DECOMMISSIONING AND DECONTAMINATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-FIFTH CONGRESS

FIRST SESSION

JUNE 15, 16, 1977

[No. 20]

Printed for the use of the
Committee on Science and Technology

U.S. GOVERNMENT PRINTING OFFICE
97-393 WASHINGTON : 1977

COMMITTEE ON SCIENCE AND TECHNOLOGY

OLIN E. TEAGUE, Texas, *Chairman*

DON FUQUA, Florida
WALTER FLOWERS, Alabama
ROBERT A. ROE, New Jersey
MIKE McCORMACK, Washington
GEORGE E. BROWN, JR., California
DALE MILFORD, Texas
RAY THORNTON, Arkansas
JAMES H. SCHEUER, New York
RICHARD L. OTTINGER, New York
TOM HARKIN, Iowa
JIM LLOYD, California
JEROME A. AMBRO, New York
ROBERT (BOB) KRUEGER, Texas
MARILYN LLOYD, Tennessee
JAMES J. BLANCHARD, Michigan
TIMOTHY E. WIRTH, Colorado
STEPHEN L. NEAL, North Carolina
THOMAS J. DOWNEY, New York
DOUG WALGREN, Pennsylvania
RONNIE G. FLIPPO, Alabama
DAN GLICKMAN, Kansas
BOB GAMMAGE, Texas
ANTHONY C. BEILENSON, California
ALBERT GORE, JR., Tennessee
WES WATKINS, Oklahoma
ROBERT A. YOUNG, Missouri

JOHN W. WYDLER, New York
LARRY WINN, JR., Kansas
LOUIS FREY, JR., Florida
BARRY M. GOLDWATER, JR., California
GARY A. MYERS, Pennsylvania
HAMILTON FISH, JR., New York
MANUEL LUJAN, JR., New Mexico.
CARL D. PURSELL, Michigan
HAROLD C. HOLLENBECK, New Jersey
ELDON RUDD, Arizona
ROBERT K. DORNAN, California
ROBERT S. WALKER, Pennsylvania
EDWIN B. FORSYTHE, New Jersey

CHARLES A. MOSHER, *Executive Director*
HAROLD A. GOULD, *Deputy Director*
PHILIP B. YEAGER, *Counsel*
JAMES E. WILSON, *Technical Consultant*
WILLIAM G. WELLS, JR., *Technical Consultant*
RALPH N. READ, *Technical Consultant*
ROBERT C. KETCHAM, *Counsel*
JOHN P. ANDELIN, JR., *Science Consultant*
JAMES W. SPENSLEY, *Counsel*
REGINA A. DAVIS, *Chief Clerk*
PAUL A. VANDER MYDE, *Minority Staff Director*

SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE

GEORGE E. BROWN, JR., California, *Chairman*

TIMOTHY E. WIRTH, Colorado
JEROME A. AMBRO, New York
DOUG WALGREN, Pennsylvania
JAMES H. SCHEUER, New York
ANTHONY C. BEILENSON, California
WES WATKINS, Oklahoma

ROBERT S. WALKER, Pennsylvania
MANUEL LUJAN, JR., New Mexico.
LARRY WINN, JR., Kansas

JAMES W. SPENSLEY, *Counsel*
DR. WILLIAM COLGLAZIER, *Science Fellow*
ALEXIS J. HOSKINS, *Research Assistant*

CONTENTS

DECOMMISSIONING AND DECONTAMINATION

The Nuclear Fuel Services Reprocessing Plant in West Valley, N.Y.

WEDNESDAY, JUNE 15, 1977

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON ENVIRONMENT AND THE ATMOSPHERE,
Washington, D.C.

The above-entitled hearing convened, pursuant to notice, at 10 a.m., in room 2325, Rayburn House Office Building, Hon. George E. Brown, Jr. (chairman of the subcommittee), presiding.

Present: Representatives Walker, Wirth, Walgren, Ambro, and Fish.

Mr. BROWN. This morning, we begin 2 days of hearings on the issues and problems associated with the decommissioning and decontamination of nuclear facilities and disposing of nuclear wastes.

These issues were brought to our attention during the authorization of ERDA's environment and safety program earlier this year. As you may be aware, the House approved the appropriation of an additional $2 million for ERDA's decommissioning and decontamination program, half of which is to be used for a general study of the consequences of decommissioning, disposal, and decontamination of elements in the nuclear fuel cycle. The remaining $1 million is to fund a study of the options for waste disposal at the Nuclear Fuel Services commercial reprocessing plant at West Valley, N.Y.

Our purpose today is to focus on the West Valley plant, which operated from 1966 until 1972. The 600,000 gallons of liquid high-level radioactive waste, which will transfer to New York State, are stored in carbon steel tanks that will eventually corrode.

The waste disposal problems at West Valley closely resemble those of the nuclear weapons program. In fact, 60 percent of the spent fuel originally came from military reactors because, at the time, the Atomic Energy Commission sought to encourage a commercial reprocessing industry by guaranteeing a market. A fund of $4 million was originally thought adequate to handle decommissioning costs, but current estimates for properly disposing of the wastes go as high as $600 million. That is just for waste disposal at the West Valley plant.

Two basic issues before us, then, are "how to manage and dispose of the wastes technically and institutionally" and "who will pay the cost".

Tomorrow, we will concentrate on generic environmental, health, safety, and economic issues associated with decommissioning other nuclear facilities, such as reactors. The hearing will examine not only the various alternatives and costs, but also the institutional mechanisms for handling, regulating, and financing the operation.

Congressman Lundine, who represents the district which includes West Valley, was unable to testify this morning, and will appear tomorrow to relate to us the concerns of his constituents on the future disposition of this facility.

This morning, we will proceed first with a panel of witnesses, and I will invite the panel to come forward. They include Dr. Richard Werthamer, chairman of the New York State Energy Research and Development Authority; Mr. Monte Canfield, Jr., Director of the Energy and Minerals Division, the General Accounting Office; and Mr Richard Lester, from the Division of International Relations, of the Rockefeller Foundation.

I would like to have you all come up and present your statements, and then we will have questions of the group en bloc after you finish.

I recognize that to most of you this is old hat, and I want to avoid rehashing anything that has been gone over too many times, and try to get to the thrust of the policy problems that face us.

I note that each of you gentlemen has a prepared statement. You may read them, summarize them; or handle them in any other way. The full text, without objection, of each of your statements will be included in the record.

Would you like to start?

STATEMENT OF N. RICHARD WERTHAMER, CHAIRMAN, NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

Mr. WERTHAMER. Thank you, Mr. Chairman and members of the committee. I am very pleased to have been invited to testify before you.

With your permission, Mr. Chairman, I would like to read my statement.

I am accompanied this morning by Ms. Barbara Kaplan, general counsel of the New York State Energy Research and Development Authority, and Prof. Alfred Schneider, senior technical consultant to the authority on the West Valley matter.

In the fall of 1976, Nuclear Fuel Services, Inc.—NFS—informed both the New York State Energy Research and Development Authority—NYSERDA—and the U.S. Nuclear Regulatory Commission—NRC—that it had withdrawn its plans to expand and reopen the only nuclear fuel reprocessing plant ever to be commercially operated in the United States. In response to that notice, and to NFS notice that it intended to transfer responsibility for the wastes at the West Valley site to NYSERDA, I wrote to Dr. Seamans, then Administrator of the U.S. Energy Research and Development Administration—USERDA—stating:

> The only course of action satisfactory to the national interest and the welfare of the State's citizens, consistent with current and projected Federal policies, and based on past events and involvements at West Valley, is a course in which ownership of the site and responsibility for its contents are transferred from NYSERDA to the Federal Government.

West Valley is an artifact of a premature Federal commercialization program. Present and future commercial nuclear facilities, whether reactors or associated fuel cycle plants, should have provisions in their licenses that clearly specify the allocation of responsibility and cost for decommissioning of the facility and decontamination of the site.

Rules and procedures for decommissioning and decontamination of future facilities are still at a preliminary, formative phase. But West Valley is an immediate problem, and one for which no provisions were made or required by the AEC in the early 1960's when the agreements were made. Moreover, it is the only facility of its kind not in Federal hands. At this time, only the Federal Government has the perspective, experience, authority, and resources to effect a timely disposition of the West Valley site.

In view of the intensive Federal attention now being paid to the development of a thorough Federal program to manage and dispose safely of all the Nation's radioactive wastes, it would be inappropriate for NYSERDA to retain its present ownership of the West Valley site, or to take upon itself the responsibility for managing the facilities and wastes on that site, and for effecting its ultimate decontamination. Indeed, under current Federal policies and regulations, State custodial care of high-level radioactive wastes is prohibited.

Between 1966, when the operating license was issued, and 1972, when NFS closed the plant for modification and expansion, about 625 metric tons of spent nuclear fuel were reprocessed. Nearly two-thirds of this came from the AEC's Hanford plutonium reactor. The 600,000 gallons of high-level liquid radioactive waste generated by this activity remain, stored in steel tanks at the West Valley site in accordance with procedures approved and licensed-by the U.S. Atomic Energy Commission—AEC.

But, in the years since NFS was licensed, Federal perceptions concerning waste management have dramatically altered. Long-term onsite storage of high-level liquid wastes in tanks, an important subject of negotiations between AEC, NYSERDA's predecessors, and NFS, is no longer acceptable procedure.

Federal policy now calls for solidification of high-level wastes and their containment in a Federal repository. But Federal rules and procedures for disposition of the wastes and for decommissioning and decontamination of the site have yet to be developed.

Were NYSERDA to become the owner and custodian of the high-level wastes at West Valley, it would be the only facility with high-level wastes not under direct Federal ownership and responsibility. West Valley would remain a clear and glaring exception to the emerging and comprehensive program for Federal management of high-level and other radioactive wastes.

THE WEST VALLEY SITE

The present dilemma is a result of New York State, through NYSERDA's predecessor agencies, becoming a party to a premature attempt by the AEC to commercialize reprocessing of spent nuclear fuels, and the perpetual care of the resulting high-level radioactive wastes.

The reprocessing and waste facilities are located on a 3,345-acre site in Cattaraugus County, N.Y., near West Valley, about 30 miles south of Buffalo. The site is owned by NYSERDA and leased to NFS. Located on the site, at present are the following:

A spent nuclear fuel reprocessing plant, shut down since 1972;

A pool facility for receiving and storing spent nuclear fuel;

Two 750,000-gallon carbon steel tanks, one of which contains about 600,000 gallons of high-level liquid wastes and sludges from reprocessing operations. These wastes are neutralized and have a high level of radioactivity. The second tank is a spare;

Two 15,000-gallon actively cooled stainless steel tanks, one of which contains about 12,000 gallons of acid high-level liquid wastes, without sludges, from the trial reprocessing of thorium-based fuel. The second tank is a spare;

A burial ground for intermediate radioactive wastes from reprocessing operations, such as spent fuel cladding hulls;

A burial ground for low-level miscellaneous solid wastes, containing approximately 2 million cubic feet of such wastes; and

An empty building once used for plutonium storage.

The history of the facility at West Valley properly begins with the Atomic Energy Act of 1954, whose intention was commercialization of atomic energy.

In my review here, I will very briefly summarize the history. A complete statement is contained in a report which the Authority prepared several months ago, and which I offer at this point for introduction into the record.

Mr. BROWN. Without objection, it will be made a part of the record.

Mr. WERTHAMER. At first, the emphasis was on nuclear power reactors, but the AEC also wished to extend commercialization into other areas of the fuel cycle. In 1946, the Chairman of the AEC announced a program to encourage private industry to enter into chemical reprocessing of spent fuel elements and long-term disposition of radioactive wastes.

Although private industry did not respond to the AEC's initial inducements, the AEC continued to reaffirm its desire to transfer both reprocessing and waste management services to private industry.

As early as 1956, the State of New York, in response to the new AEC policies, created a Council on the Development of Atomic Energy. In 1959, the State established an Office of Atomic Development (OAD) to coordinate atomic functions within the State.

The OAD identified atomic development as a key issue in industrial growth for the Northeast, and following a statewide search, acquired the present West Valley site in 1961.

Davison Chemical Co., a division of W.R. Grace & Co. and predecessor to NFS, expressed its interest in becoming a tenant on that site, for the purpose of constructing and operating a chemical reprocessing plant.

With the encouragement of the AEC, a series of negotiations took place between NFS, the AEC, and OAD, predecessor to the New York Atomic Research and Development Authority (NYARDA), which was established in 1962.

In 1963, NFS was issued a construction permit, and in 1966, with the issuance of its operating license, became the first (and only) com-

mercial reprocessor of spent nuclear fuels in the United States. However, over the next 6 years, little commercial power reactor fuel was reprocessed at NFS. Under an AEC baseload agreement, which underwrote the venture, almost two-thirds of the fuel was supplied by the AEC from the plutonium production reactor at Hanford, Wash.

During this time, the prospective construction of larger and more efficient reprocessing plants threatened NFS's market position. Accordingly, NFS shut down its plant in early 1972 for expansion and modification.

In May of 1972, NFS was advised by the AEC that plant expansion could not be completed without a new AEC construction permit. Over the next several years, while the review procedure was underway, numerous new requirements for the reprocessing plant and the waste storage facilities were developed.

Furthermore, back in 1969, the AEC published in the Federal Register a proposed statement of policy, to become appendix F to title 10, part 50 of the Code of Federal Regulations. In the amended Federal Register notice of November 14, 1970, the AEC stated:

> The Commission does not now regard storage of liquid high-level wastes in tanks as constituting an acceptable method of long-term storage. Over periods of centuries one cannot assure the continuity of surveillance and care which tank storage requires.

To accommodate the situation at West Valley, the following language was added to 10 CFR 50, appendix F, in 1971:

> With respect to fuel reprocessing plants already licensed, the licenses will be appropriately conditioned to carry out the purposes of the policy stated above with respect to high-level radioactive fission products generated after installation of new equipment for interim storage of liquid wastes, or after installation of equipment for solidfication without interim liquid storage.

Installation of solidfication equipment was required as soon as practicable. The amended paragraph now concluded:

> The application of the policy stated in this appendix to existing wastes and to wastes generated prior to the installation of such equipment will be the subject of a further rulemaking proceeding.

This rulemaking proceeding has not as yet been scheduled.

Following the adoption of the Energy Reorganization Act of 1974, the responsibility for reviewing and evaluating NFS plans, issuing the amended operating license, and instituting the rulemaking proceeding on the wastes was transferred to the newly constituted Nuclear Regulatory Commission (NRC).

In April of 1976, NFS gave notice to the newly constituted New York State Energy Research and Development Authority (NYSERDA) that it was exercising its right, under the applicable agreements, to surrender to NYSERDA responsibility for all the wastes on the West Valley site.

NYSERDA replied to the notice on May 4, 1976, stating that the contractual conditions for surrender called for (1) a determination that the wastes were in good condition (as defined in the Waste Storage Agreement) and (2) a license-amendment reflecting the transfer.

While the surrender date initially proposed was October 29, 1976, it was recognized that a transfer could not be effected by that time, and the surrender date remains open.

In the fall of 1976, NFS further informed the NRC that it had terminated its plans to expand and reopen the plant and was withdrawing from the reprocessing business.

CONCLUSION

The West Valley site and facilities are still governed by a set of agreements and an operating license drawn with the perceptions of the late 1950's and early 1960's. With AEC support and approval, a fund was established for the perpetual care of the liquid high-level wastes by periodic transfer to new storage tanks. This fund is now judged to be woefully inadequate.

In issuing the NFS license, the AEC mentioned no provisions for further solidification of the wastes, for their removal from the site, for the decommissioning of either reprocessing or waste facilities, or for the ultimate decontamination of the facilities or the site.

The Federal Government encouraged the construction and operation of the plan; it supplied three-quarters of the fuel under the base-load agreement in order to demonstrate reprocessing and waste management under private ownership. When NYSERDA's predecessors and NFS entered into long-term contractual relationships with each other and with the AEC, they did so in reliance on information and technology provided by the AEC, with the imprimatur of an AEC license, and with such provisions as the AEC judged necessary.

Barely 3 years after the plant opened it became clear that the bases upon which the license was issued were not as sound as the parties had earlier believed: Despite AEC approval, the perpetual care fund appears to be insufficient, even for liquid storage; the AEC estimates that a 1 metric ton per day reprocessing plant would be fully competitive for the foreseeable future were incorrect; and subsequent events made AEC estimates of the availability of commercial reprocessing contracts too optimistic.

If West Valley were being created today, the Federal Government would not permit the arrangements it insisted on in 1963.

Mr. BROWN. May I interrupt you just for one moment. There is a roll call on for a vote on the rule on the HUD-related agencies' appropriation bill.

I do not intend to make the vote, but any of the other members who wish to should probably leave, and I hope they will return as soon as possible.

You may continue, Mr. Werthamer.

Mr. WERTHAMER. Thank you.

The Federal Government is spending substantial time, energy, and funds to create a Federal waste management and disposal program. The goal is a consistent policy based on the best technology available, and on thorough agency, congressional, and public review. The result of these Federal efforts will profoundly affect the future development of nuclear power in the United States.

A comprehensive program demands the inclusion of West Valley among the Federal sites. As with the sites at Hanford and Savannah River, the ultimate disposition of the wastes and facilities at the West Valley site is currently unknown and is likely to remain so for some time. So long as West Valley remains the orphan of a disavowed

Federal program, the stated goal of bringing hazardous nuclear wastes into Federal custody and care will be open to serious doubt.

It would be inappropriate to place upon NYSERDA or any State agency the responsibility for accomplishing the difficult, challenging, and critical procedures of developing the requisite technology.

West Valley has to be a unique, early demonstration, as part of the AEC's program to develop a commercial reprocessing industry in the United States. When the parties entered into their original agreements they relied on the AEC for advice, and for recommendations as to the necessary provisions for financial and institutional responsibility.

The Federal Government, in those early days of optimism, failed to assume its proper role as the responsible agent for the management of nuclear wastes. Since that time, it has acknowledged that failure, and has extensively revised the regulations and criteria for waste management and disposal.

The Federal Government also failed, in those early days, to allocate responsibilities and specify procedures for the decommissioning and decontamination of those demonstration facilities whose construction it so strongly urged.

In pressing for Federal ownership of West Valley, NYSERDA is only asking that the Federal Government now recognize its obligation to correct the effects of its own failures 20 years ago.

Thank you, Mr. Chairman.

Mr. BROWN. Thank you very much.

We will now have Mr. Monte Canfield present his statement, based upon studies which have been made by the General Accounting Office, and we will see what solutions you have.

[The prepared statement of N. Richard Werthamer follows:]

PREPARED STATEMENT OF N. RICHARD WERTHAMER

Mr. Chairman, members of the Committee, I am very pleased to have been invited to testify before you.

In the fall of 1976, Nuclear Fuel Services, Inc. (NFS) informed both the New York State Energy Research and Development Authority (NYSERDA) and the U.S. Nuclear Regulatory Commission (NRC) that it had withdrawn its plans to expand and reopen the only nuclear fuel reprocessing plant ever to be commercially operated in the United States. In response to that notice, and to NFS's notice that it intended to transfer responsibility for the wastes at the West Valley site to NYSERDA, I wrote to Dr. Seamans, then Administrator of the U.S. Energy Research and Development Administration, (USERDA), stating:

"The only course of action satisfactory to the national interest and the welfare of the State's citizens, consistent with current and projected Federal policies, and based on past events and involvements at West Valley, is a course in which ownership of the site and responsibility for its contents are transferred from NYSERDA to the Federal Government."

West Valley is an artifact of a premature Federal commercialization program. Present and future commercial nuclear facilities, whether reactors or associated fuel cycle plants, should have provisions in their licenses that clearly specify the allocation of responsibility and cost for decommissioning of the facility and decontamination of the site. Rules and procedures for decommissioning and decontamination of future facilities are still at a preliminary, formative phase. But West Valley is an immediate problem, and one for which no provisions were made or required by the AEC in the early 1960s when the agreements were made. Moreover, it is the only facility of its kind not in Federal hands. At this time, only the Federal government has the perspective, experience, authority and resources to effect a timely disposition of the West Valley site.

In view of the intensive Federal attention now being paid to the development of a thorough Federal program to manage and dispose safely of all of the

nation's radioactive wastes, it would be inappropriate for NYSERDA to retain its present ownership of the West Valley site, or to take upon itself the responsibility for managing the facilities and wastes on that site, and for effecting its ultimate decontamination. Indeed, under current Federal policies and regulations, State custodial care of high-level radioactive wastes is prohibited.

Between 1966, when the operating license was issued, and 1972, when NFS closed the plant for modification and expansion, about 625 metric tonnes of spent nuclear fuel were reprocessed. Nearly two-thirds of this came from the AEC's Hanford plutonium production reactor. The 600,000 gallons of high-level liquid radioactive waste generated by this activity remain, stored in steel tanks at the West Valley site in accordance with procedures approved and licensed by the U.S. Atomic Energy Commission (AEC).

But, in the years since NFS was licensed, Federal perceptions concerning waste management have dramatically altered. Long-term on-site storage of high-level liquid wastes in tanks, an important subject of negotiations between AEC, NYSERDA's predecessors, and NFS, is no longer acceptable procedure. Federal policy now calls for solidification of high-level wastes and their containment in a Federal repository. But Federal rules and procedures for disposition of the wastes and for decommission and decontamination of the site have yet to be developed.

Were NYSERDA to become the owner and custodian of the high-level wastes at West Valley, it would be the only facility with high-level wastes not under direct Federal ownership and responsibility. West Valley would remain a clear and glaring exception to the emerging and comprehensive program for Federal management of high-level and other radioactive wastes.

THE WEST VALLEY SITE

The present dilemma is a result of New York State, through NYSERDA's predecessor agencies, becoming a party to a premature attempt by the AEC to commercialize reprocessing of spent nuclear fuels, and the perpetual care of the resulting high-level radioactive wastes.

The reprocessing and waste facilities are located on a 3,345-acre site in Cattaraugus County, N.Y. near West Valley, about 30 miles south of Buffalo. The site is owned by NYSERDA and leased to NFS. Located on the site, at present, are the following:

A spent nuclear fuel reprocessing plant, shut down since 1972;

A pool facility for receiving and storing spent nuclear fuel;

Two 750,000-gallon carbon steel tanks, one of which contains about 600,000 gallons of high-level liquid wastes and sludges from reprocessing operations. These wastes are neutralized and have a high level of radioactivity. The second tank is a spare.

Two 15,000-gallon actively-cooled stainless steel tanks, one of which contains about 12,000 gallons of acid high-level liquid wastes, without sludges, from the trial reprocessing of thorium-based fuel. The second tank is a spare.

A burial ground for intermediate radioactive wastes from reprocessing operations, such as spent fuel cladding hulls;

A burial ground for low-level miscellaneous solid wastes, containing approximately 2,000,000 cubic feet of such wastes; and

An empty building once used for plutonium storage.

The history of the facility at West Valley properly begins with the Atomic Energy Act of 1954, whose intention was commercialization of atomic energy. At first, the emphasis was on nuclear power reactors, but the AEC also wished to extend commercialization into other areas of the fuel cycle. In 1956, the Chairman of the AEC announced a program to encourage private industry to enter into chemical reprocessing of spent fuel elements.

Although private industry did not respond to the AEC's initial inducements, the AEC continued to reaffirm its desire to transfer both reprocessing and waste management services to private industry.

As early as 1956, the State of New York, in response to the new AEC policies, created a Council on the Development of Atomic Energy. In 1959, the State established an Office of Atomic Development (OAD) to coordinate atomic functions within the State. The OAD identified atomic development as a key issue in industrial growth for the Northeast, and following a statewide search, acquired the present West Valley site in 1961. Davison Chemical Company, a division of W. R. Grace & Co. and predecessor to NFS, expressed its interest in becoming a tenant on that site, for the purpose of constructing and operating a chemical reprocessing

plant. With the encouragement of the AEC, a series of negotiations took place between NFS, the AEC, and OAD, predecessor to the New York Atomic Research and Development Authority (NYARDA), which was established in 1962.

In 1963, NFS was issued a construction permit, and in 1966, with the issuance of its operating license, became the first (and only) commercial reprocessor of spent nuclear fuels in the United States. However, over the next 6 years, little commercial power reactor fuel was reprocessed at NFS. Under an AEC baseload agreement central to the venture, almost two-thirds of the fuel was supplied by the AEC from the plutonium production reactor at Hanford, Washington. During this time, the prospective construction of larger and more efficient reprocessing plants threatened NFS's market position. Accordingly, NFS shut down its plant in early 1972 for expansion and modification.

In May of 1972, NFS was advised by the AEC that plant expansion could not be completed without a new AEC construction permit. Over the next several years, while the review procedure was under way, numerous new requirements for the reprocessing plant and the waste storage facilities were developed.

Furthermore, back in 1969, the AEC published in the Federal Register a proposed statement of policy, to become Appendix F to Title 10, Part 50 of the Code of Federal Regulations. In the amended Federal Register notice of November 14, 1970, the AEC stated:

The Commission does not now regard storage of liquid high-level wastes in tanks constituting an acceptable method of long-term storage . . . Over periods of centuries one cannot assure the continuity of surveillance and care which tank storage requires.

To accommodate the situation at West Valley, the following language was added to 10 CFR 50 Appendix F in 1971:

With respect to fuel reprocessing plants already licensed, the licenses will be appropriately conditioned to carry out the purposes of the policy stated above with respect to high-level radioactive fission products generated after installation of new equipment for interim storage of liquid wastes, or after installation of equipment for solidification without interim liquid storage.

Installation of solidification equipment was required as soon as practicable. The amended paragraph now concluded:

The application of the policy stated in this appendix to existing wastes and to wastes generated prior to the installation of such equipment will be the subject of a further rulemaking proceeding.

This rulemaking proceeding has not as yet been scheduled.

Following the adoption of the Energy Reorganization Act of 1974, responsibility for reviewing and evaluating NFS plans, issuing the amended operating license, and instituting the rulemaking proceeding on the wastes was transferred to the newly constituted Nuclear Regulatory Commission (NBC).

In April of 1976 NFS gave notice to the newly constituted New York State Energy Research and Development Authority (NYSERDA) that it was exercising its right, under the applicable agreements, to surrender to NYSERDA responsibility for all the wastes on the West Valley site. NYSERDA replied to the notice on May 4, 1976, stating that the contractual conditions for surrender called for (i) a determination that the wastes were in good condition (as defined in the Waste Storage Agreement) and (ii) a license amendment reflecting the transfer. While the surrender date initially proposed was October 29, 1976, it was recognized that a transfer could not be effected by that time, and the surrender date remains open.

In the fall of 1976, NFS further informed the NRC that it had terminated its plans to expand and reopen the plant and was withdrawing from the reprocessing business.

CONCLUSION

The West Valley site and facilities are still governed by a set of agreements and an operating license drawn with the perceptions of the late 1950s and early 1960s. With AEC support and approval, a fund was established for the perpetual care of the liquid high-level wastes by periodic transfer to new storage tanks; this fund is now judged to be woefully inadequate. In issuing the NFS license, the AEC mentioned no provisions for further solidification of the wastes, for their removal from the site, for the decommissioning of either reprocessing or waste facilities, or for the ultimate decontamination of the facilities or the site.

The Federal government encouraged the construction and operation of the plant; it supplied three-fourths of the fuel under the base-agreement in order to demonstrate reprocessing and waste management under private ownership. When

NYSERDA's predecessors and NFS entered into long-term contractual relationships with each other and with the AEC, they did so in reliance on information and technology provided by the AEC, with the imprimatur of an AEC license, and with such provisions as the AEC judged necessary.

Barely 3 years after the plant opened, it became clear that the bases upon which the license was issued were not as sound as the parties had earlier believed; despite AEC approval, the perpetual care fund appears to be insufficient, even for liquid storage; the AEC estimates that a 1 metric tonne per day reprocessing plant would be fully competitive for the foreseeable future were incorrect; and subsequent events made AEC estimates of the availability of commercial reprocessing contracts too optimistic. If West Valley were being created today, the Federal Government would not permit the arrangements it insisted on in 1963.

The Federal Government is spending substantial time, energy, and funds to create a Federal waste management and disposal program. The goal is a consistent policy based on the best technology available, and on thorough agency, Congressional, and public review. The result of these Federal efforts will profoundly affect the future development of nuclear power in the United States.

A comprehensive program demands the inclusion of West Valley among the Federal sites. As with the sites at Hanford and Savannah River, the ultimate disposition of the wastes and facilities at the West Valley site is currently unknown and is likely to remain so for some time. So long as West Valley remains the orphan of a disavowed Federal program, the stated goal of bringing hazardous nuclear wastes into Federal custody and care will be open to serious doubt. It would be inappropriate to place upon NYSERDA or any State agency the responsibility for accomplishing the difficult, challenging, and critical procedures of developing the requisite technology.

West Valley was to be a unique, early demonstration, as part of the AEC's program to develop a commercial reprocessing industry in the United States. When the parties entered into their original agreements they relied on the AEC for advice, and for recommendations as to the necessary provisions for financial and institutional responsibility.

The Federal Government, in those early days of optimism, failed to assume its proper role as the responsible agent for the management of nuclear wastes. Since that time, it has acknowledged that failure, and has extensively revised the regulations and criteria for waste management and disposal. The Federal Government also failed, in those early days, to allocate responsibilities and specify procedures for the decommissioning and decontamination of those demonstration facilities whose construction it so strongly urged.

In pressing for Federal ownership of West Valley, NYSERDA is only asking that the Federal Government now recognize its obligation to correct the effects of its own failures 20 years ago.

STATEMENT OF MONTE CANFIELD, JR., DIRECTOR, ENERGY AND MINERALS DIVISION, GENERAL ACCOUNTING OFFICE

Mr. CANFIELD. Thank you, Mr. Chairman.

I will refer to a report we issued, dated March 8, 1977, EMD 77-27, entitled "Issues Related to the Closing of the Nuclear Fuel Services, Incorporated, Reprocessing Plant at West Valley, New York."

I will not go into detail, and, with the committee's approval, I will summarize my statement, skipping certain sections of it. I will tell you when I do that so it will be easy to follow along.

Mr. BROWN. As I indicated before, the full text of the statement will be included in the record.

Mr. CANFIELD. Thank you, Mr. Chairman.

We welcome the opportunity to be here today to discuss with you our report on the issues related to the closing of the West Valley nuclear reprocessing plant operated by the Nuclear Fuel Services, Inc. (NFS).

Our statement today is similar to one included in our report on which we testified in March 1977, before the Subcommittee on Con-

servation, Energy and Natural Resources of the House Committee on Government Operations.

The West Valley site was the only commercial reprocessing facility that operated in the United States. The site consists of a reprocessing plant, four high-level liquid storage tanks containing about 612,000 gallons of waste, a high-level burial ground containing about 100,000 cubic feet, and a low-level burial ground containing about 2 million cubic feet of solid radioactive wastes. NFS ceased operations in 1972.

The issues surrounding nuclear reprocessing and waste management are both important and complex. Their satisfactory resolution involves analysis of complex social, political, and institutional questions. We cannot, based on our work at West Valley, offer a comprehensive perspective on these issues nor can we offer definitive means of resolving many of the issues relating to the closing of this plant. We feel, however, that the results of our work deal with many of the aspects of these issues in sufficient depth to be useful to this subcommittee and others in the Congress in deliberations on this important matter.

Let me briefly highlight some of the major observations contained in our report.

While the Nuclear Regulatory Commission (NRC) believes that the waste tanks at West Valley are in good condition, estimating tank life is unpredictable. We believe more work needs to be done on a priority basis before a reasonable judgment can be made that the waste tanks are safe. Specifically, such work should consist of (1) reviewing quality assurance data to determine that proper techniques were used in constructing the tanks, (2) assessing the present condition of the tank vault system, and (3) assessing the characteristics of the soil surrounding the vault system.

The waste tanks may not meet current NRC seismic criteria. It is not known whether the tanks would rupture in case of an earthquake of the magnitude likely for the area. The structural integrity of the NFS tanks was questioned by AEC in 1970 because the design of the tanks—while supposedly meeting building code requirements at the time of construction—was not acceptable for its existing seismic requirements. These requirements have since been upgraded even more.

The physical and chemical characteristics of the high-level waste sludge contained in the tanks at West Valley are not completely known. Without such knowledge, it will be virtually impossible to select an appropriate removal and solidification process for this waste sludge. Removing the sludge from the tanks presents an immense problem, because of design obstructions in the bottom of the tanks.

The Energy Research and Development Administration (ERDA) is developing technology for solidifying and disposing of nuclear waste. Information from ERDA's effort is not likely to be available for 2 to 5 years, nor is criteria under which NRC will approve long-term management processes. Both of these efforts must be completed before decisions on NFS waste management alternatives are made.

It is unlikely that the West Valley reprocessing plant will ever operate again because (1) of the substantial costs ($615 million) to make the necessary modifications to expand the plant's capacity and to meet current NRC standards and (2) the plant design may not readily be susceptible to modifications which would lower the radiation exposures to workers to a level acceptable to NRC because certain

routine maintenance operations require plant personnel to work in radioactive areas.

To date, NFS and the New York Energy Research and Development Authority have not developed plans to decommission the West Valley site. Before such decommissioning plans can be prepared, NRC needs to develop decommissioning guidelines for reprocessing plants. NRC has been working on such guidelines for over 6 years, and does not know when they will be completed. It is important that guidelines be developed so that reliable cost estimates of decommissioning and long-term perpetual maintenance of radioactive material at reprocessing plants such as West Valley can be developed.

Our observations directly relate to the three key questions now confronting the State of New York, NRC, and ERDA: What can be done with the reprocessing plant and wastes? How much will it cost? Who will be responsible?

Before decisions can be made on what to do with the high-level liquid wastes, ERDA has to do years of additional research. Furthermore, before reprocessing plant and burial ground decommissioning plans can be developed, the State of New York will have to decide on the future use of the West Valley site, and NRC will have to develop decommissioning guidelines.

Because decisions have yet to be made on plant and site decommissioning, cost estimates for waste disposal and decommissioning the NFS plant are not available. An ERDA contractor has estimated that the cost of waste disposal at NFS would range from $58 million to $567 million. The contractor study did not cover the cost of decommissioning the plant. However, the contractor has estimated that it would cost from $19.7 million to $65.7 million to decommission a reprocessing plant at Barnwell, S.C.

The estimates for waste disposal at NFS could be misleading because of the use of questionable cost data, errors in computations, and inconsistent pricing and computation methods. For example, estimated costs for two carbon steel tanks were about $2 million; however, actual construction costs for similar tanks built by an ERDA contractor were $6.5 million.

The key to estimating decommissioning costs in the decision on the future use of the West Valley site. Returning portions of the reprocessing plantsite to its natural condition would require completely dismantling the plant and decontaminating the site. The areas used for the high-level burial ground and the low-level waste burial ground will require perpetual care, and thus preclude returning the other portions of West Valley to its original state.

By contractual agreement, the State of New York is ultimately responsible for managing the radioactive waste at the site, and for care and disposal of the wastes. However, the State maintains it is incapable of resolving the many technical issues without substantial assistance from the Federal Government.

The rest of my testimony will address what must be done before the NFS issues can be resolved. It will also discuss the question of who is responsible.

Mr. Chairman, I turn now to page 11 of my testimony.

