the Court's words:

"The Secretary is not restricted to the status quo. He may raise standards which require improvements in existing technologies or which require the development of new technology, and he is not limited to issuing standards based solely on devices already fully developed." (509 F.2d at1309). The Court also noted that "the ultimate facts here in dispute are 'on the frontiers of scientific knowledge', and, though the factual finger points, it does not conclude" (Id., at 1308)—a circumstance also true of the instant case. Yet, despite these uncertainties, the Court concluded, "it remains the duty of the Secretary to act to protect the working man, and to act even in circumstances where existing methodology or research is deficient." (Id.).

In the Eighth Circuit case of Reserve Mining Company v. United States, — F.2d —, 7 ERC 1618 (8th Cir. 3/14/75), as clarified by 7 ERC 1782 (8th Cir. 4/8/75), the Court considered a mining company's discharge into Lake Superior of taconite tailings containing asbestos fibers. While regarding an order to immediately cease discharges as unwarranted in view of evidence demonstrating only a potential rather than an imminent health hazard and in view of the economic and social benefits conferred by the company's continued operations, the Court nevertheless deemed an order calling for abatement without unnecessary delay to be both justified and necessary. Although the case called into play the Court's equity powers, provisions of the Federal Water Pollution Control Act amendments were also crucially involved. In particular, much reliance was placed on 33 U.S.C. §§ 1160(c)(5) and (g)(1), which speak in terms of securing "abatement of pollution", pollution "which is endangering the health or welfare of persons", and giving "due consideration to the practicability and to the physical and economic feasibility of complying" with applicable water quality standards. (Note the far stronger language of section 102(a) of the MPRSA, requiring permit denial unless the *absence of* unreasonable degradation and endangerment are proven.) Of some significance to the instant case is the Eighth Circuit's interpretation of the term "endangering" as connoting "a lesser risk of harm than the phrase 'imminent and substantial endangerment to the health of persons'", as having been used "in a precautionary or preventive sense", as encompassing within its purview "evidence of potential harm as well as actual harm", as meaning "something less than actual harm", as requiring only that "harm is *threatened*; no actual injury need ever occur", and as representing merely a "risk" which "may be assessed from suspected, but not completely substantiated, relationships between facts, from trends among facts, from theoretical projections from imperfect data, or from probative preliminary data not yet certifiable as 'fact'." 7 ERC at 1642-43.

[6] If anything, the DuPont waste was a better candidate for ocean dumping than the Philadelphia sludge involved here. For one thing, the DuPont dumping was to occur 200 miles rather than 40 miles from land; for another, an array of short-term bioassay tests found the DuPont wastes to be of relatively low toxicity (the only such tests done on Philadelphia sludge were with the hardy brine shrimp, an organism now universally acknowledged to be so inappropriate for this purpose as to render the test results meaningless. In apparent recognition of this, Philadelphia did not so much as mention them at the adjudicatory hearings).

In view of his lack of "reasonable confidence in the sufficiency and reliability of the available scientific data," the Administrator felt obliged to deny the requested permit:

"Absolute scientific certainty concerning the environmental effects of ocean disposal is rarely achievable, and is not a prerequisite to the issuance of a permit. However, the MPRSA and the public interest *do* require, at the very least, that "an informed judgment on the probable environmental effects" be made prior to any determination that there will be no unreasonable degradation. I cannot make such a determination in this case, and must therefore deny the application for a permit."

(At 3–4).

He regarded his function in making the determination called for by section 102(a) of the MPRSA as follows:

"The Administrator . . . must assess the environmental consequences of ocean disposal in light of the economic and social benefits which would thereby be obtained. In order to perform that assessment, I must be able to make a reasonable determination of the likely environmental effects of the proposed dumping.

"The hearing record reflects differing views as to which party should bear the burden of persuasion; but that is not the real issue. The function of EPA is not merely to weigh the evidence offered by the proponents and opponents of dumping. Under the statute, it is *the Administrator's* responsibility to determine that dumping will not result in unreasonable environmental degradation. That determination cannon be made in good faith without reasonable confidence in the sufficiency and reliability of the available scientific data.

"I have no such confidence in the information presented in this case . . ."

(*Id.*, at 2).

Whereas Philadelphia in the present case contends that a phase-out decision should be deferred until more research has been done and more information is available,[5] the Administrator, in the *DuPont* case, reached an exactly opposite view of his responsibilities under the MPRSA. Despite an EPA Technical Work Group report containing specific suggestions as to future research that might help answer some of the unanswered scientific questions, Mr. Train concluded that "further technical studies are necessary before a permit could be granted for ocean disposal of the DuPont wastes." (Emphasis added) (*Id.*, at 5).

Two additional legal conclusions in the *DuPont* decision are worthy of note. First, the Administrator concluded that DuPont's contention "that by issuing regulations to implement the ocean dumping program . . ., the Administrator has narrowed the scope of his discretion under the statute, i.e., that a permit must be granted if an applicant satisfied the specific conditions in the regulations, is "erroneous." (*Id.*, at 2, n. 1).

Second, the Administrator concluded that, in view of the presence in the DuPont waste of materials in the "special care" (or "gray list") category under the "Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter", although the Convention was (and is) not yet in force, "I am extremely reluctant to create a precedent indicating that, in the view of the United States, the 'special care' requirement is satisfied by granting a permit on the basis of scientific evidence as inconclusive as in the present case." (*Id.*, at 5). This rationale applies even more forcefully in the present case, because not only does Philadelphia sewage sludge contain a plethora of "special care" materials, but it contains in addition high levels of two even more toxic wastes (mercury and cadmium), which appear on the Convention's even more restrictive list of "other prohibited" or "black list" materials. If the special care requirement is not to be satisfied on the basis of inconclusive scientific evidence, how much more so must it be the case that the even stricter requirements for "other prohibited" materials cannot be satisfied on the basis of such evidence.

In addition to the above legal conclusions of the Administrator, there is one "legal and regulatory finding" by EPA's Chief Judicial Officer who prescribed at the DuPont adjudicatory hearing, that was not specifically reached by the

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[5] Counsel for Philadelphia has stated that "there certainly is not any contention that thre is no potential harm . . . . It has always been the position of the City that research should be done." (IV-706). And paragraph 6 of Philadelphia's Statement of Contentions asserts: "The Agency should undertake an adequate program of appropriate scientific research before any decision is made regarding future limitations on ocean disposal."

Administrator in his opinion, but which is certainly germane to the present proceeding:

"(Certain specified) components of the material proposed to be dumped . . . are insufficiently described in terms of (their) physical, chemical, and biological properties to permit evaluation of their impact on marine ecosystems and, therefore, may not be approved by EPA for dumping unless and until they are sufficiently described to permit such evaluation (40 C.F.R., § 227.21(c))."

Report of the Presiding Officer, at 94 (transmitted to Administrator, September 4, 1974). See also the "ocean discharge criteria" of the Water Act,[6] section 403(c)(2) of which provides: "In any event where insufficient information exists on any proposed discharge to make a reasonable judgment on any of the guidelines established pursuant to this subsection[7] no permit shall be issued under section 402 of this Act."

In short, it is abundantly clear on the law that a heavy statutory burden rests squarely on Philadelphia, and equally clear on the facts (*see, infra*) that the City has fallen far short of meeting this burden. In the final analysis, however, as the *DuPont* case indicates, the "real issue" is not which party bears the burden of persuasion, but whether the Administrator is able in good faith to conclude that the proposed dumping will not result in unreasonable environmental degradation,[8] or in human health endangerment.[9] This determination by the Administrator must be made in light not only of the statutory evaluation factors set forth in section 102(a) but also of any additional regulatory requirements[10] imposed by EPA's Ocean Dumping Criteria (40 C.F.R., Part 227).

Among such additional regulatory requirements is the prohibition, already discussed, against the dumping of "insufficiently described" materials. One further requirement of the Ocean Dumping Criteria deserves mention, however: the "implementation plan" requirement for ocean-dumped wastes like Philadelphia's which do not qualify for a "special" permit.[11] Dumpers like Phila-

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[6] The Ocean Dumping law and the Water Act, which were passed by Congress within a week of one another and with close coordination of the ocean disposal provisions of the two acts between the Senate Commerce and Public Works Committees, may and should be read together. Thus, the Senate Report on the ocean dumping bill states: "As reported, H.R. 9727 reflects an agreement between the Chairmen of the Committees on Commerce and Public Works, ensuring consistency between H.R. 9727 and the proposed Federal Water Pollution Control Act Amendments of 1971 (S. 2770)." S. Rep. No. 94-451, 92d Cong., 1st Sess. (1971), 1972 U.S. Code Cong. & Adm. News 4235.

Philadelphia itself has recognized this (at least in alleging unfairness in EPA's treating ocean outfalls under the Water Act one way and ocean dumping under the MPRSA another): "(I)t would be surprising if two statutes enacted so nearly simultaneously should have startlingly different impacts on the municipalities covered by each program." (Townsend, St.-25-26).

[7] The ocean discharge criteria of the FWPCA were deemed so similar to the ocean dumping criteria under the MPRSA, that EPA expressly chose to regulate both under the same regulatory criteria. (40 C.F.R., § 227.1(b)).

[8] The meaning of the phrase "unreasonable degradation" has never been litigated as such. However, case law under the Clean Air Act may be instructive. In NRDC v. EPA, 489 F.2d 390 (5th Cir. 1974), for example, the court construed the "nondegradation" policy of that Act: "The use of dispersion techniques is at odds with the nondegradation policy. Dispersion enhancement techniques operate by keeping pollutants out of areas of high pollutant concentration, and dispersing them to lower concentration areas; their objective is to reduce concentrations in high-concentration areas. *Inevitably*, however, *the pollutants emitted into the atmosphere must end up somewhere; and the atmosphere at their destination, wherever that may be, will be degraded, in violation of congressional policy. The only techniques fully capable of guaranteeing non-degradation are emission limitation techniques.*" (At. 408-409) (emphasis added). This philosophy is not without its relevance to our case.

That a "reasonableness" criterion is implicit in this use of the term "degradation" is evidenced by the fact that the courts have equated the Clean Air Act's "non-degradation" requirement with a "significant deterioration" standard. Sierra Club v. Ruckelshaus, 344 F. Supp. 253 (D.D.C. 1972), aff'd sub nom by an equally divided Court, Fri v. Sierra Club, 412 U.S. 541 (1973).

[9] Guidance as to what is entailed by an "endangerment" standard can be found in the Reserve Mining Case. See discussion, supra, at 5-6, fn. 1.

[10] Although Philadelphia has challenged (Statement of Contentions, Par. 2) the ocean dumping regulations as "arbitrary and capricious as applied" to Philadelphia, this contention was never pursued at the adjudicatory hearing. And, although Dr. Cox did question "the propriety of evaluating the heavy metal content of sewage sludge separately for the so-called 'liquid phase' and 'solid phase'" (Cox, St.-31), as required by 40 C.F.R. § 227.22(f) for mercury and cadmium constituents, she would and could not deny that EPA has a valid interest in knowing how much heavy metal is associated with each waste phase (Id., II-301-305).

[11] Special permittees may not, among other things, dump wastes containing cadmium or mercury at solid phase levels of more than 0.6 and 0.75 mg/kg (ppm), respectively. 40 C.F.R., § 227.22(f). As acknowledged by Commissioner Guarino (I-27:18-24), Philadelphia sewage sludge contains both these elements in concentrations many times higher than these limits.

delphia operating under an interim permit must, under 40 C.F.R. § 220.3(d)(2), develop and actively implement "a plan [meeting the requirements of § 227.4] to either eliminate the discharge entirely from the ocean or to bring it within the limitations [to which special permitholders are subject]." Following the first award of an interim permit, "a new interim permit may be issued . . . [only] upon satisfactory completion of each phase of the development and implementation of the plan." Philadelphia is now operating under its third successive interim permit, without having satisfactorily completed any part of either the development or implementation of such a plan. While EPA retains the discretion to deny an ocean dumping permit (at least for any non-whimsical reason)—even where the applicant has met all of the regulatory and statutory criteria—the failure to satisfy even one of these criteria must be regarded as tantamount to a showing of unreasonable degradation and endangerment and hence a sufficient basis for (if not an absolute necessitator of) permit denial (let alone the lesser action of requiring a dumping phase-out over a 6-year period).

In the instant case, Philadelphia not only has the burden of proving the absence of harm to the Administrator's satisfaction, but it has the added procedural burden of overcoming the presumptive correctness of the Regional Administrator's February 13 permit action. This latter obligation is clearly set forth in paragraph 9 of the Administrator's March 26, 1975 letter to the Philadelphia Water Commissioner, agreeing to Philadelphia's request for an adjudicatory hearing. (At 2).

Finally, it might be well to bear in mind, that a decision denying or limiting the privilege of ocean dumping is far less susceptible to judicial reversal (and even review) than a decision allowing the dumping to go on. This follows from the fact that the MPRSA gives the Administrator virtually no discretion in determining to *issue* an ocean dumping permit (all of the statutory and regulatory criteria must be applied and satisfied, and it must be affirmatively determined that no unreasonable degradation or endangerment will result). Under the Federal Administrative Procedure Act, where such a decision does not strictly adhere to statutory requirements it can be overturned (5 U.S.C. § 706(2)(A)) as "arbitrary, capricious, an abuse of discretion, [and] not in accordance with law." [12] On the other hand, satisfaction of all statutory and regulatory criteria merely allows but does not require issuance, making determination to *deny* ocean dumping approval, actions "committed to agency discretion by law" (5 U.S.C. § 701(a)), thereby removing them entirely from the ambit of the APA's judicial review provisions. (See, generally, Davis, Admin. Law Supp. § 28.16 (1970) and cases cited therein).[13]

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[12] Judicial reversal of an agency decision under this standard is permissible only when there is no discernible "rational basis" for the agency's treatment of the evidence, Bowman Transportation, Inc. v. Arlington-Best Freight System, Inc., 419 U.S. 281, 290 (1974), and where the agency action is grounded on no more than "impermissible whim, improper influence or misplaced zeal," Greater Boston Television Corp. v. FCC, 444 F.2d 841, 852 (D.C. Cir. 1970), cert. den. 403 U.S. 923, reh. den. 404 U.S. 877, cert. den. 406 U.S. 943. By contrast, the "substantial evidence" test of 5 U.S.C. § 706(2)(E), allows judicial reversal of an agency decision not grounded on "such relevant evidence as reasonable minds might accept as adequate to support a conclusion", Jones v. Priebe, 489 F.2d 709, 710 (6th Cir. 1973), but based on evidence that merely "creates a suspicion" of the existence of the fact to be established. NLRB v. Arkansas Grain Corp., 392 F.2d 161, 167 (8th Cir. 1968)). It should be noted that, even under the "substantial evidence" test, "the possibility of drawing two inconsistent conclusions from the evidence does not prevent an administrative agency's finding from being supported by substantial evidence." Consolo v. Federal Maritime Commission, 383 U.S. 607, 619-20 (1966).

[13] Even if permit denial under the MPRSA could be considered as not "committed to agency discretion by law" within the meaning of section 701(a), making judicial review of the Administrator's decision possible, the appropriate standard of review (contrary to paragraphs 3 and 4 of Philadelphia's "Statement of Contentions") would be the "arbitrary and capricious" rather than the "substantial evidence" standard. This is so because, under 5 U.S.C. § 706(2)(E), the "substantial evidence" test applies only to cases required by statute to be reviewed on the record of an agency hearing. And, as stated by Administrator Train in his March 26, 1975 letter agreeing to convene a "limited" adjudicatory hearing, no statute required that such a hearing be held at all, let alone that the decision in this case be made on the record of that hearing: "The EPA regulations implementing the [MPRSA] do not expressly provide for adjudicatory hearings as part of the administrative process leading to the granting or denial of an ocean dumping application."

Which, if any, standard of review applies to the present case is of little if any substantive significance, however, inasmuch as no conceivable standard of review would permit the Administrator to do anything but uphold or strengthen the Regional Administrator's permit action (i.e., the phase-out requirements contained in the permit).

B. EPA HAS ABUNDANT AUTHORITY TO REQUIRE OCEAN DUMPING PERMIT APPLICANTS SUCH AS PHILADELPHIA TO INVESTIGATE AND REPORT ON WASTE DISPOSAL AND RECYCLING ALTERNATIVES TO OCEAN DUMPING

Philadelphia has contended that "sludge management prerogatives are a City responsibility and not part of a regulating permit" (Guarino letter of February 27, 1975) and that Special Permit Conditions 7.d-h.[14], therefore, impose "unrealistic and unreasonable obligations upon the City" (April 23, 1975 "Statement of Contentions").

Sludge management prerogatives may be a City responsibility, as Philadelphia contends, but the MPRSA makes it EPA's responsibility to deny the right to "manage" sludge by means of ocean dumping where "appropriate" land-based alternatives exist. Thus, among the criteria which the MPRSA specifically requires the EPA Administrator to apply in reviewing and evaluating ocean dumping permit applications is the availability of "[a]ppropriate locations and methods of disposal or recycling, including land-based alternatives and the probable impact of requiring use of such alternate locations or methods upon considerations affecting the public interest." (§ 102(a)(G)).

The "appropriateness" and public interest "impacts" of particular alternatives are obviously things which cannot be addressed by EPA without adequate specific information as to each available alternative. As is made clear by section 104(e) of the statute, the Administrator is not limited in this review and evaluation to information voluntarily supplied by the permit applicant. This provision affirmatively directs the Administrator to "require an applicant for a permit . . . to provide such information as he [the Administrator] may consider necessary to review and evaluate such application." Similarly, section 104(b) specifically authorizes the Administrator to "prescribe . . . such reporting requirements for actions taken pursuant to permits issued by him . . . as he deems appropriate."[15]

Whether or not EPA possesses the authority to dictate to a municipality the particular land-based alternative it must adopt is not at issue here. And EPA's right to question a permit applicant's conclusory assertion that it has no feasible alternative and to require it to investigate and report on promising alternatives of which EPA is aware (which are the issues here) is so self-evident as to not be open to serious question.

C. PENNSYLVANIA LAW ENCOURAGES, RATHER THAN INHIBITS, SURFACE MINE RECLAMATION THROUGH THE USE OF MUNICIPAL SEWAGE SLUDGE

1. The Pennsylvania Surface Mining Conservation and Reclamation Act, 52 P.S. § 1396.1, *et seq.*, imposes reclamation requirements on all active surface mining in the State, including quarrying, and the extraction of sand, gravel, rock, stone, earth or fill from "borrow pits" for construction purposes.[16] Reclamation requirements include "compaction of the soil and fill", "contouring" or "terracing", and a "complete planting program providing for the planting of trees, grasses, legumes or shrubs, or a combination thereof approved by the Department [of Environmental Resources] as best calculated to permanently restore vegetation to the land affected" (or at least, if conditions do not permit complete revegetation, "alternate procedures . . . to prevent the threat of soil erosion or unavoidable siltation"). (52 P.S. § 1396.4). The Act also established a "Surface Mining Conservation and Reclamation Fund" administered by the State for reclamation purposes, into which various fees and penalties are paid.

Given the great value of sewage sludge in mediating the revegetation of

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[14] The contested permit provisions require quarterly reports on 10 sludge disposal systems already under investigation by the City, investigation of and reporting on 9 additional alternatives, reporting on proposals received for disposal of lagooned sewage sludge, continued investigation of and reporting on sludge utilization for reclamation of strip mines and (investigation of and reporting on) any other alternatives deemed appropriate by the Regional Administrator. Since most of the indicated alternatives were discussed in some detail at the adjudicatory hearing, it is perhaps not too surprising that the City has not pressed this contention very vigorously.

[15] See also, 40 C.F.R. §§ 220.3(d), 221.1(j), 221.2, 223.1(g), 227.1(e), and 227.4

[16] Or whenever fill material must be "mined" for a construction project, reclamation requirements come into play. This suggests a need for Philadelphia sewage sludge not only in Pennsylvania's hundreds of thousands of acres of surface-mined anthracite and bituminous coal lands, but also in what must be vast acreages of quarries, borrow pits, etc. from which fill materials is taken for a host of construction projects.

barren strip mine spoil banks, the obligation of surface mine operators to reclaim and regrade these mines, and Pennsylvania's own State reclamation program, it is apparent there are many incentives for a warm welcome for a properly presented sewage sludge reclamation program. Moreover, it may well be possible for Philadelphia entirely to avoid the earthmoving expenses associated with the regrading or levelling that must be done before sludge can be applied through cooperative arrangements with mine operators and/or the Commonwealth, thereby greatly reducing the price-tag associated with this alternative.

2. Even for mining activities abandoned prior to the effective date of the Reclamation Act, mining operators remain subject to liability—and hence, retain an incentive to initiate abatement measures—for acid mine drainage and other stream pollution caused by their failure to take such such restorative measures. (Cwlth. v. Barnes & Tucker, 6 ERC 1406 (Pa. 1974); see also, Pennsylvania Clean Streams Law, 35 P.S. § 691.1, *et seq.*).

3. An analysis of Pennsylvania law strongly suggests that the Pennsylvania Solid Waste Management Act, 35 P.S. § 6001, *et seq.*, is not a serious obstacle to Philadelphia's deposition into Pennsylvania surface mines of its sewage municipalities may "dispose" of "solid wastes" in Pennsylvania "mines" (§ 6007), but does not allow PennDER to issue "permits"[17] without the approval of the board of county commissioners of the county in which such mine is located" (§ 6007(g)).

In the first place, it is not clear that sewage sludge to be used for reclamation purposes is "solid waste" or that surface mines (particularly following regrading) are "mines" within the meaning of the Act. As Mr. Townsend has stated, "Sludge is not solid waste" (Townsend, II-113, 98), and the Act defines "solid waste" as "discarded materials . . . resulting from industrial, commercial, agriculture and residential activities" (emphasis added) (§ 6003(3)). With respect to the term "mine", this is undefined in the Act (and there is no legislative history to clarify the intent of the law-makers), but other Pennsylvania statutes define it as extending only to underground mines. However, even assuming that surface mines are covered by the Act, it is by no means clear that after such a "mine" has been filled-in and levelled (which would generally be prerequisites to sludge application) the resultant level or gently sloping ground could in any way be considered even a "surface mine" any longer.[18]

And, in the second place, even if the Act's permit provisions do apply, there is good reason to believe (and no reason not to) that the county commissioner approval requirement (amounting to a veto power) is unconstitutional under Pennsylvania law as a blanket delegation to county officials of a power unconfined by any articulated standards.[19]

II. Impacts of Ocean Dumping

CONTINUED OCEAN DUMPING BY THE CITY OF PHILADELPHIA WILL ADVERSELY AFFECT HUMAN HEALTH, THE MARINE ENVIRONMENT, AND ECONOMIC POTENTIALITIES

Continued ocean dumping of Philadelphia sewage sludge poses a threat to commercial and recreational fishing interests, to major economic potentialities, to the marine environment and the associated ecosystem, and to human health.

1. Dumping and Short-Dumping Threat to Human Health and Economic Potentialities

Barges carrying sewage sludge to the Philadelphia dump site pass right through the "main band" of the U.S. sea clam (also known as the Surf clam) fishery, which "ranges from Long Island to approximately Cape Hatteras with a band about 20 miles wide from the coast out to approximately the 100 fathom depth"

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[17] No permit (and hence, presumably, no county commissioner approval) would, however, be required if the proposed sludge deposition activity were part of an approved solid waste management plan (§ 6007(a)).

[18] Moreover, once "extraction of minerals from the earth" has ceased, there would no longer be any "surface mining" within the meaning of the Reclamation Act (§ 1396.3), and therefore (arguably) no surface "mine."

