



UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

120388

DEC 17 1982

RESOURCES, COMMUNITY
AND ECONOMIC DEVELOPMENT
DIVISION

Information in this report is not to be distributed outside the General Accounting Office without the approval of the Office of Congressional Relations.

E-204946

The Honorable Norman E. D'Amours
Chairman, Subcommittee on Oceanography
Committee on Merchant Marine and
Fisheries
House of Representatives

RELEASED

Dear Mr. Chairman:

Subject: Comments on a Critique of GAO's Radioactive
Waste Ocean Dumping Report (GAO/FCEID-83-45)

In your August 3, 1982, letter you requested that we review a critique of our October 21, 1981, report entitled "Hazards of Past Low-Level Radioactive Waste Ocean Dumping Have Been Overemphasized" (EMD-82-9). The critique, prepared by Mr. Clifton E. Curtis of the Center for Law and Social Policy, disagrees with the overall conclusions stated in our report that concerns over past radioactive waste ocean dumping have been overemphasized, and that monitoring past dumpsites is of limited value as an aid to developing future ocean-dumping regulations. The critique also asserts that our report did not acknowledge pertinent evidence and misrepresented other evidence which did not support our conclusions.

In contrast to our report, the critique concludes that monitoring existing dumpsites is necessary to effectively assure public health and safety and to develop sound future ocean-dumping regulations.

After carefully reviewing the evidence in the critique, we believe the findings, conclusions, and recommendations of our earlier report are valid, our presentation of scientific studies and opinion is accurate, and the methodology we used is sound. Enclosure I presents our detailed evaluation of the issues raised in the critique and the methodology we used to make our evaluation. In making this evaluation, we reviewed the evidence presented in the critique, reexamined the information we had gathered during our earlier evaluation, and discussed the critique and/or our earlier report with many of the scientists we had originally contacted.



(301595)

120388

524248

After receiving your request, we recontacted scientists from the organizations we had originally contacted. These scientists reaffirmed that our report accurately represented the consensus of scientific opinion on the public health and safety consequences of past ocean dumping. Furthermore, at Mr. Curtis' request, we provided him the names of scientists we had contacted. The critique, however, cites only one example of our alleged misrepresentation of scientific opinion. In that case, we believe we accurately presented the views of that scientist's organization as they pertained to the focus of our report.

The critique does not address much of the evidence we used to derive our conclusions. In addressing the hazards of past ocean dumping, for example, the critique does not mention Government agencies' estimates that only small volumes of radioactive wastes have been dumped, nor does it mention that most of this radioactivity has decayed--up to 90 percent according to one scientist we contacted.

The critique also concludes that past dumpsites should be monitored as an aid in developing future ocean-dumping regulations. In reaching this conclusion, however, the critique does not recognize (1) that most of the radioactivity in what was dumped has decayed, (2) the absence of baseline data on radioactivity already present at dumpsites when dumping began, and (3) the lack of information on the specific types, quantities, and locations of radioactive materials that were dumped. These constraints must be carefully considered in deciding the merits of monitoring past dumpsites. Given the limited availability of Federal funds, we believe any scientific opportunity that might be gained from monitoring past dumpsites (increasing our knowledge of transport, toxicity, pathways, etc.) could be better obtained by monitoring future dumpsites when baseline data and accurate information on the contents and locations of the wastes can be determined.

Finally, one other matter raised in both your letter and the critique requires comment. This is the concern that our report is being used in support of a reversal of U.S. policy essentially prohibiting future ocean disposal of radioactive wastes. Our report, prepared in response to the request of Senator William V. Roth, Jr., presented the results of our evaluation of the environmental and public health consequences of past radioactive waste ocean dumping. While the report discussed Federal efforts to ensure that any future dumping is done safely and in an environmentally safe manner, it neither advocated nor opposed a resumption of ocean dumping of radioactive waste.