Ultimate legal responsibility for care and disposal of the radioactive wastes at West Valley belongs to the State of New York. Although NFS is presently responsible for care of the facilities and

wastes at West Valley, it can voluntarily surrender this responsibility to the State's Energy Research and Development Authority before its agreements with the Authority expire.

This transfer would be conditional on the Authority finding that the facilities are in good condition. When NFS' agreements with the Authority expire on December 31, 1980, the transfer would take place, assuming NRC's approval.

We should point out that any readjustment of NFS' technical and financial responsibilities must have NRC approval, because it requires an amendment to the facility license. For this reason, it is possible that NRC could place further restrictions on the surrender—for example, additional storage facility requirements.

The New York Energy Research and Development Authority has asked ERDA to completely takeover the West Valley site. ERDA has not accepted this request, but has agreed to discuss West Valley issues with the Authority.

It appears to us that, at a minimum, the Federal Government will have to provide technical assistance to New York to resolve the outstanding waste management issues at West Valley.

In our report, we made a number of recommendations aimed at speeding up the decisionmaking process for finding acceptable solutions to the issues at West Valley. To assist in developing an appropriate waste disposal technology for the NFS waste we recommended that NRC do the following:

Develop waste performance criteria.

Develop criteria for decommissioning waste storage facilities so that the impact of residual sludge in the NFS tank can be evaluated.

Identify alternative processes for NFS waste management and determine their technical and economic feasibility so that a recommended process can be developed and implemented.

Characterize the physical and chemical properties of the high-level waste sludge.

Although the Commission is studying certain aspects of the condition of the high-level waste tanks, other studies are needed. We recommended that NRC:

Proceed on a priority basis in the current analyses to assess seismic integrity of the waste tanks.

In its plans to determine tank life, include a review of the stress relieving data for assurance that the proper techniques were used.

Assess on a priority basis the present condition of the vault system and the soil characteristics surrounding the vaults.

With regard to decommissioning the reprocessing plant and burial grounds, we recommended that NRC:

Require New York State to report its plans on the future use of the West Valley site.

Prepare for Nuclear Fuel Services, Inc., and New York State guidelines for decommissioning the reprocessing plant and site.

Require Nuclear Fuel Services, Inc., and New York State to submit a decommissioning plan.

Require New York State to submit a plan for correcting problems at the low-level burial site.

Require New York State to establish long-term care requirements for the West Valley site.

Finally, we recommended that NRC and ERDA develop a policy on Federal assistance to New York State for the West Valley site. Officials of NRC and ERDA generally agreed with our findings and are taking actions to implement our recommendations.

A recent development may be important. On March 10, 1977, NRC published for comment in the Federal Register their task force report on the Federal/State program for regulation of commercial low-level radioactive waste burial grounds. NRC is currently assessing the written comments it received on the report. The NRC report proposed that the Federal Government increase its control over the disposal of low-level wastes by, among other things, requiring Federal ownership and federally administered perpetual care programs at low-level burial grounds.

Adoption of the proposed policy may weigh heavily in future deliberations on who should bear how much of the technical and financial burden for disposing of the wastes and decommissioning the West Valley facilities and site.

This policy proposal raises a bigger issue concerning whether or not, and to what extent, the Federal Government should provide financial assistance to the nuclear industry by taking over some or all of the cost of managing activities in the back end of the fuel cycle.

I will be happy to discuss some of the implications of these issues during the question and answer period. However, I have not included them in this formal statement because our recent report was not intended to cover them.

Mr. Chairman, this concludes my prepared statement. We will be glad to respond to your questions.

Mr. BROWN. Thank you very much, Mr. Canfield.

[The prepared statement of Mr. Canfield follows:]

STATEMENT OF MONTE CANFIELD, JR., DIRECTOR, ENERGY AND MINERALS DIVISION

Mr. Chairman and members of the subcommittee, we welcome the opportunity to be here today to discuss with you our report on the issues related to the closing of the West Valley nuclear reprocessing plant operated by the Nuclear Fuel Services, Inc. (NFS). Our statement today is similar to one included in our report on which we testified in March 1977, before the Subcommittee on Conservation, Energy and Natural Resources of the House Committee on Government Operations.

The West Valley site was the only commercial reprocessing facility that operated in the United States. The site consists of a reprocessing plant, four high-level liquid storage tanks containing about 612,000 gallons of waste, a high-level burial ground containing about 100,000 cubic feet, and a low-level burial ground containing about 2 million cubic feet of solid radioactive wastes. NFS ceased operations in 1972.

The issues surrounding nuclear reprocessing and waste management are both important and complex. Their satisfactory resolution involves analysis of complex social, political, and institutional questions. We cannot, based on our work at West Valley, offer a comprehensive perspective on these issues nor can we offer definitive means of resolving many of the issues relating to the closing of this plant. We feel, however, that the results of our work deal with many of the aspects of these issues in sufficient depth to be useful to this Subcommittee and others in the Congress in deliberations on this important matter.

Let me briefly highlight some of the major observations contained in our report.

While the Nuclear Regulatory Commission (NRC) believes that the waste tanks at West Valley are in good condition, estimating tank life is unpredictable. We believe more work needs to be done on a priority basis before a reasonable judgment can be made that the waste tanks are safe. Specifically, such work should consist of (1) reviewing quality assurance data to determine that proper

techniques were used in constructing the tanks, (2) assessing the present condition of the tank vault system, and (3) assessing the characteristics of the soil surrounding the vault system.

The waste tanks may not meet current NRC seismic criteria. It is not known whether the tanks would rupture in case of an earthquake of the magnitude likely for the area. The structural integrity of the NFS tanks was questioned by AEC in 1970 because the design of the tanks—while supposedly meeting building code requirements at the time of construction—was not acceptable for its existing seismic requirements. These requirements have since been upgraded even more.

The physical and chemical characteristics of the high-level waste sludge contained in the tanks at West Valley are not completely known. Without such knowledge it will be virtually impossible to select an appropriate removal and solidification process for this waste sludge. Removing the sludge from the tanks presents an immense problem, because of design obstructions in the bottom of the tanks.

The Energy Research and Development Administration (ERDA) is developing technology for solidifying and disposing of nuclear waste. Information from ERDA's effort is not likely to be available for 2 to 5 years, nor is criteria under which NRC will approve long term management processes. Both of these efforts must be completed before decisions on NFS waste management alternatives are made.

It is unlikely that the West Valley reprocessing plant will ever operate again because (1) of the substantial costs ($615 million) to make the necessary modifications to expand the plant's capacity and to meet current NRC standards and (2) the plant design may not readily be susceptible to modifications which would lower the radiation exposures to workers to a level acceptable to NRC because certain routine maintenance operations require plant personnel to work in radioactive areas.

To date, NFS and the New York Energy Research and Development Authority have not developed plans to decommission the West Valley site. Before such decommissioning plans can be prepared NRC needs to develop decommissioning guidelines for reprocessing plants. NRC has been working on such guidelines for over 6 years, and does not know when they will be completed. It is important that guidelines be developed so that reliable cost estimates of decommissioning and long term perpetual maintenance of radioactive material at reprocessing plants such as West Valley can be developed.

Our observations directly relate to the three key questions now confronting the State of New York, NRC, and ERDA. What can be done with the reprocessing plant and wastes? How much will it cost? Who will be responsible?

Before decisions can be made on what to do with the high-level liquid wastes, ERDA has to do years of additional research. Furthermore, before reprocessing plant and burial ground decommissioning plans can be developed, the State of New York will have to decide on the future use of the West Valley site, and NRC will have to develop decommissioning guidelines.

Because decisions have yet to be made on plant and site decommissioning, NFS cost estimates for waste disposal and decommissioning are not available. An ERDA contractor has estimated that the cost of waste disposal at NFS would range from $58 million to $567 million. The contractor study did not cover the cost of decommissioning the plant. However, the contractor has estimated that it would cost from $19.7 million to $65.7 million to decommission a reprocessing plant at Barnwell, S.C. The estimates for waste disposal at NFS could be misleading because of the use of questionable cost data, errors in computations, and inconsistent pricing and computation methods. For example, estimated costs for two carbon steel tanks were about $2 million; however, actual construction costs for similar tanks built by an ERDA contractor were $6.5 million.

The key to estimating decommissioning costs is the decision on the future use of the West Valley site. Returning portions of the reprocessing plant site to its natural condition would require completely dismantling the plant and decontaminating the site. The areas used for the high-level burial ground and the low-level waste burial grounds will require perpetual care, and thus preclude returning the other portions of West Valley to its original state.

By contractual agreement, the State of New York is ultimately responsible for managing the radioactive waste at the site, and for care and disposal of the wastes. However, the State maintains it is incapable of resolving the many technical issues without substantial assistance from the Federal Government.

The rest of my testimony will address what must be done before the NFS issues can be resolved. It will also discuss the question of who is responsible.

NFS NEEDS TO CONFIRM THE SAFETY OF THE WASTE TANKS

From what is known about the high level waste tanks, NRC has concluded that they are in good condition and can store the waste for the foreseeable future. Although NRC is currently assessing the tanks' capability to withstand an earthquake of the intensity postulated for the area, we believe that more work is needed to confirm the safety of the tanks. For example, in April 1965, an accumulation of water in the vault excavation area floated the concrete vaults, with the steel tanks inside them, out of the ground as much as 3 or 4 feet before they settled back to new positions. This placed high stresses on the concrete and reinforcing steel. Inspections of the vault now used for the spare tank revealed several cracks to the bottom of the vault and the roof. The bottoms of both vaults were resupported with concrete. At the time of the incident, the construction contractor concluded that all of the stress was placed on the vaults and not on the steel tanks inside. Although the contractor did not submit any inspection data or engineering analyses to support this conclusion, AEC agreed, and did not require any reexamination of the welds of the steel tanks.

We believe NRC should assess the condition of the tanks, in view of the vault flotation incident. In addition, NRC should assess the soil characteristics to determine whether it would contain the wastes in the event of a breach in the tank system.

NRC SHOULD ANALYZE THE HIGH-LEVEL LIQUID WASTE PROPERTIES

The high-level waste stored in one tank was "neutralized." Neutralizing the chemically acid waste permitted NFS to store the waste in tanks constructed from carbon steel, rather than more expensive stainless steel. Neutralization caused some of the radioactive materials—including most of the long-lived plutonium and strontium 90—to precipitate out of the waste solution, settle on the tank botom, and harden ino a sludge. ERDA has estimated that about 30,000 gallons of sludge is on the bottom of the large waste tank. The properties of this sludge are not completely known. Knowledge of the properties of this sludge is important to develop techniques for removing it and converting it to a form suitable for disposal.

We believe that NRC should attach priority to analyzing the NFS waste sludge properties.

NRC SHOULD DEVELOP NFS HIGH-LEVEL LIQUID WASTE DISPOSAL CRITERIA

ERDA is now developing several alternative processes for disposing of high-level liquid waste. Before any of these processes could be selected for application to the NFS waste, however, NRC must establish waste performance criteria. NRC's only present criteria is that the liquid waste be converted into a dry solid form and be shipped to a Federal repository not later than 10 years after it is generated. However, NRC regulations exempted the NFS waste from this requirement because the technology for solidifying neutralized waste was not developed. NRC intends to establish disposal criteria for NFS wastes at some future time by means of its rulemaking procedure.

We believe NRC should establish performance criteria on a priority basis to foster the development of technically and economically feasible waste disposal processes which cover all waste, including NFS waste.

NFS WASTE RETRIEVAL AND SOLIDIFICATION PROCESSES HAVE NOT BEEN DEMONSTRATED

ERDA is conducting research on methods for extracting neutralized waste sludge from the bottoms of its own waste tanks. The research may have application to the sludge in the NFS waste tank. A prerequisite to determining if the waste sludge can be removed from the tank, however, is identifying its properties and assessing the condition of the steel tank. Removing all of the sludge from the NFS tank will be difficult if not impossible with processes now being considered, because of physical obstructions in the tank. Because of the long-lived radionuclides present, any residual sludge will present a separate problem in decommissioning the reprocessing plant site.

Perpetual tank storage of the NFS high-level liquid waste would not satisfy NRC and ERDA commitments to solidify wastes and dispose of them in a Federal waste repository. Several potential solidification technologies are under investigation, but none have yet been demonstrated. Each of these technologies re-

quires additional research and development and will not be available for application to NFS waste for many years.

DECOMMISSIONING THE NFS PLANT AND BURIAL GROUNDS

The future use of the West Valley land is the key factor in selecting a decommissioning method. These methods vary from dismantling the facilities and completely cleaning up the area to continuous surveillance and a minimum removal of radioactivity. Costs of decommissioning the NFS reprocessing plant under any of the alternatives are not known at this time, nor can they be developed until NRC establishes decommissioning guidelines and the State of New York decides on the future use of the site.

Perpetual care of the high- and low-level solid waste burial grounds will be required for centuries because of the long-lived, highly toxic radionuclides buried there. Therefore, before proceeding with site decommissioning, it is important that long term care requirements be identified, remedial action be taken to correct known deficiencies at the low-level burial ground, and a sufficient perpetual care fund be established.

At the low-level burial site, there is a problem with water seepage from the surface of three burial trenches. NFS, with the State of New York's approval, has started a program to temporarily control this problem, and the State has contracted for a study of long term control methods. Ten alternative methods identified to date would all require periodic equipment maintenance or replacement. The State's consultant has recommended further investigations before a decision is made on long term corrective actions.

The State of New York has required NFS to contribute to a fund to cover long term care of both the burial grounds and the high-level liquid waste. The balance of this fund is presently about $2.9 million. It is obvious to us that the fund is wholly insufficient to cover the cost of remedial action at the burial sites, decommission the reprocessing plant, and either dispose of the high-level liquid waste, or perpetually store the waste at West Valley.

WHO WILL BE RESPONSIBLE?

Ultimate legal responsibility for care and disposal of the radioactive wastes at West Valley belongs to the State of New York. Although NFS is presently responsible for care of the facilities and wastes at West Valley, it can voluntarily surrender this responsibility to the State's Energy Research and Development Authority before its agreements with the Authority expire. This transfer would be conditional on the Authority finding that the facilities are in good condition. When NFS' agreements with the Authority expire on December 31, 1980, the transfer would take place, assuming NRC's approval.

We should point out that any readjustment of NFS' technical and financial responsibilities must have NRC approval, because it requires an amendment to the facility license. For this reason, it is possible that NRC could place further restrictions on the surrender; for example, additional storage facility requirements.

The New York Energy Research and Development Authority has asked ERDA to completely take over the West Valley site. ERDA has not accepted this request, but has agreed to discuss West Valley issues with the Authority.

It appears to us that, at a minimum, the Federal Government will have to provide technical assistance to New York to resolve the outstanding waste management issues at West Valley.

In our report, we made a number of recommendations aimed at speeding up the decisionmaking process for finding acceptable solutions to the issues at West Valley. To assist in developing an appropriate waste disposal technology for the NFS waste we recommended that NRC:

Develop waste performance criteria.

Develop criteria for decommissioning waste storage facilities so that the impact of residual sludge in the NFS tank can be evaluated.

Identify alternative processes for NFS waste management and determine their technical and economic feasibility so that a recommended process can be developed and implemented.

Characterize the physical and chemical properties of the high-level waste sludge.

Although the Commission is studying certain aspects of the condition of the high-level waste tanks, other studies are needed. We recommended that NRC:

Proceed on a priority basis in the current analyses to assess seismic integrity of the waste tanks.

In its plans to determine tank life, include a review of the stress relieving data for assurance that the proper techniques were used.

Assess on a priority basis the present condition of the vault system and the soil characteristics surrounding the vaults.

With regard to decommissioning the reprocessing plant and burial grounds, we recommended that NRC:

Require New York to report its plans on the future use of the West Valley site.

Prepare for Nuclear Fuel Services, Inc., and New York State guidelines for decommissioning the reprocessing plant and site.

Require Nuclear Fuel Services, Inc., and New York State to submit a decommissioning plan.

Require New York State to submit a plan for correcting problems at the low-level burial site.

Require New York State to establish long-term care requirements for the West Valley site.

Finally, we recommended that NRC and ERDA develop a policy on Federal assistance to New York State for the West Valley site. Officials of NRC and ERDA generally agreed with our findings and are taking actions to implement our recommendations.

A recent development may be important. On March 10, 1977, NRC published for comment in the Federal Register their Task Force Report on the Federal/State program for regulation of commercial low-level radioactive waste burial grounds. NRC is currently assessing the written comments it received on the report. The NRC report proposed that the Federal Government increase its control over the disposal of low-level wastes by, among other things, requiring Federal ownership and federally administered perpetual care programs at low-level burial grounds. Adoption of the proposed policy may weigh heavily in future deliberations on who should bear how much of the technical and financial burden for disposing of the wastes and decommissioning the West Valley facilities and site.

This policy proposal raises a bigger issue concerning whether or not, and to what extent, the Federal Government should provide financial assistance to the nuclear industry by taking over the cost of managing activities in the back end of the fuel cycle. I will be happy to discuss some of the implications of these issues during the question-and-answer period. However, I have not included them in this formal statement because our recent report was not intended to cover them.

Mr. Chairman, this concludes my prepared statement. We will be glad to respond to your questions.

Mr. BROWN. We will proceed with Mr. Lester's statement at this time.

I note that you have studied and written on this problem extensively, and I have had the opportunity to read some of your other work, and we appreciate your being here.

STATEMENT OF RICHARD LESTER, DIVISION OF INTERNATIONAL RELATIONS, THE ROCKEFELLER FOUNDATION

Mr. LESTER. Thank you.

Mr. Chairman and members of the committee, I am pleased to have this opportunity to testify on certain problems related to the decommissioning of nuclear facilities. I will deal, in particular, with the circumstances surrounding the current storage of high-level waste at the site of the Nuclear Fuel Services reprocessing plant at West Valley, N.Y.

After a brief review of the situation, in which some of the more pertinent institutional and technical characteristics will be emphasized, I shall outline a set of recommendations aimed at resolving some of the current problems.

If I may, I will summarize my prepared statement.

Mr. BROWN. Fine.

Mr. LESTER. In 1966, the first private nuclear fuel reprocessing plant in the United States, owned by Nuclear Fuel Services, Inc. (NFS), began operation at West Valley, N.Y., some 30 miles south of Buffalo. About 625 tons of fuel was reprocessed at West Valley from 1966 to 1971, producing 600,000 gallons of liquid high-level waste.

Most of this was neutralized immediately after generation, and is now stored in a single 750,000-gallon carbon steel tank.

Mr. BROWN. Let me interrupt you just for a moment. Both you and Mr. Werthamer used the word "neutralized," and I think it should be made clear that that refers to a neutralization of acidity, and not neutralizing it from the radioactive standpoint, or anything of that nature.

Mr. LESTER. Correct.

Mr. WERTHAMER. I agree.

Mr. LESTER. No satisfactory way to remove all of the waste from this tank has been developed, yet it cannot be left indefinitely in its present form, because the tank will eventually corrode.

How did the problem arise? Until very recently, a "closed" nuclear fuel cycle was universally regarded as essential to a mature nuclear industry. That is, irradiated nuclear fuel was to be reprocessed to recover fissionable uranium and plutonium for recycle in new fuel. On April 7 of this year, President Carter announced an indefinite deferral of commercial reprocessing in the United States Fifteen years ago, when the first commercial power reactors in the country came into operation, doubts about the need for and desirability of closing the fuel cycle were rarely heard and certainly not at the Presidential level.

When, therefore, NFS was formed in 1962 as the first commercial venture into the reprocessing business, it received encouragement from both the New York State government and the Federal Government.

The former, through the State Atomic Research and Development Authority, provided a suitable site and declared its willingness to assume, at some point in the future and subject to certain conditions stipulated in the Waste Storage Agreement of 1963 between the Authority and NFS, long-term responsibility for high-level waste produced in a reprocessing plant at the site.

The Federal Atomic Energy Commission (AEC) sought to promote the introduction of commercial reprocessing, but the nuclear electric power industry—still at a fetal stage in the early 1960's—could not on its own supply enough used fuel to make reprocessing an attractive economic prospect.

The AEC therefore guaranteed to supply a substantial fraction of the NFS plant load for the first 5 years of operation. As a result, about 60 percent of all fuel reprocessed at West Valley came from AEC's "N" plutonium production reactor at the Hanford Reservation near Richland, Wash.

The West Valley plant was designed and licensed for the indefinite storage of neutralized liquid high-level waste in carbon steel tanks. The tank design, and indeed the whole waste system, were similar to those that had been developed at the AEC's Savannah River Plant for the storage of waste generated during the production of plutonium for nuclear weapons, and the choice of carbon steel for the main West Valley tank has led to most of the subsequent difficulty.

Neutralized weapons waste had also been stored in carbon steel tanks at the AEC's Hanword Reservation; those tanks were of an earlier design, however—single-walled as opposed to the double-walled type constructed later at Savannah River and then West Valley.

It was known that the tanks at West Valley would not last forever, and that periodic transfer of waste from old to new tanks would be required. But it was not known how the waste—particularly the highly radioactive sludge precipitated at the bottom of the tank when the waste was neutralized—could be removed.

Moreover, there were doubts even that as to the acceptability of liquid storage as a long-term management method, and activities were underway aimed at waste solidification and immobilization, thereby reducing the burden on future generations created by indefinite liquid storage. In a nutshell, the waste management philosophy at West Valley was a temporizing one: The system was adequate for the time being, and it was felt that something would turn up before long.

As the 1960's drew to a close, the regulatory requirements for nuclear fuel cycle facilities became increasingly stringent. The AEC announced a new policy on the siting of reprocessing plants and waste treatment management facilities in 1970.

Included in this policy were the requirements that high-level waste was to be solidified within 5 years of its generation, and that the ultimate disposal of the solidified waste was to be a Federal responsibility and could take place only on land owned and controlled by the Federal Government.

Although the existing high-level waste at West Valley was exempted from the new policy, it was clear that NFS would be obliged to manage its future waste in accordance with it. This meant, among other changes, constructing a solidification facility at the site.

Furthermore, emission standards for release of radioactivity from nuclear installations and standards for radiation exposure to operating personnel were also becoming stricter. When NFS closed down its plant in 1972 to begin alterations designed to increase the capacity, this work was to be accompanied by modifications necessary to meet the upgraded regulatory requirements.

In late 1976, however, NFS declared its intention not to reopen its reprocessing plant, citing as a principal circumstance its inability to meet upgraded U.S. Nuclear Regulatory Commission seismic requirements at a price that its customers would be willing to pay.

So much is history. The circumstances provide opportunities to blame the various participants: Nuclear Fuel Services itself; the Getty Oil Co., which now owns a controlling interest in NFS; W. R. Grace and Co., which started the venture; New York State, which encouraged it; the U.S. Federal Government, which, through the (then) Atomic Energy Commission, provided technological information, a license to operate, and fuel reprocessing contracts without which the venture would have been economically unviable; and nuclear power in general, for producing apparently ineluctable and intolerable problems.

In this case, assignation of unique technological or institutional blame is impossible. It is more constructive to look ahead, toward what might be done to ameliorate the situation.

Resolution of the West Valley problem will require that two questions be answered: What is to be done with the waste? and, Who is responsible?

Studies of technical feasibility have so far identified two broad options. First, part or all of the waste could be disposed of in situ—that is, solidified in the tanks (probably as salt-cake by a technique similar to that developed and used by the AEC for its weapons waste). However, the permanence of the disposal is doubtful.

Second, with much greater difficulty the waste could be removed from the tanks as a first step in a more thorough disposal process. It might then be solidified and placed in a structure underlying the West Valley site, or alternatively it might be treated so as to conform with the impending requirements for all future high-level waste, and transported to a Federal repository.

Another variant of the second option has received less attention. The waste at West Valley closely resembles and is a modest harbinger of the vastly larger quantities of nuclear weapons waste at the Hanford Reservation, near Richland, Wash., and at Savannah River, S.C. The alternative is to remove the waste from the tank at West Valley, solidify it with the minimum possible effort compatible with transportation safety and with any further treatment operations which it might subsequently undergo, and then transport it to one of the two weapons waste sites just mentioned.

The Nuclear Regulatory Commission is committed to developing rules for future management of the West Valley waste, and will face a number of difficulties in its efforts. In the first place, it is generally agreed that the extent to which the waste can be removed from the carbon steel tank will not be known until the extraction is actually attempted.

But any detailed regulatory policy for West Valley developed without this knowledge may be very unhelpful.

A related problem is the future of the rest of the West Valley site. Ultimately, plans will have to be developed for decommissioning the entire site, including the reprocessing plant itself, the various spent fuel and waste handling facilities, and the low-level and intermediate-level solid waste burial ground.

The extent to which the future use of the site is constrained by the presence of these decommissioned facilities should permanently influence the policy for high-level waste disposal and vice versa. Thus, the problem of decommissioning and that of future high-level waste management should be considered together, as part of a holistic assessment.

Another difficulty facing NRC in its rulemaking is that the visibility of some of the technical options depends on the resolution of a number of legal and political complexities surrounding the question of agency responsibility. Should NRC's considerations await resolution of these issues? Or should the Commission assume that there are no *a priori* political or legal obstacles, and proceed based on its own assessment of the risks and costs of the various technological options?

Finally, how should the responsibility for the future management of the waste at West Valley be allocated? A decision could be made in the courts. This approach has several disadvantages. First, it could

generate antagonism instead of fostering cooperation. Another disadvantage of a judicial settlement is that it might take a long time to achieve, and could therefore delay the start of management operations for longer than might otherwise be advisable.

It should also be noted that the difficulty of allocating financial responsibility in advance is similar to the problem that the NRC will face in developing waste management rules for West Valley in advance: the cost of the operation will not be known with any certainty until it is underway. Furthermore, the cost will clearly depend on the outcome of the NRC's proceeding.

Could an agreement be reached outside the courts? Perhaps so, but the ground would have to be carefully and publicly prepared in order to avoid lengthy court challenges, for example, by public interest groups, to whom the agreement could assume the appearances of a comfortable accommodation among established bureaucracies.

Such thoughts are, of course, speculative. Nevertheless, they suggest an alternative solution. First, should it prove necessary, the Congress would authorize the Federal ERDA—or its proposed successor, the new Department of Energy—as the entity best suited to the task, to manage the West Valley waste.

The Department would then proceed to develop an expanded set of waste management options. This assessment would be unhindered by any legal or political complexities concerning the question of agency responsibility. NRC would then formulate guidelines on the basis of the assessment, and the Congress would appropriate funds enabling the Department to fulfill its role as waste manager in accordance with these guidelines, which would probably require modification as the work proceeded.

Meanwhile, efforts would be made to allocate the financial responsibility for the waste treatment and disposition among NFS and the Federal and State governments. If that question ultimately requires judicial settlement, then so be it. But the question need not be resolved before beginning the work.

Guaranteeing the necessary funds even before the determination of financial responsibility would be an unusual step for Congress to take. Yet it is precisely here that the major advantage lies: by distinguishing between the delegation of managerial responsibility and the allocation of financial liability at the outset, the possibility of more delay can be avoided.

Concern has been shown that a Federal assumption of responsibility for the waste at West Valley would constitute a precedent for Federal "bailout" of private firms incapable of meeting federally imposed regulatory requirements. On the other hand, there has also been concern that a Federal failure to assume responsibility at West Valley would discourage—at a particularly inappropriate juncture—other private ventures into the nuclear power industry.

Clearly, both sets of concerns bear on the broader issue of the role that the Federal Government ought to play in the nuclear fuel cycle as a whole. The debate on this issue seems likely to intensify in the coming years.

Indeed, the history of the West Valley seems to contain all the major ingredients of the broader debate. So much is unavoidable, but it is necessary to caution against losing sight of the fact—easily done in such an atmosphere—that a specific job is waiting at West Valley.

In anticipation of a potentially damaging evacuation of the sphere of responsibility at West Valley, and in acknowledgment of the connection between West Valley and the future course of the nuclear power industry in the United States, we urge consideration of a two-tiered solution, in which the issue of who is to manage the waste is separated from the question of who should pay for the management.

Mr. BROWN. Thank you very much, Mr. Lester.

[The prepared statement of Mr. Lester follows:]

PREPARED STATEMENT BY RICHARD K. LESTER, THE ROCKEFELLER FOUNDATION

Mr. Chairman, members of the committee, I am pleased to have this opportunity to testify on certain problems related to the decommissioning of nuclear facilities. I will deal, in particular, with the circumstances surrounding the current storage of high-level waste at the site of the Nuclear Fuel Services reprocessing plant at West Valley, New York. After a brief review of the situation, in which some of the more pertinent institutional and technical characteristics will be emphasized, I shall outline a set of recommendations aimed at resolving some of the current problems.

In 1966, the first nuclear fuel reprocessing plant in the U.S., owned by Nuclear Fuel Services, Inc. (NFS), began operation at West Valley, New York, some 30 miles south of Buffalo. About 625 tons of fuel was reprocessed at West Valley from 1966 to 1971, producing 600,000 gallons of liquid high-level waste. Most of this was neutralized immediately after generation, and is now stored in a single 750,000 gallon carbon steel tank. No satisfactory way to remove all of the waste from this tank has been developed, yet it cannot be left indefinitely in its present form, because the tank will eventually corrode.

Whether some permanent accommodation could be found in situ, whether the main waste inventory must be removed from the site by schemes as yet unspecified, and who will pay for the operation, for which guesses have run as high as 600 million dollars, now become a topic of lively debate.

How did the problem arise? Until very recently, a "closed" nuclear fuel cycle was universally regarded as essential to a mature nuclear industry. That is, irradiated nuclear fuel was to be reprocessed to recover fissionable uranium and plutonium for recycle in new fuel. On April 7 of this year, President Carter announced an indefinite deferral of commercial reprocessing in the United States. Fifteen years ago, when the first commercial power reactors in the country came into operation, doubts about the need for, and desirability of closing the fuel cycle were rarely heard, and certainly not at the Presidential level.

When, therefore, NFS was formed in 1962 as the first commercial venture into the reprocessing business, it received encouragement from both the New York government and the Federal Government. The former, through the State Atomic Research and Development Authority, provided a suitable site, and declared its willingness to assume, at some point in the future, and subject to certain conditions stipulated in the Waste Storage Agreement of 1963 between the Authority and NFS, long-term responsibility for high-level waste produced in a reprocessing plant at the site. The Federal Atomic Energy Commission (AEC) sought to promote the introduction of commercial reprocessing, but the nuclear electric power industry—still at a foetal stage in the early sixties—could not on its own supply enough used fuel to make reprocessing an attractive economic prospect. The AEC therefore guaranteed to supply a substantial fraction of the NFS plant load for the first five years of operation. As a result, about 60 percent of all fuel reprocessed at West Valley came from the AEC's "N" plutonium production reactor at the Hanford Reservation near Richland, Washington.

The West Valley plant was designed and licensed for the indefinite storage of neutralized liquid high-level waste in carbon steel tanks. The tank design, and indeed the whole waste management system, were similar to those that had been developed at the AEC's Savannah River Plant for the storage of waste generated during the production of plutonium for nuclear weapons, and the choice of carbon steel for the main West Valley tank has led to most of the subsequent difficulty. Neutralized weapons waste had also been stored in carbon steel tanks at the AEC's Hanford Reservation; those tanks were of an earlier design, however—single-walled as opposed to the double-walled type constructed later at Savannah River and then West Valley.

It was known that the tanks at West Valley would not last forever, and that periodic transfer of the waste from old to new tanks would be required. But it

was not known how the waste—particularly the highly radioactive sludge precipitated at the bottom of the tank when the waste was neutralized—could be removed. However, there were doubts even then as to the acceptability of liquid storage as a long-term management method, and activities were underway aimed at waste solidification and immobilization, thereby reducing the burden on future generations created by indefinite liquid storage. In a nutshell, the waste management philosophy at West Valley was a temporizing one: The system was adequate for the time being, and it was felt that something would turn up before long.

As the 1960's drew to a close, the regulatory requirements for nuclear fuel cycle facilities became increasingly stringent. The AEC announced a new policy on the siting of reprocessing plants and waste management facilities in 1970. Included in this policy were the requirements that high-level waste was to be solidified within five years of its generation, and that the ultimate disposal of the solidified waste was to be a Federal responsibility and could take place only on land owned and controlled by the Federal Government. Although the existing high-level waste at West Valley was exempted from the new policy, it was clear that NFS would be obliged to manage its future waste in accordance with it. This meant, amongst other changes, constructing a solidification facility at the site. Furthermore, emission standards for release of radioactivity from nuclear installations and standards for radiation exposure to operating personnel were also becoming stricter. When NFS closed down its plant in 1972 to begin alterations designed to increase the capacity, this work was to be accompanied by modifications necessary to meet the upgraded regulatory requirements. In late 1976, however, NFS declared its intention not to reopen its reprocessing plant, citing as a principal circumstance its inability to meet upgraded U.S. Nuclear Regulatory Commission seismic requirements at a price that its customers would be willing to pay.

So much is history. The circumstances provide opportunities to blame the various participants: Nuclear Fuel Services itself; the Getty Oil Company, which now owns a controlling interest in NFS; W. R. Grace and Company, which started the venture; New York State, which encouraged it; the U.S. Federal Government, which, through the (then) Atomic Energy Commission, provided technological information, a license to operate, and fuel processing contracts without which the venture would have been economically unviable; and nuclear power in general, for producing apparently ineluctable and intolerable problems. In this case, assignation of unique technological or institutional blame is impossible. It is more constructive to look ahead, toward what might be done to ameliorate the situation.

Resolution of the West Valley problem will require that two questions be answered: What is to be done with the waste? and, Who is responsible?

Studies of technical feasibility have so far identified two broad options. Firstly, part or all of the waste could be disposed of in situ—that is, solidified in the tanks (probably as salt-cake by a technique similar to that developed and used by the AEC for its weapons waste). However, the permanence of the disposal is doubtful. Secondly, with much greater difficulty the waste could be removed from the tanks as a first step in a more thorough disposal process. It might then be solidified and placed in a structure underlying the West Valley site, or alternatively it might be treated so as to conform with the impending requirements for all future high-level waste and transported to a Federal repository.

Another variant of the second option has received less attention. The waste at West Valley closely resembles and is a modest harbinger of the vastly larger quantities of nuclear weapons waste at the Hanford Reservation, near Richland, Washington, and at Savannah River, South Carolina. The alternative is to remove the waste from the tank at West Valley, solidify it with the minimum possible effort compatible with transportation safety and with any further treatment operations which it might subsequently undergo, and then transport it to one of the two weapons waste sites just mentioned.

The Nuclear Regulatory Commission is committed to developing rules for future management of the West Valley waste, and will face a number of difficulties in its efforts. In the first place, it is generally agreed that the extent to which the waste can be removed from the carbon steel tank will not be known until the extraction is actually attempted. But any detailed regulatory policy for West Valley, developed without this knowledge may be very unhelpful.

For instance, suppose that the rule requires that all the high-level waste be shipped off-site to a Federal repository, and suppose it is later found that a significant amount of the sludge—a few percent, say—cannot be removed from

the bottom of the tank with normal recovery methods. In order to comply with the regulations, it might then be necessary to dismantle the tank and transport those sections contaminated with residual sludge to the repository. The risks posed by such an operation might be greater than those associated with disposing of the contaminated tank in some form at the West Valley site itself. But if a significant quantity of high-level waste were to remain at the site, then the argument for transporting the majority off-site would be weaker, and a revaluation of the risks and costs might lead to a decision to keep all the high-level waste at West Valley after all, as the best among a set of miserable choices. In this activity, where understanding comes step-by-step, so should the decisionmaking, hence also the rulemaking.