[19] See, e.g., Cwlth. v. Cherney, 454 Pa. 285, 312 A.2d 38, 41 (1973) ("For the legislative grant of authority or discretion to another body to be valid, legislation granting such authority must contain adequate standards which will guide and restrain the exercise of the delegated administrative function"). The leading Pennsylvania Supreme Court decision on this question is Holgate Bros. v. Bashore, 331 Pa. 255, 200 A. 672 (1938). It is in accord.

level" (Verber, IV-60, 74), and the present dumpsite is within "15 to 20 miles" of active sea clam harvest areas (*id.*, IV-68). The sea clam industry "accounts for approximately 43 percent of . . . all clams and oysters and mussels . . . harvested in the United States today", the entire industry being "virtually limited" to the area from Long Island to Cape Hatteras (*id.*, IV-71).[1]

Although the current Philadelphia sewage sludge dump site is not believed to "presently contain harvestable quantities of sea clams or ocean quahogs" (Id., St. 3), continuation of dumping at this site is of concern to the Food and Drug Administration because (*a*) there is a potential for the commercial use of this site for the ocean quahog (mahogany clam): "Just because the area is not now commercially harvested does not mean they won't be in a few years from now or could be. The populations can increase and do change considerably off shore." (Id., IV-64). And (*b*) short dumping, which has already occurred on at least two documented occasions (Exhibits 21, 37, 38), "if allowed to continue will adversely impact the approved sea clam harvest areas and may lead to additional closures." (Id., St.-4).

Moreover, there is evidence that there are Virginia fishermen fishing in the "general area" of the Philadelphia dump site "for scallops and lobster, and in-shore from that for surf clams". (Huggett, V-5-6, St.-2-3; *see also*, V-8, 13-14, 16). Sea scallops have actually been observed on the bottom of the Philadelphia dump site in concentrations of one per square meter, "except in the southeast part of the area where they were more abundant ($3\text{-}4/m^2$)." Crabs, hake, and flounder, among other organisms, were generally "present in concentration of $1/m^2$ although occasionally some were more common." (Folger, St.-5; Huggett, V-19, 20).

Health hazards to people from eating contaminated shellfish[2] have been "fairly well . . . documented over the past 50 years . . . .

"(T)he harvesting of clams and oysters back in 1925 caused in a wide scale epidemic in the United States which killed over 300 people. Fifteen hundred were hospitalized that we are aware of, and it just caused a virtual collapse of the industry . . . And we have documented (since that time) epidemic breakouts in recent years of infectious hepatitis, salmonella, gastroenteritis, that have caused problems."

(Verber, IV-70). Since 1900 "something like 600 epidemics" involving shellfish have been documented as being associated with "sewage being disposed of in water" (Id., IV-80-81). No epidemics in the United States (and presumably anywhere) have ever been related to sewage being disposed of on land[3]. (Id. IV-80).

Dumping or short-dumping of Philadelphia sewage sludge in commercial shellfish harvest areas is, therefore, of "grave concern" to the FDA (Verber, IV-55:5) both in terms of the effects it "may have on the shellfish and those being harvested and reaching the market" (*id.*, IV-74:20-22) and in terms of the associated "potential health threat, certainly" (*id.*, IV-74:22). "[w]hether [the short dumping is] in bad faith or whether it's due to a squall . . ." is quite immaterial to the Food and Drug Administration." (*Id.*, IV-76). Presumably, it is equally immaterial whether the sewage sludge is intentionally dumped in a commercial harvest area or whether it is coincidentally short-dumped there enroute to a not presently harvested, approved dump site. "We are concerned about the dump and its effect under any conditions . . ." (Verber, IV-76).

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[1] The former Philadelphia dump site, which is also traversed by the barge, "has vast quantities of sea clams" (Verber, IV-72). On January 1, 1975, following nearly 5 years (beginning May 19, 1970) of closure to commercial shellfish harvesting, this area was reopened to commercial harvesting (Id., St.-3, Exhs. B, D) for the principal reason of again making it "available to the industry" (Id., IV-72).

[2] While *heavy metal* uptake is of concern to the FDA (under the Food, Drug and Cosmetic Act) for all of these edible organisms (FDA tolerance levels presently exist for mercury; additional tolerance levels and "action levels" are under review), its National Shellfish Sanitation Program "specifically focuses on *bacterial* contamination of oysters, clams and mussels" (Verber, IV-65 because in these cases "the entire animal as a rule is eaten" and often "raw or only partially cooked" (Id., IV-66). See, 40 F.R. 25915-25935 (June 19, 1975).

[3] "(O)ysters and clams are filter feeders. So they take up the bacteria and viral particles that are in the water and hold them."(Verber, IV-60, St.-1). Indeed, shellfish are "noted for their ability to collect and concentrate bacteria from the water" at levels "at least a thousand fold" above background levels (Burge, VI-79). Whether or not a comparable concentration mechanism exists in the soil, and there is no evidence that it does, one would not anticipate the same "problem" with sewage sludge applied to land because there are no organisms in the soil "that we are harvesting for consumption." (Id., VI-80).

All of the short-dumping safeguards testified to by the president of Philadelphia's barging company contractor (Miele, VII-50-52, 57, 60-61) are aimed at preventing dishonesty by the tug captain (i.e., intentional, avoidable short-dumping), but none of these is foolproof. Coast Guard monitoring, for example, is limited to "about 1 [dump] out of 5" (Verber, IV-77:6). Even if the Coast Guard were present, they might be unable to detect a short dump carried out gradually while en route to the dump site (Miele, VII-56) or at night (*id.*, VII-58). And despite the presence of a LORAN navigation system on the tug, there is no automatically self-registering log that allows the barge's location at the time of dumping to be later verified nor any other means of really telling "where that boat is when he starts dumping" (*id.*, VII-61). Also, despite monitoring and cross-referencing or barge and tow company logs, there is no infallible way of verifying that the indicated amount of time was actually spent out at the dump site, especially since the time at the site could plausibly vary from an hour and a half to four hours or more. (*Id.*, VII-56-58).[4]

In the final analysis, in short, one is forced to rely (in preventing avoidable short-dumping) on the "integrity of the tug boat captain" (Miele, VII-61-62). And the fact is, despite all of the cross-checking of logs that is and was done, despite the absence of any motivation "whatsoever" for the tug boat captain to short-dump, and the presence of "considerable disincentives" for him to do so (*id.*, VII-52), there is at least one known instance where the tug captain not only short-dumped but also falsified the log because "he probably figured he could get away with it." (*Id.*, VII-46-47, Exh. 37).[5]

There is a more serious risk than *avoidable* short-dumping and intentional falsification of logs, however. While it is probably true that most, if not all, short dumps occur because of a mechanical malfunction or a sudden severe weather condition rather than "because of the whim or whimsey of a ship captain", "the threat is just as real" when there is a good reason for the short dumping as it is when there is not. (Verber, IV-84). And where "emergency" short-dumps are concerned, no amount of monitoring or deterrance can prevent the short-dumping from taking place. (*Id.*, IV-84, 57, 63; Miele, VII-53, 59, 64). No controls to accomplish this are even conceivable.

It may be possible to somewhat reduce the adverse effects of short-dumping by means of prompt radio notification[6] of the FDA and the Coast Guard (although this has not been the practice to date) (Miele, VII-49; Verber, IV-58), but as Captain Verber testified, even "if we were notified immediately of a short dump we would have serious control problems in trying to identify who is harvesting in that particular area and getting that particular product off the market" (Verber, IV-58).

Marine bulletins would not be adequate because "[t]here is no way of knowing whether or not a vessel has a radio on . . . We would have to go on a one to one basis" and rely "on a personal contact" (*id.*, IV-86). Considering the fact that "we're dealing with the movement in and out of this area [of the former dumpsite and environs] of something like 50 vessels which are fishing for the sea clam", and since the area were speaking of is "almost a thousand square miles", it is easy to understand why it might be "difficult" for the FDA "to watch all of these vessels and where they are harvest(ing)." (*Id.*, IV-58).

In short, other than terminating sludge dumping by Philadelphia, there is no effective way to prevent the harvesting and marketing of contaminated seafood except to "place off limits" to the sea clam industry "somewhere in the neighborhood of maybe 200 square miles" of productive shellfish beds.[7] (Verber, St.-4, IV-75-76). And it seems less than fair to penalize the shellfish industry for a problem created by Philadelphia.

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[4] Indeed, in one of the two acknowledged incidents of short-dumping, "there was enough time that had been expended between the time (the barge) left the port to the time (it) returned," to permit the tug captain (unsuccessfully in this instance, as it turned out) to "figure[ ] he could get away with" falsifying the log (Miele, VII-47).

[5] The fact that he did not get away with it in this one known case is certainly no assurance that another tug captain will never try it again (and perhaps succeed).

[6] One "could call it" an incentive to not provide such notification that every time a short-dump is reported the City has a contractual right to withhold payment for that barge load (Miele, VII-53-54).

[7] Now that the area (about 113 square miles (Verber, IV-75:15)) surrounding the former Philadelphia dump site is no longer closed to commercial harvesting (and therefore no longer routinely patrolled by the Coast Guard), the FDA no longer has any "regulatory way to handle any product from getting on the market" that has been contaminated by short-dumping of Philadelphia sewage sludge. (Verber, IV-55; St.-3).

Although this would be "completely in opposition to [the FDA's policy of] . . . trying to maintain as much area open to shellfish as possible", the FDA has been considering for several months—as possibly "the only thing that is left to us"—the closure of a corridor "something like 15 to 20 miles in length" and "perhaps up to 10 miles wide" (150 to 200 square miles) "in the vicinity of Delaware Bay and across the [harvest] paths out to the new dump site" with a width approximating that traversed by the sludge barges. (*Id.*, IV-58-59, 75-76).

Unless EPA acts to phase-out Philadelphia's dumping practices, a recurrence of short-dumps such as that of last October which took place in the midst of a region through which "better than 50 percent of the [sea clam] fleet . . . is moving" (*id.*, IV-73), is virtually inevitable, with the result that there "will [be] a very real public health threat" (*id.*, IV-58:1-2).

2. Frequency of Short-Dumping

Although the barge company's president seemed rather emphatic that there were no more than two short dumping instances out of the "approximately 158 trips" out to the present Philadelphia dump site since late April of 1973 (Miele, VII-44), Commissioner Guarino's response when he was asked if he was familiar with the practice raises an inconsistency that has never been explained: "There were two—I know *we found out about* it, and we didn't pay them. And there were *two others* that I understand *that everyone is aware* that the contractor ran into severe weather conditions and had to unload prematurely or he would endanger life." (Emphasis added) (Guarino I-59). Were there two that were made public and two that were not? And were there any others neither made public nor "found out about"? The barge company president could not explain the discrepancy. (Miele, VII-54, VII-64).

And although the FDA's Captain Verber refers to short dumps on October 25, 1974 and April, 1975 (Verber, St.-4), which corresponds more or less to the "short dump on a trip made between October 19, 1974 through October 24, 1974" and "the incident which took place on April 15, 1975" (Exhs .37, 38), referred to by the barge company president, Captain Verber also notes that "[W]e have had three dumps in that area since this particular letter [referring to Mr. Guarino's letter of November 12, 1974 concerning the October short dump; see Exhibit 37] and we haven't been able to control any of the shellfish" (Verber, IV-87).

Since Philadelphia and Camden are the only sludge dumpers south of New York and since both Philadelphia and Camden use the same barge company (Miele, VII-62), it is again unclear to what "three dumps" Captain Verber had reference.

In any case, it is clear that short dumping is a continuing problem: "These [the October and April dumps], of course, are not the only short dumps that have occurred. You are aware of that. We have had continual problems since 1966 with this particular fact." (Verber, IV-54-55).

3. Threat to Sportfishermen and to Recreational Fishing

Commercial shellfish harvesting is not the only fishing activity occurring within the area of Philadelphia dumping influence. As noted in the "Ides" cruise report (at 3): "In summer, sport fishermen are evident, after bluefish, bonita, dolphin, and, offshore of this area, the billfishes. Some winter sport cod-fishery is found in this region."

A "wide range" of "recreationally" as well as commercially important marine fin fishes are found off the mid-Atlantic Coast, including the flounder, the yellowtail, the codfish, the striped bass and so on, which utilize "components of benthic communities", such as crabs, lobsters, shrimps and other shellfish, as "the basis for (their) growth and productivity" (Pearce, IV-96-98).[9] Moreover, "the particular waste disposal site that is in question is one of the principal migratory pathways for many species of fish." (Pearce, IV-98).

Thus, it would appear that recreational as well as commercial fishery resources are susceptible to the impact of Philadelphia sludge dumping. This raises the disturbing possibility of contamination of seafood landed by sportsfishermen, since no government agency monitors sport catches, at least in a regulatory way, for either bacterial levels or heavy metals:

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[9] "This would be true of the New York Bight as well as the entire Middle Atlantic Coastline extending from Sandy Hook and the Rockaways to Cape Hatteras . . . . There is a fairly similar group of organisms that habituates that entire part of the Atlantic seaboard which we call the Middle Atlantic Coast States." (Pearce, IV-97).

Dr. DAVIS:

Question. "Does FDA do any spot checking on the sport fishers? For instance, on fishes that come off commercial headboats, on charter boats, or sport catches by individual citizens?"

Answer. "No. They don't."

Question. "Do you know of an agency that does this kind of checking?"

Answer. ". . . [C]ertainly not for regulatory purposes." (Verber, IV-69-70).

Question. "In the National Marine Fisheries Service, or perhaps your lab, is there any program going on which routinely samples sport fishes for pathogens, metals or other pollutants?"

Answer. "[W]e do not routinely scan fish."

Question. "The sport fisherman who fishes over a sludge dumping ground has what agency to protect him from contaminated marine animals?"

Answer. "I do not think he necessarily has any . . ." (Pearce, IV-136-137).

4. Economic Impact of Dumping and Short-Dumping

The impact of Philadelphia sludge dumping on economic potentialities is difficult to quantify because of uncertainties as to where sludge constituents end up, precisely where commercial landings take place, and the relative roles of (*a*) direct acute or chronic toxicity to commercially important organisms themselves and of (*b*) a reduction in their usefulness to man by virtue of their actual or perceived unfitness for human consumption.

Maryland landings of surf clams (found inshore of the Philadelphia dump site) were over 7 million pounds in 1972 and valued at $1.15 million. More than 13.6 million pounds were landed in 1970, with a (then) market value of nearly $1.5 million. (Maryland Fisheries Administration's Annual Reports, *see*, IV-47; *see also*, Huggett, St.-3; (evidently they are also contained in U.S. Department of Commerce records, Huggett, V-15)). Virginia surf clam landings in 1973 were valued at $1,777,000 (Huggett, St.-3). Virginia landings of scallops were valued at $1,855,838 and $1,340,000 for 1972 and 1973, respectively (*id.*). "Lobsters, valued at $504,326 were landed in Maryland and Virginia in 1974 alone" (*id.*). In order to obtain a better reflection of the true economic value of the fishery resource, one must take into account not only "the amount of money the man who catches them gets," but also "the money of the men who truck it from point A to point B, the people who process it, the people who sell it, and so forth" (*id.*, V-15). A multiplier factor of "six or more" (*id.*, St.-3) has been suggested for this purpose (*id.*, V-14-15).

There are, in addition, "several species of finfish near the dump site and (the) area down-current from it" (Huggett, St.-3) that have commercial importance (but which are distributed and landed over much wider areas than the shellfish described above, making the significance of Philadelphia dumping activities on their landings impossible to even roughly estimate), as well as several other species, not presently harvested commercially, such as "mahogany clams, red crabs, rock crabs, jonah crabs, searobins, spiny dogfish, hakes and others," which "offer potential for providing high quality protein food and additional economic activity." (*Id.*).

The economic impact of contamination of one type of seafood may quickly spread to other seafoods. For example, when potentially hazardous levels of mercury were discovered in swordfish, not only did the swordfish industry suffer, but" no one bought lobsters or oysters or anything else. It has a very broad effect and it takes a long time for the market to rebound."* (Huggett, V-23; St.-1).

5. Bio-Uptake and Toxicity of Heavy Metals

"Metals present in the marine environment in an assimilable form usually undergo bioaccumulation through the food chain. Thus, elements present in low concentrations in the water may be accumulated many thousandfold in certain organisms."

(Water Quality Criteria, at 240, *see* Pesch, St.-App. B). "Metals are particularly susceptible to concentration by invertebrates." (*Id.*). For example, "[O]ysters have been described in the literature as being able to concentrate zinc on a weight for weight basis in the water they inhabit by up to 100,000 times, cadmium by 300,000 times and copper by 14,000 times."

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* A similar phenomenon was evidenly involved in connection with the 1925 epidemic caused by pathogen-contaminated clams and oysters (with sewage discharges to water the apparent culprit), which "caused a virtual collapse of the industry". (Verber, IV-70).

(Ayling, 1974, at 735, Exh. 50; see also Vernberg, St.-4; Waldichuk, 1974, Table I. Exh. 63; Huggett, V-7). Biological concentration has been documented in vertebrates as well, with concentration factors of a thousand-fold having been observed in fish muscles for cadmium and copper, for example (Water Quality Criteria, at 246, 248).

The magnitude of heavy metal uptake depends on "how the metal is presented to the animal, whether it is in solution or suspension," and, in the case of a shellfish like a clam or oyster, on whether "the animal decides to open up" and is "pumping actively" as opposed to staying closed. (Huggett, V-21; *see also*, Ayling, 1974). Filter feeders of this kind can pick up enormous quantities of heavy metals from particulates in sewage sludge.

"[O]ysters are tremendous filter feeders and an oyster can filter up to 75 hundred liters of water per day, filtering out particles between two and five microns in size. This is what he eats. He passes these things through his gut, which has a pH [in the acid range which may cause adsorbed metals to be] "stripped off into the animal's gut . . ."

(Huggett, V-29). "The rate at which the animals seem to be able to accumulate unnatural levels is much more rapid than their ability to lose it." (*Id.*, V-21).

"Because certain metals are required in life processes, most organisms have a capability of concentrating them . . . Because of the ability of many metals to form complexes with organic substances, there is a tendency for them to be fixed in the tissue and not to be excreted. In other words, they have a large biological half-life. This is perhaps one of the major problems that metals pose with respect to their effects on aquatic organisms." (Waldichuk, 1974 at 9).

An even more fundamental property of metals, and another source of concern over their introduction into the marine environment, "is that they are immutable. They can neither be created nor destroyed, not can one metal be transformed into another . . . This means that once a metal is mobilized in the environment, its total amount there remains the same, regardless of form, until it is immobilized again." (*Id.*, at 2).

"Aside from the possible human health aspects, heavy metal pollution could have a profound effect on the biology and productivity of the sea. Heavy metals can influence various physiological processes of certain marine organisms; (1) the nervous system, as demonstrated by behavioral changes; (2) enzyme activity, as demonstrated by cadmium, zinc, and lead inhibition; (3) the endocrine system, as influenced by copper; and (4) respiratory and osmoregulatory alterations upon exposure to heavy metals." (Vernberg, St.-5).

"Copper, zinc, and cadmium (as well as mercury) . . .—metals which occur in high concentrations in Philadelphia sewage sludge—increase the mortality rates of larvae of oysters, shrimp, crabs and lobsters." (*Id.*, at 4). Larvae may be "a hundred times more sensitive than the adults" (in terms of mortality). (*Id.*, V-146).

On the basis of "data available at this time", the National Academy of Sciences has suggested that "concentrations of cadmium equal to or exceeding 0.01 mg/1 (ppm) constituted a hazard in the marine environment as well as to human populations" (Pesch, St.-App.B, at 246).

Their hazard level recommendation for mercury is 0.10 ug/1 (ppb) (*id.*, at 252),[10] for lead 0.05 mg/1 (*id.*, at 250), for zinc 0.1 mg/1 (*id.*, at 257), for nickel 0.1 mg/1 (*id.*, at 253), and for copper 0.05 mg/1 (*id.*, at 248). The EPA Ocean Dumping Criteria specify "special permit" limits for mercury and cadmium "in any solid phase of a waste" of 0.75 mg/kg (ppm) and 0.6 mg/kg, respectively (40 C.F.R. § 227.22(f)). These limits represent "limiting concentrations and quantities of known toxic or otherwise damaging materials which can be dumped without measurable damage based on existing knowledge" (40 C.R.R. § 220.3 (d))[11]

Philadelphia sewage sludge from the Northeast Treatment Plant of the sort presently being ocean-dumped contains zinc levels more than 50,000 times higher, mercury and lead levels more than 40,000 times higher, copper levels more than 20,000 times higher, cadmium levels more than 10,000 times higher, and nickel

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[10] The FDA's guideline for the maximum permissible concentration of mercury in fish and other food is 0.5 ppm (id., at 251).

[11] I.e., when, as in this case, these limits are exceeded, "measurable damage" can no longer be ruled out.

levels more than 3,000 times higher than NAS's suggested hazard levels in the marine environment.[12]

The fact that the ocean into which Philadelphia sludge is dumped contains a very large volume of water does not by any means ensure that the high heavy metal levels in the sludge will be rapidly diluted to insignificance. "Oceans are not infinite sinks . . . [E]verything is not being infinitely diluted." (Pearce, IV-139). "[y]ou cannot take the distance between point A and point B and the depth of the water and the width and calculate dilution. It does not work that way. The course of water may travel a great distance and not be diluted by anything . . ." (Huggett, V-33).

Among other things, the degree of "dilution" will very much depend on the physical state of the chemical entity being considered. "There is a difference between dilution when you look at something in solution or in particulate form. You cannot dilute an entity [and] a particle containing metals [in] high concentrations is essentially an entity." (*Id.*, V-34). (*See also*, Pesch, III-335, 374-375, 388-389, 303; Rogerson, IV-259).

The environmental significance of these observations can be seen from the following exchange:

Question. "I gather if you have a benthic organism at Point A and another at Point B and this particle carrying the tightly bound metal with it, comes in contact with the organism at Point B, it is not going to make a great deal of difference how large a volume of seawater the particle traveled through, assuming the same organism and [the] same biological availability?" Answer. "I agree. It does not matter how far through the set water that particle has traveled." (Rogerson, IV-260-261).

Indeed, a sludge particle if it retains its integrity will not be any more "diluted" as a result of movement through the water than the barge that carried it out to sea in the first place.

In short, the dual facts of physical adsorption and biological concentration make the prospect of biological uptake of sludge constituents in dangerous amounts a very real possibility.

Despite the absence of specific information as to the form in which metals appear in sewage sludge when released into seawater (Rogerson, IV-261), analytical chemists are so accustomed to tight complexing of metals with organic materials that they routinely employ concentrated acids to break most, but not necessarily all, of the organic complexes and "liberate" the metals (*Id.* IV-255-256). Tight binding of metals to organic matrices is a fact of physical chemistry. It is also a fact that the metals present in liquid sewage sludge as it leaves the sewage treatment plant "are concentrated in the sludge or in the particulates" (Huggett, V-28). "If you take the particulate matter out . . . as a general rule—you eliminate 70 to 75 percent of the total metal." (*Id.*, at V-32). So, while we cannot say for absolutely certain "whether or not the adsorbed metals will remain adsorbed when the organic flock . . . reaches the water column" and whether or not they "may be desorbed into the ocean waters and the organics . . . purged" (Cox, II-302), it seems a pretty safe bet there will be a high degree of continuing association between organic sludge particles and adsorbed heavy metals. That is why the "consumption" of organic sludge particles by water column and other biota (Cox, St.-32), and so-called "ocean recycling" of sewage sludge by "organisms in the ocean" that use organic sludge constituents "to increase the protoplasm of their own body" and become part of the food chain (Guarino, I-97-99), are properly of such great concern.