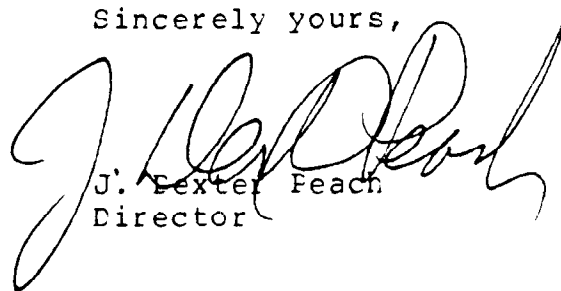
Our report did recommend, however, that as a prerequisite to developing future ocean dumping regulations, the Environmental Protection Agency should develop specific criteria for dumpsite monitoring and periodic monitoring requirements for all future dumpsites. In this context, we believe our report agrees with the thrust of one of the critique's major conclusions--that "test" sites, uncontaminated by past ocean dumping, should be monitored as one step in developing future ocean-dumping policies and regulations. Monitoring of "test sites" would help establish the baseline of data necessary to effectively monitor the effects of radioactive waste ocean dumping in the event that ocean dumping is permitted in the future.

- - - -

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time, we will send copies to Senator William V. Roth, Jr., and appropriate congressional committees. We will also send copies to the Federal agencies previously or currently having responsibilities related to radioactive waste ocean dumping, and will make copies available to others upon request.

We did not obtain official comments of any governmental agencies on this report because the report only presents our comments on the critique of our earlier report.

Sincerely yours,



J. Dexter Feach
Director

Enclosures - 2

EVALUATION OF A CRITIQUE OF
GENERAL ACCOUNTING OFFICE REPORT,
"HAZARDS OF PAST LOW-LEVEL RADIOACTIVE
WASTE OCEAN DUMPING HAVE BEEN OVEREMPHASIZED"

BACKGROUND

On January 8, 1981, Senator William V. Roth, Jr., requested that we address the following issues pertaining to past U.S. ocean dumping of low-level radioactive wastes:

- The adequacy of Federal efforts to identify the scope and locations of nuclear waste dumping by the U.S. Government and private industry.
- The effectiveness of Federal efforts to assure that the nuclear materials that have already been dumped into our oceans pose no undue hazard to the safety of our citizens or to the environment.
- The extent of Federal efforts to assure that any future dumping is done safely and in an environmentally harmless manner.

To address those issues, we reviewed major scientific studies, analyzed international documents and regulations pertaining to ocean dumping of radioactive wastes, and interviewed scientists representing Federal agencies, the Department of Energy's (DOE's) national laboratories, oceanographic institutions, the National Academy of Sciences, and environmental organizations. At the Federal level, we reviewed data collected by the Environmental Protection Agency (EPA) on past U.S. ocean-dumping activities and examined studies and records of other Federal agencies and contractors, going back as far as 1954, that had a role in past radioactive waste ocean dumping. These agencies include the National Oceanic and Atmospheric Administration, the Nuclear Regulatory Commission (NRC), the Department of State, the U.S. Coast Guard, and five Department of Defense agencies. We reviewed international documents and regulations because European nations have been dumping radioactive wastes into the sea for more than 30 years, and thus have far more experience with conducting and regulating the practice of ocean dumping than does the United States.

This work led to the issuance of our report entitled "Hazards of Past Low-Level Radioactive Waste Ocean Dumping Have Been Overemphasized" (EMD-82-9, Oct. 21, 1981). In that report, we concluded that:

- The Federal Government has no complete and accurate catalogue of information on how much, what kind, and where low-level nuclear waste has been dumped into the oceans because detailed recordkeeping was not required.
- The overwhelming body of scientific research and opinion shows that concerns over the potential public health and environmental consequences posed by past U.S. ocean-dumping activity are unwarranted and overemphasized.
- EPA has been slow in developing new low-level radioactive waste ocean-dumping regulations. Although its current approach of relying on international guidance is sound, improvements are needed in developing specific dumpsite-monitoring requirements.

At Senator Foth's request, we did not obtain official agency comments on our report. In compliance with the Legislative Reorganization Act of 1970, however, EPA informed the Senate Committee on Governmental Affairs and the House Committee on Government Operations on January 26, 1982, that it concurred with the findings of our report. EPA has terminated its search for Federal records on past U.S. ocean-dumping activities and is in the process of incorporating internationally established guidance into its criteria. EPA is also developing specific criteria for dumpsite monitoring and periodic monitoring requirements for potential future dumpsites.