A related problem is the future of the rest of the West Valley site. Ultimately, plans will have to be developed for decommissioning the entire site, including the reprocessing plant itself, the various spent fuel and waste handling facilities, and the low-level solid waste burial ground.

The extent to which the future use of the site is constrained by the presence of these decommaissioned facilities should presumably influence the policy for high-level waste disposal and vice versa. Thus, the problem of decommissioning and that of future high-level waste managemen. should be considered together, as part of a holistic assessment.

Another difficulty facing NRC in its rulemaking is that the viability of some of the technical options depends on the resolution of a number of legal and political complexities surrounding the question of agency responsibility. Should NRC's considerations await resolution of these issues? Or should the Commission assume that there are no a priori political or legal obstacles, and proceed based on its own assessment of the risks and costs of the various technological options?

Finally, how should the responsibility for the future management of the waste at West Valley be allocated? A decision could be made in the courts. This approach has several disadvantages. Firstly, it could generate antagonism instead of fostering cooperation. Another disadvantage of a judicial settlement is that it might take a long time to achieve, and could therefore delay the start of management operations for longer than might otherwise be advisable. It should also be noted that the difficulty of allocating financial responsibility in advance is similar to the problem that the NRC will face in developing waste management rules for West Valley in advance; the cost of the operation will not be known with any certainy until it is underway. Furthermore, the cost will clearly depend on the outcome of the NRC's proceeding.

Could an agreement be reached outside the courts? Perhaps so, but the ground would have to carefully and publicly prepared in order to avoid lengthy court challenges, for example by public interest groups, to whom the agreement could assume the appearances of a comfortable accommodation among established bureaucracies.

Such thoughts are, of course, speculative. Nevertheless, they suggest an alternative solution. First, should it prove necessary, the Congress would authorize the federal ERDA (or its proposed successor, the new Department of Energy), as the entity best suited to the task, to manage the West Valley waste. The Department would then proceed to develop an expanded set of waste management options. This assessment would be unhindered by any legal or political complexities concerning the question of agency responsibility. NRC would then formulate guidelines on the basis of the assessment, and the Congress would appropriate funds enabling the Department to fulfill its role as waste manager in accordance with these guidelines, which would probably require modification as the work proceeded. Meanwhile, efforts would be made to allocate the financial responsibility for the waste treatment and disposition among NFS and the Federal and State governments. If that question ultimately requires judicial settlement, then so be it. But the question need not be resolved before beginning the work.

Guaranteeing the necessary funds even before the determination of financial responsibility would be an unusual step for Congress to take. Yet it is precisely here that the major advantage lies: by distinguishing between the delegation of managerial responsibility and the allocation of financial liability at the outset, the possibility of more delay can be avoided.

Concern has been shown that a federal assumption of responsibility for the waste at West Valley would constitute a precedent for federal "bail-out" of private firms incapable of meeting federally imposed regulatory requirements. On the other hand, there has also been concern that a federal failure to assume responsibility at West Valley would discourage—at a particularly inappropriate juncture—other private ventures into the nuclear power industry.

Clearly, both sets of concerns bear on the broader issue of the role that the federal government ought to play in the nuclear fuel cycle as a whole. The debate on this issue seems likely to intensify in the coming years. Indeed, the history of the West Valley seems to contain all the major ingredients of the broader debate. So much is unavoidable, but it is necessary to caution against losing sight of the fact—easily done in such an atmosphere—that a specific job is waiting at West Valley. In anticipation of a potentially damaging evacuation of the sphere of responsibility at West Valley, and in acknowledgement of the connection between West Valley and the future course of the nuclear power industry in the U.S., we urge consideration of a two-tiered solution, in which the issue of who is to manage the waste is separated from the question of who should pay for the management.

I think your analysis and recommendations are extremely helpful to the committee.

I will ask Mr. Ambro if he has any questions or comments.

Mr. AMBRO. I have a number of them, Mr. Chairman, but I must tell you I am a bit confused at the testimony.

Mr. Lester, you say, "The circumstances provide opportunities to blame the various participants." Then you say, "It is more constructive to look ahead toward what might be done to ameliorate the situation." And then you say, "A resolution of the West Valley problem will require that two questions be answered: one, what is to be done with the waste? and two, who is responsible?"

Well, I do not know what the word "blame" means, but does not looking back with respect to blame, in that sense, indicate who is responsible?

Mr. LESTER. No.

That is not quite what I mean. The words "Who is responsible?" perhaps should read, "Who is to be responsible for the future management of the waste?"

Mr. AMBRO. All right.

Do I understand that, apart from the AEC push to get private interests involved in nuclear fuel reprocessing to complement the private sector involvement with nuclear power generation, and statements by Governors Harriman and Rockefeller, to move the State in the direction of developing nuclear industry, that legally there exists a contract between the Nuclear Fuel Services company and the State, making the State finally or ultimately responsible for nuclear waste held at the West Valley facility?

Is that correct?

Mr. LESTER. That is correct, to my knowledge.

Mr. AMBRO. Do we have a copy of the contract anywhere?

Mr. WERTHAMER. Mr. Ambro, I characterized the agreement not so much as a contract, but rather, I think, "agreement" is more in order, in which there is language to the effect that if the Authority were to fail to meet its obligations, that the State of New York would step in.

Mr. AMBRO. What Authority?

Mr. WERTHAMER. The New York State Energy Research and Development Authority, subject to the availability of appropriations.

Mr. AMBRO. That is an arm of the State, is it not?

Mr. WERTHAMER. The Authority is a public benefit corporation. Perhaps Ms. Kaplan, my counsel, would like to elaborate on that.

Mr. AMBRO. That is all right. Maybe we can elaborate in a minute, but what I am getting at is this: What were the obligations of Nuclear Fuel Services under the contract?

Did they not have any obligations under the contract? Were there any penalties for termination or withdrawal?

Mr. WERTHAMER. The contract was drawn with the vision that the reprocessing facility would operate for many years, that it would generate waste, that the waste would fill up a tank, and when the first tank became full a second tank would be built. The second tank would be filled, and a third tank, and on into the indefinite future.

It was intended that as the first tank became full, a responsibility for its care beyond that point would be transferred to the State of New York. The agreement contemplated Nuclear Fuel Services' ability to transfer responsibility for the care of the tank on notice and with conditions, to the authority for further care.

Mr. AMBRO. At no point either did the Federal Government say in any agreement or contractual way that they would assume ultimate or final responsibility, did they?

Mr. WERTHAMER. No.

Mr. AMBRO. No.

What were the obligations of NFS under the contract? It seems kind of a one-way street. Did they have any responsibilities? Were there any obligations that they were not forced to meet? Were there any penalties for failure to act or live up to the agreement?

I do not have the contract. I would like to get a copy of it.

Mr. WERTHAMER. We will certainly make a copy of all——

Mr. AMBRO. What is your answer to that question?

Mr. WERTHAMER. There were a range of conditions and obligations on Nuclear Fuel Services. The tanks had to be operated and maintained according to AEC procedure.

Mr. AMBRO. Those were their obligations of the contract?

Mr. WERTHAMER. Yes.

Mr. AMBRO. Suppose they said, "We are not going to do that. We are just going to throw up our hands and leave" which is just about what they said, ultimately.

How do you hold them to the contract, to perform under the contract?

Mr. WERTHAMER. There are two sets of agreements between Nuclear Fuel Services and NYSERDA, one of which governs the high-level liquid waste, the so-called waste storage agreement, and the other of which governs the rest of the facility on the entire site, the lease.

Under the terms of the lease, the lease runs until the end of 1980 at which point there is a renewal option, a 10-year renewal option. Nuclear Fuel Services has indicated that it is their intention not to renew, pick up this renewal option beyond the end of 1980. That agreement governs the lease.

Under the waste storage agreement, responsibility for care of the high-level waste in the tank may be transferred to NYSERDA under notice, and subject to certain conditions, the conditions broadly being, first of all, that the tanks are in good condition which is defined technically within the terms of the waste storage agreement; and second, that the NRC approve the transfer through modification of the Federal license.

Mr. AMBRO. What was the thinking behind providing them with the option or the ability to transfer to NYSERDA? What went on there, in the minds of those drawing up the agreement?

Mr. WERTHAMER. The thinking, and one must remember that this is 1962 or thereabouts, was that, on the one hand, it is inappropriate for a corporation, for a private business venture to undertake the care of radioactive waste in perpetuity, for the thousands of years over which care is going to be required, particularly if those wastes are in liquid form in a tank where active supervision is required.

It was viewed that a corporate entity was not sufficiently long lived to perform that. It was felt that a governmental entity ought to have the stability and long-term establishment which was necessary for that perpetual care.

On the other hand, it was the policy of the Federal Government through the AEC, that the AEC would not at that time accept responsibility for "commercial radioactive waste," and that the AEC encouraged private operation of reprocessing, and, in an attempt to commercialize the whole fuel cycle, said it would not, that the AEC would not undertake responsibility for the custodial care of high-level waste in perpetuity.

Within that framework, the State of New York stepped forward.

Mr. AMBRO. Then NFS has, in effect, exercised its right under the option to transfer. Is that correct?

Mr. WERTHAMER. That is correct.

I would add one other remark, Mr. Ambro, if I might, and that is that since that time, and that was 15 years ago, our perceptions as to what might be appropriate policy have changed substantially.

Mr. AMBRO. Yes, yes; without question.

Mr. BROWN. Will you yield at this point?

Mr. AMBRO. Yes.

Mr. BROWN. The policy question is obviously in flux, but I just wanted to ask Mr. Werthamer for a comment on the ultimate limits of liability in a situation like this.

Nuclear Fuel Services, I presume, is a corporation set up for the specific purpose of operating this plant. I am not sufficiently familiar to know this, but I assume that this is probably true, and that NFS has limited assets, and the ultimate recovery against the corporation under those circumstances can only consist of the assets anyway.

Would that be correct?

Mr. WERTHAMER. That is my understanding.

Mr. BROWN. So if they walk away from it, there is no way of recouping anything except whatever assets the corporation may have. In effect, they are judgment-proof.

Mr. WERTHAMER. That is correct.

Mr. AMBRO. Is the corporation made up of a consortium of groups? Did you say W. R. Grace and——

Mr. WERTHAMER. No.

At the time of formation of the Nuclear Fuel Services, when the deal was constructed in 1962, Davison Chemical Co. which became Nuclear Fuel Services was wholly owned by W. R. Grace, and, subsequently, Grace transferred its ownership to Getty Oil Corp.

Mr. AMBRO. J. Paul could bail us all out, I suppose.

Mr. BROWN. It depends upon the way in which this corporation is structured. If J. Paul Getty or his estate is liable, that is one thing. If it is not, that is another thing.

Mr. WERTHAMER. Getty Oil, as I understand it, owns the stock of Nuclear Fuel Services.

Mr. AMBRO. Here we are confronted with the situation where the solidification process could cost anywhere from $500 million—Dr. Byerly said it would probably cost more.

Mr. Werthamer, what is your estimate?

Mr. WERTHAMER. We have no independent estimates. Our judgment is only what the reports commissioned by U.S. ERDA have given to us, and those reports which we have all read had a variety of technical options—perhaps not all technical options—and a range of dollars is roughly assigned to each technical option.

There are a number of options; each differs in cost. I would say it is very uncertain, but, reading that report, one gets the figures that Mr. Canfield quoted, anywhere from $50 million to $500 plus million, in the roughest kind of way.

Mr. AMBRO. Your two-tiered approach then sounds, as the Chairman pointed out, like a good suggestion. But when one level of government assumes managerial responsibility, is there not an underlying obligation that they will ultimately assume financial responsibility as well?

Once we reach out and hold this situation, if we are responsible in some way at the Federal level then we will have to provide the funding for, let's say, what to do with the waste and if, say, a process of solidification is required, then provide $500 million, or, as they say around here, "0.5".

What would you think about that?

Mr. LESTER. I think that I do not fully understand what you mean by the "underlying obligation" for financial responsibility.

I will distinguish once again between what I see to be managerial responsibility which, as you point out, will also involve the Federal Government finding the funds to carry that responsibility out, and ultimate financial liability which I believe can be resolved some other way.

I am still not quite clear what you mean by the underlying obligation.

Mr. AMBRO. That is the problem here. I am really not clear as to what you are proposing.

If we have a situation whereby under the contract NFS can exercise its option and shift responsibility to New York State ERDA, then the Federal Government can leave the situation, and New York State fends for itself.

Cannot we just end the whole discussion that way, and say to New York State, "Go ahead and deal with the situation on your own"? If, however, we proceed in the manner that you suggest, that approach, it seems to me, carries with it the implied agreement to underwrite financially the entire process. I am willing to do it as a representative of the State of New York because I think that for the State to have to generate from $50 million to $500 million, to $600 million in order to deal with this situation is horrendous, especially given the difficulties we are having now.

I just do not see how we are going to act in a subcommittee like this, which has authorizing jurisdiction, to start with small amounts of money for decommissioning and then move up to the levels of funding that we are talking about here. Perhaps the Chairman or someone else

can enlighten me, but I really am very confused about this whole situation. I find it very difficult to deal with.

Mr. BROWN. This subcommitte has authorized ERDA to initiate a study of which we have others already, of course, and to report to the Congress on their recommendations for the handling of this problem, and has authorized $2 million for that purpose.

It is quite conceivable that, based upon that study and its recommendations, ERDA will ask for congressional approval of policies that would involve their taking over the plant, and request an authorization for the amount of money necessary to solve the problem.

It may well be that these hearings will constitute our basis for some legislative action to either approve or disapprove that.

Mr. AMBRO. I understand that part of it.

Of course, the State of New York, given its financial situation, can say: "We throw up our hands, and we will not deal with this. The problem is a Federal problem. We leave it to the Federal level to handle."

Then we will get involved, it would seem to me, in court action, which is what you are trying to avoid. I cannot see how we are going to avoid court action in any way because, as you pointed out, I think, not only will the courts be charged with determining ultimate responsibility here, but philosophical intrusions generated by the antinuclear, pronuclear groups will be a factor.

It appears that if the Federal Government lets this rest and allows the State, for example, or whomever else is responsible outside of the Federal Government to burn, then that will, from the antinuclear people, set up barriers for any further action along these lines.

Mr. Werthamer?

Mr. WERTHAMER. I would point out, Mr. Ambro, the following: Agreements were established in the early 1960's with a certain perception as to what the reprocessing industry might look like.

I characterized the West Valley venture at that point as an early experiment in full-scale reprocessing plants under private ownership, but, in retrospect, we see that many aspects of how that situation technically and institutionally were going to be handled were not perceived at that point.

We have gotten wiser as the year has gone on. We have seen more about what is involved, what the longer term consequences might be for liquid storage in a carbon steel tank, as a long-term method, or its failures.

Nationally, we increased our sensitivity to controls and regulations that should be imposed to protect the public in terms of health and safety. We have come to understand a good deal more as to what this technology is and what should be done to run it safely.

I believe it would be very inappropriate public policy to structure financial responsibility on the basis of the 1962 perception, and fail to recognize the 1977 understanding.

Mr. AMBRO. I think that is a good statement.

I just have one more question because I see that a lot of other members are here who obviously want to ask questions.

Do you have any precise knowledge of how long those tanks will last?

Mr. WERTHAMER. The tanks were designed with a nominal safe design life of approximately 40 years. The tests that are routinely done on the tanks indicate no deviation from design performance.

I would not characterize our engineering knowledge of the tanks as definitive at this point.

Mr. AMBRO. So that if it took a little while to unravel this waste disposal problem, there would be no overwhelming safety hazard?

Mr. WERTHAMER. I believe that it would be inadvisable to rely on the information that is available at this point.

I think there are more uncertainties.

Mr. BROWN. Mr. Walker?

Mr. WALKER. Thank you, Mr. Chairman.

I do not have any questions about the particular aspects of the West Valley problem. I have to admit that I do not have a lot of the details at my command on it, but it seems to me, as an observer, that in this committee we are using West Valley as kind of an overall example, but perhaps by using West Valley we are a little bit too close to the overall subject.

Maybe the ultimate solution with West Valley will rest with the courts. Maybe they will make the final determination, but it seems to me that one of the things I would like to get out of this hearing, and what the committee is aiming at, is what the overall policy for the future is going to be.

Since this problem is going to arise again, and again, and again as these plants go through their entire life cycle, I would like a comment from the panel, if possible, or from somebody, as to where the ultimate responsibility for waste disposal and handling should rest as we go about making policy, so that we do not have to go to the courts each time?

Somewhere along the line, this committee or somebody is going to have to make the determination as to where that ultimate responsibility rests.

Do any of you, in studying the situation, have an idea as to where we should place that ultimate responsibility? A secondary question to that is, if the Federal Government is going through this whole licensing process for all of these plants, shouldn't some determination as to who is ultimately responsible for that plant's wastes be a part of the licensing procedure?

Mr. Canfield?

Mr. CANFIELD. Let me make two points.

I will make one very gingerly because I do not want to preclude the fact that we are coming up here and addressing your question first thing tomorrow morning.

We have prepared a report on decommissioning and decontamination which we are issuing to this subcommittee tomorrow, and I believe that we will be the first witness before the subcommittee on the overall question of who is responsible.

In that context though, let me point out two things. One point which was not raised in the dialogue started by Mr. Ambro is that in spite of the fact that there is a contract between NFS and New York ERDA, the simple fact of the matter is that NRC does maintain a role.

To the extent that it wants to, NRC could place additional restrictions on the surrender between now and 1980, and, therefore, put the thing in limbo and keep West Valley the responsibility of NFS. NRC will not be able to expunge itself of that responsibility. It exists. It is a part of the game as it will have to be played out.

I wanted to make that clear.

The second point is that to the extent that the committee deals with West Valley, all of our studies, both this study which we did in March on West Valley and the study we are going to present to you tomorrow, clearly indicate that West Valley is in many ways an exception.

It is probably a mistake to view West Valley as the example, the harbinger of the way we ought to handle similar things in the future.

We would urge the committee to look at West Valley as an anomaly and then move on to the question of how do we look at the whole issue of Federal responsibility and the Federal role regarding the entire back end of the fuel cycle, including light water reactors decommissioning, and decontamination.

We have recommendations which we will be coming forward with tomorrow morning regarding the Federal role.

I would urge that we not focus too much on West Valley as though it is the example. It is probably a poor example.

Mr. WALKER. To follow up, is there a problem that if the courts do get mixed up in this, they will set some precedents with West Valley, which you say is an exception, which could then be applied in a lot of other cases which are more general in nature?

Mr. CANFIELD. It is possible but unlikely.

It would seem to me that the courts would be willing to listen to a statement just like I made, and probably would take that into account. That is a fairly straightforward thing.

I think most people would argue that West Valley is in fact a unique situation and needs to be handled on a unique basis.

Mr. BROWN. Dr. Werthamer?

Mr. WERTHAMER. I would support that also, Mr. Walker, in the sense that I think a fair conclusion that could be drawn from looking at West Valley is that one did not look far enough ahead.

We have pointed to West Valley as an early commercialization experiment. One of the reasons that we are here today is that not enough attention was paid to all of the consequences of initiating that action.

As I think Mr. Lester very aptly said, there was some temporizing involved. Something would turn up. I believe that one should be structuring, looking ahead as far in the future as one possibly can in future nuclear facilities, and that decommissioning, and a plan, a financial and management plan for decommissioning should be part of every licensing procedure.

Mr. CANFIELD. The implication because of the general thrust of the statements just given here on both sides of me might be that by looking at West Valley as an exception, that you automatically jump to the conclusion that there is some Federal role to "bail out," and I have used that term myself, as has the nuclear industry.

I think that conclusion is very, very premature. I would like to see enormous amounts of dialogue on that. The costs of the back end of the fuel cycle are not normally calculated into the costs of nuclear energy and the electricity generated by nuclear power.

I think it is an enormously crucial issue facing the country. There is an implicit subsidization of that industry today.

We probably will get more into that tomorrow. I would not want it implied, however, that the GAO felt that by definition Federal responsibility means Federal takeover with no costing to the consumer on a real time basis of the costs associated with the back end of the fuel cycle.

Mr. WALKER. Just to pursue one point that Dr. Wertheimer made just a minute ago, one thing that has disturbed me all the way on this whole business of nuclear waste are the statements that I keep hearing over and over again that something will turn up to solve the waste disposal problem. You just made that statement with regard to West Valley, that something will turn up.

I mean, maybe this philosophy is why we have a kind of general policy problem also. Maybe the problem is more generalized than what we do with West Valley wastes.

Thank you, Mr. Chairman.

Mr. BROWN. If I may follow up with a comment, Mr. Walker, Mr. Lester described the waste management philosophy at West Valley in the terms that you have quoted, that something would turn up. That essentially has been the philosophy in Congress, and the AEC, and ERDA with regard to the whole problem of waste disposal.

We have not reached yet a policy solution in that area. West Valley could be a prototype for the kind of a policy solution that needs to be evolved for the entire nuclear fuel cycle. I would suspect that all the panelists would hope that that policy would evolve in the fairly near future.

Most of the Members of Congress seem to feel that way, but we have not been able to get the problem resolved. One example of the difficulty of resolving this problem is the general question of what role private industry will take versus the Government, and Members of Congress are not yet sure which way they want to go.

When we had the Nuclear Fuel Assurance Act last year, which relates, of course, to the front end of the nuclear fuel cycle, and not the reprocessing, but the enrichment aspects, the Congress was not ready to decide whether they wanted to have private industry in the enrichment business or not. Likewise, Congress does not seem to be sure whether it wants them in the reprocessing and waste disposal end of the business.

We have three other witnesses who will, I am sure, continue some of this dialogue and are quite competent to do so. I want to thank all of you for the contribution that you have made this morning.

We will look forward to hearing from all of you again in connection with this matter.

Thank you very much for your cooperation.

Mr. WERTHEIMER. Thank you very much, Mr. Chairman.

Mr. BROWN. The next witness is Dr. Marvin Resnikoff, from Rachel Carson College, the State University of New York at Buffalo. He has given a great deal of attention to this problem.

Dr. Resnikoff, we are pleased to have you here this morning. You have been acquainted with this problem in your role as a citizen and representative of public interest groups, as I understand it, and we would be pleased to have your statement, which you may either read in full or abbreviate as you see fit.

STATEMENT OF MARVIN RESNIKOFF, RACHEL CARSON COLLEGE, STATE UNIVERSITY OF NEW YORK AT BUFFALO

Dr. RESNIKOFF. I will try to abbreviate.

Mr. BROWN. Your full statement will be made a part of the record.

Dr. RESNIKOFF. Mr. Chairman and members of the subcommittee, thank you for inviting me to testify at these important hearings on the decommissioning and decontamination of nuclear facilities and the disposal of nuclear wastes, with specific reference to West Valley.

My name is Marvin Resnikoff. I am a scientist with Rachel Carson College, the New York public interest research group, and the Sierra Club. The Sierra Club is a 175,000-member national environmental and conservation organization dedicated to preserving the integrity of natural systems and enhancing the quality of the human environment.

I serve as chairperson of the nuclear subcommittee of the Energy Policy Committee for the club. We have had an interest in the problems of the Nuclear Fuel Services (NFS) reprocessing plant and the West Valley site since 1970. In April 1974, we intervened as a full party in the Nuclear Fuel Services construction permit proceeding before the Nuclear Regulatory Commission (NRC).

Our petition to intervene expressed concern about the environmental consequences of the proposed expansion of the NFS plant, but we were especially concerned about the consequences of a major leak from the high-level waste tanks at West Valley and the fact that no decommissioning plans for the high-level waste tanks and the plant itself existed.

As we stated at the time, in 1974, "Neither the Sierra Club, nor, do we believe, the public at large, cares to pay for the decommissioning of NFS; it is encumbent on NFS to present detailed plans—when, how, the costs, and the future accessibility of the land to the public."

We were the first organization to bring to public attention the matter of this tremendous liability to the State of New York. Finally, as a full participant in another NRC proceeding, the generic plutonium recycle or GESMO proceeding, we submitted voluminous testimony on the operating history of NFS, which, with your permission, we would like to submit for the record here today.

The chairman has asked that we address the question of the environmental, health, safety, and economic consequences of decommissioning and decontamination of nuclear facilities and the disposal of nuclear wastes, employing Nuclear Fuel Services as an example of these issues.

I would like to begin by setting the Nuclear Fuel Services problem in a larger perspective. I believe that the underlying issue concerning the question of the overall physical responsibility for materials which remain hazardous for very long periods of time is clear. A single private corporation cannot make this long-term commitment. This was recognized by the Atomic Energy Commission in the early 1960's and by Nuclear Fuel Services in 1962.

To quote from Nuclear Fuel Services:

> . . . it is not feasible for a private corporation to assume physical responsibility for high level wastes from a chemical processing plant for the extended and possibly indefinite period of time necessary to assure adequate protection of

public health and safety. To undertake such responsibility would require management to commit the continuance of corporate activities will beyond the life of the plant.

Corporations and physical plants have a short life compared to radioactive waste materials. This holds not only for NFS and their high-level waste tanks but for electric utilities and their power reactors, not to speak of cemeteries and used car lots, though the extent of liability for this latter category is vastly different.

In order to insure the continued protection of the public health and safety, private corporations can establish a maintenance fund for the long-term care of the wastes and have the State or Federal Government assume the physical responsibility.

Payments to the maintenance fund would then be included as part of the goods or services provided by that corporation. Private corporations could live with this arrangement which implies a bounded risk. The only problem is to precisely estimate the size of the fund. In an established, mature industry with experience in handling waste materials, the maintenance fund would be expected to closely track the costs.

However, I think the less well known the technology and actual costs, and the further into the future these costs are projected, the more likely it is that a major miscalculation in the maintenance fund can occur.

This was clearly the case with NFS and it may well be the case today with nuclear reactors.

The contributions to the perpetual maintenance fund were based on the estimated costs to replace the high-level waste storage tanks after their useful life of 40 to 60 years, assuming an escalation rate of 4½ percent.

However, the agreement between the State Authority and NFS was based on rather incomplete information. The escalation rate turned out to be higher than originally projected. The technology was not completely at hand to remove the wastes from one tank and place them in another.

Indeed, there are no installed pumps and lines between one tank and its alternate. The location of the nearest earthquake fault was not even known when the tanks were constructed: it is not clear that the tanks can withstand the maximum earthquake which could occur on the site.

Were the liquid wastes to leak out of the tank, I am fairly certain, based on information from Oak Ridge, that the sludge remaining at the bottom of the tank would boil off the remaining water and become fairly hot, possibly decomposing the tank and the cement vault.

Calculations on this eventuality have not been done by the NRC. The 30,000 gallons of sludge generate 10 times as much heat as the 570,000 gallons of liquid. On top of all this uncertainty, the AEC changed their high-level waste policy in 1970. Because nonleachable solid wastes are less likely to be harmful to the public health and safety, the AEC revised their waste policy to require that future high-level waste material be solidified and shipped to a central Federal Repository. It is not clear how this policy will be applied to existing NFS waste since the technology is not yet at hand, and pilot scale facilities have not been constructed, to solidify this material.

Thus, because of these changes in NRC regulations, which were necessary to protect the public health and safety, and because of this incomplete understanding of the NFS waste situation, it now appears that the perpetual maintenance fund was grossly underestimated.

I would think it would be impossible to establish a perpetual maintenance fund, to protect the public far into the future, unless the technology and the costs could be more precisely assigned, with more realistic escalation rates. The NFS situation is symptomatic of an immature industry.

As is well known, acting under the terms of the waste management agreement, NFS requested the State of New York to assume responsibility for the low-level commercial waste burial ground, the high-level solid waste burial ground, and the high-level waste tanks. Further, upon expiration of the lease, December 31, 1980, the State of New York will also be the proud owner of one "hot" reprocessing plant.

The costs to decommission the plant alone have been estimated by the GAO, based on estimates for the Barnwell facility and not on real decommissioning experience of reprocessing facilities, as between $5 million and $65 million, depending on the decommissioning mode selected and the future use of the site.

Before addressing the question of who is financially responsible for the total decommissioning cost, which may be over $500 million, let me first state that many of us living in western New York regard economic considerations as secondary.

Our primary concern is the health and safety of the public, not only for us, but for future generations as well. Economic short cuts which delay the ultimate resolution of this waste problem to future generations must not be accepted. The overriding principle here should be that those who take the benefits, take the risks.

I might say that a coalition of organizations and individuals is forming throughout western New York to emphasize our concern and sense of urgency in resolving the West Valley waste problem, in cleaning up the site, and in locating a job-creating, environmentally compatible industry for the site. I have attached a sample petition to the statement.

Because of the potential for a major health and safety problem due to a large spill from the high-level waste tank, we consider the resolution of the high-level waste situation as the No. 1 priority. In accordance with the high-level waste policy of the NRC, we believe that this material must be solidified and removed from the West Valley site as rapidly as possible. I have attached a Sierra Club letter to the President requesting that he empanel a Special Commission on Radioactive Wastes to deal with this problem expeditiously, freed of agency encumbrances. The question of financial responsibility can be resolved concurrently, but the high level waste problem must be attacked without delay.

Mr. BROWN. Without objection, the two attachments referred to will be included in the record.

PETITION ON WEST VALLEY NUCLEAR WASTES

We, the people of western New York, recognize that the radioactive wastes stored at West Valley pose a serious threat to our health and safety and that of our children and our children's children . . .

We insist that all necessary measures be taken (i.e. economic and technical) to protect the public health and safety. This should be done as quickly as possible, consistent with the nature of the problem.

We are also in support of locating a job creating environmentally compatible industry on the site.

We support the Coalition on West Valley Nuclear Wastes in the furtherance of these objectives.

Name	Street	City	ZIP	Phone No.

Return to: Coalition on West Valley Nuclear Waste % Cold Spring Warehouse, 167 Leroy Ave., Buffalo, N.Y. 14214.

Dr. RESNIKOFF. Turning to the question of who should bear the financial burden of decommissioning the West Valley site, we believe, in the end, that the responsibility cannot rest on New York State alone, or on the Federal Government alone.

It must be shared among the several parties. For this reason, we support the ERDA authorization bill amendment which authorizes funds to study the waste problem and the financial responsibility question.

I have read the agreements between NFS and the State of New York, and it seems clear to this nonlegal mind that the State of New York has the legal responsibility to dispose of this noxious waste material. New York State, in its eagerness to bring this bright new industry to the State, seriously underestimated the costs to manage the waste materials.

New York State did not realize the problems and additional costs to remove the high-level wastes from the tank, but it did agree to take on the financial burden. Nevertheless, other considerations lead us to the opinion that the costs must be shared and that these other avenues of cost sharing must be explored by the State of New York before the Federal Government opens its treasury.

(a) NFS has a responsibility.

According to the Waste Storage Agreement, section 3.05, NFS has the right to surrender responsibility of the wastes to NYSERDA provided that the high-level waste tanks are in good condition, that all payments have been made, and all necessary licenses obtained.

If the tanks fail to be in "good condition," NFS is required to make additional payments to the perpetual maintenance fund equal to the increased costs to the Authority resulting from such failure. But what does "good condition" mean?

The lengthy definition is spelled out in the waste storage agreement, section 3.06. Among other provisions, section (e) states that "all storage parameters shall have been observed." In particular, according to schedule 3–A, the high-level waste tanks "shall contain appropriate means for the prevention of sludge for settling by agitation with compressed air. . . ."

In the NFS Preliminary Safety Analysis Report, the air mechanism is described and shown in diagrams: "The particular design as shown is required to allow for agitation of the tank contents at the bottom of the tank." NFS has failed to meet this condition because the sludge has settled to the bottom of the tank. The fact that the sludge has settled will greatly complicate the process of removing

the high-level wastes from the tank, and will greatly increase the costs to the Authority. NYSERDA should investigate.

Additionally, but of lesser importance, (i) NFS has stored low-level liquid radioactive wastes in the spare tank, contrary to the conditions of the license and the waste storage agreement. Further, (ii) because of the faulty condition of the low-level waste evaporator within the NFS plant, NFS placed less concentrated waste materials in the high-level waste tank.

It was therefore necessary for NFS to boil off the excess liquid by means of a heat exchanger placed inside the tank. Over 9 million gallons of high-level waste material have been evaporated down to 600,000 gallons within the high-level waste tank itself.

Thus, NFS operated the high-level waste tank as an evaporator, in effect. In what ways, if at all, this practice led to increased pitting and corrosion, and reduced the lifetime of the tank will have to be investigated by NYSERDA.

(b) The utilities have a responsibility.

According to the terms of the contract signed between NFS and Consumers Power, dated October 14, 1970, NFS assumed the risk of the cost for the solidification of the high-level waste materials. By transferring the high-level wastes to NYSERDA, NFS has legally passed this obligation of solidification to the State of New York.

However, according to the contract, certain costs can be recovered from Consumers Power by NFS, namely, the cost of transporting the solidified high-level waste material to a Federal Repository and the cost of the storage charge at the Federal Repository. These costs are not insignificant.

According to a recent NRC contracted study, the costs for transportation to, and storage at, the Federal Repository, constitute about one-half of the total costs for managing the high-level waste materials at West Valley.

I have not seen the other utility contracts, but if they are similar in form, there is an opportunity for NFS, or NYSERDA, as an obligated third party, to recover some of the waste management costs.

It seems fair to have the utilities, who, after all, were responsible for part of the high-level waste problem, to share some of the financial responsibility. The utilities have recovered the plutonium and uranium values from the spent fuel elements without paying the full costs of waste disposal.

It is what could be called a "strip mining" method of resource recovery. On the other hand, it seems unfair to have the State of New York shoulder the full waste burden. This is not a New York State problem, but a national problem in many ways. In particular, only 23 metric tons of spent fuel which contributed to the high-level neutralized wastes came from New York State; the remainder of the 609 metric tons came from out-of-State.

(c) The Federal Government has a responsibility.

NYSERDA has shown, in testimony before the Conservation, Energy, and Natural Resources Subcommittee, that the Federal Government encouraged the State of New York to encourage the development of a commercial reprocessing industry.

In support of this end, the Federal Government provided three-fifths of the spent fuel processed at NFS from the Hanford weapons reactor;

additional amounts were in the form of fuel leased by the AEC to commercial reactors. As an additional point, the AEC did change the rules of the waste management game at a point when NFS and the State of New York could not easily recover the additional costs. True, these changes were advisable to protect the health and safety of the public. Still, they increased the economic burden to the State of New York.

Many of us see the West Valley problem not as an anomaly, but as indicative of an immature industry. We see the waste situation as drifting toward more undesirable choices and increasing endangerment of the public health and safety. While the wastes in the future will be different than that of NFS, being either acidic or spent fuel itself, we nevertheless view the resolution of the West Valley situation as a barometer of the ERDA, NRC, and nuclear industry commitment to safe radioactive waste disposal.

I would be pleased to answer any questions you may have.

Mr. BROWN. Thank you, Dr. Resnikoff.

Do you have any questions, Mr. Ambro?

Mr. AMBRO. I would like to commend Dr. Resnikoff. The recitation is extremely clear, and it crystallizes in clear language as well the understanding that I began to evolve about what took place and how it worked out.

But where are we besides the recommendation that there should be some cost sharing with respect to this problem?

What else would you like to contribute, just that notion?