6. Evidence of Adverse Impact Based on EPA Survey Cruises

The EPA "Ides" survey cruise collected two species of shellfish, Arctica islandica (mahogany clams) and Placopecten magellanicus (sea scallops) at some 20 survey stations distributed over a wide area encompassing the Philadelphia and Dupont (Edge Moor, Dela. plant) dumpsites. (Pesch, St.-4). These samples were analyzed individually for 13 metals. (*Id.*). Of these 13 metals, five (silver, cadmium, copper, nickel and lead) are "characteristically" found in sludge (as opposed to DuPont waste) (*id.*, at 6, Table 1), four (iron, manganese, vanadium, and titanium) are characteristic of DuPont waste (Ides Re-

[12] Even in comparison with EPA's criteria for mercury and cadmium (which assume a generous and possibbly unrealistic degree of dilution and dispersion), NE Philadelphia sludge exceeds the cadmium limit by more than 175 times and the mercury limit by nearly 6 times. (Seee also, Guarino, I-27).

port, at 16; Pesch, St.-Table 1), and four (chromium, aluminum, cobalt and zinc) show a high contribution from both (Pesch, St.-Table 1). In terms of attributing metal accumulations to Philadelphia sludge dumping, it obviously makes sense to focus on the five metals for which sludge (as opposed to DuPont waste) dumped at the disposal site is the dominant source. Similarly, from the standpoint of environmental impact, it makes sense to investigate the biological availability of these metals once they enter the marine environment. The uptake of these metals by fairly sedentery bottom-dwelling organisms, such as clams and scallops, which can be caught pretty close to where their exposure to pollutants occurred is a logical measure of biological availability.[13] Finally, from the standpoint of the public health significance of metal uptake, it is reasonable to look at filter-feeding shellfish, again, such as clams and scallops, of the sort that might be used for human food.

After all the dust from a flurry of statistical analyses had settled, all parties agreed that clams and scallops had accumulated high levels of four of the five metals of interest (the single exception was lead as to which one might expect major atmospheric inputs) at one or more stations in the 1,000 square mile or so study area (Ides Report, at 16), such that these levels were statistically significantly higher (at a level of confidence of 95 percent or better) than those at all other tested stations. (Pesch, St.-Addendum; Pesch, VI-161-163). Among these statistically high values (expressed as mean concentrations for each metal tested at each station) were: 9 ppm of silver in scallops at station 2 within the Philadelphia dumpsite (Pesch, St. -Addendum, Fig. 3); 59 ppm of cadmium in scallops at station 14 northeast (seaward) of the dumpsite (*id.*, Fig. 7); 4 ppm of cadmium in clams at station 25 southeast (seaward) of the dumpsite (*id.*, Fig. 8); 12.6 ppm of copper in scallops at station 2 within the dumpsite (*id.*, Fig. 13); and 14.6 ppm of nickel in scallops at station 2 within the dumpsite (*id.*, Fig. 19).

In Dr. Pesch's words: "In summary, we found that some metals are present in high concentrations in scallops within the dumpsite and in scallops and clams in the vicinity of the dumpsite. These high concentrations indicate biological availability of metals contained in the disposed sludge." (Pesch, St.-Addendum, at; Pesch, VI-162).

Philadelphia's witnesses provided additional evidence of sludge-related bio-uptake of metal.[14]

While it is, of course, not possible (now or ever) to ascribe the entire scallop and/or clam uptake of silver, cadmium, copper, and nickel at the above-noted high-value stations to Philadelphia sludge alone (i.e. to totally rule out some contribution from the DuPont waste or from Delaware River or atmospheric sources), it would seem entirely plausible (and not at all "arbitrary and capricious") to attribute statistically significant buildups of metals characteristic of Philadelphia sludge at stations within and seaward of the Philadelphia dumpsite at least in large part to Philadelphia sludge (as opposed to land-based

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[13] There is some evidence on scallop (a different species than studied by EPA) swimming ability" (exh. 34). However, the distance covered is not large, and it is not at all in a straight line. In one study (id.), the mean horizontal distance covered was 7.5 ft. and some scallops (especially those of less than 100 mm size) could not be induced to swim at all (id., at 2135). Other witnesses testified to similar subjective impressions (Pearce, IV-137-138; Pesch VI-189-190; Lear, VI-149). Thus, the place of scallop capture, although possibly a few feet away from the place of exposure, could not conceivably be sufficiently far removed from it as to render the correlation suspect. Indeed, given the tendency of scallops to avoid disturbances, the degree of metal uptake by these organisms may undertake the exposure of other, less mobile, shellfish to sludge heavy metals. (I.e., if scallop mobility has any bearing on the significance of metal uptake data, it will be in the direction of understating rather than overstating the contribution of sludge dumping by Philadelphia).

[14] Analyses of EPA data by one Philadelphia witness showed statistically significant increases in benthic organism metal levels for at least one sludge-associated metal (Cu) at stations common to the Fetch and Ides cruises during the interval between those cruises (Cox St.-16, II-281). A similar comparison of Fetch and Ides Arctica data by another Philadelphia witness showed that copper and silver (both sludge-associated metals) levels had increased at Station E (within the dumpsite) and, in the case of copper, also at station 17 (southwest of the dumpsite). (Zar, St.-20; IV-158-159). In the case of sediment accumulations, moreover, mercury was found during the Deep Six survey to be present at station 8 (within the Philadelphia dumpsite) at a statistically significantly higher concentration (2.955 ppm) than at all other stations. (Zar, St.-A3). Whether or not these results can be regarded as "strong evidence" or a "significant harmful effect" on the marine environment (Cox, St.-20) which is certainly not the statutory test—they are certainly indicative of an effect that is at least potentially harmful.

sources 40 miles away or to DuPont dumping of only minor amounts of these metals).[15]

The availability of these toxic sludge metals at levels of the magnitude observed (e.g., nearly 60 ppm of cadmium in scallops),[16] after less than a year of sludge dumping at the present dump site, would, by itself, furnish ample justification for the dumping phase-out requirement imposed on Philadelphia by EPA Region III.

7. Presence and Significance of Onshore Currents

Another issue which received some attention at the adjudicatory hearing is "which way does the current flow from the Philadelphia dump site?" The one thing it seems safe to say is that some part of the water column will travel in every imaginable compass direction for some portion of the year. Heavy metals and other sludge components will be transported in the currents to a degree dependent largely on the physical state of these components and on the presence or absence of a thermocline or other barriers to rapid settling of sludge particles. It is impossible in the present state of the art to predict exactly how much sludge and how much heavy metal from a given dump will end up where.

Some generalizations are possible, however. Particles present in the surface layers of the water column at the dump site will respond to the wind stress. "The annual winds show an onshore component about 25% of the time" (Callaway, St.–4), with "the most likely period for onshore movement [being] from May through November" (*Id.*, at 5). The presence of a thermocline during this same part of the year might be expected to keep sludge particles in the upper portions of the water column (see, e.g., Rowe, St.–3–4) where at least some of them might become subject to wind-mediated currents.[17] Studies of surface currents in the vicinity of the Philadelphia dump site (including some actual current meter measurements within the site) indicate that "the mean initial drift of materials released (at the dump site) will move with the water column in a south to southwest direction." (Callaway, St.–7–8).

Sludge particles suspended near the bottom on the water column would be expected (at least when the "zone of divergence" is offshore of the dumpsite) to

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[15] The fact that clams and scallops sometimes showed considerable variability in the degree and distribution of their uptakes of sludge-associated metals does not, by any means, suggest that Philadelphia sludge could not have been the metal source. As was testified to repeatedly, such non-uniformity is expected in living systems, owing to physiological and behavioral differences from organism to organism and from one growth stage to another, to differences in reactivity from one metal to another, and to differential current transport of sludge metals present in different degrees of association with organic particles. (See, e.g., Pesch, III–329–330, 372–374, 384; Pearce, IV–125–131; Vernberg, V–144, 146–149, 160–161).

Nor does the fact that EPA did not necessarily look at organisms of the same age in comparing metal uptakes among survey stations make the results any less probative. While large (or old) clams and scallops will doubtless accumulate metals to different degrees than small (or young) counterparts, the correlation between metal uptake levels and size (age) is likely to be positive for some metals and negative for others. Thus, a significant positive association was found in the EPA data between cadmium concentrations in clams and scallops and the size of these organisms; a significant negative size correlation was found for nickel levels in scallops (but not clams); and uptake levels for all other metals were either negatively associated with organism size or showed no significant size relationship. (Keller, St.–16). Indeed, the reduced size of organisms inside and near the dumpsite (Id., 9, 14; Zar, St.–14, 18), may reflect growth suppression in a causal (and not just in a statistical) sense. A similar phenomenon has been observed in the New York Bight (Pearce St.-App. on "Effect of Waste Disposal . . .", at 39). (See also, Vernberg, V–147).

[16] By way of assessing the significance of seafood levels of cadmium of 60 ppm, it may be useful to consider that 0.01 ppm is grounds for rejection of a human drinking water supply under the 1962 U.S. Public Health Service Drinking Water Standards. Similarly, as noted in the NAS Water Quality Criteria (Pesch, St.–App. B, at 245–246), "[c]admium pollution resulting in the 'Itai-itai' disease in the human population has been documented", and "[c]admium, like mercury, could conceivably form organic compounds which might be highly toxic or lead to mutagenic or teratogenic effects." And: "Medical studies have shown that cadmium accumulates in kidneys and liver causing chronic disorders and that prolonged intake even at low levels leads to hypertension and reduced longevity (Yopp et al., 1974). It is carcinogenic and causes congenital abnormalities (Karolinka Institute, 1973), cardiovascular conditions and degradation of renal and testicular tissues (Carlson and Menzies, 1971). Serious loss of calcium from bones has been shown to occur when cadmium intake is prolonged due to excessive concentrations in food and drinking water (Kobayashi, 1970)." (Interstate Sanitation Commission Draft Report, Exh. 35–VIII–7). See also, Huggett, V–31.

[17] The same would be true if Dr. Cox is correct in her belief that the solid portion of Philadelphia sludge consists primarily of "many finely-divided organic particles which are most likely to remain in the water column" (Cox, St.–32).

display a "general south to southwesterly motion" (Callaway, St.-9). A ninety-six hour current meter record showed that bottom currents tending "southwesterly to westerly" do, in fact, occur within the Philadelphia dumpsite. (*Id.*, St.-7). Regardless of what proportion of time the zone of divergence—"which migrates back and forth" seasonally (*id.* IV-268) and will "[s]ometimes . . . be inside the dump site, sometimes outside" (*id.*, at 269)—is inshore of the dump site, resulting in a "net motion" offshore (*id.*), the important fact is that the net motion will be onshore for *some* significant part of the year (*id.*, at 270, for example).

In short, assuming a significant association of sludge metals with organic sludge particulates (*see supra*, at 28-29), it seems reasonable that metals will be moving shoreward from the dump site for some portion of the year, wherever in the water column they may come to rest. Even those heavier particles that do come to rest on the bottom during non-thermocline conditions, can be expected to be scoured off the bottom and resuspended more than 16% of the time. (Callaway, St.-9).

While none of this is to suggest that Philadelphia sludge is likely, at least in the foreseeable future, to wash up on Delaware, Maryland, or Virginia beaches in identifiable form, the threat to coastal marine resources and to recreational and commercial fish and shellfish catches is very real. (*See, e.g.*, Huggett, St.-4, V-27-28, 33). Even if the currents move shoreward only 5% of the time, "five percent of the time is too much" (Huggett, V-6).

8. Scientific Misgivings About Allowing Sludge Dumping to Continue

Virtually every marine scientist who testified at the adjudicatory hearing, including Philadelphia's own witnesses, voiced misgivings and concern over the prospect of continued ocean dumping of sewage sludge.

Dr. Cox. "I feel we should be concerned with metals both in the water column and in the sediments . . . ." (II-301). "I am in favor of that [phasing out of ocean dumping by DuPont]. If the alternative is equally or is more environmentally beneficial . . ." (III-6). "If we can totally reclaim the waste[s] . . . and put them to more valuable use then that's naturally more philosophically acceptable a position. If we can recycle and generate a benefit from our waste then we are that much better off." (III-7).

Dr. Rowe. "Where the accumulation would be [of Philadelphia sludge] is anybody's guess, but [that] is what [we] should be worried about . . . [I]t has to go somewhere. The metals are not going to disappear." (II-237-238).

"(E)ven if it's doing no harm—I said even if it's doing no harm—we are wasting it. . . . Therefore, we should make all attempts to do away with ocean dumping . . . If we can reuse it, recycle it, we should. Therefore, my opinion is this. Stop all ocean dumping as soon as possible and reuse the material." (II-243-244).

In a dispersal site like the Philadelphia dump site, "you can be very confident that you're not doing too much harm on a short term but on a long term basis you don't know what harm you are doing." (II-248). "Not being able to account for them [metals in ocean-dumped sludge] there is always that fraction of them that we put in that we can't account for which may be doing some damage in some subtle place that we are not aware of." (II-249-250).

"If we approach the question of how much harm is being done to the ocean by Philadelphia's dumping I think it's almost impossible to document any harm right now. And the degree with which they are dumping does not concern me. I think it would be of concern to me if they were given an open-ended permit along with a lot of other cities, coastal cities, to dump in dispersal areas. If all coastal metropolitan areas were given open-ended permits to dump in dispersal areas then that would concern me very greatly. Their dumping based on the EPA data does not concern me." (II-252).

Question. "Does it concern you that Philadelphia may be part of a general metropolitan East Coast system which is discharging effluents and sludge waste directly or indirectly into the coastal waters?"

Answer. "That concerns me very much. That if the precedent is set, that Philadelphia is allowed to dump all the other metropolitan areas will be allowed to dump. That precedent upsets me very much. Because I think we can damage the ecosystem very severely and it will probably be damaged before we realize it. Philadelphia alone I don't think is going to do that damage."

Question. "Do you mean it's a kind of cumulative effect?"

Answer. "Exactly." (II-253-254). "I think there should be an extremely heavy emphasis on land disposal methods." (II-271).

Dr. PESCH. "I think the point made [in the EPA studies of Philadelphia sludge dumping] is that the metals are biologically available. We can see them accumulated in the organism. There is strong evidence of biological availability. That concerns me." (III-331).

Dr. PEARCE:

Question "[A]s a scientist with long experience in this field do you have any concern about the disposal of sewage sludge in these active waters?"

Answer. "I have a concern. I think more than a concern. I mean much of my professional life has been devoted to understanding the exact impacts . . . sewage sludge components have on marine resources." (IV-99). "One could not say with certainty that there would be a problem (as a result of continued ~~and~~ increasing ocean dumping by Philadelphia). One could project, however, the possibility for a problem to develop." (IV-100). "I think marine scientists generally are concerned with the amounts of heavy metals that are entering into the marine ecosystem these days. Be it by discharge of sewer sludge or by . . . point source discharges of domestic waste and industrial waste. Again all of these materials are additive . . . I'm personally concerned about any substantive amounts of metals that are being added to the marine environment." (IV-103).

"Based upon my experience and the contents of the scientific literature today I would say that at the present time, since we do not know what the total impact of this material [is] . . . [it] is probably premature to give any kind of a recommendation to continue ocean dumping . . . Professionally, I do not think it's a wise course of action to take." (IV-107). "(S)cientists do regard metals as deleterious . . . There is literature today that indicates that (at) the parts per billion level, many metals will have an effect on marine life . . . It is safe to say that heavy metals are deleterious to marine life." (IV-121-122).

Mr. HUGGETT: "I think the threat of harm (to shellfish in the Philadelphia dump site area) is there." (V-24). He would say there is a "potential danger". (*Id.*) "I think there is a potential danger (to shellfish organisms in Virginia waters)." (V-28). *Re* potential health hazard: "When [you] talk about zinc and copper, I am not personally worried about it . . . But, in cadmium and lead, we are talking about a different ball game." (V-31).

Dr. VERNBERG:

Question. "I take it . . . that you have some concern about discharges of cadmium and mercury and other metals in to the marine environment. Is that right?"

Answer. "Yes, I do."

Question. "In view of the amounts of metals getting into the New York and Mid-Atlantic bight from various sources, are you at all apprehensive?"

Answer. "Yes, I am, for obvious reasons."

Question "How much of an emergency is it? . . ."

Answer. "Being ecologically conservative, I would basically think there is always an emergency when substances under the general heading of pollutants are introduced in the environment. To say the ocean is going to stop functioning in the next fe wyears, I am not prepared to go that far, but I do caution [that] the loading of the ocean's system by an increased number of inputs . . . may very well get to a point where it is irreversible . . . [W]e do not have any idea of the carrying capacity for the ocean in terms of the introduction of various substances and it seems like it is a very dangerous position . . . to determine this number after [the] fact . . . I just do not know how much you want to gamble with the introduction of foreign substances into the ocean." (V-153-154).

Dr. CARPENTER. "[S]ludge disposal on the Middle Atlantic Shelf for the projected [Boston to Norfolk] Megalopolis would exceed thhe assimilative capacity of this system and damage to our aquatic resources would be expected [by the year 2000] . . . The analysis of projected inputs did not consider . . . liquid effluents . . . If all liquid and solids that are presently being produced were transmitted to the Shelf, the capacity would be exceeded today. [F]or the specific geographical region of the Atlantic Shelf from Long Island to Cape Hatteras, present evidence for the capacity of the system to accept nutrients and heavy metals indicates that we are on the verge of unwise use of this portion of our environment . . . It is the sum of the multiple sources that appears intimidating . . . It appears that the responsibility of the Federal Government

and the Middle Atlantic States to husband the resources on the Atlantic Shelf can only be met if the City of Philadelphia proceeds to an alternate sludge disposal system without delay." (St.-1-3); *see also*, V-211-212).

III. Availability of Alternatives

THERE ARE MANY TIME-TESTED EXISTING AS WELL AS PROMISING POTENTIAL LAND-BASED ALTERNATIVES TO OCEAN DUMPING AVAILABLE TO PHILADELPHIA WELL WITHIN THE TIME-FRAME SPECIFIED BY EPA

Among the environmentally sound land-application alternatives available to Philadelphia with little, if any, lead-time are application of liquid digested sludge to nearby pasture land (including the King Ranch), use for reclamation of surface-mined lands (including sand and gravel borrow pits), use of dried or composted sludge for ornamental improvements on land (including greenhouse, home garden [non-vegetable], forest, turf-building, municipal park renovation, highway beautification, and general landscaping purposes), high-rate trench incorporation, and use of processed sludge for landfilling of construction sites. Application to agricultural farmland as a nitrogen or phosphorus fertilizer to promote the growth of agronomic crops, although of proven feasibility and safety (even at high application rates and with sludges having much higher heavy metal levels than Philadelphia's), is probably neither, the most efficient nor the wisest use for Philadelphia sludge at the present time.[1]

It is, however, another alternative that is readily available to Philadelphia.[2] Finally, in addition to all of the above, there are two promising processing alternatives—an acidified wet air oxidation process and a process for recovering anhydrous and liquid ammonia and heavy metals—which Philadelphia's own consultants have encouraged it to pursue (and one of which is being pursued in a plant-scale demonstration project largely funded by EPA).

In short, there are available to Philadelphia numerous "[a] ppropriate locations and methods of disposal [and] recycling, including land-based alternatives", within the meaning of the MPRSA.[3]

1. Alternatives favored by Philadelphia's engineering consultants

Despite their possibly unjustifiable rejection of certain alternatives, and their failure to consider certain other alternatives, Philadelphia's engineering consultants were able to identify six land-based alternatives to ocean dumping which

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[1] It is not the most efficient, because marginal and submarginal soils can benefit more than good agricultural land from sewage sludge's soil building properties. Similarly, from a fertilizer standpoint, the slow-release feature of nutrients contained in sludge is more valuable in specialty and ornamental uses than in agricultural applications.

It is not the wisest, in view of unanswered questions concerning long-range soil and food chain effects of continued heavy additions of metals to agricultural land. Dr. Hinesly of the University of Illinois, a highly-regarded soil ecologist who has studied the effects of continuous sludge application to land for a more extended period than anyone else in the country, does not believe that the level of biologically available heavy metal builds up in soil over time with repeated sludge application. "[I]t isn't a matter of how long you do it, it's not the total accumulation in soils, it's the annual application that determines what the metal levels will be . . . They accumulate in the soil but they're not available. And it's only from the annual application that you have to be concerned [with] metal buildup . . . in plants." (Hinesly, III-157). If this view is correct, safe agronomic application of sludge could be carried out without further concern over possible food-chain hazards once an appropriate initial application rate had been established. Not everyone agrees with this view, however. For example, Dr. Chaney of the USDA, an equally highly regarded plant physiologist, is not willing to dismiss the risk of long-term build-ups of biologically available heavy metals (particularly cadmium), unless the sludges being applied contain an excess of zinc over cadmium of at least 66:1 (and preferably 100:1)—to ensure that plants will succumb to zinc excess before cadmium accumulations reach potentially dangerous levels. (Chaney, VI-101-103, 89, 8, 31).

The disagreement between Drs. Hinesly and Chaney is more one of philosophy and approach than it is of interpretation of data. There are just not enough data available at the present time to give conclusive answers as to what will happen 20 or 30 years from now. Even Dr. Chaney would agree, however, that Philadelphia sludge could be safely applied to agricultural farmland at rates of a few tons per acre if accompanied by close monitoring of soils and crops. As to Dr. Hinesly's professional competence, Dr. Chaney could only say: "I think it is obvious that Tom Hinesly is an expert about land use of sludge." (Id., VI-91).

[2] Philadelphia's own consultants were able to identify from examination of topographic maps (and some overflights) contiguous blocks of farmland (potentially available for purchase by Philadelphia) of 120,000 acres at a distance from the City of 100 miles. Hundreds of thousands of additional farm acres are presumably available closer in, particularly if outright purchase by the City is not the objective.

[3] In addition to the MPRSA's general encouragement of recycling and land-based alternatives to ocean dumping, sections 201 (d) and (e) of the FWPCA specifically require the Administrator to encourage recycling and containment of potential sewage pollutants. (33 USC §§ 1281(d), (e)).

even they felt warranted "careful consideration" and further study (Ballotti, St.-35-37).

a. *Barber-Colman PURETEC acidified wet air oxidation process.*—This is a high-temperature, high-pressure process for destroying sludge organics, and recovering and reclaiming sludge nutrients and heavy metals. (Ballotti, St.-23; Exh. 42). Its main attraction for the City is its anticipated net operating cost of $10 per dry ton of sludge—less by several—fold than the City presently pays for ocean dumping. (Guarino, I-29). "If it works out the way it indicates that it does on paper, I wouldn't hesitate tomorrow to build a plant to take care of all the waste sludge from Philadelphia." (*Id.*, I-35-36).

While it will doubtless take more than a day to construct a Puretec system capable of handling Philadelphia's entire sludge output, indications are that such a system could be completed within the phase-out schedule imposed by EPA Region III.[4] A small, 16-dry ton/day plant-scale unit is scheduled to be installed and started up in Philadelphia this summer (Guarino, I-84), with data gathering and analysis to be carried out over an 18-month period of operation (Exh. 42).

b.-d. "*Land-dispersal*" *alternatives.*—The four such alternatives (in order of increasing cost) preferred by Greeley & Hansen are: (*i*) land dispersal of stabilized solids slurry by plow-in procedures; (*ii*) land dispersal of stabilized solids cake by trenching procedures; (*iii*) land dispersal of stabilized solids cake by spreading and incorporating; and (*iv*) land dispersal of stabilized composted solids cake.

Implicit or explicit in G & H's computation of the costs of these alternatives were a large number of assumptions,[5] many of which resulted in indicated costs that are almost certainly overestimates (and perhaps, gross overestimates) of actual costs.[6] But even accepting these cost figures as given, the average cost increment to Philadelphia's residential and commercial sewer customers which could be anticipated if one of these four "land-dispersal" alternatives were adopted would be only 31.8 percent (or, about 3 cents a day), according to the City's own estimates (Exh. 81).[7]

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[4] Although at several places in the transcript Commissioner Guarino expressed his view, that, if everything goes right, Philadelphia might have a full-scale Puretec system in operation by around the summer or fall of 1979 (Guarino, I-156, 158, 84-86), after being handed a note from someone in the audience he sharply revised that estimate (from 4 years) to 7½ year (ending in 1982 or 1983) (Id., I-159-160). The latter estimate assumes an 18-month design and a 36-month construction period for full-scale units (id.). (See also, id., St. 13, I-157; Townsend, St.-20). It is inconceivable, however, that at least a year or two could not be trimmed from this schedule (e.g., by use of double or triple shifts, by doing some or all of the design work during the initial 18-month to 3-year testing period, by designing the unit to handle part rather than all of Philadelphia's sludge production).