On August 3, 1982, Mr. Clifton Curtis of the Center for Law and Social Policy issued a critique which strongly disagreed with the conclusions stated in our report. Overall, the critique concluded that

- monitoring past and future dumpsites is necessary to effectively assure public health and safety and to develop sound future ocean-dumping regulations,
- international guidance on ocean dumping is not an acceptable substitute for continued dumpsite monitoring, and
- our methodology was not sound because we relied on scant evidence and misrepresented scientific studies and opinion.

After carefully reviewing the evidence in the critique, we believe the findings, conclusions, and recommendations of our earlier report were valid, our representation of scientific studies and opinion was accurate, and the methodology we used was sound. Our response to the specific criticisms raised in the critique is discussed in the following sections.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our objective was to evaluate the critique and, in light of the critique, reevaluate the findings, conclusions, and recommendations of our earlier report. Accordingly, we examined the evidence provided in the critique--higher than normal levels of radioactivity in the rattail fish, and the possibility that high-level wastes have been dumped--to determine if the evidence warranted changing any of the conclusions and recommendations in our earlier report. In addition, we reexamined written correspondence, technical studies, congressional testimony, and related evidence compiled during our earlier evaluation. Finally, we tested the accuracy of our characterization of scientific opinion. We randomly recontacted at least one representative from those organizations we had originally contacted which had not provided us with written documentation of their views. The organizations and scientists we originally contacted are identified in enclosure II. In addition, we have identified in that enclosure the scientists we recontacted in preparing this report.

Our audit was performed in accordance with generally accepted government auditing standards.

IS IT NECESSARY TO MONITOR PAST
DUMPSITES TO ASSURE PUBLIC HEALTH
AND SAFETY?

We concluded in our report that concern over past ocean dumping of low-level radioactive waste was unwarranted and has been overemphasized primarily because the weight of evidence does not support the contention of a potential hazard. Because available evidence overwhelmingly shows that past dumpsites pose neither an environmental nor a public health hazard, we questioned the value of monitoring past ocean dumpsites as a means of assuring public health and safety.

In contrast, the critique concludes "there is not enough hard evidence to provide sufficient certainty that public health and environmental hazards will not result from past dumping practices." The critique notes that information on past ocean dumping is incomplete, some high-level material has been dumped, and a higher-than-normal level of radioactivity was detected in one fish species.

Incomplete information on past ocean
dumping of radioactive wastes

The critique is critical of our overall conclusion that concern over past ocean dumping is unwarranted and overemphasized because there is not enough hard evidence to sufficiently ascertain that public health and environmental hazards will not result. The critique also concludes that the incomplete and inaccurate

information on past radioactive waste ocean dumping requires more complete investigation to determine actual or potential hazards.

We recognize, as we did in our earlier report, that the data available on past ocean dumping are incomplete, particularly with regard to the identity and quantities of specific radioactive substances in the individual containers. Despite the sketchy data, there is enough general information to characterize the magnitude of past radioactive waste ocean dumping and draw conclusions on the potential hazards to public health. According to records EPA has compiled, about 90,000 containers of radioactive waste have been dumped into the Atlantic and Pacific Oceans. A much smaller number of containers--less than 1 percent of the total amount dumped--was apparently dumped into the Gulf of Mexico. Based on these records, it appears that more than 80 percent of the waste was dumped off the eastern seaboard, and roughly 95 percent of this amount was dumped at two sites southeast of Sandy Hook, New Jersey. EPA estimates that about 99 percent of the radioactivity in the wastes dumped off the western seaboard was dumped about 25 to 60 miles west of San Francisco, California, near the Farallon Islands.

We believe it is important to put the magnitude of past ocean dumping into perspective because scientists informed us that the potential hazards are largely determined by the types and amounts of wastes dumped, their concentrations, and the ways the radiation can be returned to man. As such, our assessment of the potential health hazards posed by past ocean dumping was based on the magnitude of past dumping in relation to international regulations, the natural radioactivity of seawater, and also on available scientific studies and opinion. Our assessment showed that:

--Scientists estimate that as much as 90 percent of original levels of radioactivity in the wastes has decayed to innocuous levels.