Dr. RESNIKOFF. That is such an openended question.

Mr. AMBRO. I made it an open-ended question because, as I say, the recitation of what took place, and the clarity with which you laid it out, I thought, was just excellent. However, the only recommendation or thought that I see in your statement is that there should be a cost sharing—that the Federal Government alone or the State government alone should not pick up the cost burdens involved here. NFS should and utility companies should, as well. I understand that.

Mr. RESNIKOFF. We are hoping that the ERDA study will contribute further to this. We commend the subcommittee on allocating that additional money for that study. We support the recommendations of Mr. Canfield and the GAO. We think they are excellent also.

Mr. AMBRO. But you said just precisely the opposite of what Mr. Canfield said. He would like to consider West Valley an anomaly. You would like not to consider it an anomaly.

Mr. RESNIKOFF. That particular recommendation. I would like not to support. But the committee recommendations, the further studies that have to be done on decommissioning as such, those are the recommendations I was referring to.

Mr. AMBRO. You may have an interesting point there. I will end on this, Mr. Chairman, that this situation not be considered an anomaly. I think we have a plant in Illinois that never worked, and one in South Carolina which is up and nothing is going on with it.

Perhaps those represent three anomalies, which makes all of them less than anomalies, but disasters.

Dr. RESNIKOFF. I am also concerned about the power reactors, the over-60 power reactors that are operating in this country. I think they

are also part of this problem. They will also be radioactive for long periods of time.

Some policy must be set about that. Contrary to the NFS situation, where even a small perpetual maintenance fund was set up, I know of no reactors that have decommissioning funds set up at the present time.

Mr. AMBRO. Just one last thought. You are teaching at Rachel Carson College.

Dr. RESNIKOFF. Yes; as part of the State university.

Mr. AMBRO. Why is your testimony on Sierra Club letterhead?

Dr. RESNIKOFF. I wear three different hats. The Sierra Club has been mainly responsible for the intervention at West Valley.

Mr. AMBRO. I tell you why I ask. I was probably out of the room doing something when you went through this, but I thought you would hit the environmental question a little harder. Did you in the earlier part of your testimony?

Dr. RESNIKOFF. We are concerned about the environmental consequences of an accident of a high-level waste tank.

We have been concerned for some time with that.

Mr. AMBRO. Thank you again.

Thank you, Mr. Chairman.

Mr. BROWN. Thank you, Mr. Ambro.

Mr. Walker?

Mr. WALKER. Thank you, Mr. Chairman.

I have one brief question. Do I take it from your statement with regard to the setting up of a decommissioning fund that you are concerned at the present time that nuclear customers are not paying the full price of nuclear power? Can I make that assumption from your testimony?

Dr. RESNIKOFF. Yes.

Mr. WALKER. And that if such a fund were created, that we do not know what the costs might be, but over the long run it would make nuclear power a far more expensive commodity in terms of power generation.

Dr. RESNIKOFF. Yes, it would be more expensive.

Mr. WALKER. But at this point, we cannot calculate the kind of cost that might accrue to a decommissioning fund?

Dr. RESNIKOFF. That is right.

Mr. WALKER. I am talking about the cost to the consumer.

Dr. RESNIKOFF. Right.

It can be estimated somewhat. For instance, for power reactors the decommissioning costs have been estimated by several people at 10 percent of the construction costs, which would make it fairly large.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. BROWN. Mr. Walgren?

Mr. WALGREN. I have no questions.

Mr. BROWN. Thank you very much, Dr. Resnikoff

Dr. RESNIKOFF. Thank you, Mr. Chairman.

[The prepared statement of Dr. Resnikoff follows:]

STATEMENT OF DR. MARVIN RESNIKOFF, SIERRA CLUB

Mr. Chairman and members of the subcommittee. Thank you for inviting me to testify at these important hearings on the decommissioning and decontamination of nuclear facilities and the disposal of nuclear wastes, with specific reference to West Valley.

My name is Marvin Resnikoff. I am a scientist with Rachel Carson College, the New York Public Interest Research Group and the Sierra Club. The Sierra Club is a 175,000 member national environmental and conservation organization dedicated to preserving the integrity of natural systems and enhancing the quality of the human environment. I serve as chairperson of the Nuclear Subcommittee of the Energy Policy Committee for the Club. We have had an interest in the problems of the Nuclear Fuel Services (NFS) reprocessing plant and the West Valley site since 1970. In April, 1974, we intervened as a full party in the Nuclear Fuel Services construction permit proceeding before the Nuclear Regulatory Commission (NRC). Our petition to intervene expressed concern about the environmental consequences of the proposed expansion of the NFS plant, but we were especially concerned about the consequences of a major leak from the high level waste tanks at West Valley and the fact that no decommissioning plans for the high level waste tanks and the plant itself existed. As we stated at the time, "Neither the Sierra Club, nor, do we believe, the public at large, cares to pay for the decommissioning of NFS; it is encumbent on NSF to present detailed plans—when, how, the costs and the future accessibility of the land to the public."

We were the first organization to bring to public attention the matter of this tremendous liability to the State of New York. Finally, as a full participant in another NRC proceeding, the generic plutonium recycle or GESMO proceeding we submitted voluminous testimony on the operating history of NFS [1], which, with your permission, we would like to submit for the record here today.

The Chairman has asked that we address the question of the environmental, health, safety and economic consequences of decommissioning and decontamination of nuclear facilities and the disposal of nuclear wastes, employing Nuclear Fuel Services as an example of these issues. I would like to begin by setting the Nuclear Fuel Services problem in a larger perspective. I believe that the underlying issue concerning the question of the overall physical responsibility for materials which remain hazardous for very long periods of time is clear. A single private corporation cannot make this long-term commitment. This was recognized by the Atomic Energy Commission in the early 1960's and by Nuclear Fuel Services in 1962. To quote from Nuclear Fuel Services [2]:

". . . it is not feasible for a private corporation to assume physical responsibility for high level wastes from a chemical processing plant for the extended and possibly indefinite period of time necessary to assure ade[illegible]ate protection of public health and safety. To undertake such responsibi[illegible]would require management to commit the continuance of corporate activities well beyond the life of the plant."

Corporations and physical plants have a short life compared to radioactive waste materials. This holds not only for NFS and their high level waste tanks but for electric utilities and their power reactors, not to speak of cemeteries and used car lots, though the extent of liability for this latter category is vastly different.

In order to ensure the continued protection of the public health and safety, private corporations can establish a maintenance fund for the long term care of the wastes and have the State or Federal Government assume the physical responsibility. Payments to the maintenance fund would then be included as part of the good or services provided by that corporation. Private corporations could live with this arrangement which implies a bounded risk. The only problem is to precisely estimate the size of the fund. In an established mature industry, with experience in handling waste materials, the maintenance fund would be expected to closely track the costs. However, I think the less well known the technology and actual costs, and the further into the future these costs are projected, the more likely it is that a major miscalculation in the maintenance fund can occur.

This was clearly the case with NFS and it may well be the case today with nuclear reactors. Over 60 nuclear power reactors are presently operating in this country. Our research at NYPIRG has shown that the reactor vessels and internals may remain radioactive for up to 1.5 million years,[3] yet the technology to decommission a commercial power reactor is imprecisely known, as are the

---

[1] Sierra Club Testimony Related to Section IV E. Reprocessing. Final GESMO I by Marvin Resnikoff (Docket No. RM–50–5. March 4, 1977.

[2] Proposal of Nuclear Fuel Services, Inc. to the U.S. Atomic Energy Commission to establish a commercial nuclear fuel processing facility. June 18, 1962.

[3] S. Harwood, et al, "The Cost of Turning It Off," Environment 18 p. 17 (1976).

costs. Unlike NFS, where at least a small Perpetual Maintenance Fund was established, I know of no electric utility that has set aside a maintenance fund for decommissioning purposes. Thus, present electric rate payers are not paying the full cost of the electricity, and future rate payers, if not the general taxpayer, will be in for quite a shock.

Turning to the high level waste tank at West Valley, it is clear, in retrospect, that the costs to protect the public health and safety in perpetuity were grossly underestimated. The original contracts which bound the State of this liability were hastily arranged in a sea of ignorance; the State was an over-eager suitor besides.

The contributions to the Perpetual Maintenance Fund were based on the estimated costs to replace the high level waste storage tanks after their useful life of 40 to 50 years, assuming an escalation rate of 4½ percent. However, the agreement between the State Authority and NFS was based on rather incomplete information. The escalation rate turned out to be higher than originally projected. The technology was not completely at hand to remove the wastes from one tank and place them in another. Indeed, there are no installed pumps and lines between one tank and its alternate. The location of the nearest earthquake fault was not even known when the tanks were constructed; it is not clear that the tanks can withstand the maximum earthquake which could occur on the site. Were the liquid wastes to leak out of the tank, I am fairly certain, based on information from Oak Ridge,[4] that the sludge remaining at the bottom of the tank would boil off the remaining water and become fairly hot, possibly decomposing the tank and the cement vault. Calculations on this eventuality have not been done by the NRC. The 30,000 gallons of sludge generate ten times as much heat as the 570,000 gallons of liquid. On top of all this uncertainty, the AEC changed their high level waste policy in 1970. Because non-leachable solid wastes are less likely to be harmful to the public health and safety, the AEC revised their waste policy to require that future high level waste material be solidified and shipped to a central Federal Repository.

It is not clear how this policy will be applied to existing NFS waste since the technology is not yet at hand, and pilot scale facilities have not been constructed, to solidify this material. Thus, because of these changes in NRC regulations, which were necessary to protect the public health and safety, and because of this incomplete understanding of the NFS waste situation,[5] it now appears that the Perpetual Maintenance Fund was grossly underestimated. I would think it would be impossible to establish a Perpetual Maintenance Fund, to protect the public far into the future, unless the technology and the costs could be more precisely assigned, with more realistic escalation rates. The NFS situation is symptomatic of an immature industry.

Even the technology of burying low level solid wastes, so that the radioactivity is completely contained, was not well-known in 1963. Imagine. Humans have been digging holes for thousands of years and one would think that the technology is known. But, in fact, the trenches of the commercial burial ground, in which the radioactive material is buried, have overfilled with water like a bathtub and have leaked water into the Cattaraugus Creek watershed.[6]

As is well-known, acting under the terms of the Waste Management Agreement, NFS requested the State of New York to assume responsibility for the low level commercial waste burial ground, the high level solid waste burial ground, and the high level waste tanks. Further, upon expiration of the lease, Dec. 31, 1980, the State of New York will also be the proud owner of one "hot" reprocessing plant. The costs to decommission the plant have been estimated by the GAO*, based on estimates for the Barnwell facility and not on real decommissioning experience of reprocessing facilities, as between $5 million and $66 million, depending on the decommissioning mode selected and the future use of the site.

Before addressing the question of who is financially responsible for the total decommissioning cost, which may be over $500 million, let me first state that many of us living in Western New York regard economic considerations as secondary. Our primary concern is the health and safety of the public, not only for us, but for future generations as well. Economic short cuts which delay the

---

[4] ORNAL–4451, Siting of Fuel Reprocessing Plants . . . . p. 8–95 (July, 1970).

[5] The type of information which must still be generated is well laid out in the GAO Report to the Conservation, Energy & Natural Resources Subcommittee of the House Committee on Government Operations, "Issues Related to the Closing of the Nuclear Fuel Services, Incorporated, Reprocessing Plant at West Valley, New York", EMD–77 27, March 8, 1977.

[6] Sierra Club testimony, Docket No. RM–50–5, Figs. II.B.1 and 4.

ultimate resolution of this waste problem to future generations must not be accepted. The over-riding principle here should be that those who take the benefits, take the risks. I might say that a coalition of organizations and individuals is forming throughout Western New York to emphasize our concern and sense of urgency in resolving the West Valley waste problem, in cleaning up the site, and in locating a job-creating, environmentally compatible, industry for the site. I have attached a sample petition to the Statement.

Because of the potential for a major health and safety problem due to a large spill from the high level waste tank, we consider the resolution of the high level waste situation as the number one priority. In accordance with the high level waste policy of the NRC, we believe that this material must be solidified and removed from the West Valley site as rapidly as possible. I have attached a Sierra Club letter to the President requesting that he empanel a Special Commission on Radioactive Wastes to deal with this problem expeditiously, freed of agency encumbrances. The question of financial responsibility can be resolved concurrently, but the high level waste problem must be attacked without delay.

Turning to the question of who should bear the financial burden of decommissioning the West Valley site, we believe, in the end, that the responsibility cannot rest on New York State alone, or on the Federal Government alone: it must be shared among the several parties. For this reason, we support the ERDA Authorization Bill amendment which authorizes funds to study the waste problem and the financial responsibility question. I have read the agreements between NFS and the State of New York, and it seems clear to this nonlegal mind that the State of New York has the legal responsibility to dispose of this noxious waste material. New York State, in its eagerness to bring this bright new industry to the State, seriously underestimated the costs to manage the waste materials. New York State did not realize the problems and additional costs to remove the high level wastes from the tank, but it did agree to take on the financial burden. Nevertheless, other considerations lead us to the opinion that the costs must be shared and that these other avenues of cost sharing must be explored by the State of New York before the Federal Government opens its treasury.

(a) NFS has a responsibility

According to the Waste Storage Agreement (Sect. 3.05), NFS has the right to surrender responsibility of the wastes to NYSERDA provided that the high level waste tanks are in good condition, that all payments have been made, and all necessary licenses obtained. If the tanks fail to be in "good condition", NFS is required to make additional payments to the Perpetual Maintenance Fund equal to the increased costs to the Authority resulting from such failure. But what does "good condition" mean?

The lengthy definition is spelled out in the Waste Storage Agreement (Sect. 3.06). Among other provisions, Section (c) states that "all Storage Parameters shall have been observed". In particular, according to Schedule 3–A, the high level waste tanks "shall contain appropriate means for the prevention of sludge from settling by agitation with compressed air . . ." In the NFS' Preliminary Safety Analysis Report, the air mechanism is described and shown in diagrams: "The particular design as shown is required to allow for agitation of the tank contents at the bottom of the tank." NFS has failed to meet this condition because the sludge has settled to the bottom of the tank.

The fact that the sludge has settled will greatly complicate the process of removing the high level wastes from the tank, and will greatly increase the costs to the Authority. NYSERDA should investigate.

Additionally, but of lesser importance, (i) NFS has stored low level liquid radioactive wastes in the spare tank, contrary to the conditions of the license and the Waste Storage Agreement. Further, (ii) because of the faulty condition of the low level waste evaporator within the NFS plant, NFS placed less concentrated waste materials in the high level waste tank. It was therefore necessary for NFS to boil off the excess liquid by means of a heat exchanger placed inside the tank. Over 9,000,000 gallons of high level waste material have been evaporated down to 600,000 gallons within the high level waste tank itself. Thus, NFS operated the high level waste tank as an evaporator, in effect. In what ways, if at all, this practice led to increased pitting and corrosion, and reduced the lifetime of the tank will have to be investigated by NYSERDA.

(b) The utilities have a responsibility

According to the terms of the contract signed between NFS and Consumers Power, dated Oct. 14, 1970, NFS assumed the risk of the cost for the solidification of the high level waste materials. By transferring the high level wastes to

NYSERDA, NFS has legally passed this obligation of solidification to the State of New York. However, according to the contract, certain costs can be recovered from Consumers Power by NFS, namely, the cost of transporting the solidified high level waste material to a Federal Repository and the cost of the storage charge at the Federal Repository. These costs are not insignificant.

According to a recent NRC contracted study, the costs for transportation to, and storage at, the Federal Repository, constitute about one-half the total costs for managing the high level waste materials at West Valley.[7] I have not seen the other utility contracts, but if they are similar in form, there is an opportunity for NFS, or NYSERDA, as an obligated third party, to recover some of the waste management costs.

It seems fair to have the utilities, who, after all, were responsible for part of the high level waste problem, to share some of the financial responsibility. The utilities have recovered the plutonium and uranium values from the spent fuel elements without paying the full costs of waste disposeal. It is what could be called a "strip-mining" method of resource recovery. On the other hand, it seems unfair to have the State of New York shoulder the full waste burden. This is not a New York State problem, but a national problem in many ways. In particular, only 23 metric tons of spent fuel which contributed to the high level neutralized wastes came from New York State; the remainder of the 609 metric tons came from out-of-state.

(c) The Federal Government has a responsibility

NYSERDA has shown, in testimony before the Conservation, Energy and Natural Resources Subcommittee that the Federal Government encouraged the State of New York to encourage the development of a commercial reprocessing industry. In support of this end, the Federal Government provided 3/5th's of the spent fuel processed at NFS from the Hanford weapons reactor; additional amounts were in the form of fuel leased by the AEC to commercial reactors. As an additional point, the AEC did change the rules of the waste management game at a point when NFS and the State of New York could not easily recover the additional costs. True these changes were advisable to protect the health and safety of the public. Still, they increased the economic burden to the State of New York.

Many of us see the West Valley problem not as an anomaly, but as indicative of an immature industry. We see the waste situation as drifting towards more undesirable choices and increasing endangerment of the public health and safety. While the wastes in the future will be different than that of NFS, being either acidic or spent fuel itself, we nevertheless view the resolution of the West Valley situation as a barometer of the ERDA, NRC and nuclear industry commitment to safe radioactive waste disposal.

I would be pleased to answer any questions you may have.

SIERRA CLUB,
San Francisco, Calif., May 27, 1977.

President JIMMY CARTER,
THE WHITE HOUSE,
Washington, D.C.

DEAR MR. PRESIDENT: The purpose of this letter is to bring to your attention the urgent need for Presidential action on the development of methods for safely disposing of radioactive wastes. Because of the gravity of the situation, we ask that you consider establishing a Special Commission on Radioactive Wastes to directly address and resolve this issue on a priority basis. We support the letter of Dr. Irwin Bross in urging specific action on the existing commercial high level wastes at West Valley, New York.

As you are no doubt aware, the radioactive waste situation, in terms of both high level liquid and low level solid waste, is totally unsatisfactory. High level liquid wastes are sitting in tanks at Savannah River, Hanford and West Valley. Over 10 percent of these tanks have already leaked. All will eventually leak. Short-term, band-aid solutions, such as drying the waste materials to a salt cake within the tanks, have been practiced at Savannah River and Hanford in order to ensure that the tanks do not continue to leak. However, as far as we are aware, ERDA does not have a plan for removing this salt cake from the tanks, converting it to a nonsoluble solid and disposing of it by deep burial. There are

[7] "Alternative Processes for Managing Existing Commercial High-level Radioactive Wastes", NUREG-0043 (April, 1976), p. 142.

no plans for decommissioning these tanks. While radioactive wastes have been generated in this country for over 30 years, it is plain that no acceptable method or demonstration facilities have yet been developed for managing this material.

At West Valley, New York the situation is more untenable since the population density is greater and five hundred thousand gallons of high level wastes sit in a tank in a vault directly within the water table. The tank could not withstand the maximum earthquake which could occur on the site. The tank has a useful life of forty years though the wastes will remain highly toxic for hundreds of thousands of years. Were the wastes at West Valley to leak into the local watershed, a major health and safety problem would ensue. This liquid waste must therefore be solidified and moved to a Federal Repository before a major disaster occurs. While ERDA and NRC have hopes and dreams of dealing with this situation, we are frankly concerned about the bureaucratic inertia of those agencies in dealing with a problem that requires all due speed. We believe a Special Commission on Radioactive Wastes, focussed on the waste problem and freed of agency encumbrances, could attract the talent and expertise necessary to find new and creative solutions to this waste dilemma on an expedited basis.

The situation regarding "low level" solid wastes is also totally unsatisfactory. Some of this "low level" material is, in fact, highly radioactive, consisting of used fuel elements and the most radioactive components of reprocessing and other fuel cycle facilities. These wastes contain large amounts of plutonium and other transuranics buried in shallow trenches. The commercial burial grounds at West Valley, New York and Maxey Flats, Kentucky, are leaking, contrary to the promises of the nuclear industry. The situation at these burial grounds will not repair themselves; something positive must be done.

By any objective standards, these waste practices have been a failure. Unless there is impulse and direction from the highest offices of our government, we do not see movement toward resolution of this waste problem. Instead we see a continuing drift towards more undesirable choices and increasing endangerment of the public health and industry. We see a deepening mistrust by citizens of the governmental agencies empowered to regulate the nuclear industry. We therefore call on you to establish a Special Commission on Radioactive Wastes to resolve the radioactive waste problem. We believe that further licensing of nuclear reactors should be halted until an acceptable resolution of this waste problem can be found.

Sincerely,

MARVIN RESNIKOFF,
Chairman, Nuclear Subcommittee
of the Energy Policy Committee.

Mr. BROWN. Our next witness is Mr. R. W. Deuster, president, Nuclear Fuel Services, Inc., who I imagine has been listening with great interest to all the comments made about his organization.

We are happy to have you here. You may introduce your colleagues, if you wish.

STATEMENT OF RALPH W. DEUSTER, PRESIDENT, NUCLEAR FUEL SERVICES, INC.

Mr. DEUSTER. Mr. Chairman and members of the committee, my name is Ralph W. Deuster, and I am president of Nuclear Fuel Services, Inc., (NFS). I am pleased to appear before this subcommittee to provide information regarding the nuclear facilities at West Valley, N.Y.

With me today are Mr. Henry W. Brook and Mr. Clarence T. Kipps, counsel to NFS.

I will skip part of the early testimony which refers to the history, which has been given quite accurately.

The origin of NFS dates back to 1956 and a small nuclear fuel facility in Erwin, Tenn., owned by the Davison Chemical Co. Davison was later bought by W. R. Grace which in 1962, together with American Machine & Foundry Co., formed and incorporated NFS.

NFS was established as a separate corporate entity to pursue the AEC's requests for the entry of private industry into reprocessing. NFS made a proposal to the AEC, in conjunction with a group of five utility companies and Bechtel Corp. (known collectively as the Industrial Reprocessing Group—and IRG) and the State of New York through a predecessor of the now New York State Energy Research and Development Authority, to which I will refer as the Authority).

The Authority, pursuant to enabling legislation adopted by the State, had acquired a site consisting of approximately 3,345 acres located in Cattaraugus County, south of Buffalo.

The site had been acquired by the Authority after a 2-year search and was considered ideal to locate a reprocessing plant and attendant facilities for waste. Some of the desirable features of the site were:

proximity to the projected early commercial load in the northeast;

the presence of a silty till soil which is quite impermeable to the migration of water;

a low population density in the vicinity;

favorable meteorologic and hydrologic characteristics.

The final arrangements included appropriate financing of NFS; a lease and a waste storage agreement between NFS and the Authority; a base-load contract between NFS and the AEC; reprocessing contracts with each utility of the IRG utility group; and a construction contract with Bechtel.

The financing of the project was established to meet the AEC's requirements for financial qualifications for obtaining a license to operate the facility. A total project funding of $32 million was created.

The lease and waste storage agreement with the Authority granted NFS the right to construct and operate the reprocessing plant at the site, and delineated the responsibilities of the Authority and NFS for the care and maintenance of the radioactive wastes that would emanate from the reprocessing plant, including a specified fund to be paid by NFS to the Authority for perpetual care of the wastes by the authority.

Because of long-term health and safety considerations, perpetual care of radioactive waste has always been recognized as a function which can be discharged only by a sovereign. Pursuant to the AEC policy, New York State agreed to accept this function, which otherwise would have been performed by the Federal Government.

The initial term of the lease was set to expire on December 31, 1980, approximately 15 years after the projected commencement of plant operations. Upon expiration of the lease, unless renewed by NFS, responsibility for the entire site, the waste, and all facilities constructed or located on it, were to revert to the Authority.

The AEC's policy objectives that commercial reprocessing should be provided at reasonable charges and terms were implemented through the base-load contract. The AEC through the base-load contract set the guidelines for important aspects of the agreements with the Authority and the utilities.

The only experience that could be considered in arriving at the pricing and methodology for waste handling and shortage was that obtained from the AEC through operation of Government facilities. The amount considered to be a reasonable charge for perpetual waste care was established by the AEC in the base-load contract.

Intricate provisions were included for determining appropriate charges for a variety of projected high-level storage facilities. All of the provisions, however, including the determination of the basic charge for high-level waste storage, were predicated on perpetual care as a liquid at West Valley by the authority.

The base-load contact required NFS to utilize these same provisions in determining the method of, and charge for, waste storage under utility contracts. Additionally, NFS was required to offer reprocessing services to others at essentially the same price and terms and conditions that were being offered to the IRG utility group.

Mr. BROWN. I would like to interrupt you for a moment.

I think the three bells are the second call of a quorum call, and if you gentlemen would like to go, I will continue the hearing.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. BROWN. Please proceed, Mr. Deuster.

Mr. DEUSTER. Thank you.

Construction and operation of the West Valley facilities required AEC evaluation and approval which was granted after the AEC's thorough evaluation of the health and safety factors and financial qualifications required for the project. The plant and attendant facilities were constructed, licensed to operate, and brought into initial operation in April 1966.

Approximately 90 percent of the fuel reprocessed at the plant was provided by the AEC and the IRG utility group. Several years after commencing reprocessing operations, Grace and AMF sold the stock of NFS to Getty Oil Co. and Skelly Oil Co.

The nuclear power industry was developing in the 1960's and rapid growth was projected to continue into the 1970's and beyond. Additionally, from a review of early operations, it was apparent that the contemplated levels of radioactive releases from the plant could not be achieved for future operations without making some modifications.

Accordingly, plans for modernization and expansion of the West Valley plant were started in 1968. The objective was to increase the plant's capacity from 300 to 600 MTU/year and to correct for operating deficiencies. Blaw-Knox Chemical Plants, Inc. was selected to perform the engineering and projected the cost to be $15.8 million.

By early 1972, NFS had reprocessed all the spent fuel made available for reprocessing, and the plant was shutdown to complete the revamp and expansion program. In May 1972, NFS was informed by the Commission of the need for a construction permit and operating license review.

From the time NFS filed its application for a construction permit, there have been numerous regulatory changes which NFS would have needed to meet prior to resumption of operation of the plant. The most significant of the regulatory changes dealt with: (a) seismic protection criteria; (b) tornado protection criteria; (c) radioactive waste management; (d) safeguards; and (e) radiation protection.

Additionally, there were general regulatory problems that NFS had to consider, which potentially impacted on the cost and timing to resume operation of the plant, such as the NRC's GESMO proceeding (Generic Environmental Statement on Mixed Oxide fuel).

Although many of these requirements were identified by late 1975, the critical point was reached when in March of 1976 the NRC im-

posed increased seismic criteria for the West Valley site. NFS employed a panel of seismic experts to review this determination, and was advised that, as a practical matter, there was little likelihood that the revised criteria could be demonstrated to be unduly conservative.

In view of this development and NFS' growing concerns as to the other actions that would be needed to obtain the required licensing approvals, NFS initiated and completed in June of 1976 a comprehensive evaluation. This evaluation demonstrated that the project was and is commercially impracticable in light of regulatory requirements that have arisen since the project was initiated.

It was projected that the earliest date for resuming reprocessing would have been 1988 compared to a 1973 date when the project was conceived. The additional capital needs were in excess of $600 million, compared with $15 million in 1970.

It was projected that approximately $100 million would have been required to be invested between June 1976 and the time a construction permit might have been obtained from the NRC. There was great uncertainty as to whether it was possible (even without regard to cost) to modify the facility to meet the new standards required by the changes in regulatory requirements.

On September 22, 1976, after discussing these developments with customers who had contracted for reprocessing services, and determining their unwillingness to pay the additional costs, NFS announced its decision to withdraw from the reprocessing business. NFS' decision recognized that the millions already expended by NFS on the West Valley facilities could no longer be recovered and that NFS' role at West Valley would be reduced to maintaining the facilities until the expiration of the lease.

Now, of course, President Carter has adopted a new policy prohibiting reprocessing in furtherance of national security and the foreign policy of the United States. NFS has informed the NRC that it would no longer pursue its licensing efforts to modify and expand the facility.

NFS notified the Authority of NFS' intention to surrender the responsibility for the nuclear waste at the site to the Authority in accordance with the terms of the Waste Storage Agreement. NFS also has told the Authority of NFS' intention not to renew its lease of the site when it expires on December 31, 1980. In accordance with the terms of the lease, NFS will continue to maintain the facility in a safe shutdown condition until it is turned over to the authority.

In our view, the West Valley facilities and site can serve a useful role in furthering national objectives and programs. We believe that Congress recognizes the critical need to resolve expeditiously the national dilemma of nuclear waste management.

The West Valley plant and the relatively small quantity of high-level waste stored there (600,000 gallons) can be used as part of a program to demonstrate technology to be employed on the some 75 million gallons of the same kind of liquid waste stored at Government facilities and on possible future commercial wastes. This useful ultimate disposal of the West Valley high-level liquid wastes can also provide realistic cost figures for future waste management operations.

Indeed, as the subcommittee is aware, this possibility of constructive use has been recognized by the House Science and Technology Com-

mittee in the recently reported ERDA authorization bill, which authorizes ERDA to study the use and disposition of the West Valley site, including using the plant and facilities to demonstrate solidification of high-level waste for permanent burial.

Additionally, the plant and associated facilities can be put to other constructive uses in conjunction with necessary Federal research and development projects related directly to reprocessing technology or to other nuclear related concepts.

Further, the plant is presently being utilized to store approximately 150 tons of spent fuel discharged from utilities' reactor plants. The need for continued interim storage at West Valley of this spent fuel and possibly even additional spent fuel has become even more critical in light of the President's decision to prohibit reprocessing. After such constructive use, the facilities could be used for demonstrating the means and costs of decommissioning.

That ends our prepared testimony, Mr. Chairman.

Mr. BROWN. Thank you very much, Mr. Deuster.

Can you illuminate the problem of what limits might exist on Nuclear Fuel Services' liabilities in the event of a worst possible case situation—for example, if you were taken to court and found to be totally liable for all the mistakes that everybody else has made.

Mr. DEUSTER. I do not think I could make a projection on that.

I believe that our responsibilities are spelled out in the agreements with the State.

Mr. BROOK. We believe our legal position is very clear, and that we would not have such a responsibility at all. I believe that most of the testimony that has preceded us has adopted that view.

Mr. BROWN. I would be inclined to the same view.

I am just trying to ascertain, so that we can analyze the problem rationally. What if you were stuck for a judgment for $100 million? Could you satisfy it? Does the corporation have that kind of assets?

Mr. DEUSTER. No; it does not.

Mr. BROWN. It was set up just for the purpose of operating this particular facility, was it not?

Mr. DEUSTER. Yes; it was, basically.

Mr. BROWN. You mentioned the figure of $32 million in your statement. Does that represent the capitalization?

Mr. DEUSTER. No; that was both debt and equity. I believe there was about $7 million in equity at the time, Mr. Brown.

Mr. BROWN. Has that increased or decreased?

Mr. DEUSTER. It has decreased slightly.

Mr. BROWN. So, from a practical standpoint, that would establish the limits on what you could pay, even if liability were assessed against you?

Mr. DEUSTER. I believe so.

Mr. BROWN. I would like to find out what the State of New York's answer to that question is.

Mr. DEUSTER. I cannot give you that, sir.

Mr. BROWN. I think you have given us a very clear perception of the situation.

Can you tell us what the current status of the corporation organization is? Are you still in business and prepared to resume business if circumstances were to change?

Mr. DEUSTER. At West Valley?

Mr. BROWN. Yes.

Mr. DEUSTER. Our analysis concluded that it was impracticable, and, under the current circumstances of the President's directive, we have harbored no thoughts of reentering the reprocessing business.

We presently operate a facility in Erwin, Tenn., that does contribute to our livelihood.

Mr. BROWN. Nuclear Fuel Services does?

Mr. DEUSTER. Yes.

We manufacture a specialty fuel material.

Mr. BROWN. I see.

But you have gone into a standby mode at West Valley, and staffed it just with maintenance personnel?

Mr. DEUSTER. Yes, sir, as required for health and safety considerations, and for the surveillance of the wastes, and for the spent fuel that is stored in the pool.

Mr. BROWN. Do you anticipate that this situation will continue until the 1980 lease termination?

Mr. DEUSTER. Unless relieved by other directives.

Mr. BROWN. Would you generally concur with the other witnesses that we have to make certain policy decisions at the Federal level with regard to what our technical requirements are going to be for permanent, high level waste disposal, and what the role of private industry is going to be in this before we can come to a satisfactory solution to this whole problem?

Mr. DEUSTER. Yes, I do agree with that.

That is one of the reasons that the estimates are so broad, because no one can predict with any accuracy what will come out of the situation.

Mr. BROOK. Mr. Brown, we believe that in our testimony we say that West Valley can serve a role in accomplishing this purpose.

We think there has been too much focus on West Valley solely from a problem viewpoint rather than looking at it in terms of what it can do in the future, in contributing to solving some of these problems.

Mr. BROWN. I think that is a reasonable statement.

Do you have any particular recommendations as to the institutional structure under which that role could be best performed?

Mr. BROOK. We believe that the Federal Government is the only one that really has the perspective and the resources and the ability to make the judgments that are necessary, to choose the proper role for West Valley.

We have evaluated ourselves with a limited view as to what the programs are, and we see from that view that it has a role, but we cannot say what would be the appropriate timing, and exactly what use it should be put to first.

Mr. DEUSTER. We cannot move without Government action.

Mr. BROWN. In other words, only the Federal Government has all the powers necessary to assume the responsibility in this situation?

Mr. DEUSTER. Exactly.

Mr. BROWN. They have the resources to carry out those responsibilities?

Mr. DEUSTER. And the technology capability.

Mr. BROWN. Yes.

I think that fills in the picture pretty well for us, gentlemen.

I very much appreciate your testimony, and I hope we will be able to come up with some constructive contribution to this matter which will be in our interests as well as the public's interests.

Thank you very much.

Mr. DEUSTER. Thank you.

[The prepared statement of Mr. Deuster follows:]

TESTIMONY PRESENTED BY RALPH W. DEUSTER, PRESIDENT, NUCLEAR FUEL SERVICES, INC.

Mr. Chairman and members of the Committee, my name is Ralph W. Deuster, and I am President of Nuclear Fuel Services, Inc. (NFS). I am pleased to appear before this Subcommittee to provide information regarding the nuclear facilities at West Valley, N.Y. With me today are Mr. Henry W. Brook and Mr. Clarence T. Kipps, counsel to NFS.

The Atomic Energy Commission (AEC) commenced strong efforts to bring industry into reprocessing in the 1950's without success. It became necessary for the AEC to commit itself to reprocess the commercial spent fuel. The AEC recognized that, absent participation by private industry, it would have to construct and operate a reprocesssing plant and attendant facilities to take care of the projected commercial reprocessing load. Existing Government facilities were not designed to process commercial power reactor fuels.

The origin of NFS dates back to 1956 and a small nuclear fuel facility in Erwin, Tenn., owned by the Davison Chemical Co. Davison was later bought by W. R. Grace which in 1962, together with American Machine and Foundry Co., formed and incorporated NFS.