[5] Among these assumptions are each of the following: The need for stabilization (anaerobic digestion) applicability of the "proposed EPA guidelines" (with an assumed loading limit of 2 tons of stabilized dry solids per acre per year over 30 years), outright purchase of land application sites by the City, site locations 100 miles from Philadelphia (Ballotti, St.-10-12), the need to incur the larger additional costs associated with enclosed storage facilities (id., at 24), applications with the plow-in technique limited to 100 days per year (*id.*, at 13), applications with the spread and incorporate technique limited to land slopes of 3 percent or less and to 100 days per year (id., at 15), limitation of the composting technique to sludge dewatered to a cake of 35 percent solids (id., at 16, II-209-211) and to compost hauled by truck to recipient farmland where it is applied by the spread and incorporate method at the City's expense (id., at 16-17, II-212), the need for each alternative to handle Philadelphia's entire sludge output (id., II-145, 184), no subtraction of the 75 percent federal contribution to costs (id., II-153-154), unusability of pasture acreage (id., II-181-183, 191-192), a cation exchange capacity of 12 (id., II-186-187, 205), a 1990 design year with 518 dry tons/day of raw solids (id., St. 5-6), no credit for resale of improved land (id., II-208, 201), no reduction in heavy metal levels in sludge by 1990 despite source reduction and pretreatment (id., II-204-205), and a utility factor of 50 percent (id., II-208-209).

[6] The cost estimates are, in fact, worthless. Mr. Ballotti (II-175) acknowledged that they do "not purport to be true cost," but are merely "illustrative comparative cost estimates." And their comparative value is undermined by (1) an unexplained, factor-of-two disparity between Mr. Ballotti's and Mr. Guarino's assumed current costs of sludge disposal by barging (see, Kamlet letter of June 6, 1975 to Hearing Panel Chairman, and June 13, 1975 Memorandum of Hearing Panel Chairman to all parties), and (2) the fact that known or ascertainable current costs are being compared with unknown and conjectural future costs (Camp Dresser & McKee, for example, in estimating sludge processing costs, uses January 1975 figures, "because construction dates are uncertain and because the fluctuations in inflation rates experienced in the past few years make forecasting inaccurate"; Exh. 35, at VI-2).

[7] This estimate assumes what Mr. Ballotti himself pointed out could not be assumed, namely that the Greeley and Hansen estimates of the cost of alternatives represent actual, and not simply comparative, costs. It also assumes a land-dispersal cost based on an average of the estimated "costs" of Mr. Ballotti's four favored land-application alternatives. Therefore, all of the erroneous assumptions that went into making these individual cost figures overestimates will, upon being joined and averaged, combine to make the calculated "cost increment to customers" even more (since most, if not all, errors are in the same direction) of an overestimate.

Despite G & H's assumption of a design year of 1990, and despite other G & H estimates of 7.5 to 12.5 years as the time required to implement a land-spreading method for Philadelphia (Townsend, St.-4, II-69-71), it seems rather clear, particularly in view of Chicago's ability to plan and implement a land application system (for far more sludge than Philadelphia produces) in 3 to 4 years (McMillan, I-196-197), that Philadelphia may be able to cut this implementation time down to perhaps 2 or 3 years. (Indeed, one would expect that much of the planning that went into the design of the Letterkenny project (Exhs. 40, 41) could be made use of by Philadelphia and its consultants in further cutting the time required for planning a full-scale project.)

Certainly, it should not be necessary for Philadelphia to start from scratch and repeat all of the groundwork already laid by Chicago. Numerous witnesses agreed that another demonstration project is not needed and that it is not necessary to "reinvent the wheel each time a plant wants to go out with sludge." (O'Neal, V-111; *see also*, McMillan, I-225-226; Hinesly, III-205-206). And, Dr. Farrell of EPA, although disinclined to see Philadelphia move into a full-scale, 200-ton per day project "immediately" (Farrell, III-270), could see no difficulty "in starting off with as much as a quarter of their production" (or "50 tons per day", more or less) (*id.*, III-271), in successfully doing so with some time cut off what it took Chicago to do it—in view of "their background and all that we have obtained from what they have done"—(*id.*, III-271-272), and then proceeding to an expanded project (*id.*, III-272). Even Mr. Townsend was willing to concede that "some" of the knowledge gained from the Chicago project "might be" transferrable to the Philadelphia situation. (Townsend, II-95).

In short, what Mr. Guarino said in another context is equally true here: "Many things we do are based [on] the experience of others". (Guarino, I-46).

e. *Anhydrous and Liquid Ammonia Alternative.*—This alternative would be designed to convert excess methane [from anaerobic digestion] to anhydrous ammonia, to concentrate digester superna[ta]nt to liquid ammonium phosphate, and to dewater and acid leach the solids to remove the bulk of heavy metals.[8] (Ballotti, St.-23-24). What is most interesting about this alternative is the rapidity with which it is capable of being implemented. "I don't think it needs to be tested out (with a demonstration project) because anhydrous ammonia . . . is made from methane natural gas (right now), and so the process of converting methane into anyhdrous ammonia is a well-established process." (*Id.*, II-162).

Although the heavy metal removal feature requires "some additional pilot work" (Ballotti, II-163), the time involved is not great (*Id.*), and the process is capable of Puretec-type metal removal without the need to go to the high temperatures and pressures that the Puretec process requires. (*Id.*, II-160).

This approach, which Philadelphia has, to date, done nothing to pursue has yielded "promising" results from "(p)reliminary feasibility studies" (Ballotti, St.-36-37).

2. Other Promising Alternatives Not Adequately Pursued by Philadelphia.

a. *Use of sludge for reclaamtion of surface-mined land.*—Although use of sludge for reclamation of surface-minded lands in general, and Pennsylvania's several hundred thousands acres of strip mines in particular, was urged and encouraged by witness after witness (*see* e.g., McMillan, I-220-221, 193; Farrell, III-279; Baker, St.-5, V-195; O'Neal, St.-3; Walker, VI-27, 59, 72-73; Chaney, VI-28; Epstein, VI-29, 90-91), this alternative was totally ignored by both Mr. Ballotti and Dr. Kaplovsky in their statements on behalf of the City. And this, despite the fact that Commissioner Guarino (apart from problems of public relations) has proclaimed strip mines and spoil banks "ideal spots to get rid of the sludge" and "to reclaim the land" (Guarino, I-70), and that Mr. Ballotti himself has agreed that "that's a good solution" (Ballotti, II-192).

There are good reasons for enthusiasm about using sludge to reclaim strip mines. Dr. Hinesly has discussed some of the benefits of this mode of land application:

(*a*) one would anticipate less organized opposition to this use of municipal waste, since "no one will lose fertilizer sales", and since "the people living in extensively mined areas are willing to weigh the benefits to be

[8] Process flow sheets for "N-recovery, NH_3-production & heavy metal separation" are provided in Exhibit 83 for both 50 percent volatile suspended solids destruction (present) and 90 percent VSS destruction (potential).

gained from land reclamation against the stigma placed on an area selected for waste recycling"* (Hinesly, St.-App. 3, at 1);

(*b*) restoring strip-mined lands to their highest productivity (in the Fulton County case, the growing of row crops) "will . . . provide the county with a high level, long-term taxable resource" (*id.*, at 2);

(*c*) regarding and revegetation of surface-mined lands can reduce sediment loadings due to erosion and runoff (which can be more than 1,000 times as great as for forested areas and 100 times as great as for cultivated lands) to nearby waterways. (*id.*);

(*d*) control of acid mine drainage, which evidently is not a problem in Fulton County, would be a decided benefit in other strip-mined areas such as Pennsylvania, where it is a problem (*id.*, at 2; *Cwlth.* v. *Barnes & Tucker*, 6 ERC 1406 (Pa. 1974));

(*e*) the superior soil-rebuilding properties of sewage sludge make its application to strip-mined lands a way of rapidly increasing the soil's humus content—something that otherwise might take hundreds of years, even with conscientious regrading and covering with the original surface soil material (Hinesly, St.-4-5);

(*f*) "[w]hen strip-mined lands are for sale, they can be purchased fairly cheap compared to neighboring normal agricultural lands", "the potential for increasing [their] value for resale is considerably greater . . .", and "strip-mined lands are taxed at a considerably reduced rate as compared to normal agricultural lands" (*id.*, at 5);

(*g*) "[b]ecause lands that have been strip-mined generally involve more or less contiguous acreages, the installation of delivery and distribution systems for sludge is simplified" (*id.*);

(*h*) "because initial sludge loading rates will be considerably higher on strip-mined lands during the early phases of reclamation than could be permitted on normal agricultural lands, the cost for construction of sludge holding reservoirs and distribution equipment will be considerably less for a land reclamation program as contrasted to low rate applications on farm land" (*id.*);

(*i*) "[b]ecause of the very low organic matter content and the abundance of illite type clays that are characteristic of strip-mine spoil banks, . . . [s]trip-mine spoil materials can assimilate much greater quantities of both [organic and ammonium nitrogen] . . . than [agricultural] soils" (*id.*);

(*j*) high heavy metal-containing sludge is less likely to lead to harmful accumulations in plants on strip-mined land than in typical agricultural soils (even when crops are later grown on the reclaimed land) because [t]he high [clay] content of strip-mined land insures some irreversible adsorption of the metals and therefore decreases absolute amounts available to plants" (i.e., clay soils typical of strip-mined lands have very high C.E.C.s) (*id.*); it is also likely to be less noticeable because black shales, commonly unearthed during strip-mining, themselves contain high concentrations of many heavy metals (i.e., the stabilization of the soils accomplished by sludge application probably keeps more heavy metal out of the biosphere than it contributes (*id.*, at 5-6);

(*k*) the rock strata in strip-mined areas (at least in Illinois and Ohio) tend to be deep and "fairly impermeable to water", making problems of infiltration of sludge constituents to ground water relatively unlikely (*id.*, III-201-202); and

(*l*) regrading requirements of the sort that have been legislated in Illinois and Pennsylvania, mandating a return of strip-mined areas to original contours or topography, may greatly decrease the expense to a municipality of reclaiming strip mines by sludge application (*id.*, III-202).

And Dr. Kardos, who is Coordinator of Pennsylvania State University's Waste Water Renovation and Conservation Research Program, testified that "sludge may be very helpful in revegetating disturbed areas such as strip-mines" and in other landscaping situations, without involving "food chain aspects", and permitting "substantially larger amounts of sludge" to be applied, at least in initial treatments. (Kardos, St.-3-4). He also stated that: "Re-

* Indeed, in the Fulton County case, thee County took the initiative in calling the availability of the property to Chicago MSD's attention (McMillan, I-204; Hinesly, III-171-172).

search at Penn. State has indicated that an extremely toxic stripmine material, incapable of growing any vegetation, permitted excellent tree, grass and legume growth if treated with continuing applications of liquid sludge, or secondary effluent or combinations of liquid sludge and effluent." (*Id.*, St. 4; *see also*, St.-Appt. 1 and 2).

The potential value of this technique in Pennsylvania is illustrated by the following: "Of the 27 states (in which strip and surface mining for coal and other mineral products is going on), Pennsylvania ranks first, with about 370,000 acres of stripped land. In this state alone strip and surface mining of coal has adversely affected an estimated 3,000 miles of streams and 2,000 acres of impoundments as a result of erosion and acid mine drainage; it has caused the loss of productive crop and forest land, wildlife habitat, and recreational hunting areas; and it has impaired natural beauty by creating unsightly barren spoil banks." (*Id.*, St.-App. 1, at 1). The beneficial characteristics of sewage effluent and sludge from the standpoint of strip mine revegetation include the following:

"Municipal sewage effluent is slightly alkaline (pH 6.8–7.2) and is highly enriched with dissolved minerals; hence it should counteract acidity and low fertility. Application of the effluent should also leach acids and toxicants below plant rooting depth and provide the necessary moisture for survival and growth of vegetation. Evaporational cooling should help to moderate surface temperatures. And applying liquid digested sludge could provide organic colloids to detoxify the soluble iron, aluminium, and manganese and provide a moisture-retentive organic medium for seed germination." (*Id.*; *see also*, *id.*, V–165–166).

These are not theoretical concepts. They have been tested by Dr. Kardos on spoil bank material from Pennsylvania strip mines; by Dr. Hinesly and Mr. McMillan on Fulton County, Illinois strip mines (*see also*, Exhs. 88, 89); by Mr. O'Neal on a gravel stripmine in Maryland; and by Dr. Walker in greenhouse work, as well as on a sand mine in Prince Georges County, Maryland, and a strip mine in Western Maryland.

And, while Dr. Chaney and others urge close management of strip mine applications of high metal-level sludges and safeguards to control later use of the reclaimed land for agricultural food crop purposes, there are means of accomplishing these objectives short of municipal purchase of the lands involved. (Walker, VI–58). Dedication of these lands to non-food crop uses would make possible "much greater" application rates and metal loadings than Dr. Chaney "would ever recommend go on general farm land" (Chaney, VI–28), and would, in addition, remove such sludge application entirely from coverage under the draft EPA guidelines (Exh. 32; Farrell, III–303–305).

Although stopping short of restoring strip-mined lands to full agricultural crop production(as Chicago MSD has done) may be regarded by some (*e.g.*, Dr. Hinesly) as not exploiting the full value of sludge use, Dr. Epstein of the USDA believes that the benefits to be derived from (the organic content and humus value of) sludge applied to disturbed lands are by themselves so great that it's "ridiculous" to get involved in food crop uses where you "have to worry about . . . these other side problems (such as heavy metals)." (Epstein, VI–29, 90–91). Even without agricultural side-benefits, the value of sludge in promoting the revegetation (with non-agricultural cover crops) of barren strip-mined soils—with associated reductions in sedimentation, acid mine drainage, and ugliness—is not reasonably subject to dispute. In short, sludge application for strip mine reclamation is valuable in theory and workable in practice.

In the final analysis, Philadelphia's main, if not sole, argument against strip mine uses of sludge are that they may meet with local public and political opposition.[10] However, it is clear from the record, that the people of Pennsylvania have never been given the opportunity, with or without properly laid groundwork, to evaluate on its merits a strip-mine reclamation proposal involving Philadelphia sludge. To the contrary, there are indications from both within and outside of Pennsylvania (*see*, *infra*, section VI–7) that a properly explained reclamation operation would very likely be accepted, at least by an overwhelming majority of the people concerned.[11] It would require a needlessly cynical view of an informed citizenry's ability to rise above emotionalism and perceive its own best interests to conclude that such acceptance by Pennsylvania residents

[10] Philadelphia's contentions regarding feasibility are dealt with infra, section VI. 9.
[11] See, sections VI.7. and VI.9., infra.

is not possible. Certainly, Philadelphia has far from demonstrated its impossibility.

b. *Other non-agricultural uses of digested, composted, and heat-dried sludge.*—A number of these uses were discussed by various USDA witnesses. Dr. Epstein, for example, described the gift of "about 0,000 cubic yards" of Blue Plains composted sludge "to the National Capital Park Service for the Constitution Gardens . . . in front of the Department of Interior near the mall", and of another "about 8,000 cubic yards to Seneca Falls State Park for improvement of their property." (Epstein, VI-19). "[M]uch" composted sludge as also been given "to State and other agencies . . . for use on turf, for ornamental improvements of land." (*Id.*). The USDA is generally looking at the use of composted sludge, among other purposes, "for a whole variety of ornamental crops that you might grow in a greenhouse and in the house and in the home", as well as to promote "the growth of different tree species" and of "different lawn grasses". (Walker, VI-26-27). They have done trials successfully using as much as 200 dry tons per acre of composted Blue Plains sludge to promote the growth of "certain three species", although it is not beneficial at these rates for certain other tree species. (Walker, VI-24). Dr. Epstein believes that these kinds of non-agricultural uses are the most efficient and valuable uses to which sludge can be put. (Epstein, VI-29, VI-90-91). "There [are so many] other uses [of sludge] for . . . ornamentals and shrubbery and turf and so forth that have tremendous use and we have plenty of land of this nature in the country." (*Id.*, at VI-29). "The State of Maryland's Highway Department can use all the compost we could ever generate out of Blue Plains. The local cities spend funds on fertilizer, on peat moss and other organic material, for park renovations, for highways, for mulching . . . which is absolutely unnecessary when is absolutely unnecessary when they could use [sludge." (*Id.*, VI-90-91; *see also*, Walker, VI-43). The term "ornamentals" encompasses anything "from a rose bush to a maple tree" (Epstein, VI-30), including "all . . . house plants" (Walker, VI-30).[18]

Dr. Farrell, in commenting on the USDA composting work, stated: "The end product is a compost material which can be used as a mulch, quite a low-grade fertilizer, but it does have a compost with some nitrogen content, so it has . . . some slight fertilizer value, and can be used in homes, around homes and gardens, parks and so on. I have seen the material, and it is a very acceptable product, a fine, granular black compost." (Farrell, III-281).

Dr. Farrell also noted that the draft EPA sludge application guidelines would not cover this kind of activity, " . . . and . . . are not intended to stop this kind of work." (*Id.*).

The "plant food" produced by Organic Recycling, Inc.'s "toroidal flash-drying" process is similarly geared to the "specialty fertilizer" market. (Tarpley, III-311, 318-319, 321, 326-327). Particularly, in view of routine additions of "nitrogenous material to the sludge after it is dried" (*id.*, III-310)—which decreases the quantities which must be applied to accomplish fertilization—the required rates of application ("on the order of one or two tons per acre at the most") are not such as to justify much concern about heavy metal problems. (*Id.*, III-321; *see also*, Epstein, VI-43; Walker, VI-01). There are also indications that heavy metals in sludges heat-dried by this technique may be "only about 15 percent available as compared to 100 percent available" prior to drying. (Tarpley, III-318; *see also*, Chaney, VI-93).

Mr. O'Neal, who refers to "various opportunities" for using Philadelphia sludge "for sod production, . . . nursery stock production and other aesthetic programs" (O'Neal, St.-3), testified that his firm has "about 400 acres ready for contract" at an "[i]ndustrial park where we intend to put a sod down" using Philadelphia sludge (if Philadelphia awards them the contract) from its Northeast lagoons. (*Id.*, V-103-104).

Dr. Kardos included revegetation of "highway shoulders and medial strips" on his list of "[l]andscape situations where sludge application may be very helpful" and would "not involve food chain aspects". (Kardos, St.-3). And his testimony contains a reference to sludge and effluent application to nonstripmine "culm banks" in the Scranton area of Pennsylvania in an (apparently successful) effort to revegetate them. (Kardos, V-169-170).

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[18] Chicago MSD recently distributed in excess of 60,000 packages of air-dried (25 percent solids) Imhoff sludge packaged in two-pound bags (labelled "New Earth") to attendees at thee annual Flower and Garden Show, and the demand exceeded the supply. (McMillan, I-197-198). This illustrates one possible approach to distributing sludge for ornamental "crop" use.

Not only are ornamental fertilizer uses associated with low application rates and therefore relatively low heavy metal loadings, but in the case of composted sludge produced by the windrow, wood chip method pioneered at Beltsville, heavy metals are diluted "on the order of 40 to 60 percent" relative to their concentrations in the incoming digested sludge. (Chaney, VI-20). In addition, USDA scientists found, "much to our surprise . . . that the metal uptake from plants grown on sludge compost amended soil was less than the metal uptake by plants grown on digested sludge-amended soil" with similar metal loadings (*id.*, VI-93-94), indicating a further reduction in the possibility of heavy metal problems.

Finally, if Southwest Plant sludge, with its much lower heavy metal content relative to the Northeast Plant, were emphasized initially for dissemination to perform the fertilization and reclamation functions described above, one could develop in relatively short-order (and continuing at least until Philadelphia's plant-upgrading is completed) a distribution program for getting rid of a major portion of Philadelphia sludge, at little expense to the City and with minimal risk of heavy metal toxicity. Even Mr. Ballotti, who did not consider the possibility of separate handling of the two sludges, agreed in retrospect that it might make sense to look at the problem that way. (Ballotti, II-145). Dr. Kardos has noted that "the Southwest Philadelphia sludge approaches the composition of the Hydig sludge of the West Hertfordshire Main Drainage Authority in England" which, it is claimed, can be safely applied at the rate of 10,000 gallons per acre per year over a period of thirty years, with a built-in safety factor of almost 2 to 1 (Kardos, St.-3).

Even Northwest Plant sludge, and even over the longer term, should be susceptible to safe and inexpensive dissemination for various land application purposes, provided restrictions are imposed to limit the utilization of this material to non-agricultural crop purposes. (A variety of controls are possible, including requirements of nutrient supplementation and restriction of marketing to small packages recommended only for use on ornamental plants.) Judging by Mr. Tarpley's testimony that there are at least 18 plant food distributors in the northeast alone each able to "take the whole output of the Washington [Blue Plains] plant and sell it immediately", and that Milwaukee has never been able to satisfy the demand for Milorganite (Tarpley, III-318-319, 324-325), it would appear that Philadelphia could find a ready market for much or all of its sludge output. (*See also*, Chaney, VI-113-114; Walker VI-114). The only time required to implement this approach would be the time needed to install a drying or dewatering system of which there are a wide variety available. This should not take long at all, particularly if it proved possible to distribute (even free of charge) a partially dried sludge cake (i.e. 25% solids) similar to Chicago's New Earth.[13]

c. *Composting.* Although this technique has already been mentioned in terms of potential uses of its product,[14] it deserves further discussion from the standpoint of its mechanics and feasibility within the time-frames available to Philadelphia

The USDA's pilot composting operation at Beltsville involves composting of digested sewage sludge with wood chips (in a volume ratio of 3:1) by the windrow method. Since April of 1973 (coincidentally, the month the ocean dumping law became effective), this facility has been successfully "composting" upwards of 50 filter cake [23 percent solids] tons of digested sludge every single day" on a site only 5 acres in size.[15] (Epstein, VI-12-18). The same site could compost "between 100 and 150 tons of [sludge] a day 7 days a week" (25 to 35

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[13] Dr. Bauer ((V)-88-89, St.-7-8) testified that Philadelphia could design a viable land application system of the Toledo or Chicago type (for 20 percent sludge cake) to handle 60 dry tons of sludge a day by July of 1975 and its entire output by July of 1980.

[14] "The properties of compost make it attractive . . ." It is "hygienic if . . . composted properly" and "it is dry" if you get temperatures exceeding 55 degrees Centigrade. "It improves the soil properties, particularly moisture holding properties or structure." And it provides "the balance of nutrients" if used in quantities designed to improve soil properties. (Epstein, VI-12-13).

As noted by Mr. McKewen (St. 2): "Composting of the sludge is a method of treatment which is energy and resource conservative. The finished compost can be stored, transported and applied without difficulty and is acceptable to the general public. Although not a true fertilizer, the compost provides many desired results when applied to or mixed with the soil."

[15] It should be noted that Mr. Ballotti's analysis for Philadelphia did not consider the Beltsville-type composting technique at all.

dry tons per day). (*Id.*, VI-16). Presumably, a site somewhere between 5 and 8 times this size (25 to 40 acres) could handle Philadelphia's entire sludge output of about 190 dry tons per day. (Additional acres would be required for a storage area, roadways, buffer zones, and a runoff collecting pond if necessary.) With larger windrows, even less space would be taken up. (Walker, VI-18). And, a research-stage technique under development since 1974, involving the composting of undigested sludge, which "at the present time appears to be satisfactory" (Epstein, VI-12), if it works out on a large scale will not only "reduce the [required] land area considerably" but would also provide a better compost material (*id.*, VI-49). (This is because raw sludge composts very rapidly to very high temperatures, allowing it to be moved out of the windrow.)