--The total estimated volume of all U.S. ocean dumping, which occurred between 1946 and 1970, is significantly less than what has been dumped in the international dumpsite in the Northeast Atlantic Ocean. For example, the total volume of radioactive wastes dumped by the United States, estimated to have contained about 95,000 curies of radioactivity, 1/ is far less than the 166,000 curies dumped in the Northeast Atlantic dumpsite in 1980 and 1981.

1/A curie is the basic unit to describe the intensity of radioactivity in a sample of material and/or a quantity of any nuclide having 1 curie of radioactivity.

--Scientists believe even if the wastes dumped consisted entirely of plutonium 239--probably the most hazardous, and very long-lived radioactive waste material--it would still constitute only a small hazard relative to natural radioactivity in seawater.

--In the early 1960s, DCE's Hanford reservation discharged more radioactive material into the Columbia River in a single month than the estimated total of all U.S. ocean dumping over a 25-year period without any adverse consequence along the Columbia or in the Pacific Ocean at the mouth of the river.

The possibility that high-level waste was dumped

The critique is critical of our report because, it says, we assumed that all the wastes dumped were low level and therefore low risk. In challenging our report, the critique equates high level with high activity and high risk using a quantitative definition that is different from the definition we used in our report. Citing a 1955 Atomic Energy Commission (AEC) report and records of congressional hearings, the critique stated, for example, that

"* * * materials are considered high level when the emitted radiation intensity is so strong as to materially reduce the time a person can be near the radiating body * * *." 1/

Much of the criticism of our report in this area is semantic. "High-level" radioactive waste does not necessarily equate to "high-risk," nor does "low-level" necessarily equate to "low-risk." The definition we used for low-level wastes was based on NRC criteria which define waste according to its source rather than the level of activity. While this definition is generally used by both NRC and the nuclear industry, we have pointed out inadequacies in radioactive waste definitions in the past. In a March 31, 1980, report entitled, "The Problems of Disposing of Nuclear Low-Level Waste: Where Do We Go From Here?" (EMD-80-68), we reported that an adequate definition of low-level waste for a sound low-level waste land disposal system does not exist. Accordingly, we recommended that the Chairman of NRC define low-level wastes by establishing categories based upon requirements for safe disposal.

Notwithstanding the definitional problems, we do not agree past ocean dumping presents a hazard to public health simply because some high-level wastes may have been dumped. A host of factors much more important than whether the wastes are called "high-" or "low-" level must be considered in determining a

1/A.E. Joseph, "Radioactive Waste Disposal Practices in the Atomic Energy Industry--A Survey of the Costs" (1955).

potential hazard. These factors include not only what was dumped but also how much was dumped, and the ways the radiation can be returned to man. Based on the evidence presented earlier on the magnitude of U.S. ocean dumping, even if some wastes of high radioactivity levels have been dumped, the overwhelming consensus of scientific opinion is that it was not in sufficient quantities to pose a hazard to public health and safety.

Nevertheless, we cannot state conclusively that no high-level wastes (using the standard NRC definition) have been dumped into the ocean. However, on October 7, 1980, NRC testified before the Subcommittee on Environment, Energy and Natural Resources, House Committee on Government Operations, that it does not believe high-level radioactive wastes, as NRC defines such wastes, have been dumped in the ocean.

Higher-than-normal levels of
radioactivity in the rattail fish

The critique is critical of our report because it failed to acknowledge an EPA survey that found higher-than-normal levels of radioactivity (americium-241) in rattail fish samples taken at one of the Atlantic Ocean dumpsites. We were aware of this study but did not discuss it because EPA considers the results of the sample to be inconclusive due to conflicting and contradictory evidence. Specifically:

- State-of-the-art measuring techniques for this radionuclide were not used to verify the measurements that were taken.
- The levels detected were much higher than ever measured before in marine samples collected in the Atlantic Ocean. This includes samples taken at a nuclear-processing plant at Windscale, England, where far greater amounts of radioactive material have been dumped into the sea.
- The fish sample measurements were inconsistent with the americium levels measured by the same EPA contractor near the waste containers at the dumpsite.
- Because americium-241 is a decay-product of a plutonium isotope, it would be expected that greater quantities of plutonium would also be measured. However, no abnormal levels of plutonium were detected.