NFS was established as a separate corporate entity to pursue the AEC's requests for the entry of private industry into reprocessing. NFS made a proposal to the AEC, in conjunction with a group of five utility companies and Bechtel Corporation (known collectively as the Industrial Reprocessing Group—and IRG) and the State of New York (through a predecessor of the now New York State Energy Research and Development Authority, to which I will refer as the Authority). The Authority, pursuant to enabling legislation adopted by the State, had acquired a site consisting of approximately 3,345 acres located in Cattaraugus County, south of Buffalo. The site had been acquired by the Authority after a 2-year search and was considered ideal to locate a reprocessing plant and attendant facilities for waste. Some of the desirable features of the site were:

Proximity to the projected early commercial load in the northeast;

The presence of a silty till soil which is quite impermeable to the migration of water:

A low population density in the vicinity; and

Favorable meteorological and hydrologic characteristics.

The final arrangements included appropriate financing of NFS; a Lease and a Waste Storage Agreement between NFS and the Authority; a Base-Load Contract between NFS and the AEC; reprocessing contracts with each utility of the IRG utility group; and a construction contract with Bechtel.

The financing of the project was established to meet the AEC's requirements for financial qualifications for obtaining a license to operate the facility. A total project funding of $32 million was created.

The Lease and Waste Storage Agreement with the Authority granted NFS the right to construct and operate the reprocessing plant at the site, and delineated the responsibilities of the Authority and NFS for the care and maintenance of the radioactive wastes that would emanate from the reprocessing plant, including a specified fund to be paid by NFS to the Authority for perpetual care of the wastes by the Authority. Because of long-term health and safety considerations, perpetual care of radioactive waste has always been recognized as a function which can be discharged only by a sovereign. Pursuant to the AEC policy, New York State agreed to accept this function, which otherwise would have been performed by the Federal Government. The initial term of the Lease was set to expire on December 31, 1980, approximately 15 years after the projected commencement of plant operations. Upon expiration of the Lease, unless renewed by NFS, responsibility for the entire site, the waste, and all facilities constructed or located on it, were to revert to the Authority.

The AEC's policy objectives that commercial reprocessing should be provided at reasonable charges and terms were implemented through the Base-Load Contract. The AEC through the Base-Load Contract set the guidelines for important aspects of the agreements with the Authority and the utilities. The only experience that could be considered in arriving at the pricing and methodology for waste handling and storage was that obtained from the AEC through operation of government facilities. The amount considered to be a reasonable charge for perpetual waste care was established by the AEC in the Base-Load Contract. Intricate provisions were included for determining appropriate charges for a variety of projected high level storage facilities. All of the provisions, however, including the determination of the basic charge for high level waste storage, were predicated on perpetual care as a liquid at West Valley by the Authority. The Base-Load Contract required NFS to utilize these same provisions in determining the method of, and charge for, waste storage under utility contracts. Additionally, NFS was required to offer reprocessing services to others at essentially the same price and terms and conditions that were being offered to the IRG utility group.

Construction and operation of the West Valley facilities required AEC evaluation and approval which was granted after the AEC's thorough evaluation of the health and safety factors and financial qualifications required for the project. The plant and attendant facilities were constructed, licensed to operate, and brought into initial operation in April 1966.

Approximately 90 percent of the fuel reprocessed at the plant was provided by the AEC and the IRG utility group. Several years after commencing reprocessing operations, Grace and AMF sold the stock of NFS to Getty Oil Co. and Skelly Oil Co.

The nuclear power industry was developing in the 1960's and rapid growth was projected to continue into the 1970's and beyond. Additionally, from a review of early operations, it was apparent that the contemplated levels of radioactive releases from the plant could not be achieved for future operations without making some modifications. Accordingly, plans for modernization and expansion of the West Valley Plant were started in 1968. The objective was to increase the plant's capacity from 300 to 600 MTU/year and to correct for operating deficiencies. Blaw-Knox Chemical Plants, Inc. was selected to perform the engineering and projected the cost to be $15.8 million.

By early 1972, NFS had reprocessed all the spent fuel made available for reprocessing, and the plant was shut down to complete the revamp and expansion program. In May 1972, NFS was informed by the Commission of the need for a construction permit and operating license review.

From the time NFS filed its application for a construction permit, there have been numerous regulatory changes which NFS would have needed to meet prior to resumption of operation of the plant. The most significant of the regulatory changes dealt with: (a) seismic protection criteria; (b) tornado protection criteria; (c) radioactive waste management; (d) safeguards; and (e) radiation protection. Additionally, there were general regulatory problems that NFS had to consider, which potentially impacted on the cost and timing to resume operation of the plant, such as the NRC's GESMO proceeding (Generic Environmental Statement on Mixed Oxide Fuel).

Although many of these requirements were identified by late 1975, the critical point was reached when in March of 1976 the NRC imposed increased seismic criteria for the West Valley site. NFS employed a panel of seismic experts to review this determination, and was advised that, as a practical matter, there was little likelihood that the revised criteria could be demonstrated to be unduly conservative. In view of this development and NFS' growing concerns as to the other actions that would be needed to obtain the required licensing approvals, NFS initiated and completed in June of 1976 a comprehensive evaluation. This evaluation demonstrated that the project was and is commercially impracticable in light of regulatory requirements and have arisen since the project was initiated.

It was projected that the earliest date for resuming reprocessing would have been 1988 compared to a 1973 date when the project was conceived. The additional capital needs were in excess of $600 million, compared with $15 million in 1970. It was projected that approximately $100 million would have been required to be invested between June 1976 and the time a construction permit might have been obtained from the NRC. There was great uncertainty as to whether it was possible (even without regard to cost) to modify the facility to meet the new standards required by the changes in regulatory requirements.

On September 22, 1976, after discussing these developments with customers who had contracted for reprocessing services, and determining their unwillingness to pay additional costs, NFS announced its decision to withdraw from the reprocessing business. NFS' decision recognized that the millions already expended by NFS on the West Valley facilities could no longer be recovered and that NFS' role at West Valley would be reduced to maintaining the facilities until the expiration of the Lease.

Now, of course, President Carter has adopted a new policy prohibiting reprocessing in furtherance of national security and the foreign policy of the United States. NFS has informed the NRC that it would no longer pursue its licensing efforts to modify and expand the facility. NFS notified the Authority of NFS' intention to surrender the responsibility for the nuclear waste at the site to the Authority in accordance with the terms of the Waste Storage Agreement. NSF also has told the Authority of NFS' intention not to renew its Lease of the site when it expires on December 31, 1980. In accordance with the terms of the Lease, NFS will continue to maintain the facility in a safe shutdown condition until it is turned over to the Authority.

In our view, the West Valley facilities and site can serve a useful role in furthering national objectives and programs. We believe that Congress recognizes the critical need to resolve expeditiously the national dilemma of nuclear waste management. The West Valley plant and the relatively small quantity of high-level waste stored there (600,000 gallons) can be used as part of a program to demonstrate technology to be employed on the some 75 million gallons of the same kind of liquid waste stored at Government facilities and on possible future commercial wastes.

This useful ultimate disposal of the West Valley high-level liquid wastes can also provide realistic cost figures for future waste management operations. Indeed, as the Subcommittee is aware, this possibility of constructive use has been recognized by the House Science and Technology Committee in the recently reported ERDA Authorization Bill, which authorizes ERDA to study the use and disposition of the West Valley site, including using the plant and facilities to demonstrate solidification of high-level waste for permanent burial. Additionally, the plant and associated facilities can be put to other constructive uses in conjunction with necessary Federal research and development projects related directly to reprocessing technology or to other nuclear related concepts. Further, the plant is presently being utilized to store approximately 150 tonnes of spent fuel discharged from utilities' reactor plants. The need for continued interim storage at West Valley of this spent fuel and possibly even additional spent fuel has become even more critical in light of the President's decision to prohibit reprocessing. After such constructive use, the facilities could be used for demonstrating the means and costs of decommissioning.

Mr. BROWN. Our last witness this morning will be Mr. Richard Cunningham, Acting Director of Fuel Cycle and Material Safety, Nuclear Regulatory Commission, which of course has been responsible for all of these problems. [Laughter.]

STATEMENT OF RICHARD CUNNINGHAM, ACTING DIRECTOR, FUEL CYCLE AND MATERIAL SAFETY, NUCLEAR REGULATORY COMMISSION

Mr. CUNNINGHAM. Thank you, Mr. Chairman.

We do appreciate this opportunity to appear before the subcommittee to participate in its examination of the decommissioning of nuclear facilities.

In order to conserve time, with your permission I will skip through portions of my written testimony and submit it for the record, as well as a background supplement of information on the NFS plant.

Mr. BROWN. We appreciate receiving that, and, without objection, the full text and the background material will be made a part of the record.

Mr. BROWN. You may proceed.

Mr. CUNNINGHAM. Thank you, Mr. Chairman.

As requested in your letter, my oral remarks this morning will concentrate on problems related to the Nuclear Fuel Services' reprocessing plant in West Valley, N.Y.

However, before I discuss this facility, I would like to point out that there are several different kinds of nuclear facilities, including nuclear power reactors and the various fuel cycle plants which support nuclear power production.

The decommissioning of nuclear reactor facilities has been relatively well developed and is routinely considered in the licensing process. We examine various decommissioning plans, costs, and environmental impacts prior to the issuance of an operating license for a reactor facility. Over 50 reactor facilities have been successfully decommissioned, including five licensed power reactors. I would like to submit for the record supplemental written testimony on the economics, environmental, and technical aspects of decommissioning this kind of nuclear facility.

Mr. BROWN. Without objection, so received.

[The information follows:]

STATEMENT TO THE ENVIRONMENT AND THE ATMOSPHERE SUBCOMMITTEE OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY REGARDING NUCLEAR REACTOR DECOMMISSIONING, U.S. NUCLEAR REGULATORY COMMISSION, JUNE 15, 1977

BACKGROUND

This testimony discusses the decommissioning of nuclear reactor facilities. Decommissioning nuclear reactors is not new to the NRC. Various concepts for decommissioning have been under study and have been put into practice for a number of years.

Since 1960, 5 licensed nuclear power plants, 4 demonstration nuclear power plants, 6 licensed test reactors, 28 licensed research reactors and 20 licensed critical facilities have been decommissioned. The experience gained in these decommissioning actions has been factored into the present Nuclear Regulatory Commission (NRC) requirements for reactor decommissioning.

CURRENT REGULATIONS AND GUIDES FOR DECOMMISSIONING OF LICENSED REACTORS

Regulations applicable to licensed reactor decommissioning are described in the Code of Federal Regulations Title 10. Title 10 CFR Part 50 Section 50.82, "Application for Termination of Licenses" provides rules by which a licensee may make application to the NRC for authorization to dismantle a reactor facility and terminate its license upon satisfactory completion of dismantlement. Title 10 CFR Part 50 Section 50.59, "Authorization of Changes, Tests and Experiments" and Section 50.90, "Application for Amendment of License or Construction Permit" provides the rules by which a licensee may amend his license to attain a "possession only" status. This state of a facility license results from NRC approval of deletion of requirements in the facility Technical Specifications that are applicable to reactor operations. Title 10 CFR Part 20, "Standards for Protection Against Radiation" establishes procedural requirements and the radioactivity concentration limits for release of radioactive material to the environment.

Title 10 CFR Part 51 Section 51.5, "Requirement for Environmental Impact Statements, Negative Declaration and Impact Appraisals" requires the preparation of either an environmental impact statement or a negative declaration for license amendments or orders authorizing the dismantling or decommissioning of nuclear power or test reactors. An environmental impact appraisal must be prepared to support the negative declaration. Negative declarations and environmental impact appraisals have been prepared by the NRC staff for dismantling and other decommissioning actions involving licensed reactors as required by Title 10 CFR Part 51 Section 51.5.

Title 10 CFR Part 50 Section 50.33 "Contents of Application; General Information" requires that an applicant for a license show financial ability (a) to operate the plant and (b) to cover the cost of permanently shutting down the facility and maintaining it in a safe condition, i.e., meet decommissioning costs. Title 10 CFR Part 50 Section 50.71 "Maintenance of Records, Making of Reports" requires a licensee to file a copy of its annual financial report with the NRC. This requirement continues in effect until the license is terminated.

Regulatory Guide 1.86[1] "Termination of Operating Licenses for Nuclear Reactors" describes conditions and procedures currently acceptable by the NRC staff for each decommissioning alternative. Published in 1974, this guide has been distributed to utilities and other organizations that possess facility operating licenses.

METHODS FOR DECOMMISSIONING

The three methods of decommissioning delineated in Regulatory Guide 1.86 as acceptable to the NRC are mothballing, entombment, and dismantling.

Mothballing is the process of placing a facility in a non-operating status. The facility may be left intact except that all reactor fuel, radioactive fluids and non-fixed radioactive wastes such as ion exchange resins, contaminated scrap materials and contaminated chemicals are removed. The existing license is amended to a "possession only" status and continues in effect until residual radioactivity decays to levels acceptable for release to unrestricted access or until residual radioactivity is removed. The "possession only" license is a reactor facility license that permits a licensee to possess the facility but prohibits operation of the facility as a nuclear reactor.

Entombment/protective storage consists of removing all fuel assemblies, radioactive fluids and wastes followed by the sealing of remaining radioactive material within a structure integral with the biological shield or by some other method to prevent unauthorized access into radiation areas. A program of inspection, facility radiation surveys and environmental sampling is required for a licensed facility that has been entombed. However, the annual costs of access control would be less than for the first discussed alternative of mothballing as security guards would probably not be required. The entombment of the facility would permit this relaxation of security guard access control because physical access to the "sealed" residual radioactivity would be made very difficult.

Dismantling is defined as removal of all fuel, radioactive fluids and waste, and all radioactive structures. Surface contamination levels have been established in Regulatory Guide 1.86 (Table 1) which must be met prior to termination of the facility license. In addition to meeting the surface contamination levels, the acceptability of the presence of materials which have been made radioactive by neutron activation would be evaluated on a case-by-case basis prior to termination of the license. In general, however, all significantly activated components, such as the reactor structural components near the core, would have to be removed to meet the surface contamination limits (Table 1).

A brief description of the major activities that would be involved in decommissioning a nuclear power reactor are described below.

1. The first step that would be taken in decommissioning a reactor facility would be to remove all of the fuel from the reactor and using appropriate containers ship the spent fuel to offsite storage facilities. When all of the spent fuel is removed from the facility essentially all of the high level waste will have been accounted for.

2. The spent resin materials, radioactive liquid and other non-fixed radioactive materials will be packaged for shipment to off-site facilities. This activity is part of normal operation, and poses no unusual technical problems.

3. Decontamination of radioactive components by use of appropriate chemical agents would be undertaken as necessary. Since it is expected that the components would probably be discarded, strong chemical agents can be used and effective decontamination achieved. The radioactive decontamination solutions used for this purpose would again be removed to off-site disposal.

---

[1] *Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delinate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations and compliance with them is not required. Methods and solutions different from those sets out in the guidess will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.*

4. Removal of components with induced radioactivity. If it is desired even the most highly radioactive components of the primary system could be dismantled and shipped for off-site disposal. There is, however, strong economic consideration as well as other factors which will be discussed later which make it desirable to postpone the ultimate dismantling for long periods of time. Some development work may be required for this phase of the decommissioning operation if early dismantling is desired. Experience with dismantling the Elk River components provide clear evidence that such techniques are practical.

The foregoing operations would also be generally applicable to decommissioning of fuel reprocessing facilities. A unique difference is that in a reprocessing plant the separated fission products (high level waste) must be solidified and shipped off-site. This process has not been demonstrated on a commercial scale for a fuel reprocessing facility. In the case of the reactor the fission products are contained in irradiated fuel which is easily transported to a reprocessing plant or in the future to a disposal facility. There are over 25 years of experience in transporting irradiated spent fuel elements without mishaps.

To date, all but one of the 11 licensees of power or test reactors have chosen mothballing as the alternative for decommissioning. A recent Atomic Industrial Forum (AIF)[2] report indicates that modern 1,100 MWe nuclear plants may be mothballed, also, but will probably be dismantled at some time in the future. In this respect, the AIF report estimates that after Cobalt 60 radiation has decayed sufficiently (approximately 100 years) the residual radioactivity would be removed. The 11 smaller test and power reactors now mothballed may retain possession only or by-product material licenses until radioactivity has decayed to levels acceptable for license termination. More likely, however, the residual radioactivity will be removed from these facilities also at sometime in the future to allow the licenses to be terminated. The Saxton facility licensee for instance has indicated that the residual radioactivity may be removed after about 50 years.

The AIF study confirms our conclusion that permanent entombment is not a practicable alternative in decommissioning modern (1,100 MWe) nuclear power plants because the concentrations of Ni 63 and Ni 59 would be too high relative to 10 CFR Part 20 concentration and radiation exposure limits. The AIF study indicated, however, that temporary entombment (about 100 years) may be the best alternative for certain nuclear power plants.

The Commission does not currently require that a specific decommissioning alternative be selected at the time of licensing but the Commission does examine various decommissioning plans and their costs and environmental impacts prior to issuance of an operating license for a commercial power reactor or test reactor. We assure ourselves in each case that feasible decommissioning alternatives, including alternatives for complete dismantling, exist and that the applicant either possesses or has reasonable assurance of obtaining the necessary funds, as required by our Regulations (10 CFR 50.33F). We do not require bonds or setting aside of any contingency funds at the operating license stage and do not impose any particular decommissioning plan as a condition of the operating license.

Federal and State regulatory commissions have historically treated plant decommissioning and maintenance costs as allowable operating expenses recoverable through rates chargeable to customers. It is therefore reasonable to assume that the decommissioning and subsequent maintenance costs would be charged to operating expenses either in the year they are incurred or amortized over a period of years according to the policy of the rate making regulatory authorities.

The cost to decommission has been shown by the AIF study and our independent evaluation referred to above to be a small factor in the overall cost of operating a nuclear power plant. Our environmental statements consider the impacts of decommissioning for the alternatives previously described. Estimated costs of decommissioning for mothballing are about $1 million plus an annual maintenance charge on the order of $100,000. Estimates or entombment or dismantling show a large variation arising from different assumptions as to level of restoration. For example, complete restoration, including regrading, has been estimated to cost $70 million.

At present land values, consideration of an economic balance alone likely would not justify a high level of restoration. However, planning required of the

---

[2] Atomic Industrial Forum, AIF/NES P009, "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives," November 1976. This study was performed by the Atomic Industrial Forum for its nuclear industry members to aid in establishing preferred decommissioning alternatives. This study is still under review by the NRC.

applicant at this stage will ensure that variety of choice for restoration is maintained until the end of useful plant life. The licensee should be able to fund these costs out of current revenue. Therefore, we do not perceive the cost of decommissioning nuclear power reactors several decades from now—as a crisis situation or a problem that requires crash efforts to resolve. We do believe that an orderly effort to establish procedures and requirements to provide greater assurance that these funds will be available should be initiated.

For the large modern plants, it is clear that postponing the removal of certain components until the radioactivity has decayed to permit more direct access for dismantlement may prove to be the most desirable alternative with respect to the environment, radiological effects and cost. The degree of dismantlement would be determined by an economic and environmental study involving the land and scrap value versus the complete demolition and removal of the complex. The AIF study concluded that the most effective means of decommissioning a facility would involve either an initial mothballing or entombing approach followed by dismantling. It would appear that this approach, if it is proven as the most cost effective, has several distinct advantages. Perhaps the most important factor is that the reactor facilities are located on sites which have favorable characteristics as energy production centers. Therefore, after a reactor facility has been used for its designed lifetime mothballing or entombing until the induced radioactivity levels are reduced to acceptable values could be easily accommodated. This is especially true if the utility continues to use the particular site as an electrical generating center. While predictions as far into the future as 100 years would be viewed with some reservation continued assessment of that activity would be available to the NRC. If for any reason a site were to be considered for other uses, dismantling of the facility could always be achieved.

In light of the fact that decommissioning of a nuclear power reactor will not occur until about 35 years after the issuance of an operating license, it should be recognized that requiring a specific plan for decommissioning at the time of licensing may foreclose other more desirable methods which may be developed in the future unless the plan can be changed in the future. Assuming the latter, it appears that our present practice of assuring that various alternatives have been considered provides for the necessary assurance that economically viable methods of decommissioning will be available when needed.

Since EPA is responsible for developing generally applicable environmental standards, any criteria the NRC develops for acceptable levels of contamination must be consistent with EPA standards. In the meantime, however, the NRC has provided guidance for use with respect to acceptable surface decontamination limits (Table 1, Regulatory Guide 1.86). Specific guidance for materials which have been activated during the operation of the reactor are being developed in the current study underway at Battelle Northwest Laboratories.

There are essentially no high level radioactivity wastes which are an integral part of a nuclear power reactor. These fuel elements will be shipped offsite for ultimate storage. All other radioactive waste—solid, liquid, and gas—would be packaged and removed from the site at a time and in a manner deemed most practical. It is important to note that the high level wastes contained in the reactor fuel are in a form that is readily transportable to ultimate storage facilities without further processing.

Therefore, in summary, the NRC

1. Has established considerable effort to the study of decommissioning nuclear reactors.
2. Has established reactor decommissioning alternatives acceptable to the NRC.
3. Has had experience in decommissioning over 50 licensed reactors.
4. Does consider decommissioning at the time of issuance of a Construction Permit and again at the time of issuance of an Operating License.
5. Does have studies in progress on reactor decommissioning including costs, methods, and acceptable levels for unrestricted release of radioactive materials.
6. Does believe that an orderly effort should be initiated to establish procedures and requirements to provide greater assurance that funds to accomplish decommissioning will be available when needed.

Mr. CUNNINGHAM. With regard to nuclear fuel cycle facilities, decommissioning is an important issue that requires increased attention. Work needs to be done both to improve the technology for decommis-

sioning and to establish suitable ways to assure that decommissioning will be properly financed.

The subject of this testimony today, NFS, illustrates problems concerning both the technology for decommissioning and financing such operations.

MAJOR ISSUES

There are several complex and interdependent problems which we are addressing now in the NFS case. These problems are:

Determining how stored high-level radioactive liquid wastes should be disposed of.

Assuring that, pending final disposition of high-level liquid wastes, the current method of tank storage is safe.

Determining what actions should be taken with the facilities at West Valley regarding the possible decommissioning of the site or other use.

At the time the facility was licensed, it was thought that the wastes would be permanently stored at the site.

Subsequent to licensing NFS, there was an evolution in thinking by AEC on how high-level wastes should be managed and disposed of. In 1970, AEC regulations—10 CFR part 50, appendix F—were changed for new plants to require solidification of high-level wastes and shipment offsite to a Federal repository. This change was intended to limit both the number of sites where high-level waste could be perpetually stored and the inventory of liquid waste during operations.

Mr. BROWN. May I interrupt you at that point, Mr. Cunningham?

The actual selection of sites for high-level solidified wastes has not been made yet, has it?

Mr. CUNNINGHAM. No, sir.

ERDA is right now in the process of selecting a site. According to their present plans, ERDA will have a high-level waste repository in operation by 1985. In order to accomplish this, site selection and preliminary site analysis have to start within the next couple of years, and they are actively pursuing this right now.

Mr. BROWN. Is it inconceivable that the West Valley site might be selected as one of those permanent disposal sites?

Mr. CUNNINGHAM. One of the options which we keep open is that high-level wastes at the site might be stored there, permanently, and, if that is the case, it would be a Federal repository in accordance with the present concepts.

Now, whether or not that site would be suitable for adding additional high-level wastes as a larger repository, I do not know. You would have to ask ERDA that.

Mr. BROWN. I am assuming that that decision cannot be made at this point, but I just wonder if anything has been developed that would rule that out completely?

Mr. CUNNINGHAM. I think this is one of the many things we have to consider in looking at a range of options for use of the site, and the disposition of those wastes. Certainly it is not foreclosed.

Mr. BROWN. Thank you.

Please proceed.

Mr. CUNNINGHAM. AEC committed to review the NFS situation as a special case and issue a separate rule. Although the review is underway, the rulemaking has not been completed for several reasons.

First and foremost, the technology for dealing with the neutralized waste has not been adequately developed. Unlike the wastes planned for future reprocessing plants, wherein the acid wastes as produced in the reprocessing plant are directly solidified, the NFS waste was neutralized similarly to military wastes generated by the weapons program.

Neutralized wastes are more difficult to solidify because of their sodium content. It was thought that technology developed to deal with the weapons program wastes could be applied to the NFS problem. If so, duplication of effort and research and development costs could be minimized. Until NFS decided to withdraw from reprocessing, it appeared that time was available to allow the technology to mature; and then the waste could possibly be worked off after the plant was restarted.

It now appears to NRC that actions with regard to the high-level waste at West Valley—that is, development of technology and safety criteria—should proceed in a stepwise fashion. It also appears that ERDA is the only organization with the technical experience and resources to deal with the problem of developing the technological alternatives for management of high-level wastes and, therefore, should take the lead in this area.

Mr. BROWN. Let me interrupt you again.

Could you give us any idea of the rate at which the technical problems with regard to the solidification of neutralized waste are being solved?

Is there a program, and perhaps I should be better acquainted with this, which holds the potential to resolve these problems within, say, a 5-year period, or something like that?

Mr. CUNNINGHAM. I am not sure of the period, Mr. Chairman. I understand that the DuPont Co. at Savannah River has started a program with their wastes in their tank to see how they can be solidified. Those tanks, incidentally, are very similar to the NFS tanks. There is also a large program at Hanford, looking at the broad problem of solidifying the military wastes, and something must be eventually done with those.

The NFS wastes are very small compared to the volume or the activity of the military wastes.

Mr. BROWN. I understand that the military waste is stored in single-walled tanks also, or at least in some cases.

Mr. CUNNINGHAM. I understand that is the case for some of the earlier tanks, although the newer tanks are double-containment tanks.

Mr. BROWN. Thank you.

Mr. CUNNINGHAM. The issue of assigning financial responsibility for the disposition of the waste should not delay developing technical solutions. On March 4, 1977, NRC requested ERDA to take the lead in providing the technology applicable to solutions to the NFS high-level wastes problem. NRC will work with ERDA while we develop the associated safety and environmental criteria for the technology.

COSTS ASSOCIATED WITH THE NFS SITUATION

When the West Valley plant was initially licensed, the AEC received written assurance from the State of New York that care of the waste would remain a New York State responsibility even if the

specific State authority (NYSERDA) should be unable to provide this role. By contractual agreement with NYSERDA, NFS has made installment payments into an escrow account, setting funds aside for the perpetual care of the waste. The funding arrangement contemplated only the eventual transfer of the waste to new tanks, in perpetuity, and did not consider facility decommissioning during the early part of the license term.

The waste cost situation was altered extensively for NFS when the AEC issued its new high-level waste management rule, the previously mentioned appendix F to 10 CFR part 50. Although the new rule made an exception for the existing wastes at West Valley, its possible application to those wastes would increase the cost of managing the wastes, perhaps a hundredfold over the funds provided.

These costs depend on things such as how the existing wastes will be treated, use of the existing facilities for the solidification process or alternative purposes, proposed uses of the site following decommissioning, and so on.

RELEVANCE OF NFS TO THE NUCLEAR ENERGY PROGRAM

The NFS situation has been used occasionally as an example of the problems faced by the national program for the management of the much larger quantities of waste expected from the nuclear power industry. We do not believe this example is directly translatable to the present or projected nuclear power industry.

National policy on long-term management of high-level waste was established after the plant began operation (10 CFR 50, appendix F). Had this policy been established before operation, the design of the plant might have been altered considerably.

Nonetheless, the NFS situation is a good example of the consequences of inadequate planning. The lessons to be learned from the NFS situation have not been lost and have significantly influenced all aspects of our fuel cycle licensing program.

For example, in preparing a generic environmental impact statement (GEIS) on uranium milling the NRC is examining mill tailings reclamation and financial surety arrangements.

This will be the basis for NRC regulations and regulatory guides. Until the GEIS is issued and new regulations implemented, NRC is taking a conservative approach with respect to licensees and new applicants. For new applications, we are requiring applicants to develop and commit to a tailings management plan as a license condition that reduces the impact of the tailings to essentially the same impact as occurs at that site in the natural state.

In addition, NRC is requiring that the applicant provide a financial surety arrangement to assure that the tailings management plan will be carried out. With regard to existing licenses, NRC is requiring that a tailings management plan and financial surety arrangement be committed to at the time of license renewal as a license condition.

The NRC has responsibility not only for the care of the environment and safety of licensed activities, but also for the long-term consequences of the same activities. We have learned that assurance should be provided at the initiation of fuel cycle licensing activities, that decommissioning will be properly undertaken at the end of life of each

facility. We are attempting to take this into account for each type of facility.

In the specific instance of the West Valley site, we are taking precautionary measures to reinforce our understanding of the safe surveillance of the site and are undertaking a stepwise effort to resolve the questions of its long-term disposition. We believe ERDA has been and will be very helpful in this task.

The entire nuclear community has learned a number of valuable lessons from the experience at West Valley as well as other facilities which have ceased active use. We have studies planned or under way for major facilities to provide systematic understanding of the detailed decommissioning options and costs.

Fuel reprocessing plants will be one of the first for which a study will be complete. Pending completion of these studies we have taken steps in our licensing actions directed toward assuring satisfactory decommissioning of both new and existing facilities.

In the course of our studies we shall identify possible design changes which could facilitate decommissioning. ERDA will have a substantial role in the research and development regarding such design changes and the development of any needed technologies for implementing decommissioning plans.

We shall identify to ERDA opportunities for such research and development as they arise from our studies.

This completes my testimony, Mr. Chairman. I will be prepared to answer other questions. There are other members of the NRC staff here to assist me.

I might also mention, Mr. Chairman, that in your consideration of H.R. 6181 tomorrow, while we are not presenting testimony, we will have staff members present to answer questions should they arise.

Mr. BROWN. We appreciate that very much, Mr. Cunningham.

Just as the nuclear industry has had to go through a learning process in some of these situations, Congress has to go through a learning process in trying to develop policies that will apply to them, and we are all at a very low point in learning right now. We need all of the help we can get.

Now, I would like to refer to your statement that you are taking a conservative approach with respect to licensees and new applications, with regard to plans for managing the mill tailings. By comparison, in handling the problems of decommissioning and so forth, the representatives of NFS indicated upon questioning that their equity investment in that operation was probably on the order of less than $7 million, and I understand that the escrow that was set up to handle some of the problems related to decommissioning, and so forth, was probably around $4 million, whereas the scope of the problem could be in the neighborhood of $500 million. That is obviously an example of where we do not have a very conservative approach to meeting the problems that come at the back end of the nuclear fuel cycle.

There are good reasons for that. I am not being too critical because obviously the technology and the regulatory rules were not especially well developed to be able to project the costs of waste disposal and decommissioning at that time.

The question is, Do you think they are now? When you make a statement, either in the case of mill tailings, or in general, that you

are taking a concerted approach, do you think that we have sufficient knowledge of the technologies and the regulatory situation that you can even be sure of what a conservative approach is?

Mr. CUNNINGHAM. Not entirely, Mr. Chairman.

Let's use mill tailings as an example. We are presently conducting a study, a generic environmental impact assessment, to get a much better handle on what the real risks might be for mill tailings.

As the committee might know, the tailings of the uranium mill contain a very small amount of radium that is left in the tailings when the uranium is separated. The content is about 600 micrograms of radium per ton of tailings, or about a millionth of a pound per ton. It is a very small quantity.

The level of radiation is very low. There is no comparability to the radiation problem in a mill and a reprocessing plant.

We have not completed our studies to know how these tailings should be stabilized in the long term. These are huge piles of very low-level radioactive material.

What we have done in the meantime is come up with some interim criteria that we believe are conservative, but it is our best estimate.

We have also gone to the States and asked the States to hold bonds to assure performance of these stabilizations. Now, there are several issues this brings up. For example, the NRC does not presently have authority to hold a bond, a performance bond. After we do our environmental assessment, this could possibly be something that we would want to come back to Congress with, that is, to ask for such authority. But, because of the financial structures of the various types of plants, businesses, or utilities involved in the nuclear industry, I do not know that any single way of assuring an optimum solution.

I think there might be a range of methods for assuring performance. But that is just an example of what we are trying to do. We are taking interim measures. We do not think we have the final answer, but we are trying to be conservative.

Mr. BROWN. The creation of a sinking fund, or an escrow account of some sort would be an alternative to bonding, I suppose.

Mr. CUNNINGHAM. Yes, sir. That is part of the study we are doing, how best to finance these, and taking into account how the plants are structured. There are a whole range of things that could be done.

Mr. BROWN. You say you have some question about your legal authority to utilize certain of these techniques, such as holding up performance bonds?

Mr. CUNNINGHAM. My understanding from our attorneys is that we do not have this authority in our legislation.

Mr. BROWN. I would like to explore this further; perhaps tomorrow we could go into it. I think performance bonds is one of the most widely accepted and customary ways of assuring that performance will actually be in accordance with a license or contract, or something of that sort.

Mr. CUNNINGHAM. I have a member of our legal staff here.

Mr. Malsch is a member of the Executive Legal Director's Office; he is a legal director.

Mr. MALSCH. We can provide you with more details tomorrow, but the question about holding the performance bond is inseparable from the question of our authority over the tailings themselves, and because

of the particular way the Atomic Energy Act is drawn, and because of the nature of tailings, the tailings do not constitute material over which we have direct regulatory authority, once the mill license is terminated, and that has caused us problems in terms of assuring long-term management and licensing authority over the tailings over a long period of time.

U.S. NUCLEAR REGULATORY COMMISSION,
Washington, D.C., August 8, 1977.

Hon. GEORGE BROWN,
Subcommittee on Environment and the Atmosphere, Committee on Science and Technology, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: During the hearings held by your subcommitee on June 28, 1977, regarding decommissioning of nuclear facilities, you asked that NRC provide more details regarding its authority to require licensees to post performance bonds. (Hearing TR. 105). The attached discussion of NRC statutory authority on this matter was developed in response to this request.

Sincerely,

HOWARD K. SHAPAR,
Executive Legal Director.

Enclosure.

NRC AUTHORITY TO REQUIRE ITS LICENSEES TO POST PERFORMANCE BONDS

The Nuclear Regulatory Commission (NRC) derives its legal authority primarily from the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended. Neither statute grants NRC specific authority to require licensees to post bonds. However, the Atomic Energy Act does grant NRC broad authority to adopt measures which it decides are necessary or desirable to protect the health and safety of the public. For example, section 161b grants authority to the Commission to "establish by rule, regulation, or order, such standards and instructions to govern the possession and use of special nuclear material, source material, and byproduct material as the Commission may deem necessary or desirable to . . . protect health or to minimize danger to life or property." Section 182 of the Act authorizes the Commission to look into the financial qualifications of applicants as appropriate to the issuance of a license. We believe our statutory authority is sufficiently broad to enable the NRC to require licensees to post bonds to assure performance of regulatory requirements.

This matter is not, however, entirely free from doubt. In 1963 the Atomic Energy Commission (AEC), NRC's predecessor, proposed an amendment to the Atomic Energy Act that would have given it specific authority to require licensees to post bonds. In proposing the legislation to the Congress, and during hearings held by the Joint Committee on Atomic Energy on the proposed legislation, AEC took the position that it lacked sufficient authority under the Atomic Energy Act to require licensees to post bonds. However, the Congres took no action on the proposed legislation. While, as indicated above, we believe the better legal view to be that NRC does have authority to require licensees to post bonds, the existence of a prior AEC opinion to the contrary would likely be cited by an opponent of bonds should the matter of legal authority arise in litigation.