That Philadelphia sludge can be readily composted is demonstrated by the fact that Beltsville researchers successfully composted lagooned Philadelphia sewage sludge in May of 1974 without any difficulty. (Epstein, VI-12, 14, 18).[16]

Dr. Farrell described the Beltsville-type composting method as "feasible", in the sense of "cost effective and environmentally suitable", for the City of Philadelphia. (Farrell, III-291). He also said it is "ready for scale-up to full scale", having been "demonstrated for a substantial period of time" with the production of a "high-grade product" which "[w]e had no trouble getting rid of". (*Id.*, III-291-292).

And the Appendix attached to Dr. Baker's statement indicates a socioeconomic climate favorable toward composting in Pennsylvania, as illustrated by the success of a composting plant (for municipal solid waste) in Allentown, built and operated by the Lehigh County Authority.

d. *Trenching.* This is another technique deserving of consideration. As described by Mr. McKewen, this technique is presently being used by the Maryland Environmental Service to dispose of raw (undigested) sludge from the Blue Plains plant at sites in Montgomery and Prince Georges Counties, Maryland. (McKewen, St.-5). Between 200 and 250 wet tons (20 percent solids) per acre are placed in "two foot wide by two foot deep" trenches. Application rates of up to 1500 wet tons (20-22 percent solids) are said to be possible. (*Id.*, St.-4-5). The technique is said to require "careful design and supervision", but is able to confine "the bacteriological and heavy metal contents of sludge within the trench". (*Id.*). According to Mr. McKewen, "[a] system for land containment of Philadelphia's sludge could consist of entrenching limed vacuum filtered sludge in marginal land with suitable geologic characteristics." (*Id.*). In the case of Montgomery County, the trenching operation was designed and implemented in a 7 month period. "It could have been substantially less had there been property more readily available and . . . had there not been unusually bad luck with weather conditions." (*Id.*, IV-12-13).

Mr. McKewen describes the Montgomery County trenching operation, begun "last January", as very successful. (*Id.*).

"We have not had odor problems. We've not attracted insects . . . We've picked up no evidence [based on monitoring of "a number of test wells" and sampling of existing "farm wells in the area"] of any groundwater pollution caused by the operation." (*Id.*, IV-13).[17]

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[16] Although the composting operation as carried out at Beltsville employs sludge with a solids content in the range of 20 percent (Epstein, VI-49) and the "drier the filter cake the better" (*id.*, III-50), Dr. Epstein would not rule out the successful composting by his technique of 14 percent sludge of the sort produced at Philadelphia's Northeast plant. (*Id.*, VI-60-61). If necessary, additional sludge dewatering could readily be accomplished by any number of widely used techniques (centrifugation, vacuum and pressure filtration, heat drying, etc.). It would simply take a little time to order and install the necessary dewatering equipment. (If enough land could be found for air-drying, perhaps right on the compositing site, the need for additional equipment might be obviated.)

[17] Although it is possible to carry out trenching of sewage sludge as purely a disposal operation, cramming the maximum possible amount of sludge into a given piece of land (*id.*, IV-14), the concentration being applied in Montgomery County is said to be one that "will have some agricultural value" (*id.*). In essence, however, the Maryland program is clearly "primarily a disposal operation, not an agricultural enhancement operation." (*Id.*, IV-16). While we would not favor the adoption by Philadelphia of any long-term disposal-oriented trenching operation (because it wastes the resource values of sludge), this approach may have merit over the short-term and on a small scale as a means of enabling Philadelphia to meet the 150 million gallon limit (if any excess does, in fact, materialize) under its present ocean dumping permit. Much to be preferred, however, as Mr. McKewen has acknowledged, "if you wanted to combine the best of both worlds", would be a "fairly barren [soil] that was in need of enrichment with organic matter and put a heavy dose in there." (*Id.*, IV-15). Revegetation with a grass crop for a recreational or park use would be ideal.

Trenching permits higher acceptable rates of sludge application than with surface-applied or plowed-in sludge, because "if the trench is deep enough . . . it may never be penetrated by plant roots" and, in any case, "not all of the sludge is readily available." (*Id.*, IV-5, 17).[18]

A trenching study has been carried out by the USDA's Biological Waste Management Laboratory at Beltsville since 1972. (See generally, Walker, VI-44-47; Exhs. 20, 31; McKewen, IV-11-12). The movement of nitrogen, metals, chlorides and pathogens have all been followed closely. (Walker, VI-44). To date no elevated levels of nitrate have appeared in test wells; the small increases in drainage ponds were well below drinking water standards. (*Id.*, VI-44-45). The USDA studies have concluded that "[t]renching is a suitable procedure for high rate disposal and application of sewage sludge to land" and that "[p]roperly used, trenching is environmentally safe and compatible with use of the land for some agricultural purposes." (Exh. 31, at 7).[19]

Estimated operating costs for entrenching dewatered raw-limited Blue Plains sludges during interim treatment (400 filter cake tons per day) were $50 per dry ton with capital costs amortized over a 2-year period. (Exh. 31 at 6). Although this estimate does not include transport costs (id.), it can be reduced by at least $5.37 per dry ton (Exh. 83, App. 1) since digestion will not be required if the raw sludge is limed (as here) preparatory to trenching.

One great advantage to Philadelphia that would be afforded by the trenching technique is much reduced land acquisition required, owing to the much greater permissible application rates.

In short, trenching is an environmentally acceptable, cost-competitive, low lead-time, and highly feasible option for Philadelphia sludge.

c. *Application to pasturelands.*—This alternative (again, not considered by Philadelphia's consultants) is an attractive one for a number of reasons. First, from an environmental standpoint, grasses are generally not only the most tolerant of "crops" to heavy metal toxicity, but they also absorb "the least amount of metals" (Exh. 31 at 5), thereby minimizing any possible food-chain impact. Moreover, not only are grasses not directly consumed by human beings (thereby minimizing possible public health problems), but grazing cattle which do feed on these grasses are equipped with physiological mechanisms for avoiding uptake of heavy metals (especially into meat and dairy products that might be used for human consumption).[20]

Second, from an availability standpoint, sludge can be applied to pasture land (unlike farm land) all year round (Walker, VI-74-75) and, more importantly there is a 10,000-acre (about 5,000 of which would be usable for sludge application) grass "farm" and cattle ranch, the King Ranch, in Chester County,(Pennsylvania within 30-40 miles of Philadelphia, which is available virtually immediately to receive applications of Philadelphia sewage sludge (O'Neal, V-113-115). At a planned application rate of about 15,000 gallons or 5 dry tons per acre, this one site could receive close to half (75 million gallons) of Philadelphia's present sludge production. (Id., V-114). Moreover, the Pensylvania Department of Environmental Resources has already given its approval for use of the site (attachment to O'Neal St.), Dr. Chaney of the USDA has reviewed the site's soil characteristics and concluded that the soil "would benefit" from the sludge, with no "unusual hazard[s]" and no need to "worry" about groundwater contamination (Chaney, VI-96-97, 105-106), and Dr. Hinesly, who has "been on the

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[18] According to the USDA, trenching can be carried out at rates of up to 500 dry tons per acre (Walker, VI-44), with a recommended rate of 350 dry metric tons per hectare (about 140 dry tons per acre) (Exh. 31, at 8).

[19] Although sludges dewatered to 20 to 25 percent solids (Exh. 31 at 1) are easiest to handle and apply (Walker, VI-52), it is posible to use a flowering liquid sludge but you "don't get as much into the soil and it's a more difficult problem" (id., Walker, VI-52-53). Asked about Philadelphia's Northeast Plant sludge with its solids content of 14 percent, Dr. Walker expressed the view that "some sludge at that moisture content would go O.K. into a trench without sloshing around." (Id., VI-61).

[20] Thus, Dr. Chaney spoke of feeding cadmium-containing grains "to an animal which allows us to leave most of the cadmium in manure, rather than in the animal's muscles" (Chaney, VI-87:18-20; see also, VI-95). "It doesn't go into the milk. It doesn't go into the edible meat, although it is stored in the kidney and liver." (Id., VI-112-113). Similarly, Dr. Hinesly analogized the digestive system of ruminant animals to "the anaerobic digestion that we use to digest sludge," with many of the metals of concern being "precipitated into insoluble forms" so that "ruminant animals" absorption of these metals is probably much less." (Hinesly, III-151, 156).

King Ranch to look at soils there" (Hinesly, III, 174), has concluded that "there are some very good sites there" with "five to six feet of soil material before you get down to the shale material" (id.), that it "could have been made into [a] very useful place for sludge" (id., III-203), and that any potential erosion or run-off problems could be handled simply by building "some terraces there and most of it would have been grass lands anyway because they fertilize their grass lands there to run cattle." [id.]

And third, from an experience point of view, although there is not a lot of research information on "what happens when you apply the sludge to pastures" (Walker, VI-36),[21] there are many documented cases of where it has been successfully done for a long time (id.).Not only is pasture application of sludges common in England, Poland, Australia, etc. (id.; see also Walker, VI-74-75), but "it's been done extensively right in Pennsylvania" (Chaney, VI-36), and "[t]here are cases where high cadmium or other high metal sludges are going on pastureland (in Pennsylvania and elsewhere) in the United States" (id., VI-37, 63). Dr. Chaney testified to the presence of sites in Maryland and Pennsylvania which have been fertilized for up to 50 years exclusively with sewage sludge (Chaney, VI-63). At sites which he examined in Hagerstown, Maryland, Dr. Chaney "could not detect a significant increase in the content of cadmium or lead in the . . . grass pastures that were growing there [after] 25 years of [sludge] application" (id., VI-64). The same was true "everywhere I visited in Pennsylvania and Virginia and Maryland . . . because of a number of factors having to do with the tolerance of metals [by] grasses and so on" (id., VI-95). "All you see is a nutrient response. All you see is a lusher pasture unless too much is applied at one time . . . Many, many people have had tremendous benefit, economic return from the use of sludge on pasture land . . ." (Id.)

Some of these sites are "a half hour's drive" from Philadelphia. (Chaney, VI-64).

Finally, the restrictive formulas applicable to land application of sludges applied to agricultural land (Exh. 32, at 14, etc.) do not apply to forage and pasture crop applications. The important guideline for such applications is to avoid direct ingestion of sludge by animals, which can be accomplished by not permitting grazing animals "on pastures before thorough removal of sludge, by rain or some similar method." (Id., at 16). The proposal for the King Ranch would follow this approach. (O'Neal, V-114-115).

f. I.U. conversion systems landfilling process.—The IUCS process involves the addition of fly ash, soil, and lime to digested sewage sludge (Kleiman, III-216) to produce a landfill material impervious to leaching of heavy metals and other constituents (id., III-256-257; see also, appendices to Kleiman St.). Although the process entails a volume increase on the order of 3-3½-fold (id., III-216), the proponents of this process have already identified one site requiring 5 to 10 million cubic yards of fill "immediately adjacent to the southwest sewage treatment plant in Philadelphia" and another needing "about 18 million [cubic] yards of fill" located "half-way up the Jersey Coast" (id., III-217). Five million cubic yards of fill would accommodate on the order of 25 years' worth of Philadelphia sludge, based on a 200 dry ton per day rate of sludge production. (Id., III-218).[22]

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[21] One exception to this generalization is Exhibit 87, a University of Illinois study of sludge use for pasture reclamation.

[22] The only real drawback (assuming the ability of IUCS to line up the necessary back-to-back contracts, which Mr. Kleiman is confident can be achieved) to the immediate (i.e., within a year or two) disposition of Philadelphia sludge (id., III-261) by this technique is the apparent desire for a sludge starting material with a solids content of 20 percent, which would require some additional dewatering of Philadelphia's present sludge (Northeast plant sludge as presently barged to sea average 14 percent solids). Although Mr. Kleiman appears to prefer that Philadelphia do this additional dewatering itself (id., III-262-264), something which might take up to several years to engineer (id., III-263-264), the record indicates that IUCS is equipped to do a certain amount of dewatering itself (id., III-215-216), and that it could build a "filter facility" of the sort "which is required for our own operations in filtering sludge" (id., III-263) in 18 months (id.). It is, therefore, not clear whether IUCS would be willing to receive 14 percent sludge from Philadelphia and do any additional required dewatering itself.

But even if Philadelphia had to do further dewatering itself, this is something which will probably be done sooner or later in any event (because the more compact the sludge is, the less the handling and transportation costs), making the IUCS process an attractive "back-up" alternative for handling at least a portion of the City's ongoing sludge production.

Because, however, the IUCS process would essentially waste the resource values of sludge, it should not be favored as the sole, long-term sludge handling alternative.

IV. General Preferability of Land Application

THE EXISTENCE OF SOIL AND PLANT MECHANISMS IN THE LAND ENVIRONMENT WHICH OPERATE TO PROTECT THE BIOSPHERE AGAINST HAZARDOUS SLUDGE CONSTITUENTS APPLIED TO LAND AND THE ABSENCE OF THESE MECHANISMS IN THE OCEAN, ALONE DICTATES AS A MATTER OF LOGIC AND ENVIRONMENTAL GOOD SENSE THAT OCEAN DUMPING OF SEWAGE SLUDGE BE PHASED OUT IN FAVOR OF LAND APPLICATION AS QUICKLY AS POSSIBLE

The record is replete with references to the general advantages of land application as opposed to ocean dumping of sewage sludge:

1. "[I]f a problem should arise, it will be more easily contained, analyzed and a remedy developed in a terrestrial system than in an open ocean situation." (Wood, St.-7).

"Ocean dumping of municipal sludges is undesirable because, if for no other reason, control over chemical constituents is relinquished . . . When sludges are used as fertilizer or as a soil amendment, chemical elements applied as constituents of the sludge remain in place if precautions are taken to control soil erosion to low levels and institute management practices designed to minimize leaching losses." (Hinesly, St.-1).

"Thus, since their location in the environment is known, there are soil and crop management practices which can be instituted to eliminate or modify conditions which might be detrimental to plants should such conditions ever develop. We do not have these control options when sludge constituents are disposed of [by dumping in the oceans] . . ." (Hinesly, St.-App. A, at 7). (See also, Id., St.-App B, at 18).

"If we could account for all the metals we could be much closer . . . to assessing what their impact [on the marine environment] is. Not being able to account for them there [particularly at a dispersal-type disposal site like that of Philadelphia], there is always that fraction . . . that we can't account for which may be doing some damage in some subtle place that we are not aware of." (Rowe, II-240-250).

2. "[C]hanges in the ecosystem dynamics of terrestrial systems are more easily predicted and greater control can be exercised by man than in ocean systems." (Wood, St.-7). For example,

"All [terrestrial] animals have home-ranges which are predictable and an extreme of that in any given animals that might enter [an area treated with sludge] and [their movements] can be predicted. The animals can be tested on site [for] those animals who are resident on site and animal movements on and off that site are relatively easily monitored. If those animals are periodically tested and you do not have a problem on site, there is not much reason to expect one off-site." (Wood, V-131).

In the ocean, by contrast, even if sludge deposition could be confined to a discrete geographical area, there is constant movement in and out of the area of a host of organisms with no fixed home ranges which cannot possibly be kept tabs of. (The only exceptions are sedentery bottom-dwelling marine organisms.)

3. "[T]he expense [and feasibility] of an environmental monitoring strategy adequate to track the fate of potential environmental contaminants in the ocean would be considerably greater than [that] for a terrestrial system." (Wood, St.-7).

"I think that is a matter of logic. In a land system, the material is by and large contained, we know where it is, we can identify the area . . . This is assuming no major catastrophic openings of large size [which is not very probable] . . . Whereas, these kinds of things can occur in the ocean with current shifts and things of this nature, storms changing the distribution of materials in water [etc.]." (Id., V-130).

"When you are dealing with complications that are obvious in an ocean system, the monitoring system is going to have to be more complicated. For instance, it is [much] cheaper for me to get [in] any three thousand dollar car and drive 40 miles to an area to do some [monitoring] work on it, than it is for me to get into a 20 thousand dollar boat [a monitoring vessel would, in fact, be far more expensive] and ride out 40 miles into the ocean . . ." (Id., V-133).

"[I]t is easier to monitor terrestrial environments than marine environments . . ." (Vernberg, V-155). "As a generalization, I think that there is probably some common sense to that [i.e., that pollutants that tend to disperse in the ocean can be contained on land and be easier to monitor]." (Carpenter,

V-227). "[T]he disposal of sludges by means other than utilization as a fertilizer or soil amendment seems likely to result in the dispersal of various chemical elements in the environment where their concentration levels may go unmonitored." (Hinesly, St. 1; see also, id., III-198-190).

4. "Short-dumping" is not a problem on land.

5. The potential for a high degree of concentration of virus particles and bacteria by edible organisms such as shellfish that is present in high degree in the ocean environment does not exist on land. (Verber, IV-90, St.-1; Burge, VI-79-80).

6. In contrast to the well-known toxicity and persistence of pesticides and other organochlorine compounds in the marine environment, sludge applications may modify the soil environment so as to favor the maintenance of a highly active bacterial population capable of rapidly degrading these compounds (Hinesly, St.-App. B, at 12; Kaplovsky, I-202).

7. "[I]ntroduction of potentially hazardous materials that might be contained in sewage wastes into ocean systems has the potential for greater exposure to man in the food chain than it would in terrestrial systems where these materials must pass through a soil filter" (Wood, St.-7). "[T]he processes are completely different." (Chaney, VI-84). Materials bound to organic matter" are part of the physical matrix of the soil"; "[t]hey are not part of the solution that the plant takes metals from * * *" (*id.*, VI-84-85). So, the first barrier to heavy metal uptake in the soil-plant system is "the fact that the mercury . . ., lead[,] . . . chromium [and some of these other ions] react very, very strongly" with the soil in the first place (*Id.*, VI-85).

"Then, we have a second [barrier], which is, as soon as they get into the root of the plant—things like mercury in particular, * * * are bound to parts of the root matrix * * *" (Id.). "We then have a further level of discrimination because the metals are excluded during grain filling or fruit formation * * * For instance, the cadmium content of grains is usually ten times lower than the cadmium content of the leaf of the same crop." [1] (Id.). "It's very interesting that the combination of growth of grain crops and feeding the animals [the grains] allows us to exclude [from the food chain] almost everything that might ever have been of concern * * * For instance, [if cadmium is taken up by animals] from the top of the plant, it doesn't go into the milk. It doesn't go into the edible meat * * * Lead is kept in the roots of a plant. If it had been ingested some might have shown up in the milk, but because it doesn't get into the part of the plant that the cow would eat, we don't get it in the milk, and so on." (Id., VI-112-113).

In short, mercury and many other sludge metals do not "constitute the food chain accumulator[s] in agriculture that [they do] in the oceans." (Chaney, VI-84; see also, id., Exh. 30, at 105, 106, 108; Kardos, V-181-182; Kaplovsky, St.-16, I-275, 289, 289-290; cf., Pesch, St.-App. B).

There is another very important reason for preferring land application and its associated soil-plant protective mechanisms. And that is, as Dr. Hinesly points out (III-189), "how do we know what to be concerned about[?]" In other words, there may be constituents in Philadelphia sewage sludge far more dangerous than cadmium whose toxicity or carcinogenicity we do not yet appreciate (recent developments in the drinking water area make this a not implausible possibility). Until we know what these additional risks are, it makes sense "to put these things where [we're] pretty sure they're going to be" when we need to do something about them. And the soil "is one place they will stay." (Id.).

8. In general, terrestrial plants and animals have evolved under more changeable and stressful conditions and therefore tend to be more adaptable to and tolerant of environmental dislocations than would be marine organisms that have evolved in a relatively changeless amniotic fluid-like aquatic medium far farm land. I.e., not only sewage sludge, but pollutants generally, can do more harm to organisms with which they come in contact in offshore ocean waters than to their counterparts on land. (Hinesly, III-155).

9. Not only is ocean dumping more harmful to the environment than land application, but it is much more wasteful of resources. Sewage sludge has many resource values which can be recovered on land, but not in the ocean; fertilizer value, organic matter content/humus building value, groundwater recharge

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[1] Dr. Hinesly (III-180) believes that the degree to which plants protect seed or fruit from abnormal levels of trace metals is so great that "[t]hey will almost die before they let these concentrations reach too high." (See also, id., III-184).

value, digester gas energy value, and metal resource value. The only potential "resource value" of sludge in the ocean is its fertilizer/nutrient qualities. But in many if not most circumstances, sludge nutrient inputs to the ocean will have a negligible if not actually negative effect, (Rowe, II-240, 243-244; Pearce, St.-App. on "Waste Disposal Effects * * *", at 41, 51, 58; Carpenter, V-211-214).

V. Reduction of Heavy Metal Levels

PHILADELPHIA'S CONTENTIONS THAT MORE STRINGENT EFFORTS TO CONTROL INDUSTRIAL HEAVY METAL SOURCES WILL NOT APPRECIABLY AFFECT SLUDGE METAL CONCENTRATIONS AND THAT ACCELERATION OF FWPCA PRETREATMENT REQUIREMENTS WILL PLACE PHILADELPHIA INDUSTRIES AT A SERIOUS COMPETITIVE DISADVANTAGE ARE UNSUPPORTABLE AND ERRONEOUS

Of Philadelphia's "8,000 different industries" (Guarino, I-147), all but two (refineries) discharge into the City's sewer system (Kulesza, III-124). Despite a longstanding industrial surcharge system in Philadelphia based on B.O.D. and suspended solids (Guarino, I-30; Kulesza, III-93), despite the existence in other large cities such as New York and Chicago of permit programs and sewer regulations for limiting sewage system inputs of industrial heavy metals (McMillan, I-212, I-227-228; Nash, VII-25-29; Kulesza, III-96), and despite the obviously large (if not presently quantifiable) industrial contribution to the high heavy metal levels in Philadelphia sewage sludge (Guarino, I-26:6-14, 140-141; Townsend, II-60, 62, 63-64; Kulesza, III-103, 110; Exhibit 78), Philadelphia has no ongoing metal source control program (Townsend, II-10:18-22, 107; Kulesza, III-95). The only effort Philadelphia has made at all in the direction of heavy metal source control is a preliminary heavy metal source identification survey, on the doubtful premise that before any control action can be taken "[y]ou've got to know what you have" (Guarino, I-31:11). And even this survey was conducted solely or largely in response to Federal requirements (Exhibit 78:2,19). In support of its do-nothing approach to heavy metal source reduction and pretreatment, and in defense of its contention that special condition 7(b) of the February 13, 1975 EPA permit (requiring the development of measures to control industrial heavy metal inputs) is "arbitrary and capricious" (April 23, 1975, Statement of Contentions by the City of Phildelphia, paragraph 5), Philadelphia argues that (1) pretreatment of industrial heavy metal sources "is not an effective method of reducing metal concentrations and serves no other necessary or desirable purpose" (Statement of Contentions), envrionmental benefits derived from industrial heavy metal control efforts "would be negligible" (February 27, 1975 letter from Guarino to Train), and "more stringent efforts to control industrial sources of heavy metals will . . . not appreciably effect [sic] the metal concentrations in sludge" (Guarino, St.-9), and that (2) the "imposition of (an industrial heavy metal pretreatment requirement) is discriminatory and unfair" (Statement of Contentions), "would create a serious competitive and economic disadvantage for industries in Philadelphia" (February 27, 1975 Guarino letter), "we don't feel it's fair to close all the platers inside Philadelphia and let all the other platers remain in business" (Guarino, I-67), and "when 1977 comes and as the law [FWPCA] dictates that pretreatment is required that is the time we will give it further consideration" (Guarino, I-30).