EPA cannot resolve the anomaly presented by the rattail fish until additional sampling is conducted. At this time, EPA believes that (1) an error occurred in the measurement, (2) the data were not properly interpreted, or (3) the americium resulted from fallout caused by nuclear weapons testing.

SHOULD PAST DUMPSITES BE MONITORED
TO DEVELOP FUTURE REGULATIONS?

The critique disagrees with our conclusion that monitoring past dumpsites to develop future ocean dumping regulations is of minimal value. The critique concludes that monitoring of past dumpsites is both necessary and useful to provide data on radioactive material toxicity, transport, critical pathways, fates, and effects that will contribute to responsible policies and regulatory requirements. The critique also cited statements by an EPA official ^{1/} that technology exists or can be improved to properly evaluate past dumpsites, and the monitoring of past dumpsites can provide key study areas for determining container packaging performance and radionuclide transport processes.

We do not believe it is practical to monitor past dumpsites to develop future ocean-dumping regulations. The usefulness of monitoring past dumpsites is severely limited by the lack of

- baseline data on the amounts of natural and fallout-related radioactivity existing at the sites prior to disposal and
- information on the specific contents and locations of the waste that was dumped.

Without knowing what types of radioactive wastes were dumped, where they were dumped, and how much nuclear weapons testing-related fallout radioactivity there was at a site to begin with, it will be extremely difficult for EPA or anyone else to derive conclusive results from any monitoring efforts. For example, at October 7, 1980, hearings before the Subcommittee on Environment, Energy and Natural Resources, House Committee on Government Operations, EPA testified that:

"There are deficiencies in the data and there is no universally accepted method of data interpretation. To determine background levels, it is necessary to review the existing literature for credible measurements or previous estimates of radionuclide levels in various locations, and to calculate, from the most closely related data, what the expected levels of "background" radiation should be at particular locations today. In the case of biological samples this is especially difficult. There can be so much variation in the bioaccumulation of different radionuclides from species to species, that extrapolation of the data is highly uncertain."

Despite undersea apparatus that can be used to retrieve the waste containers and collect sediment samples, monitoring of past dumpsites may not be as practical as the critique implies.

^{1/}Robert S. Dyer, "Nuclear Waste Management: The Ocean Alternative," Washington, D.C., February 1980.

According to EPA's Project Leader, Ocean Disposal Program, finding the waste containers is itself a formidable task due to the size of the oceans, sketchy knowledge of precise dumping locations, and unpredictable movement of the containers caused by undersea turbidity. This EPA official also told us large volumes of sediment samples must be collected to measure minute levels of radioactivity. He said this is difficult because good weather conditions are required and essential specialized deep sea equipment is limited in availability. Finally, we were told that the collection of large volumes of sediment is hampered by the limited capability of the specialized equipment in collecting large volumes of sediment and decay of the radioactive materials that were dumped.

The difficulty in accomplishing these tasks is reflected in the cost of monitoring. EPA's recovery of only three waste containers and related analysis cost \$360,000, or \$120,000 per container. Given the limited availability of Federal funds, we believe any scientific opportunity that might be gained from monitoring old dumpsites (increasing our knowledge of transport, toxicity, pathways, etc.) could be better obtained by monitoring future dumpsites, if approved, when baseline data and accurate information on the contents and locations of the wastes can be determined.

CAN WE RELY ON INTERNATIONAL
GUIDANCE TO REGULATE FUTURE OCEAN
DUMPING?

The critique also misinterpreted our position on using international guidance to regulate future ocean dumping. It stated that international guidance is not a substitute for monitoring because the ocean is not a homogenous environment, and international guidelines cannot take into account site- and basin-specific peculiarities of the ocean. The critique also cited benefits that can be realized from monitoring future and past dumpsites that international guidance cannot provide. These benefits include developing a complete inventory of all radionuclides deposited in the ocean by human activity and improving the technical adequacy of models to allow radiation exposure to be calculated with greater reliability and accuracy. Finally, the critique stated that our criticism of EPA for not incorporating international guidance in its regulations "rings hollow" because U.S. policy since 1970 has been not to use the oceans for radioactive waste disposal.