In addition, in one situation NRC's authority to require licensees to post bonds might be subject to an additional legal challenge. This situation could arise where NRC seeks to require a bond to assure compliance with certain conditions and restrictions intended to continue after license termination. Here, one could argue that an NRC requirement that a bond be posted amounts to an attempt to exert regulatory control over materials not subject to regulation under the statute. For example, NRC presently is asking new uranium mill licensees to make financial arrangements which can include the posting of bonds to assure compliance with health, safety, and environmental conditions and restrictions dealing with uranium mill tailings stabilization. Uranium mill tailings themselves are not subject to NRC licensing under the Atomic Energy Act and current NRC regulations. Once the uranium milling license is terminated, and there is no longer any material subject to NRC licensing, the argument could be made that requiring a bond amounts to an attempt to do indirectly (through the coercive power of a bonding arrangement) what cannot be done directly (license possession of the tailings). Whether such argument would be convincing to a court

is difficult to predict. We believe that the better legal view is that NRC has the necessary statutory authority. However, the question whether NRC needs added authority in this area will be examined as part of the generic environmental statement on uranium milling.

Mr. BROWN. The question of your ability to hold a bond, in other words, as part of a particular licensing operation is not a general problem but relates more specifically to the peculiarities of the mill tailing situation?

Mr. MAISCH. I think that is part of the problem, sir.

Mr. BROWN. If we could get that clarified, it would be helpful to us, I think.

A number of the witnesses commented on some of the problems of a technological nature in connection with the West Valley plant.

For example, the situation in the tanks is such that it seems there will be difficulties in removing the sludge because of the way the plants were originally designed and constructed, and this requires some novel technological solutions. The general question that we are interested in, I think, is not whether a solution exists but whether an adequate, bona-fide effort is being made to achieve the solution.

I raise that question in connection with the solidification of the neutralized liquid waste. Is there, within the NRC or ERDA, an effort being made to resolve this problem as represented by the difficulty of getting the sludge, the precipitated sludge out of the tanks?

Mr. CUNNINGHAM. That is part of the total problem, Mr. Chairman.

We have requested ERDA to explore a range of technical solutions. Implicit in those technical solutions must be the ability to deal with that sludge.

Again, there are active programs, and I mention again the one at Savannah River, where, to my understanding, they also have sludges in tanks. There is active research going on in this area.

But addressing the NFS case specifically, ERDA in its work that we anticipate that they will do for us; they have done some work and will continue; they must take this into account in arriving at solutions. There is research support work going on in this connection.

Mr. BROWN. One of the questions brought up again by some of the previous witnesses was the question of whether the radioactive sludge could be completely removed from the tank, so that if you require the waste itself to be removed from the site, but it cannot be adequately removed from the tank, you have the problem of apparently cutting the tank up and removing it also. This problem is a technological problem that I gather has not been adequately resolved.

Mr. CUNNINGHAM. It has not been resolved, Mr. Chairman.

It is a very real problem and a very difficult problem, and that may drive us to the solution; that is, it may be the driving force to use the site as a repository. It is a very real problem. We do not have a solution at this time.

Mr. BROWN. Are you satisfied that in the normal course of events, both technical and regulatory answers are going to be forthcoming in a timely fashion to meet these needs?

I raise that question because there seems to have been an underlying assumption in the nuclear program from the beginning that unresolved problems would be solved in a timely fashion, yet the public perception is that these are major, unresolved problems which, from a political standpoint, are threatening the future of the nuclear industry.

I am not talking specifically about the particular technical problems that we have discussed here, but of general problems of waste disposal. In the political sense, these are problems that are causing all sorts of headaches to Members of Congress and to a lot of other people.

Mr. CUNNINGHAM. One of the two most important problems we face in the nuclear industry today is the solution, the overall solution, to the waste management problem.

I know the NRC has given this issue a very high priority. We had essentially no waste management capability residing within the NRC when the NRC was formed. Most of that capability went to ERDA. We have gone into extensive efforts to staff up our waste management capability and develop a program.

The schedule is set for the repository. It was set by President Ford. That schedule still holds. We are gearing our program to develop the necessary environmental and safety criteria to meet that schedule. We will license the ERDA facility. We are geared to that program.

We plan to meet those schedules for a 1985 repository.

The disposition of many of these issues hinges on that date.

Mr. BROWN. Mr. Ambro, do you have any questions?

Mr. AMBRO. No, Mr. Chairman.

I did not hear the testimony.

Mr. BROWN. Obviously, we would like to explore some of these issues in more detail. Mr. Cunningham, but we will be coming back to you for further help as we go along.

We hope to illuminate some of the more general problems tomorrow. The session tomorrow will be devoted to the general problems of waste disposal and decommissioning, and we will try to develop our own background more fully.

I want to thank you for coming over. I hope we can continue to count on your help in this matter.

Thank you.

Mr. CUNNINGHAM. Thank you, Mr. Chairman.

[The prepared statement of Mr. Cunningham follows:]

TESTIMONY PRESENTED BY RICHARD E. CUNNINGHAM, ACTING DIRECTOR, DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, U.S. NUCLEAR REGULATORY COMMISSION, JUNE 15, 1977

Mr. Chairman and Members of the Subcommittee, we appreciate this opportunity to appear before the subcommittee to participate in its examination of the decommissioning of nuclear facilities. As was requested in the letter from the Chairman, the Honorable George E. Brown, Jr., my oral remarks this morning will concentrate on the problems related to the Nuclear Fuel Services (NFS) reprocessing plant in West Valley, New York. However, before I discuss this particular facility, I would like to point out that there are several different kinds of nuclear facilities, including nuclear power reactors and the various fuel cycle plants which support nuclear power production. The decommissioning of nuclear reactor facilities has been relatively well developed and is routinely considered in the licensing process. We examine various decommissioning plans, costs, and environmental impacts prior to the issuance of an operating license for a reactor facility. Over 50 reactor facilities have been successfully decommissioned, including five licensed power reactors. I would like to submit for the record supplemental written testimony on the economics, environmental, and technical aspects of decommissioning this kind of nuclear facility.

With regard to nuclear fuel cycle facilities, decommissioning is an important issue that requires increased attention. Work needs to be done both to improve the technology for decommissioning and to establish suitable ways to assure that decommissioning will be properly financed. The subject of this testimony today.

NFS, illustrates problems concerning both the technology for decommissioning and financing such operations.

STATUS OF THE NUCLEAR FUEL SERVICES PLANT

NFS and New York State Energy Research Development Authority (NYSERDA) are co-licensees at the site under an NRC provisional facility license, CSF-1. In this arrangement, NFS has operational responsibility for the activities ongoing at the site. NYSERDA's responsibilities include site ownership and the long-term care of high-level wastes. Under the terms of the license, NFS has a continuing responsibility for the safety of the site. The license covers conditions for protecting the health and safety of the public and employees associated with the reprocessing of nuclear fuel and storage of the separated wastes.

The NFS reprocessing facility was originally licensed in 1966 by the Atomic Energy Commission (AEC). In 1972, NFS decided to suspend operations for modification and upgrading of the facility. On September 22, 1976, NFS announced its intention to withdraw from reprocessing. The plant is now in an inactive status.

Since their decision in 1972 to suspend reprocessing operations, NFS has been providing surveillance of high-level waste and stored spent fuel. The spent fuel storage pool is about two-thirds filled with light water reactor spent fuel. The mechanical and chemical process sections of the plant have been partially flushed and decontaminated in preparation for the modification that were anticipated. The 600,000 gallons of liquid high-level wastes from previous operations are in storage and are closely monitored. Some solid high-level wastes from the reprocessing operations are buried on site. The low-level radioactive waste treatment plant is periodically operated to treat water from the low-level radioactive waste burial grounds or the retention lagoons. The NRC staff has made, and continues to make, frequent visits to the plant to confirm its safe status. We have prepared supplemental written testimony which provides more detailed information on the history and background of this operation. With your permission, we would like to submit this for your use.

MAJOR ISSUES

There are several complex and interdependent problems which we are addressing now in the NFS case. These problems are:

Determining how stored high-level radioactive liquid wastes should be disposed of.

Assuring that, pending final disposition of high-level liquid wastes, the current method of tank storage is safe.

Determining what actions should be taken with the facilities at West Valley regarding the possible decommissioning of the site or other use.

Work on these problems has been underway; but before the West Valley problem can be finally resolved, policy decisions must be made regarding (1) what the future use of the site may be, (2) who is responsible for financing and implementing the solution, and (3) whether the West Valley site should be a federal waste repository for the NFS waste.

At the time the facility was licensed it was thought that the wastes would be permanently stored at the site. Subsequent to licensing NFS, there was an evolution in thinking by AEC on how high-level wastes should be managed and disposed of. In 1970 AEF regulations (10 CFR Part 50, Appendix F) were changed for new plants to require solidification of high-level wastes and shipment off site to a federal repository. This change was intended to limit both the number of sites where high-level waste could be perpetually stored and the inventory of liquid waste during operations.

AEC committed to review the NFS situation as a special case and issue a separate rule. Although the review is underway, the rulemaking has not been completed for several reasons. First and foremost, the technology for dealing with the neutralized waste has not been adequately developed. Unlike the wastes planned for future reprocessing plants, where the acid wastes as produced in the reprocessing plant are directly solidified, the NFS waste was neutralized similarly to military wastes generated by the weapons program. Neutralized wastes are more difficult to solidify because of their sodium content. It was thought that technology developed to deal with the weapons program wastes could be applied to the NFS problem. If so, duplication of effort and research and development costs could be minimized. Until NFS decided to withdraw from reprocessing, it appeared that time was available to allow the technology to mature; and then the waste could possibly be worked off after the plant was restarted.

It now appears to NRC that actions with regard to the high-level waste at West Valley (i.e., development of technology and safety criteria) should proceed in a stepwise fashion. It also appears that ERDA is the only organization with the technical experience and resources to deal with the problem of developing the technological alternatives for management of high-level wastes and, therefore, should take the lead in this area. The issue of assigning financial responsibility for the disposition of the waste should not delay developing technical solutions. On March 4, 1977 NRC requested ERDA to take the lead in providing the technology applicable to solutions to the NFS high-level wastes problem. NRC will work with ERDA while we develop the associated safety and environmental criteria for the technology.

A problem which has an important bearing on the final solution to the high-level waste issue is that it may not be feasible to remove all of the waste from the high-level waste tank. The liquid in the large high-level waste tank has been chemically neutralized with sodium hydroxide. This neutralization has caused much of the radioactivity in the wastes to be precipitated in the form of insoluble silt or sludge. Because of the complex inner structure of the tank, removal of this sludge will be difficult. This issue and others will have to be dealt with and decisions made as research progresses and technology is developed.

In the meantime, the NRC has evaluated the present safety of continued tank storage. We believe that the wastes can be safely managed with essentially no risk to the public while the technology for final disposition is being developed. Nevertheless, we are conducting further investigations of tank integrity to enhance this conclusion.

Work is currently underway with Battelle Northwest Laboratory to evaluate how best to proceed with decommissioning a reprocessing plant. Battelle has prepared a draft report for us on this subject. We have reviewed the report and suggested some further work prior to publication. The report is more intended to be applicable to future plants but may be of some help for the NFS reprocessing plant. There is some discussion that the NFS plant might be used for development work or otherwise treating the high-level wastes.

COSTS ASSOCIATED WITH THE NFS SITUATION

When the West Valley plant was initially licensed, the AEC received written assurance from the State of New York that care of the waste would remain a New York State responsibility even if the specific State Authority (NYSERDA) should be unable to provide this role. By contractual agreement with NYSERDA, NFS has made installment payments into an escrow account setting funds aside for the perpetual care of the waste. The funding arrangement contemplated only the eventual transfer of the waste to new tanks, in perpetuity, and did not consider facility decommissioning during the early part of the license term.

The waste cost situation was altered extensively for NFS when the AEC issued its new high-level waste management rule, the previously mentioned Appendix F to 10 CFR Part 50. Although the new rule made an exception for the existing wastes at West Valley, its possible application to those wastes would increase the cost of managing the wastes, perhaps a hundred-fold over the funds provided.

As can be seen from what I have said, there are options that need to be explored, safety and environmental analyses conducted, and technologies developed before the final disposition of the plant and the wastes can be established. Cost is one of many factors that needs to be analyzed by all those involved in the decision-making process as work progresses. We do not have at this time sufficient information which would enable us to estimate cost for (1) decommissioning the plant, (2) licensing alternative uses of the plant, or (3) disposal of the high-level waste. These costs depend on things such as how the existing wastes will be treated, use of the existing facilities for the solidification process or alternative purposes, proposed uses of the site following decommissioning, etc. We are exploring with ERDA the development of a program and schedules to consider a range of alternatives. We will, of course, be exploring cost with all those concerned in making decisions about the future of the site.

RELEVANCE OF NFS TO THE NUCLEAR ENERGY PROGRAM

The NFS situation has been used occasionally as an example of the problems faced by the national program for the management of the much larger quan-

tities of waste expected from the nuclear power industry. We do not believe this example is directly translatable to the present or projected nuclear power industry for two reasons. First, national policy on long-term management of high-level waste was established after the plant began operation (10 CFR 50 Appendix F). Had this policy been established before operation, the design of the plant might have been altered considerably. The decision to neutralize high-level reprocessing wastes was made primarily on the basis of a short-term financial consideration (i.e., neutralized wastes could be safely stored in mild steel tanks instead of more expensive stainless steel tanks). This was done with the belief that perpetual care of the wastes could be undertaken permanently at the site. Therefore, the effect neutralization would have on the possible subsequent need to remove the waste from the storage tanks for transfer to a repository as a solid was not a factor in the analysis. In addition, the reprocessing facility itself was designed with the same perspective that the sites would be permanently committed as a repository. Second, the technology for converting neutralized high-level liquid wastes to a solid form suitable for final disposal is more difficult and expensive than it will be for the acid wastes in the current generation of reprocessing plants.

Nonetheless, the NFS situation is a good example of the consequences of inadequate planning. The lessons to be learned from the NFS situation have not been lost and have significantly influenced all aspects of our fuel cycle licensing program. For example, in preparing a Generic Environmental Impact Statement (GEIS) on uranium milling the NRC is examining mill tailings reclamation and financial surety arrangements. This will be the basis for NRC regulations and regulatory guides. Until the GEIS is issued and new regulations implemented, NRC is taking a conservative approach with respect to licensees and new applicants. For new applications, we are requiring applicants to develop and commit to a tailings management plan as a license condition that reduces the impact of the tailings to essentially the same impact as occurs at that site in the natural state. In addition, NRC is requiring that the applicant provide a financial surety arrangement to assure that the tailings management plan will be carried out. With regard to existing licenses, NRC is requiring that a tailings management plan and financial surety arrangement be committed to at time of license renewal as a license condition.

Also, for new major fuel cycle licenses and at the time of renewal for existing licenses, the licensee is being requested to provide decommissioning plans and financial arrangements for defraying these expenses. Additionally, the staff is exploring what statutory or regulatory changes are desired or needed to provide adequate protection over the long-term. NRC does not plan to firm up details until after a study on financial surety arrangements now being carried out as part of the GEIS on uranium million is completed, since most of the considerations dealt with in that study will also be applicable to fuel cycle licenses.

SUMMARY AND CONCLUSIONS

The NRC has responsibility not only for the care of the environment and safety of licensed activities, but also for the long-term consequences of the same activities. We have learned that assurance should be provided at the initiation of fuel cycle licensing activities that decommissioning will be property undertaken at the end of life of each facility. We are attempting to take this into account for each type of facility.

In the specific instance of the West Valley site, we are taking precautionary measures to reinforce our understanding of the safe surveillance of the site and are assisting in the step-wise effort to resolve the questions of its long-term disposition. We believe ERDA has been and will be very helpful in this task.

The entire nuclear community has learned a number of valuable lessons from the experience at West Valley as well as other facilities which have ceased active use. We have studies planned or underway for major facilities to provide systematic understanding of the detailed decommissioning options and costs. Fuel reprocessing plants will be one of the first for which a study will be complete. Pending completion of these studies we have taken steps in our licensing actions directed toward assuring satisfactory decommissioning of both new and existing facilities.

In the course of our studies we shall identify possible design changes which could facilitate decommissioning. ERDA will have a substantial role in the research and development regarding such design changes and the development of any needed technologies for implementing decommissioning plans. We shall

identify to ERDA opportunities for such research and development as they arise from our studies.

BACKGROUND MATERIAL

LEGISLATIVE AUTHORITY

The Nuclear Regulatory Commission (NRC) is an independent regulatory agency, created by the Energy Reorganization Act of 1974, as amended (42 USC Section 2011 *et seq*). The Commission's primary statutory mandate is the licensing and regulation of commercial nuclear energy in a way which insures the protection of the public health and safety and the common defense and security of the United States.

The Atomic Energy Act of 1954, as amended (42 USC Section 5801 *et seq*) established the class of nuclear materials and facilities which are subject to NRC authority. This statutory responsibility extends to the storage, reprocessing and disposal of spent fuel from commercial nuclear power plants. Also, the 1974 Energy Reorganization Act gave the NRC additional responsibility for licensing ERDA facilities to be used for the receipt, long term storage and disposal of high level nuclear waste.

Section 274 of the Atomic Energy Act, enacted in 1959, recognizes the interests of the States in the peaceful uses of nuclear energy and establishes a framework for Federal/State cooperation, with respect to certain aspects of nuclear regulation. According to Section 274(b), NRC is authorized to enter into agreements with the Governor of any State providing for the State's assumption of regulatory authority for byproduct, source and special nuclear materials in quantities not sufficient to form a critical mass. The State's program must be compatible with the Commission's program and be adequate to protect the public health and safety. Under the provisions of 274(b), States entering into agreement with the NRC assume regulatory authority over commercial shallow land burial facilities located within the States.

HISTORICAL ASPECTS

One of the purposes of the Atomic Energy Act of 1954 was to facilitate the development of a commercial nuclear energy industry. Until that time, nuclear work was largely confined to the Atomic Energy Commission (AEC). When the nation embarked on a commercial nuclear program, a separate Division of Civilian Application was established in the AEC to regulate commercial applications and thereby protect the health and safety of the public. As time passed and the commercial nuclear program grew, the AEC's regulatory arm also grew. With the Reorganization Act of 1974, this group took the regulatory responsibility as the independent Nuclear Regulatory Commission.

When the commercial nuclear industry began to develop, there was a need for formal regulations so that important safety requirements could be stated clearly for all to understand and so that they could be given the force of law to ensure compliance. The AEC began to promulgate regulations for civil nuclear work in Title 10 of the Code of Federal Regulations. The AEC and now the NRC have issued and revised its regulations as knowledge has been gained and technology has advanced during the 23 years of civil nuclear work.

In the late 1950's, the State of New York undertook a program of nuclear development under the guidance of its Office of Atomic Development (OAD). The OAD has been succeeded by the Atomic Research and Development Authority (ARDA, in 1962), the Atomic and Space Development Authority (ASDA, in 1964), and now by the New York State Energy Research and Development Authority (NYSERDA, in 1976). The OAD acquired the 3, 300-acre West Valley site and designated it the Western New York Nuclear Service Center. The OAD and ARDA engaged in a long series of negotiations with private industry and the AEC to develop its West Valley site. The negotiations and relations with the AEC involved both the promotional and regulatory functions of the AEC. In order to promote the development of commercial fuel reprocessing, the AEC provided design assistance and entered into an agreement to provide a base load of spent fuel for the proposed reprocessing plant. With that assurance, and the substantial support of the OAD, Nuclear Fuel Services (NFS) agreed to build and operate the reprocessing plant at the West Valley site.

The NFS reprocessing plant was designed in the early 1960's based on technology developed at Federal plants. The plant was subject to the requirements contained in 10 CFR Part 50 as a production facility. Other pertinent regulations existed in 10 CFR Part 20 for controlling radiation exposure of personnel

and release of radioactive materials to the environment, and in 10 CFR Part 70 for handling special nuclear material (such as plutonium and enriched uranium).

The development of regulations is an evolutionary process. Regulations change as we obtain better understanding of the issues and as there are technological advances to improve safety and reduce environmental impacts. Between the period of 1966 when NFS was first licensed to operate and 1972 when it shut down to make improvements and in the several years following the 1972 decision to shut down, some important modifications to regulatory policies and requirements relating to safety and protection of environmental values were developed.

It is apparent from regulatory actions and statements at the time the plant was designed that the West Valley operation was viewed as both a reprocessing center and as a waste repository. In a letter dated February 18, 1963, R. Lowenstein, AEC, to O. Townsend, ARDA, the AEC indicated certain responsibilities for perpetual care of the high level wastes separated from the irradiated fuel in the course of reprocessing which would have to be assumed by ARDA and the State of New York. The State provided appropriate assurances that these responsibilities would be met. The technology accepted for perpetual storage of the high level liquid wastes at NFS, i.e., as neutralized liquid in carbon steel tanks, and the technology for burial of other radioactive wastes at the NFS site was consistent with the practice at that time at AEC sites.

The design requirements for construction and operation of the NFC plant were consistent with the AEC regulations which had been issued up to that time. The seismic criteria applied to the design of the NFS structures were consistent with the existing building codes for reinforced concrete structures. The more conservative AEC seismic design criteria developed for reactors, and which were later applied to fuel reprocessing plants were developed and implemented over subsequent years, culminating in the publication of Appendix A to Part 100 in 1973. Reactors have been designed to meet these more conservative seismic design criteria as the criteria evolved from the mid-1960's on. The later commercial reprocessing plants at Morris, Ill., and Barnwell, S.C., were designed to the more conservative seismic criteria.

Regulations governing the release of radioactive materials to the environment and radiation exposure of personnel are contained in 10 CFR Part 20. Since 1970, Part 20.1 has included a specific statement that exposure of personnel and release of radioactive material to the environment should be kept as low as reasonably achievable below the limits specified in the regulations. Once the NFS plant began to operate, difficulties were encountered with radioactive releases and radiation exposures. Releases were kept within the regulatory limits specified in 10 CFR Part 20, but were close to limits and could not be considered as low as reasonably achievable. There was increasing AEC pressure on NFS to reduce radioactive releases during operation.

A similar situation prevailed with radiation exposures to plant workers. With operation, various deficiencies in plant design were revealed. NFS corrected many of these deficiencies as they went along. However, normal operational maintenance entailed radiation exposures to some of the plant staff which could be reduced through design changes. While NFS was generally able to keep radiation exposures to individuals within regulatory limits by hiring many temporary workers for maintenance work, good radiation safety practices dictated plant modifications be made to reduce the total personnel exposure at the plant.

In 1970, the Atomic Energy Commission decided that it was in the interest of the public health and safety to limit the quantity and mobility of high level waste stored onsite at commercial fuel reprocessing plants. Perpetual storage as liquid in tanks no longer appeared to be a practical solution to commercial high level waste management particularly since it would limit the extent to which a reprocessing plant site could be decommissioned after the end of its useful life. It was believed that disposal of high level wastes at a few federal repositories would reduce the social cost of perpetual care over that of maintaining the wastes at a number of reprocessing plant sites. Accordingly, 10 CFR Part 50 was amended by adding Appendix F to require that high level waste at reprocessing plants be solidified within 5 years after separation and shipped to a Federal repository within 10 years after separation. This regulation was not made retroactive and thereby does not apply to those liquid high level wastes currently stored at the NFS reprocessing plant site. It was noted at the time the regulation was issued that wastes being generated at the NFS plant prior to installation of waste solidification equipment would be subject to a further rule making proceeding.

[Whereupon, the hearing was adjourned at 12:35 p.m., to be reconvened the following morning at 9:30 a.m.]

DECOMMISSIONING AND DECONTAMINATION

Proposed Generic Study

THURSDAY, JUNE 16, 1977

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE,
Washington, D.C.

The above entitled hearing convened, pursuant to notice, on Thursday, June 16, 1977, at 9:30 a.m., in room 2325, Rayburn Office Building, Hon. George E. Brown, Jr. (chairman of the subcommittee), presiding.

Present: Representatives Walker and Wirth.

Mr. BROWN. The subcommittee will come to order.

We expect some other members of the subcommittee momentarily, but in the interest of time of our distinguished witness this morning, I think we had better begin.

We are in the second day of 2 days of hearings on the general problem of decommissioning of nuclear installations, and the specific problem represented by the West Valley plant in New York.

There has been legislation introduced dealing with the problem of decommissioning and decontamination of nuclear facilities, H.R. 6181, and it is our intention to treat this, today's hearing specifically, as a legislative hearing for the purposes of determining whether further action should be taken on this legislation.

However, Congressman Lundine, whose district includes the West Valley plant, was unable to be with us yesterday, thus he is with us as our first witness this morning. He will give us some background with regard to his concerns about West Valley.

After that, we will have a number of witnesses dealing with the generic, environmental, health, safety, and economic issues associated with the problem of decommissioning nuclear facilities such as reactors, reprocessing plants, and any other similar facilities. We hope to examine not only the various technical alternatives and costs, but also the institutional mechanisms for managing, regulating, and financing the operations, in our hearing this morning.

We welcome you, Congressman Lundine, this morning. We look forward to hearing from you as to your concerns about the West Valley plant.

STATEMENT OF THE HONORABLE STANLEY LUNDINE, U.S. REPRESENTATIVE, STATE OF NEW YORK

Mr. LUNDINE. Thank you, Mr. Chairman.

I appreciate this opportunity to appear before you today as you begin to investigate the history and current status of the Nuclear Fuel Services Center, at West Valley, N.Y.

It is appropriate that the subcommittee begin their inquiry into the environmental, health, safety, and economic consequencies of decommissioning and decontaminating nuclear facilities and disposing of nuclear wastes with West Valley. As the only commercial nuclear fuel reprocessing center ever to operate in the United States, the problems at West Valley go to the very heart of the future of the nuclear industry in the United States, including important technical, environmental, and economic questions.

As the Federal Government becomes more deeply involved with the West Valley question, I feel strongly that careful consideration should be given to the past experiences and future possibilities affecting the town of Ashford and Cattaraugus County, which I represent in Congress, and where the plant is situated.

It should be noted that the land on which the site is located was acquired by the State of New York from productive farmers and homeowners who were forced to relocate. In exchange for this sacrifice, the State promised that the town would experience exponential economic growth as an important energy producing center of New York State. Quite the contrary, what has resulted is a failing enterprise that has instead threatened to destroy the economic base of this community.

As this historical experience at West Valley unfolds before your committee, Mr. Chairman, I am sure you will conclude that the people living in Cattaraugus County have borne the brunt in their daily lives of an experience which is national in scope, with national ramifications for our energy program.

As pointed out during the markup of H.R. 6796, Authorizing Appropriations for the Energy Research and Development Administration for fiscal year 1978, by the full Science and Technology Committee just a few weeks ago, nearly 80 percent of the nuclear wastes which were reprocessed at West Valley between 1966 and 1972 when the facility operated were Defense Department wastes.

GAO officials report that one of the primary reasons that the NFS operation was not cost effective was because of continually revised regulations by the Nuclear Regulatory Commission which required the additional investment of huge sums of money.

Finally, the Federal Government in the past has failed to devote adequate attention to the important technical problems of nuclear waste management, which makes finding a solution to the West Valley problem particularly difficult and expensive—an expense and uncertainty which the people of Cattaraugus County, and indeed all of New York State, are being asked to bear.

I feel that the Federal involvement in the problems at West Valley is well documented, and for this reason I have expressed my support for Federal technical and financial assistance to the State of New York to solve this problem. In addition, I feel strongly that impact

aid should be granted to help the people of Cattaraugus County make the transition to a new economic base.

There are 32,204 acres of land in the township of Ashford, of which the State owns 3,300 acres. The assessed value of the State owned land which surrounds the Western New York Nuclear Fuel Services Center is $597,000, from which no revenue is realized.

The buildings owned by Nuclear Fuel Services are assessed at $900,000, and this year will pay $19,089 in county taxes, $31,104 in town taxes, $2,729 for fire protection, and $64,297 in school taxes, providing nearly 40 percent of the tax base for these entities. Needless to say, people living in Cattaraugus County will experience a significant depletion of their tax base in 1980 if the present contractural agreement between Nuclear Fuel Services and the State of New York is terminated and the facility is held by a tax exempt entity.

H.R. 6181, which is the subject of these 2 days of hearings before your subcommittee, Mr. Chairman, focuses on the environmental and safety aspects of decommissioning and decontaminating the site and handling the wastes at West Valley. I am concerned that the people in my district are not unnecessarily exposed to health hazards, and that this situation be handled with a minimum of radioactive exposure for the people of the area.

Frankly, I am quite concerned that nearly 100 instances of overexposure occurred in the NFS plant between 1966 and 1972, of which only 67 have been documented by the Nuclear Regulatory Commission.

We need an objective, indepth environmental health analysis of the West Valley area. Sensational reporting in the popular press has caused alarm resulting in serious detriment to the area. It should be determined whether the NFS operation has resulted in any unusual incidence of health problems based on empirical evidence, not rumor and suspicion.

Lack of a national policy for low level waste burial ground management and for handling the 600,000 gallons of high level liquid nuclear wastes in storage tanks at West Valley also causes me serious concern. There are indications that these nuclear wastes located on the site present potential dangers and that time is short if we are to protect against serious environmental damage.

Although I have heard estimates of between 40 to 100 years for the life of the carbon steel tanks now storing the high level wastes, one of the main findings of the GAO study done for the Environment, Energy, and Natural Resources Subcommittee of the House Government Operations Committee is that tank safety is uncertain, and that it cannot be assured that the waste tanks are in good condition or that the waste would not be released into the environment if a tank failed or ruptured.

Specifically, the GAO report stated:

> The tank life is unpredictable and therefore a tank could fail at any time. The NFS tanks may not meet certain seismic requirements, and on past occasion, an accumulation of water in the vault excavation area forced the waste tanks and vault system out of the ground.

I feel that it is absolutely necessary that we proceed cautiously with the technical solutions to these problems. The Energy Research and Development Administration has proposed solidification of the

high level wastes into a glassy substance and burial in a salt bed for permanent storage.

They have set 1985 as a target date for having this process in place, but needless to say the process must be accelerated if we are to avert a serious environmental and economic crisis in New York. I applaud the recent action of President Carter which called for a complete review of our nuclear waste management programs, and I hope the Congress can work with the administration to solve some of these problems.

Beyond this, a few aspects of the technical process worry me, questions for which there are not as yet satisfactory answers. As I understand it, in addition to the neutralized liquid wastes in the high level tanks at West Valley, a thick substance commonly referred to as sludge is believed to contain much more of the highly radioactive elements than is dispersed throughout the remaining liquid in the tank.

To my knowledge, there is no technical procedure available to successfully remove this sludge from these tanks and the longer the tanks remain in place the worse the problem will become. I feel strongly that this is an aspect of the problem which must be addressed without delay.

As you may know, I was involved in drafting an amendment which was approved by your full committee just a few weeks ago calling for a 1-year study of the West Valley problem, to be carried out jointly by the Environment and Safety and Waste Management Divisions at the Energy Research and Development Administration. As finally submitted to the Congress, the study is to include a plan for decommissioning the plant and handling the wastes, and for any possible alternate uses for the site.

There are those with whom I have met in the last few months who believe that the Nuclear Fuel Service Center at West Valley can be utilized in a productive manner, which will offset the huge amount of money the Federal Government is being asked to allocate for the site and the wastes located there.

I am satisfied in my own mind that the NFS facility can never again be used for nuclear reprocessing, and even though New York is under consideration by the Energy Research and Development Administration as a possible Federal repository for wastes, I have serious doubts that the area could meet the necessary geological and seismic criteria.

I am intent on insuring that the people in my district are not exposed to additional unnecessary environmental hazards, nor once again asked to make substantial sacrifices for experimental programs which cannot have a positive impact on their daily lives.

On the other hand, if the facility can be used for a worthwhile purpose and the economy of the area thereby improved without endangering environmental health, I would obviously strongly support such use. I will be looking forward to recommendations from the Energy Research and Development Administration with these thoughts and goals in mind.

As we examine the issues raised by the problems at West Valley, it is important that we focus upon the proper question: "What has to be done and who is most qualified to do it." There has been too much

emphasis on: "Who is responsible and who should pay for it?" The national goal of meeting our energy needs while protecting the environment demands the proper, positive perspective.

As you continue these hearings of the situation at West Valley, I hope you will give my concerns, and the concerns of people in my district, every possible consideration. I, and members of my staff, will continue to be available to assist your subcommittee on this matter in any way possible.

Thank you.

Mr. BROWN. Thank you, Congressman Lundine.

I appreciate very much your remarks, and I want to acknowledge the initiative which you displayed in promoting the amendment to the ERDA authorization bill which focuses attention on this West Valley problem.

I think we have made a beginning in getting the situation in proper perspective as a result of that amendment, and we are hopeful that with that, and these hearings, and other initiatives that we will be able to come up with some concrete action in the fairly near future.

I will just ask one or two questions with regard to your statement.

You made reference on page 3 to possibly 100 instances of overexposure at the plant. I do not think any of our previous witnesses have dealt with that problem. I wonder if you could elaborate on that a little bit?

Apparently, there are more instances that you recognize than NRC has had information on.

Mr. LUNDINE. According to the records of the Nuclear Regulatory Commission, it was our understanding that there were about 117 instances of overexposure during the operation of the plant.

We wrote a letter sometime ago which I will be happy to make a part of the record, and we asked NRC for their evaluation of those instances. We have received a reply addressed to 67 of those instances.

I, frankly, have not come to a conclusion. We were concerned at the time of writing as to whether this might have been one individual overexposed 30 times, and that would account for 30 such instances, or whether the overexposures had resulted in any health problems, and whether there had been followup with these people who had been working at the plant.

In my own mind, I am not certain. I am not saying that we do not have or cannot get the answers to those questions, but I am not certain of the answers yet. I would be happy to share any information that we get.

Mr. BROWN. We would appreciate it if you would do that.

[The letters and information follow:]

CONGRESS OF THE UNITED STATES,
HOUSE OF REPRESENTATIVES,
Washington, D.C., February 7, 1977.

Mr. MARCUS A. ROWDEN,
Director, U.S. Nuclear Regulatory Commission,
Washington, D.C.

DEAR MR. ROWDEN: In an attempt to more fully understand the issues related to the future of the nuclear reprocessing facility at West Valley, New York, I have begun to examine in more detail the operations of the plant itself, and maintenance of the surrounding grounds and facilities. It is my understanding that the proposal submitted by Nuclear Fuel Services, Inc. for plant modification is pending before the Nuclear Regulatory Commission.

I am particularly seeking answers to several serious health and environmental concerns regarding the West Valley plant. First, in a recent G.A.O. briefing on West Valley, I learned that prior to closure of the plant in 1972, there had been 117 known over exposures in the plant. At the time of the G.A.O. briefing, the facts of these overexposures were not available. It was not known, for example, whether these 117 overexposures were a few people exposed a number of times, or 117 different people who had each been exposed once. More importantly, it was not clear to me what steps were taken, or required to monitor these instances, and what medical steps are taken, if any, to follow up each occurrence.

Second, it is also my understanding from the G.A.O. briefing that the low level waste (which I understand to be materials which have been exposed to radioactivity such as gloves, masks, etc) are buried in an open trench, and that to re-open the plant would require upgraded seismic standards. In the event of an earthquake, what are the dangers of exposure from the low level waste buried in these trenches? If there is an environmental danger of over-exposure from these trenches, what are the alternatives to leaving the waste buried here and the costs involved with possible reallocation?