For a variety of reasons, the National Wildlife Federation regards Philadelphia's arguments as unpersuasive and unsupportable and believes that Philadelphia must be required to initiate an industrial heavy metal control effort without further delay:

1. A comparison of the heavy metal composition of digested sewage sludge from Philadelphia's Northeast treatment plant (see, e.g., Table 3 of Ballotti St.) with typical "domestic" sludges, as determined by extensive sludge analyses by the USDA's Agricultural Research Service (Exhibit 29, Table 6, at 34; Chaney, VI-103-104), shows Northeast Philadelphia sludge to contain more than 500 percent of the cadmium, more than 250 percent of the zinc, more than 200 percent of the lead and more than 150 percent of the nickel contained in a "domestic" sludge.[8] With the expected upgrading by 1980 of each of Philadelphia's sewage treatment plants to "full secondary treatment" and the associated enhanced removability (i.e., increased deposition in sludge) of metals, this disparity is likely to grow even larger (Guarino, I-37, 141:5-7). As Dr. Rufus

[8] Northeast sludge also contains substantially more cadmium than even New York City sludge. (Compare Table 3 of Ballotti-St. with Table II-4 of Exh. 35, at II-10).

Chaney of the USDA, who has analyzed more sludges from different cities than any other person in the United States (Chaney, VI-108:24-25), has stated, it is difficult to understand how a city with a thousand ppm cadmium can claim that it can't find the source when its neighboring city with the same water supply but no cadmium dumpers has only five ppm cadmium (Chaney, VI-104:1-14).

"The technology for finding [heavy metals] in terms of sampling [and] analytical equipment is available. If a city has laws, announces those, you could even license every importation of cadmium into Philadelphia so you knew who used it, if you wanted to. Tools are available to get cadmium out of the sewage." (Chaney, VI-104:17-22).

2. The relationship between high heavy metal sludges and industrialization, and the desirability of control measures to reduce heavy metal inputs are so widely acknowledged that witnesses at the adjudicatory hearing, including Philadelphia witnesses, repeatedly referred to it.[8]

3. The metal source data thus far developed by Philadelphia are so incomplete and susceptible to error that little if any confidence can be placed in conclusions drawn from these data concerning relative contributions of so-called "controllable" or "identifiable" industrial sources. In the first place, Philadelphia is far from a situation in which it is able to do a materials balance and account for all or nearly all of the metals flowing through its sewage treatment system. "[T]he total sources that we have looked at and grouped as categories and have listed . . . are not all of them . . ." (Townsend, II-50:11-13). "We have not been able to precisely [develop a mass balance] . . ." (*id.*, II-60). The 11 listed heavy metal sources "are not all of the sources of every metal" and are not all of the sources that could have been identified (Kulesza, III-100). In rather marked contrast to New York City's similar heavy metal source survey (Exh. 36) which was able to account for 95-100% of all heavy metals passing through that system (Nash, VII-35), Philadelphia has so far been able to account—in the case of the Northeast Plant, for example—for no more than one-fourth or one-fifth of the metal loadings to its sewage system (Kulesza, III-103, 110; Exh. 78, Table III). If one looks at individual metals and compares the total identified loadings with total "overall" influent levels (Exh. 78, Table III), it is apparent that Philadelphia has identified only about one-thirty sixth of the influent Mn, one-eighth of the Fe, one-fifth of the Ni, one-fourth of the Zn, one-third of the Cd and Cr, and one-half of the Cu. (They have also identified more than 100% of the influent Pb and Hg). Although Mr. Kulesza (III-98: 17-18) expresses a confidence that the listed sources are a fair "representation of the ones which are basically controllable" and Mr. Guarino (I-146:5-7) thinks "we have analyzed most of . . . the pertinent industr(ies) where we think metals would be coming from . . ." and that what you have to do is "go to a representative group of [industries] and you check them" (Guarino, I-147: 10-14), decisions as to "representativeness", "controllability", and "pertinence" are necessarily subjective judgments. In any case, with 75-80% of the metal inputs totally unaccounted for (whether or not "controllable"), it seems foolhardy and premature to bandy statistics back and forth about what proportion of the metals are or are not contributed by industry. (See, Kulesza, III-110: 14-21).

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[8] Thus, Commissioner Guarino (I-20:6-11) early on let slip his own similar beliefs by indicating that he would expect metal levels (in Philadelphia sludge) to vary from day to day "because most industries operate from Monday to Friday." Dr. Kaplovsky, another Philadelphia witness, upon being asked whether he would agree that Philadelphia should do everything possible in the way of pretreatment to minimize the introduction of heavy metals discharged by industrial sources, responded: "I not only agree with [the] pretreatment standards concept, I'm a member of the committee on pretreatment standards . . . Yes, of course." (Kaplovsky, I-272). Among non-Philadelphia witnesses, typical comments were: Dr. Baker (St.-5): "[A]n identification and elimination of industrial sources of Cd, Zn, Cu, Ni, Pb, and Cr could enable the sludges to meet the criteria for land application on field crops other than vegetables. Generally metals should be recycled to their source or origin." Dr. Chaney (VI-42:21-25): "I think we have to keep in mind the whole issue of abatement. That we feel that a sludge which is considerably above the domestic sludge description we've made can easily be taken to that by use of abatement. Good enforcement of the laws." Mr. McKewen (IV-43): "[I]t is possible certainly to take measures that will both reduce the heavy metal concentration in the sludge . . . by control of industrial waste principally." Dr. Pearce (IV-102:15-21): "The amount of heavy metal in any particular sewage sludge is really dependent upon the community from which the sewage sludge is emanating. If you have generally a household type community, the amount of metals are lower. [If] [y]ou are serving a community where there are a large number of industries discharging into the domestic sewage treatment plant the amounts of metals are higher."

In the second place, there is an unexplained large variation in influent metal values between 1973 and 1974 (Exh. 78, Table III). For the Northeast Plant, for example, the difference between the two years is as much as a thousand-fold (in the case of Hg), with variations of three-fold, four-fold, and ten-fold being almost the rule. Mr. Kulesza acknowledges that there is "quite a bit of difference [in influent values] between 1973 and 1974" (III-111), and is unable to account for these inconsistencies in any way other than that "there might be something wrong with the laboratory technique" (Kulesza, III-112:24-25, 113:14-18). Again, with this range of error (and the metal source totals do not even all go up or down in the same direction—let alone to the same degree—as the influent metal totals), generalizations as to relative industrial contributions and controllability would appear to be highly suspect.[4]

Finally, even in the case of the plating industry, which was probably the most intensively and extensively studied Philadelphia industry (i.e., small, as well as large, facilities were monitored and Water Department employees took "anywhere between three and somewhere over twenty samples per company") (Kulesza, III-122, 119), there is extraordinary variability in the metal analyses from one sample to another. Thus, in the case of the Aetna plating firm alone (chosen at random from Table XIII of Exh. 78), for which 20 separate samples were taken and analyses performed, the range of variation in the measurements of cadmium loadings was fifty-fold (Kulesza, III-132). If the other 22 platers in the Northeast drainage system show similar variability in their discharges of cadmium, it seems quite possible (especially given the relatively small number of samples taken and the absence of an effort to coordinate sample collection with peak plating periods for a given metal) that the percentage figures provided in Table VI of Exhibit 78 for metal loading due to plating could be off by as much as plus or minus 2500 percent (i.e., with platers contributing from well under 1 percent to well over 100 percent of the total influent cadmium, for example) (*id.*, III-120-122). At best, since you would expect the metal data "to fluctuate for an individual [plating] plant depending on which particular metals were being plated at the time, the shape of the parts being plated, this type of thing" (*id.*, III-113, 118), and since Philadelphia lacks a mechanism by which platers are required to report their plans to dump baths of plating wastes into the sewage system (*id.*, III-126-127), the possibility of totally missing or grossly underestimating large plating discharges (at least for specific metals) seems very great.

In short, the degree of error and variability inherent in the metal source data thus far provided by Philadelphia is so great that there is certainly no warrant for the conclusion that industrial heavy metal pretreatment controls would not be "effective" in accomplishing "appreciable", "significant", and/or "desirable" reductions in sewage sludge heavy metal levels.

4. In any case—even accepting Philadephia's heavy metal source survey at face value (i.e., ignoring the large error factor)—it is difficult to find warrant for blanket assertions that the sources of 80 percent or more of Philadephia's heavy metals are uncontrollable and that pretreatment will not "appreciably" affect the sludge's metal content. Thus, although it is doubtless true that "all" of the metals cannot be accounted for by industry (Guarino, I-141:19-20), it is certainly equally true that industry may account for far more of one metal than another (*id.*, I:16-19) and that some industries may be major sources of some metals. For example, fully 62.1 percent of the nickel in Northeast Plant influent during the 1974 sampling period is attributable to plating inputs alone (Exh. 78, Table VI). This coincides with the New York City experience (Nash, VII-40). Similarly, this time looking at the 1973 influent sampling period, 38.7 percent of the cadmium is ascribable to plating sources (Exh. 78, Table VI). Indeed, for Northeast Plant sludge, more than half of the Cd and Ni and nearly half of the Cr inputs thus far identified as to source come from plating waste (Townsend, II-47-50; Exh. 78, Table III). (How can we know that the same is not also true of those inputs not yet identified?) Moreover, for every heavy metal for which information is provided, with the exception of lead (which is ubiquitous as a result of its use in leaded gasolines), the plating contribution to the Northeast Plant far exceeds that described as "domestic" (Exh. 78, Table III). Likewise, in the Southeast Plant's drainage system, "galvanizing" sources appear to con-

[4] As Mr. Guarino noted at the Jan. 14, 1975 permit hearing in Ocean City (at 3), "additional influent-effluent analyses at the treatment plants is required" before "more statistically significant averages" can be established.

tribute large quantities of zinc which might be usefully controlled (id., Table IV).[5] "Source reductions" for lead, copper, zinc and other metals commonly used for plumbing and related purposes (and thereby contribute to both "domestic" and industrial metal discharges) might correspondingly be accomplished through appropriate modification of building, plumbing, and housing codes (Carpenter, V-217).

Finally, as Dr. Chaney has suggested (VI-104), another tool for getting cadmium (for example) out of Philadelphia sewage might be to license every importation of this metal into Philadelphia so you knew who used it.

In sum, Philadelphia's heavy metal source survey (even if assumed to be accurate), does not justify the categorical and self-serving conclusion that the heavy metal sources of Philadelphia sludge cannot be controlled appreciably enough to be worth the bother. (See, e.g., Kulesza, III-105:13-16).

5. Nor is there any justification for Philadelphia's premise (Guarino, I-31:11) that the Water Department must go out itself and identify every source that Mr. Kulesza would regard as "basically controllable" before any action can be taken. Permit systems, surcharge systems, and questionnaires can all be used, singly or in combination, to require metal sources to step forward themselves and to supply any desired information about heavy metal discharge levels and patterns (which can then be verified by Water Department personnel on a spot-check basis). Toxic metal discharge limits, once established, if sufficiently well publicized can, in conjunction with a suitable reporting and monitoring mechanism, be (at least in theory) made almost self-enforcing. Indeed, Philadelphia Water Department personnel have conceded that they are "considering" many of these possibilities as possible ways of meeting their responsibilities under the pretreatment provisions of the FWPCA: surcharge to recover a fee to help remove metals and to deter excessive metal loadings (Guarino, I:30-31); permit system (*id.*, I:145:8-15; Kulesza, III-100); pretreatment ordinance (Townsend, II-107; Kulesza, III-128); reporting requirements (Kulesza, III-08, 127-128).

6. There can be no doubt as to the City's legal authority to adopt any and all of the indicated regulatory approaches, notwithstanding the Federal regulatory scheme as specified in sections 301, 304, and 307 of P.L. 92-500.[6] Indeed, whether or not they enforce them, many municipalities have specific heavy metal discharge limits on the books that apply to industries that discharge to their sewage treatment systems. (Kulesza, III-96). Chicago and New York City are two examples. (McMillan, I-212, 227-228; Nash, VII-25-29).[7] It is therefore clear that it is possible for a municipality to design a mechanism capable of keeping toxic metals out of its sewage treatment plants. There are no legal constraints that stand in the way.

7. Regardless of the mechanism that is ultimately adopted, it is reasonable to expect that the heavy metal levels of Philadelphia sludge are going to go down (with perhaps a temporary upsurge as treatment efficiency is upgraded). Air and water pollution controls and Federal pretreatment and source reduction requirements will ensure that this is the case. One would expect significant heavy metal reductions by 1981 and certainly by 1990 (the latter being the time-frame considered by Mr. Ballotti). Estimates of permissible application rates by Mr. Ballotti (with attendant land requirements and costs), since they assume no

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[5] And, although this is a "control" of a different sort, with respect to lead, for which "dust and street 'dirt' potential" is described as a major source (Exh. 78, Tables III-V), it seems clear that this "source" will greatly decline as the use of leaded gasolines diminishes and the estimated 2 million pounds a year of lead discharged into Philadelphia's atmosphere (Kulesza, III-114) diminish. There appears to be no reason why similar "controls" could not be established for other atmospheric metal discharges that contribute to dust and street dirt and other sources of metal "runoff."

[6] I.e., there is no Federal pre-emption. (See, FWPCA §§ 510, 308(c); 33 U.S.C. §§ 1370, 1318(c)).

[7] The City of Philadelphia itself has an ordinance and regulations that presently prohibit the discharge to the sewer system of anything that would be harmful or deleterious to the sewage system, including, presumably, toxic substances such as heavy metals. (Kulesza, III 128). Perhaps this is what former Water Commissioner Baxter was referring to when, in testimony before a Senate Committee, he testified that: "For any of the metals or wastes that we think are toxic we try, through our own industrial waste division and we think we have succeeded—in keeping them out of the sewage treatment plants." (Hearings on Water Pollution Control Legislation, Ocean Dumping. Before the Subcomm. on Air and Water Pollution of Senate Comm. on Public Works, 92d Cong., 1st Sess., Pt. 5, Ser. H 10 (1971, at 2110; cf., Townsend, II-8-10; Kulesza, III-94-95).

reduction in heavy metal levels by 1900 (Ballotti, II-204-205),[6] must be taken with a grain of salt.

8. While it is possible to regard tightened pre-treatment requirements on Philadelphia platers as "discriminatory" and "unfair", the same could easily be said of the Philadelphia platers' present dual advantage over their direct discharging and non-coastally located competitors (which must do all of their own treating and which must meet more or less strict federal, state, interstate, and local direct discharge limitations).

9. It cannot be seriously doubted that EPA has the authority to direct Philadelphia, as a condition on its interim ocean dumping permit, to require all its industrial discharge sources to adopt "[p]retreatment or other control measures to reduce metal concentrations", to an extent and in accordance with a schedule to later be determined by EPA (Permit, special condition 7(b)). This is especially so where, as here, the cadmium concentrations in Northeast Plant sludge "are well over 100 times greater than the limit that would be the rule to receive a special permit" (Guarino, I-27:18-24). The EPA Ocean Dumping Criteria make clear the ocean dumping permit applicants' obligation "[a]s a condition on every interim permit," to "bring his waste within acceptable limits" (40 C.F.R. § 227.4).

VI Need For Firm Phase-Out Schedule

A. It is Easy to Ascribe Philadelphia's Lack of Progress in Developing Land-Based Alternatives for Handling Its Sewage Sludge to Foot-Dragging and Lack of Good Faith

A review of the transcript of this proceeding makes it very easy to ascribe Philadelphia's singular lack of progress in developing land-based alternatives for handling its sewage sludge to foot-dragging and lack of good faith:

1. Despite their sponsorship of Dr. Kaplovsky as a witness,[7] Philadephia has not "worked at all" with Dr. Kaplovsky's people on their Ocean County, N.J. project (Guarino, I-162:3-17), and they have never retained Dr. Kaplovsky to investigate land disposal for the City of Philadelphia (Kaplovsky, I-318, 320).

2. Despite the presence right in Pennsylvania of "a State University that has people that are expert . . . in using sludge on land" (Walker, VI-66; Townsend, II-88), and despite the presence at Pennsylvania State University of an Institute for Land and Water Resources (Kardos, V-162) which has researched sludge use for stripmine reclamation since 1969 (*id.*, V-178-179) and wastewater renovation and conservation since 1962 (*id.*, St., App. 3), Philadelphia has done nothing more than make brief contact "about two or three years ago" with "some people in the agronomy extension division" at Penn State (*id.*, V-185), and talk about not yet "formalized" or "documented" (Townsend, II-15) plans "perhaps with State College, [to] put together some [land application] program of our own [at one of our treatment plants] on a small scale to see what we can or cannot do with our sludge" Guarino, I-161-162, I-149).[8] The City has no "ongoing relationships . . . or programs with Penn State right now, looking toward the future" (Townsend, II-88).

3. Despite the great expertise of the USDA's Biological Waste Management Laboratory at Beltsville, Maryland in land application of sewage sludge since "October of '71" (Walker, VI-3:8), despite extensive assistance by this Laboratory to the District of Columbia and adjacent municipalities in dealing with their sludge disposal problems (*id.*, 12-14), despite the Laboratory's successful composting of some of Philadelphia's lagooned sludge in May of 1974 without diffi-

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[6] They also do not consider the higher application rates and reduced land requirements possible for Southwest Plant sludge alone, made possible by the much lower heavy metal content of that sludge (Ballotti, II-145).

[7] Dr. Kaplovsky was retained by Philadelphia at the eleventh hour and solely in preparation for the EPA adjudicatory hearing to evaluate land application alternatives (Kaplovsky, I-318, 320, 323). He is a sanitary engineer (*id.*, St.-2), who focusses exclusively on the crop growth alternative because "we felt the least arduous task was to concentrate on one aspect" (*id.*, I-264:19-20), who nevertheless regards it as "very apropo that we consider all aspects," but acknowledges that he has not considered either all the land application aspects or the ocean dumping aspects, disclaims expertise in either ocean dumping or land application, and proclaims himself "a water pollution man . . . [who] deal[s] only with the transport of the soils" (*id.*, I-299-300). When Dr. Rufus Chaney of the USDA, a universally respected expert in land application, was asked whether he could call Dr. Kaplovsky an expert in land use of sludge, his response was: "I think he's a sewage engineer, sanitary engineer, not a soil and crop person." (Chaney, VI-94-95).

[8] And then only as a prelude to additional larger scale projects (Townsend, II-117-118).

culty (Epstein, VI-12) and its transmittal of the results "to the plant that gave us the material" (*id.*, VI-18), and despite the Laboratory's continuing availability "to help when we can" (Walker, VI-65-67), the USDA Laboratory has not been requested by Philadelphia to assist it in solving its sludge problem (Epstein, VI-18).

4. Instead, whom does Philadelphia retain to identify sludge disposal alternatives? A Chicago firm "engaged exclusively in the practice of sanitary engineering" (Ballotti, St.-1), with no expertise in either ocean dumping or land application (*id.*, II-141, 166, 171-172), and one which was initially hired to consider all of Philadelphia's wastewater treatment and disposal problems, with emphasis on the treatment aspects (*id.*, II-165-166).

5. Despite Commissioner Guarino's protestations that "the problem [with developing land application alternatives] is not the cost that an engineer comes up with, but it's the availability of land" (Guarino, I-57), two separate witnesses, representing independent consulting firms, who repeatedly approached Mr. Guarino with proposals involving specific available parcels of land, were told that "this is more costly than his present ocean dumping" (Kleiman, III-251:5-6) and that he was "firmly convinced that the most economical and best way to handle the sludge is to put it in the ocean" (Bauer, V-91:5-15).[3]

6. Philadelphia bases its assertions of widespread public opposition in Pennsylvania to land application of sludge in general, and to strip mine reclamation in particular, largely on the negative reaction to a recent proposed land application demonstration project for sludge at the Letterkenny Army Depot in Chambersburg, Pa., and to a not-so-recent plan to dump garbage at a strip mine site in Snowshoe Township. (Townsend, St.-5, 7-10, II-20; Nelson, St.-3-4; Guarino, St.-10, I-65:14-17, 77, 128-29). Yet, despite the acknowledged need for careful public education efforts (Townsend, II-21, 29:6-9, 30), Water Department personnel testified that they could not say what, if any, public education efforts had been made prior to undertaking these two projects—in the Snowshoe Township case, because that "situation was handled through the Streets Department" (*id.*, II-19), and in the Letterkenny case, because "this was an EPA project" and "I am not sure of each step that they took in this pattern" (Guarino, I-124-126). Lack of knowledge did not stop them from voicing very definite pessimistic opinions, however.[4]

7. And, while one Philadelphia witness could not see much difference between dumping of garbage and application of sludge for reclamation purposes, (cf., Kardos, V-183; Hinesly, III-172), and went so far as to express the view that "if we ever solve the solid waste problem we could automatically solve the sludge disposal problem" (Guarino, I-76:13-16), that same witness evidently did not see much relevance to the sludge question of the fact that two Pennsylvania counties have agreed to allow strip mine deposition of Philadelphia trash. (Guarino, I-77:18-25). In other words, a bad public reaction to a trash or garbage-dumping plan was viewed as augering ill for the prospects of land application of sewage sludge, while a receptiveness to trash deposition in strip mines was not regarded as having any particular significance at all for sludge disposition prospects.[5]

8. With respect to the repeatedly referenced Letterkenny project, one Philadelphia witness expressed his fervent belief that "no matter how they [EPA] handled that [the public education or public relations effort], they would have wound up the same way" (Guarino, I-126:9-10), while another was persuaded that "the people want facts" and that they could not have been involved any sooner in Letterkenny because there would have been no facts to involve them with any sooner (Townsend, II-23). In actuality, however, the record suggests

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[3] These two witnesses testified on different days and there is nothing to indicate that they were aware of one another's testimony.

[4] One Philadelphia witness did concede that, in the Letterkenny case, the public education effort, such as it was, began only after "the citizens in the area of Chambersburg found out about our intentions" and "starting from an already hostile and already formed opinion." (Townsend, II-21). It takes no great insight to recognize that this is not the best way to win friends and influence people.

[5] At the same time, another Philadelphia witness was acknowledging that "disposal" and "reclamation" might have different connotations (Townsend, II-18-19), that "disposing of something" is not the same as "using it" (*id.*, II-38), and that "[s]ludge" is not "solid waste" (*id.*, II-113, 98).

that the people of Chambersburg could, in fact, have been informed a good deal sooner of (*a*) at least the facts that were presented to the military people when the initial approvals were sought to use the Army Depot (*id.*, II-27:24-25, 28:1-9), and of (*b*) many of the facts that were ultimately released in various fact sheets and information papers at the time of the news leak (*id.*, II-25: 10-16). Whether or not an adequate public education effort could have altered the Letterkenny result,[6] it is certainly not reasonable to make the blanket statement that Letterkenny "represents the reaction of people now" (Guarino, I-124: 12).

9. As further evidence of the hostile disposition of Pennsylvania residents, one Philadelphia witness spoke of having "approached 27 counties in the last year or so' but "only two would talk to us concerning an area for solid waste disposal" (Guarino, I-65: 23-25'). He also spoke of attempts "to buy land and people won't even talk to you. When we go up to Scranton the people from the rental agencies don't even want to be seen with you. We have approached the people in Girardville . . . . But . . . [the] people resent it." (*id.*, I-70-71). But these contacts, as it developed, were not made by the Water Department and were not made in an effort to find a resting place for Philadelphia's sewage sludge: "If you want to know county by county where the City of Philadelphia has gone to obtain land, then I think it would be best to call in the Streets Commissioner. . . ." (*id.*, I-123:5-9). As another Philadelphia witness acknowledged, the Water Department has not had any program looking for suitable land application sites. (Townsend, II-97). Thus, other than Letterkenny, the impressions of Water Department personnel as to adverse reaction have all been second-hand and did not involve use of sludge for reclamation purposes.