The critique misinterpreted the point of our recommendation which called for EPA to take advantage of existing international guidance and build upon this guidance as appropriate. We specifically recommended that EPA, "in addition to embracing the internationally established guidance, develop specific criteria for dumpsite and periodic monitoring requirements." We favored monitoring future sites to assure public safety and heightened national concern over the ocean disposal alternative.

Finally, we do not believe our criticism of EPA for being reluctant to incorporate international guidance into its regulations "rings hollow." U.S. policy since the 1970s of not using the ocean for radioactive waste disposal does not, in our opinion, make international guidance a moot issue. Ocean dumping could be resumed in the future. Although it is still very tentative, the Navy is considering ocean disposal for decommissioned nuclear submarines and DCE is advancing a proposal to dispose of thousands of cubic yards of contaminated soils and other materials from nuclear energy programs. Such renewed interest in using the ocean as the medium for disposing of radioactive wastes makes it imperative that EPA be ready to assure that any future dumping is done safely and in an environmentally acceptable manner.

WAS OUR METHODOLOGY ADEQUATE?

The critique challenged the methodology we used to derive our conclusions and recommendations. In its view, our report was based on scant evidence, misinterpretation of the studies referenced in our report, and misrepresentation of the views of organizations and individuals we had contacted.

We do not believe the criticism of our methodology is valid. Our report focused on the potential health consequences presented by past ocean-dumping activities. Our conclusion that past ocean dumping does not pose a health or environmental hazard was based on much more than "scant evidence." It was based on (1) EPA's estimates on the amount and location of past U.S. dumping; (2) scientific studies sponsored by EPA, the National Academy of Sciences, AEC, the National Oceanic and Atmospheric Administration, and other environmental and oceanographic groups; and (3) the opinions of 37 scientists representing Federal agencies, environmental organizations, DCE national laboratories, and oceanographic institutions. (See enclosure II.) As such, our conclusions were based on a wide variety of information, scientific studies, and expert opinion.

Furthermore, we do not believe we misrepresented or misinterpreted the views of the scientists we contacted or the studies we relied on. Primary support in the critique for its criticism of our methodology came from the Executive Vice-President of the Oceanic Society. In our report, we stated that an October 1980 report of the Society's Ad Hoc Scientific Advisory Committee on Ocean Dumping of Radioactive Wastes concluded that there is no evidence of a serious present or future threat to aquatic or human health at past ocean dumpsites. As the critique states, however, the Executive Vice-President of the Society subsequently advised us that we had misrepresented the Ad Hoc Committee. The Executive Vice-President told us the Committee's report went on to state:

"* * * present evidence indicates a relatively small increase in radiation exposure from eating fish at the highest level of radiation detected * * * and we recommended"

"that an expanded monitoring program be developed for boney fish, shell fish and other marine food items * * * and that the monitoring program extend along the entire affected coasts."

As we replied to the Oceanic Society official, we did not see the recommendation for an expanded monitoring program as directly relevant to answering the question of whether any current or future health hazards exist. Within this same context, studies by the National Academy of Sciences and the National Oceanic and Atmospheric Administration have advocated monitoring even though these studies show no adverse effects from past U.S. ocean dumping of radioactive wastes. As specifically stated in the Oceanic Society report and these other two reports, there is no evidence to indicate a hazard from past U.S. ocean dumping. This position was reflected in our report.

The critique also points out that our report does not identify the scientists we relied on. At his request, on June 10, 1982, we provided the author of the critique with the names of these scientists. These names are included as enclosure II. With the exception of the above example, however, the critique, dated August 3, 1982, presents no specifics on how our report misrepresented the views of any other scientists we contacted.