Third, water has recently been discovered in the trenches storing the low level waste, which is being pumped out and slowly released into the Cattaraugus Creek. I am concerned with the safety of this procedure, and the steps that are being taken to monitor the creek to protect against radioactive environmental damage.

Any information you could provide me with to respond to me concerns and questions would be greatly appreciated. Thank you in advance for your time and consideration.

Sincerely,

STANLEY N. LUNDINE,
Member of Congress.

U.S. NUCLEAR REGULATORY COMMISSION,
Washington, D.C., March 2, 1977.

Hon. STANLEY N. LUNDINE,
U.S. House of Representatives,
Washington, D.C.

DEAR CONGRESSMAN LUNDINE: We are pleased to respond to your letter of February 7, 1977, concerning the Nuclear Fuels Services facility at West Valley, N.Y. The facility license, for the West Valley site, CSF–1, was issued to Nuclear Fuel Services and the New York State Atomic and Space Development Authority (now the New York State Energy Research and Development Authority, NYSERDA) on April 19, 1966. Under the terms of that license and their agreements with NYSERDA, NFS operated the reprocessing facility from 1966 to early 1972, processing approximately 640 tons of irradiated fuel during this period.

On October 3, 1973, NFS submitted an application for modification of the facility to increase production rates and correct certain deficiencies noted during operation. On September 22, 1976, NFS announced that it was withdrawing from reprocessing and requested that the NRC suspend ongoing reviews of their application pending NFS consultation with NYSERDA.

With respect to your inquiry about occupational exposure at West Valley, individuals at nuclear facilities are permitted to receive doses of up to 1¼ to 3 rem per calendar quarter, i.e., 5 to 12 rem per year, depending on age, if records are properly kept on Form NRC–4 and eventually reported to the NRC. These occupational limits are set forth in 10 CFR 20.101 and 20.102. If the dose received in any quarter is greater than permitted by these limits, it must be reported within 30 days to the NRC as prescribed in 10 CFR 20.405, 'Reports of overexposure and excessive levels and concentrations." A dose exceeding these limits is termed an overexposure. Our records indicate 67 overexposures (some very slightly) during the entire operating period of 1966 to 1972. We present this information in Table 1 attached.

The 117 persons you refer to were not overexposed, but were persons having received more than 5 rem in the year 1970. Persons over 21 years of age can receive up to 12 rem per year. The 117 persons (NFS actually reported 124) received over 5 rem, but less than 12 rem, still within the aforementioned Part 20 limits. Table 2 shows the total exposures at the site for the years 1969 through 1972. The Commission has taken the position that this exposure is not as low

as reasonably achievable. One of the primary reasons for the modification program was to correct plant design deficiencies which contributed to these exposures.

With respect to your concern as to the medical steps taken for overexposures, the Commission retains medical consultants for this purpose and advice is solicited when there may be some question as to acute exposures or excessive ingestion of radioactivity. In the instances shown in Table 1 there was no need for medical assistance since these over-exposures were not acute and no discernible effects would be expected.

The low level waste burial ground at the West Valley site has been operated by NFS under license from the State of New York. New York is an Agreement State, i.e., has assumed authority from the NRC for regulating activities involving radioactive materials such as the low-level waste burial ground. A trench must be opened in order to bury the waste, but the trenches are closed and marked after burial. The seismic standards (design basis earthquake) you speak of were being applied in our evaluation of new structures associated with the reprocessing plant, not the low-level waste burial ground. The earthquake postulated by this criteria (20% of the acceleration of gravity) would not affect the confinement of the burial ground. In the extremely unlikely event an earthquake were to occur in this area, it would occur on the Clarenden-Linden fault. This fault, at its closest point, is 23 miles from the burial ground. There would be no dangers of exposure from the low level waste buried in the trenches from such an earthquake. Tremors that would be experienced at the site should not affect the integrity of the trenches.

You also inquire about the alternatives and costs for relocating radioactive wastes buried at the site if there is an environmental danger. Operation of the site to date has resulted in no environmental danger or hazard to the public health and safety. During the late 1960's and early 1970's water accumulated in trenches in the north burial area. In March 1975 several of the trenches filled and overflowed releasing small quantities of radioactivity. The flow was estimated at about one gallon per day. No significant increase in radioactivity in local streams which drain the site was detected; however, NFS voluntarily suspended operation of the site.

The operating and trench construction practices used during the early years of operation in the north burial area in conjunction with the site physiography and hydrogeology appear to be the principal factors for the seepage. Water infiltrating the trench cap collected in the voids between packages and the rate of infiltration through the cap was probably higher than the surrounding undisturbed soil. As the packages decomposed and collapsed, the trench cover settled and cracked and further increased the infiltration rate. The low permeability of the surrounding geology prevented lateral movement of water from the trench. Eventually the trenches filled and overflowed. (Similar problems have not been detected in the new south burial area where improved capping and cap compaction procedures are used which retard water infiltration.)

Subsequently, NFS requested and obtained approval from the State Department of Environmental Conservation to pump liquids from the trenches to a holding lagoon. Since March 1975, the liquids have been processed through a low-level waste treatment system and released. The results of a State study regarding the site concluded that the continuous discharge of untreated trench water from the site would not produce a "statistically significant" health effect. Since the trench water is processed through a low-level waste treatment system the estimated doses are even lower than those resulting from release of untreated trench water. (A copy of this paper is enclosed.)

The licensee and State have conducted environmental monitoring programs at the sites since the early 1960's. The routine State program consists of collection of samples from natural streams, wells, springs including drainage and seepage from the site, and vegetation and farm products in the area. The 1974 Annual Report of Environmental Radiation in New York State indicates "The samples of surface water taken from around the NFS burial site continued to show no major source of underground migration of radioactivity from the burial site. The data from the first three months of 1975 indicated seepage of radioactivity out of the surface cover over trenches No. 3, No. 4 and No. 5. This seepage was visually evident in March 1975. It was necessary to pump down trenches No. 3, No. 4 and No. 5 to prevent water from continuing to seep or physically break through the cover over the trenches at the lowest points." The State monitoring reports for 1975 show detection of low levels of radioactivity resulting from release of trench water.

There has been an extensive evaluation of the environmental aspects of the West Valley low level burial ground. NYSERDA has a current study being conducted by Dames and Moore. EPA has also funded a study by the New York State Geologic Survey.

Removal of the waste from the trenches may present greater hazards and potential environmental releases than leaving the waste in place and taking appropriate corrective action (e.g., pumping trenches dry, recapping, grading, and establishing a vegetation cover). Such actions are being taken to improve site operations. A recent report of the National Academy of Sciences emphasizes that removing the waste may pose more hazard to man and his environment than leaving the waste in place.

We understand that NFS does not plan to reopen the low level waste burial ground at this time. Please let us know if we may be of further assistance in this matter.

Sincerely,

WILLIAM J. DIRCKS.
Assistant Executive Director for Operations.

TABLE 1.—NFS REM OVEREXPOSURE [1]

Year reported	Whole body			Skin			Extremities		
	Number exposed	Range	Total person-rem	Number exposed	Range	Total skin-rem	Number exposed	Range	Total hand-rem
1966	0	0	0	0	0	0	[illegible]	0	0
1967	0	0	0	0	0	0	6	19-31	145
1968	4	3.1-3.4	13	4	7.7-9.8	35	9	19-44	173
1969	1	3.2	3.2	3	7.7-8.1	24	8	19.5-30.2	190
1970	12	3.20-7.65	41	6	7.6-10	49	9	21-50	221
1971	2	8-9.1	17	1	10.1	10.1	1	45	45
1972	0	0	0	0	0	0	[2] 1	[2] 90	[2] 90
	19			14			34		

[1] Limits: Whole body 3 rem, skin 7.5, extremities 18.75.
[2] Not confirmed.

TABLE 2.—SUMMARY OF WHOLE BODY EXPOSURES TO EXTERNAL RADIATION RECEIVED BY INDIVIDUALS AT NUCLEAR FUEL SERVICES, INC., WEST VALLEY, N.Y.

Calendar year	Number of estimated accumulated remodses in each of the following ranges											Total monitored	Total over 1.25 rem
	0-1.24	1.25-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-12		
1969	234	19	35	21	37	26	23	23	2			420	186
1970	465	108	50	34	19	20	20	20	30	18	[1] 16	800	335
1971	830	189	123	67	37	27	28	29	28	20	[1] 22	1,400	570
1972	646	124	85	59	31	23	11	8	8	5		1,000	354

[1] None exceeded 12 rem whole body.

I also appreciate your emphasis throughout your statement on the impact of this operation on the surrounding community. You have documented that very well.

I think this needs to be kept in mind constantly as we consider the necessary new energy developments of all kinds that the present energy situation requires.

I might say that in the last year or two the Science and Technology Committee has devoted a great deal more attention to community impacts in connection with energy legislation. Written into much of their legislation are comprehensive procedures for dealing with that, but 10 years ago when this plant was put into place there apparently was very little consideration given to that sort of thing.

Mr. LUNDINE. Yes; I think that is true. I do not want to mislead the subcommittee into thinking that there is any degree of panic in that community.

In fact, it is exactly the opposite. There is a great deal of calm in the community. With respect to the health issue, for example, the school principal has told me that in every incidence of records that are kept normally by a school, they have fewer health problems than would be the norm.

They are really amazingly stable and calm in the face of being looked at by outsiders as something of a weird place. They have a lot of experiences where folks are driving by looking for two-headed cows, and all sorts of unusual phenomena.

In fact, it is a very peaceful, delightful little community, in a very rural setting.

They are focused more on the economic part of the issues than on the environmental/health part simply because they understand the economic issues better than the environmental/health issues.

As a community, I think the way they have expressed their attitude to me is, "We expect you to take responsibility because we do not understand the health issues." And by "me," I do not think that is just one person. I think they mean the licensing agency and the State that promoted the project.

Mr. BROWN. Mr. Walker, do you have any questions or comments?

Mr. WALKER. No; Mr. Chairman.

Mr. BROWN. Mr. Spensley, do you care to ask any questions?

Mr. SPENSLEY. No thank you.

Mr. BROWN. Thank you very much, Mr. Lundine. Your testimony is very much appreciated.

Mr. LUNDINE. Thank you.

Mr. BROWN. Our next witness this morning will be a repeat performance by Mr. Monte Canfield, Jr., Director of the Energy and Minerals Division of the General Accounting Office, who is going to provide us with the latest report of that esteemed organization.

We appreciate your coming back this morning, Mr. Canfield.

STATEMENT OF MONTE CANFIELD, JR., DIRECTOR, ENERGY AND MINERALS DIVISION, GENERAL ACCOUNTING OFFICE

Mr. CANFIELD. Thank you, Mr. Chairman.

Mr. Chairman, I will proceed as far as I can. The last 24 hours, I seem to have picked up some sort of a stomach bug, having nothing to do with radioactivity, and I may not be able to stay with you the whole time, but I will carry on here, and I am sure that Mr. Carlone can complete the statement if I cannot.

Mr. BROWN. We appreciate that very much.

Mr. CANFIELD. We appreciate the opportunity to be here today to discuss, in connection with H.R. 6181, our report entitled "Cleaning Up the Remains of Nuclear Facilities—A Multi-Billion Dollar Problem"—EMD-77-46, June 16, 1977.

We are issuing this report today. When we learned of H.R. 6181 and these hearings several weeks ago, we were immersed in an evaluation of Federal efforts to clean up nuclear facilities. Our schedule called for reporting on this evaluation several months from today. However, so as to maximize our contribution to this hearing, we have accelerated our work, and, in some areas, reduced its scope in order to issue our report. We feel, however, that our report deals with the issues in enough detail to be useful.

As with every industry, nuclear facilities and equipment may be shut down, replaced, or become obsolete. Cleaning up the remains of nuclear activities, however, presents special problems because of radioactivity and contamination which can endanger public health and safety. Some radioactivity remains hazardous for thousands of years making final and absolute disposal at best a difficult and expensive task.

In short, the problem of protecting the public from the hazards of radiation lingering at inactive nuclear facilities needs Federal attention if a strategy for finding a solution is to be developed. A strategy to clean up these privately and federally owned nuclear facilities, which continue to accumulate, cannot be developed until basic questions on the magnitude of the problem, such as costs, radioactivity, and timing have been answered.

Responsibility for cleaning up inactive nuclear facilities rests primarily with two Federal agencies, with additional help from a third and the 50 States:

The Energy Research and Development Administration is responsible for disposing of, or decommissioning, the radioactive facilities it owns.

The Nuclear Regulatory Commission is responsible for regulating private users of nuclear materials, including powerplants, uranium mills, and processors of nuclear fuel.

The 50 States have traditionally been responsible for controlling the hazards of using accelerators and radium.

The Environmental Protection Agency has overall responsibility for issuing standards for the protection of the environment from all sources of radiation. But to do this, it must have cooperation from the other two agencies identified.

Radiation is encroaching on man's environment. Radiation has become a household word with almost daily news of its dangers. For example, the press and testimony before congressional committees discuss radiation hazards associated with high-level radioactive waste using highly charged words such as "impossible solutions" and "doomsday issues."

The two types of hazards that could be involved in cleaning up a nuclear facility are induced radioactivity and surface contamination. Induced radioactivity results from a nuclear reaction and is embedded in the equipment or material coming into contact with the nuclear reaction. This induced activity can remain dangerous for thousands of years. For this reason, a structure containing induced radioactivity should be dismantled at some point in time before deterioration of the structure begins. This is essential to preclude radioactivity from entering the environment.

Surface contamination results from facilities or equipment coming into contact with radioactive material. As opposed to induced activity, material having surface contamination can often be cleaned up by scrubbing and washing.

In the jargon, the words decontamination and decommissioning are often used in discussions of disposing of nuclear structures. Decontamination denotes the process of cleaning up surface contamination. Decommissioning indicates the closing or shutting down of a facility with some actions taken to prevent—at least temporarily—health and safety problems. It does not necessarily denote a final and absolute solution.

There are various types of nuclear facilities that comprise the decommissioning problem, including reactors, nuclear fuel fabrication facilities, uranium mills, nuclear fuel reprocessing plants, and accelerators.

THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

ERDA has not paid enough attention to its facilities that are now obsolete. It has not compiled relevant details of the facilities it owns—obsolete or operating—which would permit it to assess the magnitude of the decommissioning problems they pose.

Funds for decommissioning have been used for several specific projects. One project involved sites used 20 to 30 years ago to develop the first atomic bomb and for other early nuclear projects. These sites had been released for unrestricted use by the general public. However, a concentrated effort is being made now to identify any of these sites that are still contaminated and to do what is necessary to eliminate remaining hazards.

Meanwhile, ERDA's facilities in need of decommissioning have been accumulating. Reliable estimates have not been made but it seems probable that the cost to decommission federally owned nuclear facilities will run into billions of dollars.

In a memorandum to the Office of Management and Budget, ERDA estimated it would cost $25 to $30 million a year for the next 100 years—or a total of $2.5 to $3 billion—to decommission just those facilities that are now excess. However, we do not believe this is a credible estimate because:

ERDA does not have sufficient data to support this estimate;

ERDA does not have the information necessary to assess the magnitude of the problem posed by its excess facilities;

ERDA lacks similar information for its operational facilities;

An ERDA contractor estimated in 1972 that it could cost as much as $4 billion to decommission the largest of ERDA's 26 facilities alone (exclusive of waste); and

ERDA has not developed cost estimates for disposal of 71 million gallons of high level waste it has. The disposal of 600,000 gallons of high level waste at West Valley, N.Y. has been estimated to cost as much as $565 million.

THE NUCLEAR REGULATORY COMMISSION

Almost a quarter of a century has passed since commercial nuclear activities began, and NRC has done relatively little to plan for and to provide guidance for decommissioning commercial nuclear facilities. Studies sponsored by NRC on acceptable alternative methods to decommission are several years from completion. It does not require owners of nuclear facilities—except for uranium mills— to develop plans or make financial commitments to cover the cost for future decommissioning.

Consequently, the true cost of nuclear power is not being reflected in the cost to the consumer of nuclear power. Without this financial commitment, the Federal or State governments can be asked to pay for problems that rightfully should be paid by private industry.

Situations where this has happened, or may, have already arisen. For example, the Federal Government will pay about $85 million to

clean up residues from inoperative uranium mills that were privately owned. Also, as much as $600 million may be needed to decommission a privately owned nuclear fuel reprocessing plant at West Valley, N.Y.

The State government is legally responsible for cleaning up the plant but has asked the Federal Government for assistance. In a case at Clinton, Tenn., the Federal and State governments shared the cost—approximately $110,000—to decontaminate a facility that the owners walked away from in 1971.

A conference of State officials has recommended that States protect themselves from financial loss should a company not be able to pay to decommission its activities. However, only seven States require some some form of bonding or advance accumulation of funds for decommissioning.

Although cost estimates to decommission private facilities have not been developed by NRC, a recently completed study by a private organization estimated the cost to decommission a commercial nuclear reactor to be as much as $39 million. No cost data, except for wide-ranging estimates, is available for decommissioning other facilities, such as uranium mills or fuel fabrication plants.

MAJOR QUESTIONS DO REMAIN UNANSWERED

Thus far, I have tried to highlight first order questions which, unfortunately, have not been answered by the responsible Federal agencies:

How much will it cost to decommission nuclear facilities?

Who will pay these costs?

How many facilities need or will need to be decommissioned?

I will now discuss other important questions which must be answered to develop an acceptable decommissioning strategy.

HOW SHOULD COMMERCIAL POWER REACTORS BE DECOMMISSIONED?

NRC permits three alternatives for decommissioning a power reactor. Two of these alternatives call for either "entombing" or "mothballing" a reactor and then providing perpetual security, radiological surveys, and maintenance of the facility.

These alternatives are questionable because of the perpetual custody feature. The third alternative NRC permits is total dismantlement as soon as the reactor is shut down. A serious disadvantage of this alternative is the radiation hazard to the workers doing the dismantling.

The most feasible approach seems to be a combination wherein the reactor is permitted to "cool down" for 70 to 100 years and is then dismantled.

WILL CURRENT RADIATION STANDARDS CHANGE?

There is a historical trend for increased conservatism in radiation standards. These standards play a major role in determining the ground rules and procedures for decommissioning a facility. If the trend continues, the rules that we now use to govern decommissioning might be considered unsafe years from now.

WHAT DOES THE FUTURE HOLD FOR NUCLEAR POWER AND DECOMMISSIONING?

Until recently, the role of nuclear power as an electrical generating source for the future has been a clear and unchallenged Government policy. Light-water reactors, and then breeder reactors with their ability to replenish their own fuel, have been viewed as long-term, almost perpetual, energy sources.

The President is now trying to implement an energy program that would change the future of nuclear power. It is his policy to (1) defer the U.S. commitment to advanced nuclear technologies that are based on the use of plutonium and (2) use more of the current light-water reactors to meet our needs.

Light-water reactors require a supply of natural uranium. How much natural uranium exists is a major question that, when answered, dictates the viability of light-water reactors as any energy source. Estimates of U.S. uranium resources range between 1.8 and 3.7 million tons. This amount of natural uranium could fuel about 250 to 500 large light-water reactors for 40 years.

Sixty-four reactors are now licensed to operate. The number that will be operating in the future is, of course, speculative but estimates for the number expected in the year 2000 range from less than 200 to several hundred more than that.

Obviously, use of light-water reactors cannot be expected to continue indefinitely. If another generation of nuclear reactors cannot be developed or is not needed because another energy source, such as solar energy, has been introduced, the end of light-water reactors could also be the end of the commercial nuclear power industry.

The possibility of this industry ending raises questions as to whether there will be nuclear-related organizations, nuclear equipment, and individuals expert in the nuclear field that would be capable of dealing with the decommissioning and decontamination problems that could remain for about 100 years after the last reactor is shut down.

CONCLUSIONS AND RECOMMENDATIONS

The problems that nuclear-related operations leave behind are increasing because of the expansion of nuclear technologies. ERDA has accumulated a large number of excess facilities which will involve a monumental cleanup effort. At this point in time, it lacks the necessary information to even plan this task. It does not know the radiation and contamination problems at its facilities, the decommissioning methods that should be used, the corresponding costs, or priorities. ERDA has begun to gather this information at one of its reservations, but this is only the beginning.

While elimination of these excess facilities is important, it is also important that ERDA begin to consider and plan for decommissioning in all future projects. This requires that decommissioning costs be recognized at the outset of a project.

Similarly, NRC, which has responsibility on the commercial side, has not developed cost estimates, acceptable methods, or standards needed by industry to plan decommissioning or disposal of their facilities. NRC has not paid much attention to one of the biggest problems

that may confront the public in the future—that is, who will pay the cost of decommissioning nuclear power reactors. It has not made any plans or established any requirements for advanced accumulation of funds for decommissioning reactors or any facilities it licenses, with the exception of uranium mills.

We believe the cost of decommissioning should be paid by the current beneficiaries, not by future generations. Just as ERDA should consider decommissioning costs in its projects, private companies have an obligation to accumulate funds for decommissioning during the life of their projects. NRC should make advance planning for decommissioning mandatory at the time of licensing, including provision for funding.

If the States are to maintain their responsibility over selected nuclear activities they must be made aware of the problems with decommissioning and be encouraged to adopt legislation that will assure that proper decommissioning and decontamination is carried out.

Answers to basic questions are missing which preclude developing a strategy for solving a problem that we are losing ground on. The solution may very well be expensive—but the expense should be known so that it can be planned for and paid for by the responsible parties.

In our report, we make several recommendations to ERDA and NRC aimed at developing the necessary information to help answer these questions.

Although the task of cleaning up the present problem and preventing future problems will involve a concentrated effort by all those involved, the Federal sector must lead the way and set the example. In the past, the Federal Government has been shortsighted in its approach to solving decommissioning problems. The Federal agencies must now view decommissioning with an eye toward the future, particularly in the areas of financial responsibility, radiation standards, and capability to perform the needed decommissioning tasks.

H.R. 6181 directs ERDA to comprehensively study decommissioning. The study should provide basic information needed to develop a strategy to solve decommissioning problems.

RECOMMENDATIONS TO THE CONGRESS

Because of the magnitude, cost, and time already lost, the Congress should designate one lead Federal agency to approve and monitor an overall decomissioning strategy.

ERDA should continue its research and development efforts aimed at finding alternatives for decommissioning and decontamination of nuclear facilities. However, we believe NRC is uniquely suited for the lead role because of its charter to independently regulate commercial nuclear activities to assure public health and safety.

This position is consistent with a previous GAO report and testimony wherein we advocated independent assessments by the Commission of certain ERDA operations.

In addition, placing this responsibility with the Commission would in our view add to the credibility of Federal regulation over nuclear energy.

Mr. Chairman, this concludes my prepared statement. We would be glad to answer any questions you may have at this time.

I would like my colleagues here to introduce themselves to you, in case I have to leave.

Mr. BROWN. OK; we would be happy to have them do that.

Mr. MYSLEWIEZ. My name is Carl Myslewiez.

Mr. CARLONE. My name is Ralph Carlone. I am an Associate Director in the Energy and Minerals Division.

Mr. HOWARD. I am Jim Howard, Assistant Director of the Energy and Minerals Division.

Mr. BROWN. We appreciate your being here.

Mr. Canfield, I want to say to you that your statement is extremely valuable, and I think it points to one of the more significant problems that may face the Congress, a problem which will become increasingly important in the very near future.

I have not had a chance to review your report dated today, which I assume amplifies on your statement, but I rather imagine that it is going to be a best seller in the halls of Congress as the Members become more aware of the need to become informed about some of the problems in the nuclear field.

Mr. CANFIELD. We certainly wish we could have handed it to you sooner, but we were still printing it last night at 10 p.m.

Mr. BROWN. I recognize the fact that you speeded up your schedule, and we are very grateful to you for doing that. It is particularly appropriate, I think, to have it available at a time when the attention of the Members of the Congress is going to be focused very strongly on nuclear problems in connection with the ERDA authorization bill, which may come up next week, and with the breeder reactor issue, which will cause many Members to want to inform themselves more fully about all aspects of the nuclear situation.

I am a little surprised, perhaps shocked is a better word, at your statement that present procedures do not provide an automatic funding mechanism for the processes of decommissioning and decontamination.

I think that this is such a simple and logical extension of the normal practice of private business to set up sinking funds and take other economic steps to insure the availability of funds to meet any down-the-road problems, that it seems almost unbelievable that something has not been done along this line in the field of decommissioning of nuclear plants.

Are you confident that that situation is as bad as you presented it here?

Mr. CANFIELD. I am afraid it is.

I would like my colleagues to speak in more detail on this.

Part of the problem is that when you are looking 40 years, 100 years down the road, decommissioning does not look terribly expensive. Also, when you look at the total cost of decommissioning versus the total capital cost of a plant, decommissioning looks like it is just not going to cost all that much. The problem is, we do not know what it is going to cost.

In addition we did not find many organizations setting aside money and allowing it to accumulate to pay for future decommissioning. Perhaps Mr. Carlone could elaborate on that.

Mr. Carlone?

Mr. CARLONE. That is true, Mr. Canfield, except for the uranium mills. NRC has recently started requiring as a condition of the license

that uranium mill owners set up a bonding arrangement to assure financing for cleaning up the facilities once operations have ceased.

But I think, as you stated, Mr. Chairman, the simple matter of the fact is that provisions have not been made for accumulating funds for either nuclear reactors under the auspices of NRC or for the Government-owned facilities under ERDA.

Mr. BROWN. I presume that they are following normal accounting practice for setting up depreciation accounts?

Mr. CARLONE. Yes.

Some State rate-setting commissions, as part of their accounting procedures, recognize decommissioning costs, but the money is not being set aside to take care of the problem in the future.

Mr. BROWN. I am even more surprised that ERDA has not progressed further itself in setting up plans and procedures for its own facilities.

I do not expect you to be able to answer the question of why that has occurred, but Dr. Liverman, who may be able to shed some light on that, will testify a little later.

I suspect that part of ERDA's problem has been that the Congress has not given them much of an impetus to go ahead with that.

Would you speculate on that situation?

Mr. CARLONE. I will speculate.

I think that is part of the problem. I think funding is part of the problem. As we mentioned in our report, we are talking about numbers that range from $25 to $30 million a year, over a 100-year period, or a total of $2.5 to $3 billion. We have some concerns as to whether that will be enough.

Mr. BROWN. Has your study made any recommendations with regard to legislation to approach this problem?

Mr. CARLONE. No; we have not.

Mr. BROWN. Has your study recommended any time frame in which you think resolutions should be put in place?

Mr. CARLONE. We think that the studies, as recommended in the bill which is before this committee now, should be started with haste.

Mr. CANFIELD. The recommendation in our report for NRC to be the lead agency in the decommissioning area would require legislation. NRC has no authority now over ERDA facilities. It would require legislation to give them authority over ERDA facilities.

When I testified 3 or 4 weeks ago on the question of health and safety and safeguarding of special nuclear materials, we made a similar recommendation which would require legislation to give NRC authority as a lead agency for oversight authority.

This raised the issue of whether that meant NRC would license ERDA's facilities. We argued that it does not necessarily mean licensing. It means supervision.

Mr. BROWN. You raised a very intriguing point when you pointed out the possibility of the nuclear industry being phased out over some finite period of time.

I do not think any serious thought has been given to this possibility, yet all of our planning, which now extends well past the beginning of the next century, contemplates the possibility of other sources of energy which might require the phasing out of the nuclear industry, or at least putting it in jeopardy, if we had other more attractive sources

of energy, particularly sources for generating electrical power such as the fusion process.

Considering the half-life of the high-level radioactive wastes, it would seem to me that this is possibly a much more serious problem than we had thought. A thousand years down the road, we may have huge repositories of high-level radioactive wastes, yet we may be into an era in which we really do not care about a nuclear industry anymore.

Mr. CANFIELD. You will certainly lose all of the private interest in the nuclear area which makes it very obvious that the Government is going to end up performing and paying for decommissioning. I think it is a very sobering kind of problem which has not been given a great deal of attention.

We appreciate your picking up on it.

Mr. BROWN. Dr. Colglazier, do you have any questions?

Dr. COLGLAZIER. I will just ask one.

I see in your study that you mention the cost estimates of the Atomic Industrial Forum which they have reported recently.

Did you have a chance to evaluate those?

Mr. CANFIELD. No; we did not evaluate them. They are in our report because they are the only ones that exist. We had to get an estimate from somewhere, but we did not have a chance to evaluate it. There is not much literature in the area.

Mr. BROWN. Do you have any idea based upon the work done in preparing your report, as to the reasons why we do not have better cost estimates for the impact of decommissioning and decontamination programs? It seems to me that it would be an almost inevitable part of any program, that there be some estimate made on this problem, and that some rudimentary plans be made at least to take care of it.

Now, I do not want to assign or attribute any malign motives to anyone, but is it conceivable that fear of the impact of these costs on nuclear power rate structures, or some cause of that sort, might have been behind this failure to do a better job?

Mr. CANFIELD. That would be almost pure speculation on our part.

I think part of the problem which we alluded to in previous discussions on West Valley is that you get a domino effect. If you do not know the nature of the problem, how important it is you do not know what criteria to establish, and consequently what standards would come from that criteria—then you just keep rolling off in a domino effect, one after another. You cannot get to the cause. Since nobody has really tried to develop a basic, fundamental understanding of what the scope of the decommissioning problem is and how much it is likely to cost, then you just cannot get there from here.

The other thing is, if you are in the private sector, there is very little impetus to worry about costs which are going to occur 40 to 100 years from now. If you discount the 21st century at any reasonable discount rate by present economic standards, it is not worth worrying about.

When you look at what you think the decommissioning cost is likely to be relative to the current capital cost, it looks so small and piddling today that you just trust in clairvoyance and pray a lot.

Mr. BROWN. Would that lead you to the conclusion that conventional economic analysis may not be the best way to approach this?

Mr. CANFIELD. It sure would.

We have approached a lot of things with conventional economic analysis that I think we cannot afford to continue to do.

We have to have a new system of accounts when we look at some of these things which go far beyond the normal ideas of what constitutes amortization. We need to develop a system which takes into account future generations and the problems of future generations.

Mr. BROWN. Conventional economics would tell you when you are looking at the cost of something way down the road, that you can put aside a dollar and it will cover almost any conceivable cost, compounded annually at 6 percent interest, a couple hundred years from now. And yet that very fact may lead people to avoid putting aside the dollars which are necessary to do it.

Mr. CANFIELD. Exactly.

I think it is an extremely serious problem if you assume that there is some possibility that the current nuclear industry may not exist within the time frames that we are talking about.

The point was raised in the testimony that a particularly difficult problem is that it is not clear as to how you maintain the infrastructure necessary to even solve the problem within the Federal Government for an energy source which might not be all that popular at that point in time.

However, if we go ahead with breeder reactors and fusion and fusion proves to be a success, then you might have a whole different ballgame.

Mr. BROWN. I personally have a great deal of confidence in the technical capabilities of the people at ERDA and the other agencies to develop an analysis and solutions for these problems.

We have some of the most competent scientists in the world involved in this.

Any contemplation of this problem on a systems analysis basis would lead to the determination that there must be some reason, which we have not yet identified, that these solutions have not been developed. The kindliest interpretation is that the scientists assessed these problems as all being fairly simple and easy to solve, and thought that the time was ample, and, therefore, have not given them the priority necessary to go ahead with solutions.

I think this may be a mistake in judgment.

Mr. CANFIELD. We certainly did not find stupidity involved, in any sense.

We simply found that those are problems for the future, and people are not worrying about them.

Mr. BROWN. In the interest of time, and your delicate condition, I am going to defer further questioning, but we will want to keep in close touch with you on this matter.

We very much appreciate your help.

Mr. CANFIELD. We will be happy to work with your staff on any detail, as you like.

Mr. BROWN. Thank you.

I want to thank your colleagues again for coming.

Mr. CARLONE. Thank you.

Mr. BROWN. I will ask Mr. Wirth if he will take the chair temporarily while I go over to the Rules Committee on a couple of other bills, and he will introduce the next witness.

Mr. WIRTH. Thank you, Mr. Chairman.

Our next witness is Mr. Richard Jones, commissioner of the Connecticut Public Utilities Control Authority.

Mr. Jones?

Mr. Jones, welcome and thank you for being with us. It is my understanding that the State of Connecticut has considered this issue in a rate case.

Is that correct?

STATEMENT OF RICHARD O. JONES, COMMISSIONER, CONNECTICUT PUBLIC UTILITIES CONTROL AUTHORITY

Mr. JONES. That is correct.

Mr. WIRTH. You can therefore enlighten us with the benefit of your experience and knowledge.

Mr. JONES. Mr. Chairman, I would like to apologize to the committee and particularly to the reporter this morning for not having prepared copies of my statement, but I would be happy to provide whatever additional copies and documentation the subcommittee would wish.

Mr. WIRTH. If you could leave at least one copy with us, we could make the appropriate copies.

Mr. JONES. Fine.

My name is Richard Jones, and I am here today in my capacity as one of the five commissioners of the Connecticut Public Utilities Control Authority. The Authority is the regulatory body in Connecticut which has jurisdiction over the generation, transmission, distribution, and sale of electrical energy within the State.

Connecticut is strongly committed to the nuclear generation of electricity. The Connecticut Yankee plant, put into service in 1968, was one of the first commercially operated nuclear plants in the country. Since that time, two other nuclear plants have been built and put into service: Millstone I in 1970 and Millstone II in 1975. Millstone unit No. III is now under construction and expected to be completed in 1982.

All told, the current nuclear capacity of plants in Connecticut totals 2,065 megawatts, of which approximately 1,450 megawatts is directly owned by Connecticut utilities.

On the average, over the last 6 months, 49.65 percent of Connecticut's electrical needs were met by nuclear generation. The proportion ranged from a low of 40 percent in November of 1976 to a high of 60.9 percent in March of 1977.

The Authority was invited to testify today concerning its treatment of anticipated decommissioning costs associated with nuclear plants in recent rate case decisions, specifically the December 1976 decisions involving the Hartford Electric Light Co. and the Connecticut Light & Power Co.

In those cases the companies proposed that we recognize a negative net salvage value with respect to their nuclear plants and that the negative salvage value be incorporated into depreciation rates over the remaining lives of the plants.

Negative net salvage occurs whenever costs of removal exceed the gross salvage receipts. For depreciation purposes, this means that the

company must recover not only its original plant costs but an addition amount equal to the difference between the cost of removal offset by the salvage receipts.

It is clear that this will be the case in the decommissioning of nuclear powerplants, regardless of the decommissioning method chosen.

It is important to note that negative net salvage is neither new, as a concept for regulators, nor is it unique to nuclear plants. It has been argued that the retirement of conventional fossil-fuel plants, pipelines that have to be removed or neutralized, and even telephone poles will require similar treatment.

Once the concept of negative net salvage is accepted one must address the costing alternatives: Who will pay the cost and when? Expensing the cost of decommissioning, when it occurs, or financing it at that time offers the advantage of accurate cost information. However, it does not allocate the costs involved to those who benefited from the plant, that is, those who consumed the energy it produced.

The other alternative is to assume a cost to decommission, the negative salvage cost, and to allocate that cost among customers during the life of the plant. Doing so allocates costs properly to those who benefit but relies on the least accurate data in so doing.