The only "site survey" in Pennsylvania in which Water Department personnel could claim any role were "several visits to the [anthracite] strip mine regions of Northeastern Pennsylvania in the summer of 1973" which revealed that "deep-pit surface mining techniques had been used in these areas" with "[p]its up to 400 feet deep" being "common in this anthracite coal-mining region of Pennsylvania." (Townsend, St.-5). Despite the facts that "there must be shallow strip mines in Pennsylvania somewhere" (*id.*, II-15:21-25), that Philadelphia has never investigated the willingness of private mine owners or the Commonwealth to bear part or all of the earthmoving costs (*id.*, II-17), that the City never developed any specific information at all about feasibility and cost of strip mine reclamation (*id.*, II-18), that Philadelphia has never made any specific effort to locate and determine the availability of pits in Pennsylvania of a depth that would make sludge application more feasible (*id.*, II-73), that surface mines in the central and western parts of Pennsylvania are of a shallower depth than in the northeastern part of the State (*id.*, II-116), that there are "gently sloping mines" within about 100 miles of Philadelphia (Exhibit 33), that demonstration projects involving sludge application to Pennsylvania strip mines are proceeding successfully (Exhibit 33), and that the head of Pennsylvania's Bureau of Surface Mine Reclamation and other PennDER officials are highly receptive to the use of sewage sludge for strip mine reclamation (Exh. 33)—despite all these facts, Philadelphia's sludge disposal coordinator[7] felt compelled to entertain negative feelings about the feasibility of strip mine reclamation through the use of sewage sludge (Townsend, II-20:2-4), to sharply contrast Pennsylvania's deep strip mines with the shallow ones of Illinois, and to assume that the "major reclama-

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[6] A number of witnesses had some instructive things to say about public education. For example, according to Dr. Walker, "most people, if you tell them and describe a problem that you are having with using sludge . . . on land, . . . want to help you solve the problem, and they will probably be much more helpful than you ever thought . . . if you present it to them adequately." (Walker, VI-72; see also, *id.*, at 41:2-4, 69-70, 71:22-23, 72:1-2, 76:19-25, 77:1-2, 108-109, and 114:9-10; see, generally, Epstein, VI-71; Chaney, VI-113-114; Kardos, V-184:10-24; Baker, V-193-194; Bauer, V-60:1-6; O'Neal, V-103:10-15; McKewen, IV-48-49). Note also the following exchange between Philadelphia's counsel and Dr. Hinesly:

Question. "Do you think people can always be educated?"

Answer. "I believe we always can be. I think we are in very bad shape if they can't be."

Question. "Well, we may be sometimes. Do you think people are always willing to look objectively to the facts. . . ."

Answer. "Not all of the people. But a majority of them can."

[7] It may say something about the strength of Philadelphia's commitment to develop a satisfactory sludge disposal program that it appointed as "coordinator" of this program—representing "by far the most complex [problem] we can deal with in the whole pollution field" (Kaplovsky, I-302:21-23)—a sanitary engineer fresh out of undergraduate college, who is not an expert in marine biology, is not an expert in soil problems, and is not an expert in economics (Townsend, II-83-86).

tion work required for these areas would be earthmoving rather than sludge application to enrich the soil"[8] (id., St.-5; II-15:10-12). This unwillingness to fairly investigate the availability of Pennsylvania strip mines for sludge reclamation is particularly unfortunate in view of the Commissioner's acknowledgement as a general proposition that "strip mines . . . are ideal spots to get rid of the sludge" and that "it's an ideal way to mix the spoil banks with sludge and to reclaim the land" (Guarino, I-70-71), and the agreement of another Philadelphia witness that application of sludge on top of leveled strip mines is "a good solution" (Ballotti, II-102).

11. Although advertising contracts for the removal and disposition of sludge is a standard technique for eliciting proposals from private contractors (and the one used by PennDOT to get sludge cleared out of Philadelphia lagoons in the path of the I-95 highway project), and indeed is regarded by some if not all contractors as necessary to show the seriousness of the advertiser in proceeding with a project which they require as a first step before they will commit themselves to a firm bid (Kleiman, III-248-250), the only contract advertising done by Philadelphia for sludge removal was limited to procuring the evacuation of sludge from two lagoons at the Northeast Treatment Plant in the way of a planned plant expansion (Guarino, I:167). The first two of three such advertisements (*id.*, I-107:12-15, 94:5-6) evidently resulted in "contracts" (which had to be "cancelled" for reasons that are unclear from the record). (*Id.*, I-167:9-25). Two conclusions seem warranted: (*a*) Philadelphia knows how to advertise contracts when it decides it has to (i.e., necessity is the mother of invention), and (b) presumably, there are contractors ready, willing, and able to respond to advertisements of this kind. (See also, O'Neal, V-102).

12. At one point in the hearing, Philadelphia's Water Commissioner, seeking to brush aside the Chicago experience as a fluke with little if any applicability to Philadelphia, observed that Chicago has "over 7,000 . . . [m]aybe 10,000 acres" of land, presumably handed to them on a silver platter. "[W]here," moaned the Commissioner, "would I obtain that land in Pennsylvania [?]" (Guarino, I-38:25-39:1-3). One answer to the Commissioner's rhetorical question is the King Ranch, which has around 10,000 acres, willing owners (Townsend, II-35), is located in Chester County, some 30 miles from the Southwest Treatment Plant (*id.*, II-33), has excellent soil (Chaney, VI-96-97; Hinesly, III-174, 203), has received PennDER approval for sludge application (O'Neal, St.-App.), and is available right now (O'Neal, V-113). Philadelphia's sludge disposal coordinator conceded that the City Water Department had never independently explored the possibility of applying some of its sludge at this site (Townsend, II-35), that he regarded the original proposal (involving Southwest lagoon removal) as "PennDOT's thing" (*id.*, II-33), that the City had "no involvement in that site at that time" (*id.*, II-114), and that he regarded concerns raised about possible pollution of the Brandywine (*id.*, II-34) and means of alleviating these concerns as things for the contractor to worry about (*id.*, II-114).[9]

13. An effort to apply sewage sludge at Philadelphia's Fairmount Park was cited by the Commissioner as evidence that the City has spent "some number above zero" on pilot or demonstration land application projects (Guarino, I-67:22-24, 68:1-10). It was described as a "low key effort" (*id.*, I-150:18-25), involving the application of "some liquid sludge" (*id.*, I-149:1-20) to "maybe acre plots" (*id.*, I-151:15-16). Evidently, some digested Southwest plant sludge (Nelson, I-248) was laid down in the middle of a field designated by the Fairmount Park people "close to some tennis courts". "[M]aybe 3 or 4 thousand gallons of sludge" were involved. It was applied by means of tank truck (not equipped with flotation wheels) that had been "gerrymandered" from another Department. (*id.*, I-243-243A).

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[8] Despite substantial earthmoving costs in Fulton County, Chicago MSD has been able to proceed with sludge application to strip mines. Mr. McMillan testified, for example, that earthmoving costs at Fulton County range from $1,000 to $4,000 (McMillan, I-225). By comparison, according to Camp Dresser & McKee, the unit costs for grading an abandoned strip mine in northern Pennsylvania (the reference appears to be the deep anthracite mines in the Wilkes Barre/Scranton area) would be around $6,000 per acre (Exh. 35, at 21-23). This cost does not appear to be so much higher as to render an otherwise desirable project infeasible. It also does not take into account possible full or partial cost assumption by present or former mine operators.

[9] As a further testament to the sludge disposal coordinator's familiarity with and interest in this large Chester County ranch virtually in the City's backyard, he identified its location as "Bucks County" (Townsend, II-33).

The Commissioner characterized the results of the Fairmount Park sludge application as "marginal". When asked what he meant by that, his response was: "The grass got a litle greener and we had trouble." (Guarino, I-149:1-20). "We thought if we could demonstrate to the Fairmount Park people that this would be helpful to them that they would say okay, bring your sludge trucks and we will take all that you can give us. However, it was not really that effective . . . ." (*id.*, I-150:18-25). Another Philadelphia employee had a similar description of the results:

"The grass grew a little higher, it was a little greener, but there was no overwhelming effect. Fairmount Park did not come out and tell us please, please give us all you can right now. Nothing like that." (Nelson, I-243A:15-18).

It is a little unclear what sort of effect could have "overwhelmed" the Park Commissioners, especially given their dislike for fertilizer, since "[w]hen you use fertilizer you have to cut the grass." (Nelson, I-248:3-7). Perhaps the fact that the grass "grew a little higher", necessitating cutting, was the "trouble" the Commissioner was referring to.

One would think that some sludge-fertilized ornamental trees, shrubs, and flowers (which don't require cutting) (Epstein, VI-29; Walker, VI-25) might be just the thing to spruce up the Park in honor of the Bicentennial celebration. The ready dismissal of Fairmount Park, the Country's largest municipal park, as a possible site for application of at least some of Philadelphia's sewage sludge simply because the Water Commissioner "think[s] the citizens of Philadelphia would object" (Guarino, I-149:1-20), and because the Park Commissioner allegedly "felt it was not in the best interest of the city to use any of the land for that purpose", rings somewhat false in light of the lack of any apparent outcry against applying sludge even in a field "close to some tennis courts", and in light of the Commissioner's efforts to distinguish Philadelphia from the 50 or more Pennsylvania communities [Chaney, VI-65] which currently land-apply sludge on the ground that "[w]e have no land of our own" (Guarino, I-70:4-13). It also makes it more difficult to persuade a distant county to accept Philadelphia sludge when Philadelphia (through its officials) is not willing to accept any itself. (*id.*, I-152:1-6).

14. According to the Water Commissioner:

"We are having such a tough time getting land that we are going to take plots of land at one of our treatment plants and perhaps with State College, put together some program of our own on a small scale to see what we can or cannot do with our sludge." [10] (Guarino, I-161-62, 149).

The objectives of the study, which is slated to begin "this summer" and will involve the use of "small-scale demonstration type plots", are "to demonstrate that you can apply sludge and you can grow crops on them [sic], and hopefully to get some environmental monitoring out of the same program." Demonstration and use of the City's recently acquired sludge application tank truck with flotation tires is also to be a major part of the effort. (Townsend, II-11-13).

Although the project may be of some value in helping to overcome public opposition (Townsend, II-13), it was made quite clear by Philadelphia's sludge disposal coordinator that such a project could never take the place of a large-scale Letterkenny-type project, and that the City still preferred to await the results of such additional study before committing itself to a land-application program. (*Id.*, II-117-18). Evidently, despite the Commissioner's acknowledgement that land application is a "time-tested method" of sludge disposal (Guarino, I-92), and his vigorous assertion—at least in the ocean dumping context—that, "This is the way people do things. . . . Many things we do are based [on] the experience of others" (*id.*, I-45-46), the most that the City's sludge disposal coordinator was willing to say of the knowledge gained from the Chicago project was that "possibly some of it might be" transferable to the Philadelphia situation, but "I don't think that nearly enough of it would be" (Townsend, II-95).

If small test plots at the treatment plant sites have any bearing on full-scale sludge application at distant out-of-City sites, then why isn't Chicago MSD's extensive operational experience correspondingly sufficient to render further preliminaries by Philadelphia altogether unnecessary?

15. Philadelphia's sludge disposal coordinator, in addition to not exploring the feasibility of sludge reclamation of Pennsylvania strip mines at other than

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[10] The participation of Penn State, it turns out, is something of which they have not been apprised (Kardos, V-185), although the plan is elsewhere described as not yet "formalized" or "documented" (Townsend, II-15).

a single northeastern Pennsylvania location, to not independently investigating the use of the King Ranch site which is virtually in Philadelphia's backyard, and to not advertising contracts to acquire land suitable for sludge application except in connection with clearing lagoons out of the way of a planned treatment plant expansion, has also failed to: (a) consider air-drying as opposed to heat drying of sludge (Townsend, II-39) as an economical and non-energy consumptive means of dewatering (Bauer, St.-3, V-82-85); (b) investigate the operation of Blue Plains' torroidal flash-drying unit with regard to its ability to process digested sludge (which would be the logical thing for Philadelphia to look into if its interest were sincere) (*id.*, II-40); (c) give serious consideration to the IUCS sludge processing approach because "[t]here is no outlet for this material that I have been able to demonstrate" (*id.*, II-74), although the proponents of this approach have already identified more than enough land to receive many years' worth of Philadelphia sludge (Kleiman, III-218); (d) fully investigate the possible present use by small communities or otherwise of Pennsylvania strip mines for sludge disposal (Townsend, II-78); (e) inform himself of sludge disposal activities in Huntington, W. Va. strip mines (*id.*, II-78); (f) inform himself of the use of sludge on strip mine land in Allegheny County Pennsylvania (*id.*, II-79), or to talk to anyone in Pittsburgh about it (*id.*); (g) familiarize himself with strip mine disposal of sewage sludge in Ohio (*id.*, Townsend, II-79), or with Cleveland's use of strip mines in Stark County, Ohio (*id.*, II-80); cf., Hinesly, III-169); (h) seek the advice of marketing specialists on the distribution of sludge-derived fertilizer (Townsend, II-99); (i) talk to the people in Houston or Milwaukee about the sludge marketing operations of those cities (*id.*, II-101); and (j) evaluate the advisability of the Bahamian concept before dismissing it as "exporting pollution" (*id.*, II-107).

16. The City's approach to finding a use for its sludge has been generally to sit back and wait for people to come to it with ideas. "[I]f this material is all that good why didn't someone come and take it from me." (Guarino, I-80:24-25). "[W]e have had no [fertilizer] brokers coming in to see us to get this material. . . . If that market was there, you would think somebody might approach us." (Townsend, II-99).

Many people have, in fact, contacted the Philadelphia Water Department, offering land, contracts, and ideas. For example, there have been at least two recent contacts from Maryland communities offering the use of land application sites. (Guarino, I-95). There have been discussions of "land" with "people in Maryland and also people in Bucks County." (*id.*, I-163). "[W]e have had people from Maryland approach us and they want to try it on their farmland." (*Id.*). Despite the probable presence of farmers associations within 100 or 200 miles of Philadelphia (*id.*, I-65) and the acknowledged need to identify farmland in the vicinity of Philadelphia (Townsend, II-96), the Water Department has not corresponded with any farmers. (Guarino, I-165). We "have never gone to a farmers group to speak with them." (*Id.*, at I-163). "The question you asked is have I spoken to farmers and farmers groups? I have not done that as yet." (*Id.*, at I-164).

"There have been some letters coming to us from time to time [from farmers who] read about this in the paper and they will write to us and give us different ideas, nothing very definite but at least enough to know that the farmers are recognizing that we do have sludge available." (*Id.*, at I-165).

Again, there has been no follow-through by Philadelphia.

One Philadelphia objection to making fertilizer available to farmers is that "you have to have equipment to bag it" and "[w]e do not have that equipment because we are not sure that is the way we are supposed to go." (*Id.*, at I-164). "The only other way would be to put it in tank cars and transport it by [tank trucks]" (*id.*,), the argument against which is "you would need a whole flock of trucks to accomplish that" (*id.*). Apart from ignoring the fact that other municipalities have been able to manage such a system (*e.g.*, West Hertfordshire sludge land use system. Exh. 28, at 18-19; Walker, VI-73-77), and that it may be possible to lease the necessary equipment for the "short time during the year" when it would have to be intensively used (Bauer, St.-7), this argument also neglects to consider that, for the $4 million or so it would take to buy a barge and tug to haul Philadelphia's sludge to sea (Miele, VII-63)—a course of action Philadelphia's consultant feels would be economical (Ballotti, II-180)—the City could purchase at least one hundred and thirty three $30,000 tank trucks equipped with floatation tires (Guarino, I-68).

The "discussions" Philadelphia said it has had with "some of the fertilizer brokers" (Townsend, II-42), turned out to be a conversation with a single individual associated with the Organiform process (*id.*, at II-43), who "came to our office" (*id.*, at II-100). Other consulting firms have taken the initiative of contacting Philadelphia and making specific proposals and then have never heard from the City again (Bauer, V-90-91; Guarino, I-179).

In short, the City's search for land application alternatives could be described as "a flurry of inactivity".

17. Although the City, when it felt itself aggrieved by a New Jersey statute which barred the transportation of out-of-State solid waste into New Jersey for disposal, "took the State to court" (Guarino, I-76), the City hasn't "as yet" considered taking any action to litigate the legality of the Pennsylvania Solid Waste Management Act provision giving county commissioners veto power over solid waste deposition in their county (*id.*, at I-78.).[11]

18. While Mr. Townsend speaks of shipping our sludge to other countries as "exporting our pollution" (Townsend, II-45) and o fwhat he regards as the "inconsistency" of pursuing land application of sludge "for beneficial use" on the one hand and of favoring its being taken out of the country "without having any controls upon it at all" on the other (*id.*), Administrator Train, in an April 25 address to the Composting and Waste Recycling Conference, spoke of the much more obvious "inconsistency" of our cities seriously contemplating "shipping sludge thousands of miles to African countries while domestic fertilizers double in cost"—an inconsistency Mr. Guarino said he recognized (Guarino, I-80).

19. Three of Philadelphia's so-called "expert" witnesses (not including Mr. Kulesza) were Water Department personnel. Although these individuals were undoubtedly competent to discuss aspects of Philadelphia treatment plant operations, they also chose both in their direct testimony and in their responses to cross-examination, to not only voice conclusions but to voice them emphatically on subjects as to which they not only often lacked any expertise at all but as to which they frequently had very little familiarity.[12]

In this case, the missing expert (Mr. Kulesza) was supplied for cross-examination. In all too many other instances, assertions made by non-expert Philadelphia witnesses, "familiar with the results" but unable to discuss their significance, could not be tested at all because the "experts" they relied upon were not present and were not made available.[13]

20. Although Mr. Guarino was able to say that, "In 1900 or 1959 . . . to the best of our knowledge there was no harm whatsoever being experienced (as a result of ocean dumping by New York City)" (Guarino, I-45-46), when asked whether he is "confident from what you have been reading and what you have been told that there is no major harm to the ocean from the Philadelphia sludge", his answer was that he didn't "think we know enough at this point in time to draw any conclusions (*id.*, I-62).[14] When the Commissioner later was asked what

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[11] See, section I.C., supra.

[12] For example, although Commissioner Guarino was quite specific and insistent about the uncontrollability to any "appreciable" extent of metal loadings to Philadelphia's sewage system (Guarino, St.-8-9), when it came to testing the validity of the Commissioner's assertions and his underlying assumption, Mr. Guarino repeatedly referred his questioners to Mr. Townsend for the "details" (*id.*, I-26:23-24, 144:21-23, 147:19-25, 148:1-9). Mr. Nelson, who indicated that the heavy metal source report had been prepared under his "supervision," again disavowed the ability to answer "very detailed" questions about it (Nelson, I-244:8-13), and counsel for Philadelphia volunteered that as "I've already stated three times, Mr. Townsend can give the most detailed information of the three witnesses we have today" (Nelson, I-249:1-5). As it turned out, when Mr. Townsend's turn came, he conceded that: "I am not familiar with the program. I am familiar with the results of the program. I was not involved in implementing it." (Townsend, II-58:7-10). Ultimately, Philadelphia decided to bring Mr. Kulesza down, because "Mr. Kulesza actually is aware and has the most detailed knowledge of exactly who was tested, how often, when, and matters of that nature." (Townsend, II-59:14-23).

[13] Examples are references to the results of studies of the former Philadelphia dump site (Guarino, I-51:20-25, I-52:1-25, I-53:1-14), references to difficulties in obtaining land in Pennsylvania (Guarino, I-65:23-25, I-77:18-25, I-123:1-14; I-124-126, I-128-129), references to the infeasibility of sludge use for reclamation of strip mines in Pennsylvania (Townsend, II-15-19), references to the infeasibility of using the King Ranch site for sludge application (Townsend, II-34-35, II-114), references to the unwisdom of transporting sludge to other countries (Townsend, II-45, II-107), etc.

[14] This open-minded attitude is commendable, especially when contrasted with the statements of New York City's Assistant Water Commissioner concerning ocean dumping to the effect that "we all believe in it" (Nash, VII-12:16, 13:22), that "ocean disposal for New York City and for the environment may be the best solution" (*id.*, VII-12-13), and that raw sludge "might be the elixir of life" to marine organisms (*id.*, VII-21:19-20).

type of proof of harm it would take for him to recommend termination of ocean dumping, his answer was that he "would like to have some definite proof that we are harming the ocean" (*id.*)—a seemingly not *too* unreasonable desire (at least for a non-marine scientist). However, when this line of inquiry was pursued to its logical conclusion and the Commissioner was asked what he would do if he had the "proof" he wanted, his answer was: "*I would do the same thing that I have been doing* for the last several years. I would look for another alternative." (Emphasis added) (*id.*, I-64:8-25).

In a similar vein, after expressing the view that "no matter what you do with this sludge it is going to have some impact, whether you put it in the ocean or on land" (Guarino, I-62; see also, I-81:18-21), the following exchange occurred:

Question. "If evidence is presented to show that the harms are not equivalent, but that the potential hazards are far less for land application than for ocean dumping, would that alter your thinking on the matter?"

Answer. "It would alter my thinking in that respect and concerning that statement, yes."

Question. "Would you do anything differently?"

Answer. "Certainly I would."

Question. "What would you do differently?"

Answer. "I cannot tell you, I cannot anticipated how I am going to act three years from now."

—(*id.*, I-126-127).

Even Mr. Ballotti, Philadelphia's engineering consultant who personally has urged Philadelphia to save money by expanding its barging operations took a far less equivocal view:

"[I]f there was harm or it was demonstrated that there was any harm [as a result of ocean dumping], then I don't think it's a question of value. I think it is then a question of ceasing . . . My reaction is, if there is a little bit of harm, you ought not to do it." (Ballotti, II-173-174; see also, II-167).

In short, Mr. Guarino's attitude appears to be that, whether or not ocean-dumped sludge is the "elixir of life" to marine organisms, and despite a showing of "definite harm" as a result of ocean dumping, Philadelphia should and would proceed on a business as usual basis doing nothing differently than before.

21. Philadelphia originally requested permission to ocean-dump 165 million gallons of sewage sludge (Permit Application). This estimate was revised at the Ocean City hearing, where permission was requested to dump an additional 25 million gallons (Statement of Mr. Guarino). The justification for this increase (Addendum to Statement of Mr. Guarino) indicates, however, that "the volume of sludge required to be removed each year from the Philadelphia wastewater treatment plants" really is in excess of *195* million gallons, but that an increase to "only" 175 million gallons (for permit purposes) was being requested in the realization that a request for the full 33% increase "could cause undue alarm from concerned citizens". The justification document also "strongly emphasized" that the "*175 MGY rate is necessary for proper operation* of the water pollution control plants" (emphasis in original) and that "[s]hould [the] request [for an increase to 175 MGY] not be granted, the result would be a decrease in effluent quality" and an increase in pollutants "discharged to the Delaware River".

When these numbers were explored at the adjudicatory hearing, the Chief of the Philadelphia Water Department's Water Pollution Control Division indicated that he would as a matter of fact be "more comfortable with 185" million gallons a year and that even if Philadelphia were to get the permission it seeks to dump 175 million gallons, it might still find itself, before the expiration of the EPA permit, in a position of having to violate the permit or to make supplemental requests. (Nelson, I-254).

To further confuse matters, the Water Pollution Control Division Chief also testified (and the justification statement likewise reflects this) that "the numbers are based on an average of, oh, three or four years. So whether I'm six months before or after it's not going to make a difference. And these type of calculations whether I'm basing it on fiscal '75 or fiscal '76, the quantities are close enough and you cannot break it apart."—(Nelson, I-251).

If the numbers are based on a 3- or 4-year average which cannot be broken apart, why was a 150 million-gallon-a-year limit adequate for calendar year 1975, when 165, 175, or 185 million gallon limits are successively claimed to be neces-

sary for calendar year 1976? And does anyone really know? It appears to us that from the record it is possible to justify any and all quantity figures from 150 to 195 million gallons.