Nevertheless, we recontacted scientists from the organizations we had relied on for our conclusions. All of the scientists from the organizations we recontacted were of the opinion there is no evidence to support the contention past ocean dumping presents a potential hazard. Representatives from several environmental and oceanographic research organizations, however, still favor monitoring past dumpsites to be absolutely sure no hazard exists and to aid developing future ocean-dumping regulations. For example, the Union of Concerned Scientists informed us in a July 12, 1982, letter that "past ocean dumping by the U.S. does not appear to have created a major threat to public health and safety." That organization further believes that past U.S. ocean dumping is less of a threat than land dumping of chemical wastes and that the relative hazard of past ocean dumping should be reflected in EPA's monitoring priorities. Nevertheless, the Union believes monitoring past dumpsites should be conducted if future dumping is contemplated.

CONCLUSION

After carefully evaluating the critique, reexamining our documentary evidence, and recontacting many of the scientists and organizations on whom we relied in preparing our report, we see no need to revise our report's conclusions. The report was accurate and after careful reexamination, we feel it is valid. The relatively small volume of wastes dumped, the decay of most of the wastes to innocuous levels, the lack of data on baseline radioactivity at the dumpsites, and the lack of specific information on what has been dumped are all crucial issues that must

be considered in deciding whether past dumpsites should be monitored. The critique's position that the lack of definitive information on past dumping activities indicates that a need to continue monitoring past dumpsites would be costly to implement. Furthermore, unless the limitations we identified can somehow be overcome, the scientific benefit of any further monitoring of past dumpsites, compared to the cost of such monitoring, would be limited at best.

We also continue to support our previous conclusion that past ocean dumpsites should not be monitored to develop future ocean-dumping regulations. The limitations in available information and the decay of what was dumped make it difficult for EPA to monitor past dumpsites for this purpose. In view of these limitations, we continue to believe it is more appropriate for EPA to concentrate its efforts on developing baseline data on proposed future dumpsites and then monitor these sites once they are in use. In that sense we agree that future dumpsites should be monitored. However, any Federal efforts to monitor past ocean dumpsites for developing future ocean-dumping regulations should be undertaken only after full consideration of the constraints that are discussed in this report.

INDIVIDUALS CONSULTED DURING
GAC EVALUATION OF PAST OCEAN
DUMPING OF LOW-LEVEL NUCLEAR WASTE

DEPARTMENT OF ENERGY

Helen McCarron
 Robert L. Waters
 Charles L. Osterberg 1/
 Glen L. Sjoblom 4/
 Herbert L. Volchock 1/

DCE NATIONAL LABORATORIES

Victor E. Noshkin 1/
 Jerry J. Cohen 1/ 2/
 William L. Templeton 1/
 D. Richard Anderson 1/
 Norman Cutshall 1/

ENVIRONMENTAL PROTECTION AGENCY

Roger J. Mattson 3/
 Robert S. Dyer 1/
 Raymond Johnson 1/

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Donald Matineau
 Robert Landis
 R. Lawrence Swanson 1/
 P. Kilho Park 1/
 Thomas C'Connor
 Thomas Fyle
 Wesley Hall
 Millington Lockwood
 T. F. Fice
 D. W. Engel
 F. A. Cross
 P. J. Hansen

1/Recontacted to affirm the accuracy of our report.

2/Currently with Science Applications, Inc.

3/Currently with NRC.

4/Currently with EPA.

WOODS HOLE OCEANOGRAPHIC INSTITUTION

Charles D. Hollister 1/
Vaughan T. Bowen

SCRIPPS INSTITUTION OF OCEANOGRAPHY

Edward D. Goldberg 1/

OCEANIC SOCIETY

Michael J. Herz 1/
Jerold M. Lowenstein
James Kelley

NATIONAL RESOURCES DEFENSE COUNCIL

Thomas Cochran 1/

UNION OF CONCERNED SCIENTISTS

Gordon R. Thompson 1/

UNIVERSITY OF CALIFORNIA (DAVIS)

Marvin Goldman 1/

UNIVERSITY OF CALIFORNIA (SANTA CRUZ)

W. Jackson Davis

MITRE CORPORATION

Amelia Hagen

F.R. JOHNSON ASSOCIATES, INC.

William L. Lennemann 1/

1/Recontacted to reaffirm the accuracy of our report.