B. PHILADELPHIA'S EFFORTS THUS FAR AT FINDING OCEAN DUMPING ALTERNATIVES HAVE BEEN LARGELY LIMITED TO "IDENTIFYING" PROBLEMS RATHER THAN DEVELOPING SOLUTIONS TO THESE PROBLEMS

Despite the apparent indications of foot-dragging and bad faith, however, there is another and simpler explanation for the lack of progress on Philadelphia's part in developing land application alternatives for sewage sludge management. That explanation is human nature. Until EPA Region III announced its permit decision on February 13, 1975, Philadelphia had little if any inkling that its ocean dumping activities and expectations were in anything like imminent jeopardy. While Water Department officials must have anticipated that the "day of reckoning" would someday arrive, it was evidently a great surprise to them that this "someday" was suddenly a series of specific dates. "[T]he type of disposal chosen by a community is a commitment not easily changed." (Farrell, III-282). Sometimes it takes a little prodding.

While obviously one cannot legislate or prescribe the impossible, specific legal directives or other forms of compulsion equally obviously do necessarily * * * cally responsible municipality's approach to the thing or things it is being directed or otherwise compelled to do.[18]

It seems rather clear from the testimony of Philadelphia Water Department personnel that it was a surprise if not a shock to them that EPA would impose constraints on Philadelphia's continued ability to ocean dump its sewage sludge. "I was quite shocked when we received the permit with the 150,000,000 gallons in it. I didn't expect it. We had no fallback philosophies . . ." (Nelson, I-256-257). Evidently, both Philadelphia and New York City have grown accustomed to receiving automatic approval to ocean dump whatever quantities of sludge they indicated they required.

"[The New York City people] indicated that, when it came time to [apply for permits, they] estimated . . . the amount of material they required to be barged to the ocean then they indicated the same quantities to the EPA and it was an automatic thing just put in the permit. I asked did they ever have any trouble like this [i.e., the permit issued by Region III], and they said not to date." (Nelson, I-260).

"I discussed this with individuals from New York City . . . and after they got over the initial shock they had no immediate suggestions" (Nelson, I-259:8-11). "When I did talk with New York they were quite surprised at the problem I was having." (Nelson, I-259:18-19).

It is not hard to understand that efforts to identify and implement land application alternatives might be rather low-key and preliminary, with more emphasis on the identification and study aspects than on the implementation, at a time when ocean dumping activities are in full swing with no immediate end in prospect and with no immediate compulsion or necessity to find a suitable substitute.

This explanation is borne out most clearly, perhaps, by the testimony of Philadelphia's sludge disposal coordinator. Mr. Townsend described his job responsibilities as "conceptually developing" projects and trying to "identif[y] . . . things we must consider in evaluating an alternative" (Townsend, II-88, II-93). Similarly, he described the City's efforts over the last two or three years as "looking at land application", as opposed to "looking for sites" (Townsend, II-97). He

[18] Thus, when ordered by EPA to do so, Philadelphia was able to move to a new ocean dumping site within three weeks. Heavy metal pretreatment regulations are going to be developed by Philadelphia only because the Water Pollution Control Act Amendments and EPA regulations say they must (Guarino, I-30, I-67, I-145, I-176; Townsend, II-10, Kulesza, III-92:23-24, III-95, III-129-128). And back in the late 50's when it became apparent that on-site storage space was running out (necessitating the identification and substitution of some other sludge management approach), Philadelphia was able to design and implement an ocean disposal program in "somewhere like a year or two" (Guarino, I-44:3-21). Similarly, with the assistance of a court order, the District of Columbia and surrounding jurisdictions in Virginia and Maryland were able to design and implement a large scale land application program in a matter of months. (McKewen, IV-30, IV-32-33; Farrell, III-296; Walker, VI-106), so that now "nearly all sludge generated in the Washington Metropolitan D.C. Area, that is, in Maryland and the District does go on land now." (Walker, VI-4; Epstein, VI-56).

carefully emphasized that his job did not require him "to become an expert in any one particular area" (Townsend, II-88), and that "I don't think it requires an expert to identify a potential problem area" (Townsend, II-91).

Philadelphia's outside consultants, Greely & Hanson, evidently operated under the same groundrules. "We were requested by the City of Philadelphia to identify as many alternatives as we could think of and to investigate them to see how they might be utilized . . ." (Ballotti, II-132). "[W]hich do you do first? . . . (D)o you buy the land first, and then try to develop a program, or do you develop a program and then find [the land] . . . I don't know which one of those is the right way to do it." (Ballotti, II-138). "At the present time, that [helping Philadelphia to put together a demonstration land application program] is a little premature because we don't know where to put the program together" (Ballotti, II-140). "The City at the present time is not proceeding with anything that I am aware of, at any rate, in connection with putting [sludge] on an actual site" (Ballotti, II-157). "[T]he data that is presented in the statement that we submitted does not purport to be true cost, does not purport to be what we consider the actual cost of doing some of these things . .. [T]hese are illustrative comparative cost estimates".[16] (Ballotti, II-175).

Similarly, Dr. Kaplovsky (who was retained more as a witness than as a consultant), when asked whether he had gotten into Philadelphia's specific problem, responded: "Of course not. We deal with basic principles and concepts that may apply." (Kaplovsky, I-320: 11-12).

In short, with the exception of two demonstration projects developed and largely financed by EPA, and a "low-key" effort in Fairmount Park, the search for sludge management alternatives has been handled as a paper exercise.

Mr. Townsend was undoubtedly correct when he stated:

"You consider if the roof was going to fall on your head, you wouldn't have to ask an expert to consider it. You may have to ask an expert to decide how to build it." (Townsend, II-90).

Philadelphia's difficulty in going to land application of sludge may be less a matter of conscious bad faith and intentional foot dragging than it is a matter of spending all their time "considering if the roof was going to fall" rather than "deciding how to build it".

One of the problems with hiring non-experts even to simply "identify" or "consider" problems and alternatives in an area as complex as sludge management is that just doing the weighing and evaluating themselves involve matters requiring sophisticated technical judgments. That is why so many of Mr. Ballotti's assumptions turned out to be faulty. That is why the non-experts can regard draft EPA guidelines as etched in concrete (see, e.g. Kaplovsky, I-282; Ballotti, II-141, II-171-172), while the experts see them as providing no more than limited, temporary guidance to be modified or ignored as circumstances dictate (Chaney, VI-31, VI-92; Walker, VI-34, VI-38-40, VI-68; Farrell, III-273-274, 281, 303-305; Kardos, V-170A). That is why Dr. Kaplovsky chose to look at the crop growth alternative as the "least arduous" land application approach to look at (Kaplovsky, I-264:19-20), while USDA land application experts "can't understand why we have to talk about food crops, as if that's the only solution we have to sludge or to waste" and "think it's a ridiculous way to look at it" because the material can do the most good "on a soil that is disturbed, whether it's gravel, mine, parkland, or highway where you can put it into turf and grass, and (where) you don't have to worry about any of these other side problems" (Epstein, VI-90-91). And that is why Commissioner Guarino and all the identifiers and considerers on his staff and on retainer could harm in the ocean versus harm on the land (Guarino, I-81).

The one thing that is evident, particularly in light of Mr. Guarino's "message" have no inkling that there might, indeed, be different mechanisms" determining that Philadelphia's role is to "cooperate" rather than initiate (Guarino, I-67:11-21), is that EPA must take the lead in prescribing what must be done and when. And despite Mr. Townsend's eversion to being held to a fixed end-date (Townsend, II-70-71) or Mr. Guarino's reluctance to being "chased out" of the ocean (Guarino, I-171), it is apparent that, unless EPA tells Philadelphia in no uncertain terms that the roof is falling, the City will not devote its full energies to deciding what to do about it.

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[16] Even their comparability is in doubt in view of the large disparity among the various estimates of current waste disposal costs.

CERTIFICATE OF SERVICE

I, Kenneth S. Kamlet, attorney for the National Wildlife Federation, hereby certify that I have this 27th day of June, 1975, served copies of the foregoing Brief for the National Wildlife Federation upon all other parties to this proceeding by hand delivery to counsel of record with offices in Washington, D.C. and by first class mail, duly addressed and postage pre-paid, to all other counsel of record.

KENNETH S. KAMLET.

Senator BEALL. Our next witness is Dr. Donn Gorsline, Univesity of Southern California.

STATEMENT OF PROF. DONN S. GORSLINE, UNIVERSITY OF SOUTHERN CALIFORNIA

Dr. GORSLINE. We have a very brief statement here. It represents, I think, pretty much a summary of the report we completed on the disposal of marine environment and oceanographic assessment.

During the course of our study, several aspects of the management of ocean disposal activities came to our attention. First, amanagement of all waste disposal including, dredge spoils in estuaries, coastal waters, and the ocean should be the responsibility of one regulatory agency, in this case the Environmental Protection Agency.

Therefore, the ambiguity in responsibilities that exists between the corps and the EPA should be resolved.

Second, in order to make the scientific evaluation of the environmental alteration due to ocean disposal more effective and to reduce the potential for bias, EPA involvement should extend from baseline surveys to active participation in the monitoring phase.

The details of each of these baseline and monitoring surveys will have to be specified on a case-by-case basis and should be reviewed by an independent science advisory group.

Third, deficiencies in scientific knowledge of basic ocean processes need to be remedied if dispute over the administration of the ocean dumping permit program is to be forestalled. As long as scientific uncertainties associated with the effects of ocean disposal remain large. Federal agencies responsible for administration of the program will experience difficulty in developing decisive courses of action to follow.

Fourth, a regulatory decision method which explicitly recognizes inherent scientific uncertainties must be adopted. The adopted regulatory mechanism, environmental and effluent criteria, acts in the absence of definite scientific information.

It is an intermediary between the pressure to discharge waste and the mandate to protect the environment. Since environmental and effluent criteria are an important basis of the existing system, their limitations must be clearly spelled out.

The EPA should document and make publicly available the rationale on which specific criteria are based. In particular, one should explicitly recognize that criteria do not protect against unknown chronic effects. Existing criteria and monitoring systems assume that environmental damage will be reversible and not catastrophic.

There is no scientific assurance that these assumptions are always correct.

In a second major subject area, our analyses of the materials themselves lead to several conclusions:

First, every possible effort must be made to limit or to prevent the entry into the ocean of known or suspected dangerously toxic materials, such as certain halogenated hydrocarbons, plutonium, carcinogens, teratogens, mutagens, and materials in certain reactive states.

Second, there is a group of effects of waste chemistry on the environment that are related to a series of chemical elements or compounds which require special consideration.

They include: trace metals, nutrients, biologically active materials, synthetic organic compounds, petroleum, hydrogen sulfide, and methane.

Where possible, the flux of these chemicals from origin to disposal should be carefully controlled. In addition, work on the development of analytical capabilities should be supported.

I would like to stress that. The problems of analysis of many of these compounds in small quantities is still difficult.

Third, because we recognize that it may not prove feasible to eliminate ocean disposal of sewage sludges and dredge soils, we recommend minimization of the entry of toxic trace contaminants into city sanitation systems and increased waste and sludge treatment to reduce the deleterious impact of the disposed material on marine organisms and to diminish the risk to humans.

Site selection and monitoring are a major part of current administrative responsibilities and form a third major part of our analysis.

First, timely baseline and monitoring studies of current and proposed ocean disposal sites are essential. No disposal site should be abandoned in favor of a new site until field data evaluation demonstrates that the new site is less objectionable from an environmental standpoint than the old site.

Second, data supporting off-shelf sites for waste disposal are lacking; therefore, extreme caution must be applied to any but the most innocuous use of the area.

Third, monitoring should not ignore the potential for broad-scale chronic pollution of the coastal ocean which could become, if undetected, a far more serious threat than the degradation of restricted areas.

Therefore, longtime large area monitoring away from specific dump sites is necessary.

Fourth, to aid in the monitoring of nutrients, synthetic organics, and other criterial chemical compounds, it is vital that emission-proportioned composite samples be made available to valid regulatory and environmental research programs upon request, as an obsolete condition of discharge.

In closing, I would like to comment that they may be some controversy during the course of these oversight hearings which stems from the scientific uncertainty associated with determining the effects of ocean disposal.

However, this scientific uncertainty should not obscure more substantial questions. Therefore, I wish to propose just two of these more substantial issues in hope that your deliberations can encompass them.

First, many ocean disposal issues are debated solely in terms of protecting the ocean from adverse impacts. Clearly this is only a portion of the problem as society will continue to generate residual materials and minimizing their total impact on air, land, and water should be the goal rather than exclusively protecting one sector of the environment.

Therefore, in my opinion, part of any program to cease ocean disposal must have built into it viable alternatives for disposal in other ways. It is only through comparative scientific analysis of environmental impact aimed at minimizing the total negative effects that success can be achieved.

A second and even more important issue is governmental and relates to transboundary problems. Again, scientific uncertainty can often become involved in these disputes.

Actually, these debates develop when one unit of government or one municipality assumes the benefits while, through transportation of the waste material, another location must bear the risks associated with disposal.

Under those circumstances, the risk taker will always view available scientific data with a different perspective from the disposer. Resolution of this issue which currently plagues major cities in the East will depend upon a careful analysis of the distribution of benefits and effects of major urban areas on surrounding less-developed areas.

Thank you for the opportunity to express my views on these issues.

Senator BEALL. Thank you, Dr. Gorsline, for your testimony this morning.

Do you think that the Federal dollar levels are adequate to effectively evaluate the health and environmental effect of current ocean dumpling?

Dr. GORSLINE. My personal opinion is that they are not. I draw the conclusion from the fact that at the present there are 19 active areas being used for disposal throughout the United States. In the testimony given today, and much of the published information that all of us have read, it is evident that only a small portion of these areas are being examined in a regular way. That is basic evidence of the need for more money in this area.

I agree with the statement in the committee report of this month which notes that—I think this keys into something we have said earlier in our report—there is need for the coordination of the research. There should be some agency that has the primary role in coordinating that research.

I'm sure there are gaps that are being left in the total system.

Senator BEALL. The previous witness indicated we were spending a lot of effort researching the New York Bight, and perhaps we should extend our efforts elsewhere because of the long history of dumping there.

Dr. GORSLINE. Five-sixths of the total disposal is being done in the New York Bight area by barge disposal means, and therefore we must continue monitoring studies in that area.

Also, we should expand that study to a larger area surrounding the impacting area. I would rather see an icrease in funds to examine the other areas of concern as well as the New York Bight.

Senator BEALL. What alternatives to ocean dumping appear to you to be most attractive?

Dr. GORSLINE. That is a difficult question. Of the limited amount of thought I have given to that particular problem, I must confess I'm attracted to pyrolysis. That tends to break down these toxic compounds into their oxide components. I think that is probably one of the best apparent means.

Senator BEALL. Do you think we lack coordination in this effort?

Dr. GORSLINE. I suspect, and again this is a personal opinion, that there may be a certain inertia here. I get the impression from some of the reports I have read that the fact that treatment plants are under construction has perhaps a subtle effect on this problem. Redirection of that planning and construction will be very expensive.

Senator BEALL. Thank you very much.

Our next business was scheduled to be Mr. James B. Coulter, secretary, Maryland Department of Natural Resources.

We have a statement from Mr. Coulter which will be put in the record.

[The statement follows:]

STATEMENT OF THE STATE OF MARYLAND

On April 1, 1976, representatives of Maryland were asked to attend a meeting arranged by Daniel Snyder, the Regional Administrator for the Environmental Protection Agency's Region III, in EPA's offices in Washington. The purpose of the hastily called meeting was to ascertain what action could be taken in Federal court to handle the chemically prohibited sludge emanating from the Blue Plains Sewage Treatment Plant. As you all know, that plant treats sewage from Virginia, the District of Columbia, and Prince Georges and Montgomery Counties, Maryland. Under a consent decree filed in July, 1974 with the U.S. District Court in the District of Columbia, Prince Georges and Montgomery Counties were to handle the deposition of sludge while Blue Plains was being upgraded. Since that time, sludge has been entrenched in both Prince Georges and Montgomery Counties as well as composted at the Beltsville Agricultural Center, as well as dried by a drying mechanism installed and operated at the Blue Plains site.

On April 1st, the Justice Department attorneys, with the assistance of the EPA, drafted a request for the Court to order that an interim sludge site be designated within approximately 7 to 10 days in Montgomery County, and the site be made available by April 28th. This request may not have been all that unreasonable because back in 1974, digested sludge was entrenched on agricultural land within days of the agreement.

Let there be no mistake about it, there is a great deal of resentment by various citizens to the placement of sludge in their neighborhoods, and Maryland has now taken an active position in resisting certain delaying action in Montgomery County. But, there was a will on the part of the State of Maryland to recognize a problem and to do something about it. This recognition was manifested again at the county levels of government.

The Ocean Dumping Act, 33 U.S.C. § 1401, *et seq.*, recognized that dumping of materials will only be permitted when it is affirmatively shown that the proposed dumping "will not unreasonably degrade the human health, welfare, or amenities, the marine environment, ecological systems, or economic potentialities." On occasion what is emphasized in the law has been recognized by the environmental agency and when it suits their convenience, they have refused to issue permits to dump certain wastes into the ocean. For instance, on October 3, 1974, Administrator Train refused to issue a permit to duPont to dump offshore in the Gulf of Mexico. To date, however, there is no set policy which has been promulgated or voiced by the EPA relative to the national problem of ocean dumping. Ocean dumping determinations vary on a regional basis. Region III always says off the record that if I think they are not carrying out the law to the proper degree, I should just look at the practice in Region II. There the lethal and sublethal effect of the continued dumping in the ocean bight areas offshore Long Island have been documented for years by various agencies of the Federal government. Those researchers have stated that the area has been rendered biologically dead. Yet dumping continues.

Not only does it continue, but dumping has actually increased for Philadelphia and Camden since the passage of the Ocean Dumping Act. That Act really has accomplished nothing if it is viewed in the context of what has happened with Philadelphia and Camden.

Prior to the passage of the Ocean Dumping Act, Philadelphia and Camden were informally authorized to dump their sludge in an area approximately 12 miles off the coast of Cape Henlopen, Delaware, but subsequent to the enactment of the Ocean Dumping statute, without any environmental study, the EPA designated a site approximately 35 miles directly east of Ocean City, Maryland since they wanted to take the contamination from the area already contaminated in order to contaminate a new area. I emphasize this to the Committee, that there were no baseline studies of the new site, there were no environmental assessments; there was absolutely nothing except some bureaucrat sitting down in an office making a determination to utilize sites which had been used by the Army Corps of Engineers back in the 1950's to deposit industrial salts.

Contrast the decision process accorded sludge disposal for the City of Philadelphia with the process for sludge disposal from the Blue Plains facility. The City of Philadelphia has testified that it evaluated 14 alternative sludge disposal systems back in the early 1960's. At that time, for primarily economic reasons, the choice of Philadelphia was ocean dumping. The city is currently researching 10 more alternatives with no more commitment taken than to consider them, the EPA has attempted to phase out one half of the ocean dumping by January 1, 1979, with the remainder to be phased out by January 1, 1981. In response to these deadlines, the City of Philadelphia contends that if everything goes as planned, they may be able to meet the cutoff dates. Interestingly, EPA's Assistant Administrator for water and hazardous materials (Mr Train's top technical administrative aide), firmly projected a maximum of 2 to 3 years for Philadlephia to get out of the ocean completey. Contrast this with the 8 years or more EPA actually is allowing under its permits issued since April, 1973.

Camden is not as sophisticated in contracting out for consultant work as the City of Philadelphia. The Camden sewage treatment facilities were built in 1955. In 1965 it had some problem with its vacuum filters, which are the mechanisms used to absorb liquid from the sludge. The operator of that plant quite frankly stated it was cheaper to go to ocean dumping rather than to fix the facility. And, since 1965, Camden has closed down even more of the facility, giving almost no treatment to its sewage. The City now dumps the very liquid-like sludge into barges and thence into the ocean.

There are no pretenses in the Camden situation—the sludge is raw; it contains bacteria and viruses. It is only 3% to 5% solid because of the lack of almost any treatment. The failure of the EPA to attain the rehabilitation of that facility all these years not only increased the hazard attributable to the raw sludge, but also allowed the facility to continuously discharge wastes into th eDelaware River in violation of the law.

It should be recognized that proper sludge management goes hand in hand with proper waste treatment under the 1972 amendments to the Water Pollution Control Act 33 U.S.C. 1251 *et seq.* If Camden were properly treating its sewage and digesting its sludge, the sludge would be much more amenable to an alternative, land-based disposition. By not giving proper treatment to the sludge and by not requiring pretreatment by municipal and industrial contributors to the sewage treatment facility, Camden produces sludge which is most difficult to handle.

It is ironic that the worse the operation of the sewage treatment facility, the better the position of the municipality to claim that alternative uses and disposition of the sludge are not available.

We do not want to dwell merely on the Camden situation, for the Philadelphia situation has many of the same issues. There is no pretreatment ordinance; there is minimal control on contributors to the system. The major similarity is the unwillingness of both cities to get off the stick and do something about taking care of their sludge in an environmentally acceptable and useful manner. There is no mystery about utilizing sludge on land. A goal which must be achieved is to recycle the sludge as a resource which can add nutrients to the earth. Sludge can be utilized in parklands, on highways, on spoil piles, and on abandoned and unabandoned strip mines. Sludge is being used by the State of Delaware on its highways and along the Chesapeake and Delaware Canal to revegetate the spoil extracted from the deepening of the canal.

This litany is an attempt to indicate to this honorable group that sludge does not have to be dumped in the ocean. However, in order to compel the localities to

overcome their reticence and to utilize sludge on the land, the Federal government must take strong affirmative action.

In addition, the ocean dumping permits issued by the EPA are a sham over and above the illegal designation of the sites. Records produced in the Philadelphia proceeding indicate that there has been and will be in the future, short dumping of sludge en route to the site. The Food and Drug Administration when notified of dumping near shellfish areas which lie enroute to the dump sites, must close down those areas to harvesting.

Dumping is not monitored. The Coast Guard has stated that it does not have sufficient men or equipment. We believe that not one act of dumping has ever been witnessed by EPA officials. There is no monitoring required for bacteria or viruses, even though the EPA's records indicate that a polio virus has been recognized within the dump site.

Although there were no baseline studies of this dump site to compare with, several preliminary reports based upon findings of the latest cruise on December 7 through 6, 1975, which sampled an area extending 10 miles south of the Philadelphia dump site, indicate that an identifiable "sludge blanket" 2 to 4 miles wide may have developed through these entire 10 miles. I enclose herewith a copy of a memorandum from the EPA regional lab in Annapolis to the Regional Director verifying the finding of a sludge blanket.

EPA is violating its own regulations. Those regulations state:

It is prohibited to dump any material which would:

(a) Extend the range of biological pests, viruses, pathogenic microorganisms or other agents capable of infesting, infecting or altering the normal population of organisms.

(b) Degrade uninfected areas, or

(c) Introduce viable species not indigenous to an area. (Part 227.36)

Sludge does contain viruses, bacteria and pests and the introduction of these organisms into areas in which they are not naturally found violates the regulation and contaminates the area. Viruses do persist in the marine environment. A recent study accomplished at the University of Maryland indicates that enteric viruses can persist in the ocean environment for as long as 18 months.

We should close by emphasizing that we do not see the beneficial results in the passage of the 1972 Ocean Dumping Act based upon the following factors:

1. Dumping existed prior to the Act, but has actually increased subsequent to its passage.

2. There has been no real environmental assessment carried out prior to designation of any site.

3. EPA has not adopted a uniform policy for all of its regions which would prohibit ocean dumping except under the most unusual, yet highly investigated, circumstances.

The cost of ocean disposal, the real cost, the cost of ocean monitoring, the cost of sampling and survey should be borne by the dumpers. Not only does this place the cost where it should be, but it will detract from the economic attractiveness of ocean dumping.

We are told by various oceanographic experts that the continental shelf area lying between Long Island and Cape Hatteras has reached its assimilative capacity. This means it cannot safely be used as a sink for the garbage and wastes of those unwilling to achieve acceptable, alternative methods of disposal.

Thank you very much.

Senator BEALL. Are there other people who desire to be heard who are not on our list?

If not, the hearing is adjourned.

[Whereupon, at 1 p.m., the hearing was adjourned.]

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