The absence of reliable cost data is a serious problem. Obviously, no commercial size nuclear plants have been decommissioned to date. Some smaller, experimental facilities have been retired and per kilowatt costs to decommission have been developed, or at least estimates have been developed.

The relevance of these data is open to debate because of the methodology utilized and the number of observations involved. Thus today, the regulator is faced with estimating costs that will be incurred 20, 30, or 40 years into the future. Despite the difficulties inherent in estimating costs the Authority deemed it to be preferable, because the cost of retirement of the plant was properly allocated to those customers who benefited from the plant's output.

In the recent rate cases, referred to earlier, the Authority considered estimates of the costs of mothballing, entombment, and site restoration. I have listed them in order of increasing initial cost.

I am assuming that the subcommittee is familiar with these terms, and I will not take up the subcommittee's time to define them.

We based our calculations for ratemaking purposes on mothballing, with its lowest initial costs, because of two principal factors:

(1) All the plants in question are located on a single large site. It was assumed by the Authority that future plants would be built on that site. This means that security for the operating plants, present and future, can provide for much of the security needs associated with the mothballed plants.

(2) The rapid expansion of knowledge in this field over the next decade, which we assume will occur, should provide for dramatically improved estimates of costs to be utilized in future rate cases. At the time of future cases, the Authority will be able to adjust the depreciation rate over the remaining life of the plant to correct for the revised cost estimates. This approach to reviewing depreciation rates periodically is known as the remaining life method and has been accepted by the Connecticut Authority for ratemaking purposes.

In terms of cost, the Authority estimated that, on a composite basis, 10 percent of initial construction costs would be required to mothball

the plants. This equates to approximately $31 per kilowatt of capacity, which is higher than most mothballing estimates but lower than most estimates of entombment costs.

I fully concede the lack of precision in our estimates, but suggest to you that the lack of precision is insufficient justification to ignore the obligation to provide for the inevitable costs of decommissioning.

I have also been advised, and would like to mention at this time, that to the best of my knowledge the portion of depreciation expense claimed by a utility company and attributable to future decommissioning costs is not accepted by the Internal Revenue Service as a deductible business expense. That means that, in essence, this depreciation charge is paid for with after-tax dollars, and I would question whether that is really consistent with the necessity for providing these funds in the present for dealing with the future problem.

In reviewing the letter which invited the authority to appear today, reference was made to the general subject of reprocessing, salvage, and waste disposal.

During the rate cases in question, the companies involved indicated that in their opinion it was impossible for them to estimate the costs of reprocessing, salvage, or waste disposal, and they proposed a zero net salvage figure be used by the Authority, and this was accepted. This speaks also to the absence of reliable cost estimates and data.

With respect to the future, we see a very great need for more accurate data on costs and alternatives for decommissioning, reprocessing, and waste disposal. Proposed H.R. 6181 seems to be a significant step forward in developing the sort of data base which will become increasingly important in the future.

We, therefore, support the proposal and urge its adoption.

Thank you.

Mr. WIRTH. Thank you very much, Mr. Jones.

Have any other States had experience with this?

Mr. JONES. I am not familiar with the experience of other States.

It is my belief that Massachusetts has taken a similar stance to the one that we took in Connecticut, but I am not sure about other States.

Mr. WIRTH. Where did you go to try to figure out how you were going to get a handle on this issue?

Mr. JONES. The concept of negative net salvage, as I pointed out, was not new to us.

It had been rejected earlier by the agency in Connecticut, not because of a conceptual flaw but because of the manner in which the costs had been calculated. Therefore, we were familiar with it as a concept.

We took testimony in the rate case as to the estimates of consultants engaged by the Authority, as well as engaged by the companies, as to the possible range of costs that might be involved. It was based upon this testimony during the rate case that we developed the general feeling that about 10 percent of the capital investment costs would be necessary to decommission, coming to about $31 per kilowatt of capacity.

Mr. WIRTH. You were doing the best you could, in terms of searching the literature and finding out what decommissioning might cost?

Mr. JONES. Precisely.

Within the context of an adversary proceeding, which is really not conducive to doing the best kind of research.

Mr. WIRTH. Once you start collecting that money, or the utility starts collecting that money, what do they do with it?

Mr. JONES. To the best of my knowledge, well, I can say that the Authority established no escrow provision or no provision for earmarking funds, in this case any more than in any other depreciation expense.

Presumably, the enterprises are continuing enterprises, and the assumption is that dollars set aside today or utilized today would be available in the future to be used for this purpose, but there is no earmarking or escrow provisions at the present time.

Mr. WIRTH. There was a conscious decision not to do that?

Mr. JONES. I think that our view was that this was a depreciation expense, as other depreciation expenses, and we treated it similarly.

Based on what I have heard here this morning, the Authority may consider in the future whether such earmarking or escrow provisions would really be the wiser course.

Mr. WIRTH. If a company just walks away from the whole issue, somebody gets left holding that bag.

Mr. JONES. He certainly does. That certainly would present some very serious problems.

Mr. WIRTH. Mr. Spensley?

Mr. SPENSLEY. Mr. Jones, I have just one question. You indicated that you rejected the negative net salvage concept, that you were familiar with it. Has it ever been utilized in the State of Connecticut, and is it unique to a nuclear facility?

Mr. JONES. It has been utilized before in Connecticut with respect, I think, to certain telephone company equipment.

It is certainly not unique to nuclear plants, and indeed, as I attempted to point out, it is argued at the present time that this same condition will apply to fossil fuel plants, where the costs to remove the plant in this day and age will probably exceed the salvage value of the plant.

Therefore, it involves a negative salvage value, or a net expenditure on the part of the company involved.

Mr. SPENSLEY. Thank you.

Mr. WIRTH. Dr. Colglazier?

Dr. COLGLAZIER. I have one question.

You chose the mothballing technique for estimating the price. Was price the only reason you did not look at entombment or the prompt dismantlement?

Mr. JONES. We rejected total site restoration as being unduly expensive and unduly conservative based upon our limited knowledge.

We considered entombment. We considered mothballing. We adopted a cost figure that falls somewhere in between the two, although we accepted mothballing. Our view was largely colored by the facts that I mentioned—first, that the plants involved are part of a large site which presumably will continue and will require surveillance and security.

Secondly, we felt and assumed that the degree of expertise, the amount of data that would be available, the procedures necessary would hopefully be clarified significantly within the next decade perhaps, and at that time, if we had erred, we would be in a position to correct that situation well before the anticipated useful life of the plant was finished.

Dr. COLGLAZIER. Thank you.

Mr. SPENSLEY. I have one other question.

Do you feel that the Connecticut Public Utilities Control Authority would have any authority to require a nuclear facility within the State to provide additional moneys to cover any costs of decommissioning the facility after its life cycle?

Mr. JONES. Do you mean, Mr. Spensley, do we have the authority to require the escrow provision?

Mr. SPENSLEY. Yes.

Mr. JONES. I think we do. I would see no problem with that.

Mr. WIRTH. Mr. Jones, what kind of public response have you gotten to the efforts of the Authority in looking at the long-term issue of decommissioning?

Mr. JONES. The effects of the Authority's look at the long-term issue have largely been ignored by the public. The public, quite normally, I think, is much more concerned with short-term considerations and what is going to happen to the rate next month.

Mr. WIRTH. You have not seen any increase in public concern about this?

Mr. JONES. Not as a part of the rate case activity that has taken place.

I would say that Connecticut citizens are concerned on a par with the degree of concern of other citizens across the country.

Mr. WIRTH. Were you surprised at that lack of interest?

Mr. JONES. I do not know that I was surprised. I think it was about normal.

Mr. WIRTH. Finally, would you be interested in writing to the committee about your concern with the IRS, which you suggested earlier?

Mr. JONES. I would be happy to, or to have someone more skilled in those matters than I communicate with the subcommittee.

Mr. WIRTH. Certainly. I think your experience is going to be useful in other places as well. Perhaps it is something that the subcommittee would like to know about, and perhaps would communicate either with the Committee on Ways and Means, or with the IRS directly.

Mr. JONES. I would be happy to provide that information. (See Appendix, page 275.)

Mr. WIRTH. We would very much appreciate it, and as you know, the record will remain open for any other material which you might like to submit that you think might be helpful.

Thank you very much for being with us, Mr. Jones.

Mr. JONES. It is my pleasure.

Mr. WIRTH. Our next witness is Mr. Howard Larson who is vice president of the Atomic Industrial Forum.

We welcome you, Mr. Larson.

STATEMENT OF HOWARD J. LARSON, VICE PRESIDENT, TECHNICAL PROGRAMS, ATOMIC INDUSTRIAL FORUM

Mr. LARSON. Thank you, Mr. Chairman.

I appreciate this opportunity to be present at this subcommittee hearing. I intend to outline the major findings of a recently published Atomic Industrial Forum-funded study on the decommissioning of commercial nuclear power reactors.

My name is Howard J. Larson, and I am the vice president, technical programs, of the Atomic Industrial Forum.

With me is Dr. Philip Garrett, the manager of the Forum's National Environmental Studies Project, under whose direction the study was completed; and Mr. James Smith, consulting environmental engineer for the General Electric Co., who is a member of the consulting industry task force that was formed to review the report.

Mr. WIRTH. Gentlemen, we are delighted that you are here.

Mr. Larson, I might add that if you would like to summarize your testimony, it will be included in full in the record.

You may do whatever you feel would be the most helpful and appropriate way to proceed.

Mr. LARSON. Our full report was more than 400 pages; when we tried to summarize it, it came out to about 40 printed pages, and I have tried to summarize the summary, so maybe I had better just stick with what I have submitted.

Mr. WIRTH. Fine.

Mr. LARSON. The title of the work I wish to address is "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives." This investigation was funded through the Forum's National Environmental Studies Project (NESP) and was performed by Nuclear Energy Services, Inc., a division of Automation Industries, Inc., Danbury, Conn.

The principal investigator was Mr. William J. Manion, president, Nuclear Energy Services, Inc. He was unable to be here today due to physical disability.

Mr. Manion has had some 20 years' experience in the nuclear industry, and more specifically, insofar as power reactor decommissioning experience, he has held the project manager position for two noteworthy decommissioning programs.

One involved the entombment of the BONUS—boiling nuclear super-heat reactor—nuclear reactor 50 megawatts electrical—in Puerto Rico, and the other field experience related to the prompt and complete dismantling of the Elk River power reactor—58 megawatts electrical—Elk River, Minn.

In addition to Mr. Manion and his staff, the study benefited from the participation of 14 industry representatives who served on a Forum task force established to oversee this investigation. The study required more than one year to complete.

While no large commercial power reactor has yet been decommissioned, there has been a broad experience with the decommissioning of relatively small ones. In the United States alone, over 65 experimental and demonstration reactors have been either mothballed, entombed, or dismantled. Mothballing has been the most frequently selected mode of decommissioning in this country to date.

The Elk River facility is unique because it is the only nuclear power reactor that has been completely dismantled and removed from its site.

Although the size of these plants is significantly smaller than the commercial power reactors that have been used as a point of reference for this study, they have served to demonstrate the basic approaches and technologies that might be applicable to future decommissionings of much larger facilities.

In this regard, the primary purpose of this study was to investigate the feasibility and practicability of decommissioning large commercial power reactors.

The study addressed pressurized and boiling-light water reactors (PWR's and BWR's) as well as high-temperature gas reactors (HTGR's). For each of these three reactor types, the three primary decommissioning alternatives and the two combination decommissioning alternatives that were evaluated are: mothballing, entombing, prompt removal/dismantling, mothballing-delayed removal/dismantling combination, and entombing-delayed removal/dismantling combination.

The study's scope included the following objectives: Detailed descriptions of the work procedures and end products; detailed estimates of costs including sensitivity and reliability analyses; detailed estimates of occupational radiation exposures; the identification of generic environmental effects; and the identification and definition of pertinent regulations and guidelines.

The study is primarily an investigation of the generic aspects of decommissioning and as such, it identifies the kinds of detailed information that are required for evaluating power reactor decommissioning on a site-specific basis.

Because of the significant differences that exist between the accounting and other financial aspects of individual utilities, and because of certain site-specific variables, especially those of an environmental nature, the study's scope excluded economic analyses and detailed environmental impact assessments. Nonetheless, much of the study, while generic in scope, is directly applicable or readily adaptable to site-specific analyses.

From a regulatory point of view, the objective in decommissioning a power reactor is to place it in a condition which adequately protects the public health and safety and which would eventually result in the termination of the licensee's responsibilities to the Nuclear Regulatory Commission.

This objective can be accomplished by a number of different approaches to decommissioning, which include mothballing, entombing, removal/dismantling, or some combination of these primary modes. Hence, termination of a reactor license can be achieved provided the licensee demonstrates that the retired facility poses no radiological hazard to the public.

At the outset of a decommissioning campaign, the reactor operating license remains in force, which includes the relevant technical specifications. The licensee must continue complying with these operating license requirements from the point in time when the reactor is shut down for the purpose of decommissioning until issuance of the possession-only license. A possession-only license allows a licensee's possession of, but prohibits his operation of, the reactor being decommissioned.

After completion of the decommissioning work activities, certain post-decommissioning possession-only license requirements are applicable to the mothballing and entombing alternatives. Once work activities are completed for the prompt removal/dismantling mode, the possession-only license can be terminated.

The possession-only license for mothballing and entombing remains active until certain criteria are met. The regulations affecting the post-decommissioning period are primarily related to the implementation of the security requirements and periodic environmental surveys that are stipulated in the possession-only license.

Mothballing is defined by the Nuclear Regulatory Commission as consisting of:

> * * * putting the facility in a state of protective storage. In general, the facility may be left intact except that all fuel assemblies and the radioactive fluids and waste should be removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures should be established under a possession-only license to ensure that the health and safety of the public is not endangered.

In contrast to the common meaning of the term "mothballing," it is not intended that a mothballed power reactor would be reactivated and placed into commercial operation at some later date. Also, it should be noted that while the Nuclear Regulatory Commission's definition of mothballing is silent on the duration of this alternative, the findings of this study indicate that permanent mothballing would not be a cost-effective approach to decommissioning.

Entombing is defined by the Nuclear Regulatory Commission as consisting of:

> * * * sealing all the remaining highly radioactive or contaminated components (e.g., the pressure vessel and reactor internals) within a structure integral with the biological shield after having all fuel assemblies, radioactive fluids and wastes, and certain selected components shipped offsite. The structure should provide integrity over the period of time in which significant guantities of radioactively remain with the material in the entombment. An appropriate and continuing surveillance program should be established under a possession-only license.

It should be pointed out that the entombing alternative described in this study does not correspond to the solid concrete structure that is usually associated with entombment. Rather, it is a form of protective storage of the residual high activity sources that is designed to permit removal of the very long-lived radioactive materials (nickel–59, nickel–63, and carbon–14) 100 to 150 years beyond shutdown with limited entombment structure demolition work being required.

This is in contrast to the extensive work that would be necessary to remove the radionuclides from a solid entombment structure.

In other words, the entombing alternative presented in this study lies between mothballing and a mausoleum or massive concrete block type of entombment; it provides a greater degree of protective storage relative to mothballing, and in the future, removal of the remaining materials would not be difficult in comparison to a massive concrete entombment structure.

Prompt removal dismantling is defined by the Nuclear Regulatory Commission as follows:

> All fuel assemblies, radioactive fluids and waste, and other materials having activities above accepted unrestricted activity levels should be removed from the site. The facility owner may then have unrestricted use of the site with no requirement for a license. If the facility owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed and disposed of.

Although the Nuclear Regulatory Commission does not require that the nonradioactive portions of a facility be dismantled and shipped offsite in order to terminate a possession-only license, the prompt removal/dismantling decommissioning alternative as it is presented in this study includes the complete dismantling of the facility to below grade.

With the mothballing-delayed removal/dismantling combination alternative, a facility is placed in a state of protective storage accord-

ing to the mothballing alternative described above and, after a period of time, the facility is dismantled as outlined in the removal/dismantling option above. Although the duration of the mothballing period is not fixed by regulation or engineering considerations, there are specific time dependent breakpoints where significant cost reduction can be realized because radioactive decay permits use of manual rather than remote removal procedures.

Similarly, the entombing-delayed removal/dismantling combination consists of sequentially entombing and then removal/dismantling a facility after a period of time.

The cost estimates in 1975 dollars for the three primary decommissioning alternatives, which are mothballing, entombing, and prompt removal/dismantling, are as follows:

	Millions
Mothballing	$2.5
Entombing	$6–8.0
Removal/dismantling	27–31.0

These cost estimates vary somewhat depending on the reactor type and location; they are based on a reactor capacity of about 1,150 Mwe.

These cost estimates for the mothballing and entombing are initial costs only and do not include certain annual maintenance and surveillance costs.

For mothballing, the additional costs are estimated to be $88,000 per year if a 24-hour manned security force is not required (for example, a site with continuing operations) and $167,000 per year if such a security precaution was found to be necessary.

In the case of entombing, the annual maintenance and surveillance costs are estimated at $58,000 for the duration of the entombment period. These estimates of the annual costs exclude charges for major structural repairs that would probably be necessary if the mothballing or entombment period extended much beyond 100 to 150 years.

I might add that a quick review of the GAO report indicated that they did have a specialist look at the integrity of the structure and whether it would last for a period of 70 to 100 years, and it was felt that there would be no problem in maintaining the integrity of the plant.

There are no annual costs associated with the prompt removal/dismantling alternative.

For the primary mothballing and entombing alternatives, this study has found that the termination of a possession-only license would require the passage of about 505,000, 234,000, and 51,350 years for PWR's, BWR's, and HTGR's, respectively.

These very long durations of the mothballing and entombment periods are due to the time that is necessary for nickel-59 (for LWR's) and carbon-14 (for HTGR's) to decay to acceptably low activities.

Even though it would probably be demonstrated that permanent mothballing and permanent entombing are feasible alternatives for reactor decommissioning, they are unlikely to be practical solutions for the permanent disposition of such facilities.

For the prompt removal/dismantling alternative as it is defined in this study, it was assumed that the entire power plant would have to be dismantled to below grade, which would include cooling towers, turbine, and administrative buildings, the reactor vessel containment, and other nonradiactive structures. Again, however, it is important to recognize that Nuclear Regulatory Commission regulations pertaining to

the termination of a possession-only license do not in any way require the dismantling of any nonradicactive structures.

Whether or not such structures are demolished is an option open to the licensee. Therefore, the $27 million to $31 million range for the prompt removal/dismantling option exceeds the minimum cost to terminate a possession-only license by $5 million to $11 million, depending on the reactor type. Hence, the range of costs associated with Nuclear Regulatory Commission requirements for terminating a possession-only license is $17 million to $26 million.

The results of this study suggest that while the prompt removal/dismantling mode is feasible, its selection would probably not represent the best choice of the decommissioning alternatives available to the licensee because of costs, occupational radiation exposure, and environmental considerations.

The cost estimates for the two combination alternatives are as follows: Mothballing-delayed removal/dismantling, $13 million; entombing-delayed removal/dismantling, $15 million.

Again, these cost estimates vary somewhat depending on the reactor type and location. They include the annual surveillance and maintenance charges, but exclude the costs of a manned security force, which may be necessary for the mothballing option only, and the removal of the nonradioactive structures.

If these additional two costs are included where appropriate, the cost estimates are: Mothballing-delayed removal/dismantling, $32 million; entombing-delayed removal/dismantling, $25 million.

Of the five decommissioning alternatives considered, the most cost-effective means of terminating a possession-only license would probably involve either the mothballing-delayed removal/dismantling or the entombing-delayed removal/dismantling combination modes.

From a cost perspective, licensee would probably select the mothballing-delayed removal/dismantling combination, but would stop short of completing the alternative by leaving the nonradioactive structures in place.

While this investigation did not identify any reasons to suspect that mothballing a retired reactor for about 100 years would be considered unacceptable by regulatory agencies or the public, there may exist site-specific situations which would call for selecting the entombing-delayed removal/dismantling combination.

For example, a utility with a single reactor station and no planned continuing use of the site may have to provide a manned security force unless the entombing mode is selected. The preferred approach to the entombing phase of this second combination mode would likely consist of entombing the highly radioactive materials that lie within the reactor containment building and mothballing the balance of the facility.

For example, it should be adequate to mothball the radwaste system and the turbine building (including BWR's as a part of the entombing-delayed removal/dismantling combination.

This approach would provide a suitable restriction to public access to the really hazardous radioactive materials (the reactor and its components) and yet it would keep the costs of decommissioning in balance with the relative risks.

The estimated occupational radiation doses for the two combination alternatives range from 315 to 460 man-rems. For the prompt

removal/dismantling option, the range is 550 to 1,690 man-rems. These results indicate that occupational radiation doses can be controlled to a level comparable to occupational doses experienced with operating reactors through the use of appropriate work procedures, shielding, and remotely controlled equipment. The largest doses, which are associated with the prompt removal/dismantling alternative, can be reduced if the reactor is first mothballed or entombed to allow the cobalt–60 activity to decay to levels that permit manual removal (as opposed to remote removal) of the reactor vessel and its internals.

The estimated airborne radiation doses (lung) to an individual stationed continuously at the controlled access fence of a facility decommissioned by the prompt removal/dismantling alternative are estimated to be about four orders of magnitude less than the recommended level in appendix I to 10 CFR 50. That is a factor of 10,000.

This study did not identify any significant generic environmental impacts that might result from the mothballing, entombing, or prompt removal/dismantling of a large commercial power reactor.

This determination is based on the identification of and, to the extent practicable, the quantification of the nonradioactive liquid and gaseous effluents; the consumption of water and other resources; the land commitment at the decommissioned site and radioactive waste burial ground; the noise generated; the economic and social effects to the community; the use of public roads; and the aesthetic effects that can be expected before termination of a facility's possession-only license.

It should be noted, however, that the prompt removal/dismantling of a retired power reactor would cause relatively greater environmental impacts as compared to the other alternatives available, and that therefore, selection of the prompt removal/dismantling option should be given careful consideration with regard to environmental concerns.

Although the availability of new sites for future power stations in this country was not investigated in this study, it should be anticipated that consumers will someday value the sites of existing steam-electric power plants as irreplaceable national resources, the likely consequence of which will be the indefinitely continued use of such land and water resources for the siting of future electric power generating stations.

In this regard, society should give careful consideration as to whether it is cost effective to completely dismantle a retired facility for the sole purpose of marginally improving the visual aesthetics associated with these relatively isolated industrial structures.

In conclusion, the findings of this study show that the decommissioning of large commercial power reactors is feasible and practical from the standpoints of costs, occupational radiation exposures, and environmental impacts. While the Forum task force and the contractor recognize that the cost and occupational radiation dose estimates are significantly lower than many earlier estimates, it should be noted that the estimates in this study are based on detailed engineering analyses and not primarily extrapolations, which have been the bases of the earlier estimates.

The study is currently undergoing extensive scrutiny by industry and government, but at this time it would be premature to draw any conclusions from these independent reviews.

I have attached a copy of our study to my testimony and presented it to the reporter. Mr. Smith, Mr. Garrett, and I will be pleased to answer any questions you may have on this subject which are within the scope of this study.

Thank you.

Mr. WIRTH. Thank you very much, Mr. Larson.

Mr. Garrett or Mr. Smith, do you have any additional comments that you would like to make at this time?

Mr. SMITH. No.

Mr. GARRETT. No.

Mr. WIRTH. The obvious question is, why do we allow mothballing or entombing as an acceptable methodology?

As I listened to your statement, what you are saying is that it is okay to allow mothballing for a period of time, as long as you ultimately dismantle the operation, but that NRC does allow us to simply mothball.

Is that correct?

Mr. LARSON. Yes, sir.

Mr. WIRTH. As I understand what you were saying in your testimony, mothballing or entombing by itself is neither a good idea in terms of safety, nor is it cost-effective. Is that right?

Mr. LARSON. As we indicated, there are five alternatives that are possible, all of which are acceptable, but you try to look at it from a balancing of the costs and the benefits, and the exposures received, and the practicality of it, and it seems to us that the best thing to do would be to remove those parts of the reactor plant that do possess these long-lived radioisotopes in order that the facility can be returned to a state where unrestricted access to it could be gotten in a reasonable period of time, of 100 to 150 years.

Mr. WIRTH. In other words, mothballing, as it is currently defined and accepted by the Nuclear Regulatory Commission, is in your opinion not an acceptable solution to what you do with used-up nuclear power plants?

Mr. LARSON. Not at this time.

Mr. WIRTH. Are you in agreement with that statement, or not?

Mr. LARSON. We believe, well, mothballing is acceptable.

Mr. WIRTH. I am taking this out of page 6 of your testimony. Mothballing as currently defined by the Nuclear Regulatory Commission, as I understand what you are saying, is not an acceptable approach to coping with aged nuclear power plants.

Is that correct?

Mr. LARSON. When we started the study, we believe, based on the past experience with these other 65 plants that had been mothballed, entombed, decommissioned, dismantled, that the principal problem would be cobalt-60 which has a half-life of about 5 years.

After we got into this—as a matter of fact, I believe the first draft of the study was out, and we asked for comments, and we got some comments back indicating that there was a problem potentially with nickel-59. The immediate reaction of those involved in the study was that, you know, that is crazy. But when we looked into it and looked into the fact that the plants we are talking about decommissioning in the future are facilities that we expect to operate for about 40 years with a capacity factor of 65 to 80 percent, you do generate a quantity

of this nickel–59 which had not really been present in the prior plants that had been decommissioned.

It had really never been a problem.

Now, to try to put that into perspective, the 2 years after shutdown of a reactor, when you get into the decommissioning mode, the the contact/dose level from nickel-59 is .032 roentgen per hour.

The cobalt-60 contribution to radioactivity is about 36,000 roentgens per hour. The cobalt-60, with a 5-year half-life, after 150 years has been through 30 half-lives, and the radioactivity which you would receive as far as roentgens per hour from the nickel-59 has not changed at all. The activity level from the cobalt-60 is down about eight orders of magnitude, or about 100 million.

So what I am saying is that when these regulations were put out, and based upon the experience that had been gotten, this nickel-59 problem never really seemed to be a problem.

Mr. WIRTH. But it is a problem in 1977. Is that right?

Mr. LARSON. Yes.

Mr. WIRTH. The question is, where do we go?

What do you think we ought to be doing with the definitions and acceptability, as defined by the Nuclear Regulatory Commission, of the five alternatives which you presented?

Mr. LARSON. I could say I would let them address it. We did this study because questions had come up in several of the States.

I think there have been seven States where this question has been raised by various commissions: What did it mean to decommission a facility?

People would come up with cost estimates ranging all the way from 50 percent of the initial capital costs of the nuclear power plant to 100 percent of the capital costs of the nuclear power plant.

Everybody intuitively felt it was less than that based upon experiences that they had had with the plants that they were decommissioning. So this activity that we performed and the study that we completed was instituted by the members of the forum, of which we have about 90 of them who contributed to this National Environmental Studies Project, asking us to conduct a study to try and quantify what decommissioning would really cost.

There have been a few other studies done. I think there was one where tentative results were given from a study that was conducted in Europe that came out with relatively the same number of dollars.

I think what our study has shown though is that the relative costs of decommissioning a power plant range in the order of 3 to 5 percent of the initial costs of the plant.

Mr. WIRTH. Dr. Garrett or Mr. Smith, do you have any comments?

Mr. SMITH. I might say that I think the basic point here is a simple technical fact, that once the cobalt has decayed it is important to achieve proper protection for that very small part of the plant, and that the most cost-effective thing to do is to remove those to another safe storage point so that you can clear the rest of the facility.

It was this realization in recent years of the minor buildup in the reactor internals of these long-lived activities which has reached the conclusion that mothballing alone for an indefinite period is perhaps not the most cost-effective thing to do.

So there is no fundamental problem with the regulation as it is written. It is merely the development of additional information which would indicate that after a period of time there are some small parts of the plant that need some additional custody.

Mr. WIRTH. Is the logical followup to that, Mr. Smith, that the Congress should say to the Nuclear Regulatory Commission that long-term mothballing does not make any sense?

Mr. SMITH. I do not think so.

It would be a natural development which I am sure will be taken care of in the regulatory guides.

Mr. WIRTH. I have a feeling that we are going around in a circle.

Maybe it is my dimness in understanding this, but it seems to me that we are in a situation where Mr. Larson has said to us, on page 6 of his testimony, that it should be noted that while the Nuclear Regulatory Commission's definition of mothballing is silent on the duration of this alternative—we do not want to leave a power plant in mothballs forever.

Is that right?

Mr. SMITH. Because it would not be cost-effective, because of the maintenance requirements.

Mr. WIRTH. Therefore, if that is the case, if we just take cost-effectiveness and maintenance requirements alone, and you are saying it is not cost-effective, then why does the Nuclear Regulatory Commission allow long-term mothballing?

Does it not follow that you say, because it is not cost-effective, we should not allow it? You would therefore say it is a better investment, and when you are dealing with problems like the gentleman from Connecticut deals with, we come out and we say:

> One way we can help you cope with this problem is to point out to you that if you proceed with long-term mothballing, you will find it is not a cost-effective way, in terms of setting the rate as to how you are going to dismantle this facility.

Mr. SMITH. A combination of the two methods within the regulatory guides of the Commission is, as a result of our study, the logical thing to do.

There is no problem with the definitions. It is merely proper use of a combination of the definitions.

Mr. WIRTH. I would find myself coming at this issue from the perspective of saying there are probably going to be a lot of people who are going to walk away from this kind of thing, and that somehow the public, whether it is the citizens of Connecticut, or New York State, or whatever, are going to get stuck holding the bag.

We have to work through these regulatory commissions, whether at the State or Federal level, to make sure that does not happen.

How are we going to constrain them from walking away?

Mr. Spensley?

Mr. SPENSLEY. I just have a couple of questions on your approach to the study.

It is called the National Environmental Studies Project. It may be just the emphasis of your testimony, or perhaps your study is more specific, but you started in your testimony by saying that you really did not consider any detailed environmental impacts because of the site-specific variations. You also said you were not considering the economic aspects of it.

Then your testimony goes on to talk about nothing but the dollar figures involved in decommissioning, and then a very general conclusion that there were no significant generic environmental impacts resulting from any of these three options.

I was expecting more of an emphasis on the environmental impacts of decommissioning since it is the National Environmental Research Project, so I would like to ask you, are there more specifics in your report about how you assessed whether there were any generic environmental impacts associated with these three alternatives?

Mr. LARSON. Mr. Garrett, do you want to answer that?

This was not an engineering cost study, however, so when we say we did not get involved in the costs, we did not get involved in the costs as related to a specific utility, to a specific site and what it had to do.

This is what it would take to decommission that plant, to dismantle it, remove the equipment, bring in fill. One of the things that was discussed earlier was the salvage value.

We looked at how much steel, and rebar, and concrete, and dirt, and stuff, and pumps, and other equipment, that maybe you could cut out intact, and maybe would have some use. But we assigned no salvage value to anything because it would be, much of it anyway, slightly contaminated, and maybe because of the fact that it came from a nuclear power plant, even if it was not contaminated, nobody would want to use it.

Mr. SPENSLEY. Maybe I misunderstood.

It was funded through the Forum's National Environmental Studies Project, but is my understanding then that your study did not actually look at environmental impacts?

Mr. LARSON. Oh, no.

Mr. SPENSLEY. It did?

Mr. GARRETT. We did in some detail, and found that a detailed evaluation of the environmental effects were very site-specific and beyond the scope of the study. On a generic basis, however, we could not identify any significant environmental effects. We looked at exposures to workers, and of course, exposures to the public. I guess the largest effect that we identified would be the loss of tax-base to the community, if the State tax structure is such that the community gets the taxes directly.

Otherwise, the use of public roads, dust, water resources, and so forth, were not really impacted.

Mr. SPENSLEY. To determine your generic environmental impacts, you had to look at site-specific plants; did you not?

Mr. GARRETT. No: not site-specific, in that sense.

Mr. SPENSLEY. How do you do a generic environmental impact assessment, then?

Mr. GARRETT. You know approximately how much water, for example, that a particular power plant uses.

We made estimates of how much water would be consumed in the decommissioning process, and a comparison of those two numbers is how we got that, is how we did that.

Mr. SPENSLEY. So you at least have to conclude that an alternative that was not considered, or, let's say, a result that was not considered would be that a specific decontamination process of some particular plant might have significant environmental impacts.

Mr. GARRETT. In the case of the decontamination or cutting of materials, the reactor was treated as a whole. That would not vary site to site. Radioactive materials are cut up either under water or in an envelope inside the containment structure, and, after they pass through a certain number of filters, and so forth, cannot escape to the environment.

So in that sense, the assessment of radioactive effluents can be handled on a generic basis and are not particularly site-dependent.

Mr. LARSON. Let me go through a few of the titles in our index here.

This is in our generic environmental effects' summary, and of course the book goes into it in much more detail. We looked at radiological effects to the public, and gaseous effluents, and what would be the estimated airborne radiation dose to an individual at the site boundary and at a distance for the three different kinds of plant, and we looked at the aqueous effluents for the process waste volume, distilled, and concentrated, the process waste activity, and the unprocessed waste.

We looked at transportation, highway use, nonradiological effluents, the volumes of cubic yards of waste that would be generated, and how much would have to be put in the land use commitments that you would make, and the economic and social effects, and how many trucks would come through.

Once again, we did not pick any one town. We said, OK, here is an 1,150-megawatt-electrical plant.

Mr. SPENSLEY. In other words, your evaluation was basically a paper evaluation based on evidence of other reports and studies that had been done. You did not do any site measurements or any kind of original environmental analysis.

I do not means to demean it by saying it is simply a paper study, but you pooled together all of the facts that were already available in terms of original work.

Mr. LARSON. We looked at what goes into a nuclear power plant—how many tons of steel, and how it is put together, and how you would take it apart, and it was tempered by the expertise of a fellow that we had, and his staff, and their experience at doing a couple of the only types of activities that have really been done in this country.

Mr. SPENSLEY. The reason I am trying to get at this, Mr. Larson, is simply to see if there is any information in your study, any overlap that might be in our bill, H.R. 6181, in terms of asking ERDA to do a study of environmental safety and health aspects in decommissioning.

I am trying to see if you have already done that work, or if it is something that we can build on, or if what you did was different.

Mr. LARSON. We also looked at what it would take in accordance with the objectives of the committee, insofar as research and development activities are concerned.

We asked ourselves: "Is there anything that would be needed to be done in order to decommission a current generation light-water reactor, or prospective current generation high temperature gas reactor," and we did not really feel it was even in the research category. In order to cut up a pressure vessel, you need a large laser arc that we have not developed in this country yet, at least as far as we know, for the thickness and size of the pressure vessel and the components that you are looking at. It had been developed and used, on a smaller scale, for these reactors that we talked about, Elk River and BONUS.

We felt that a reasonable extrapolation of that technology, you know, would probably be a little over a $1 million development cost. We tried to look at the rest of this, but we did not see anything else that was really necessary.

Mr. SPENSLEY. Let me ask one more question.

When you dismantle a plant, you cut it up into a number of pieces. I would assume the large pieces might be a big as the table you are sitting at. What do you do with that then, after you cut it up? Where does it go? What did you assume would be done with it in terms of disposing of it?

Mr. SMITH. The disposition is one of two routes. If the material is radioactive, it goes to a licensed storage location. If it is not, it would go to an authorized landfill.

Mr. SPENSLEY. Thank you.

Mr. WIRTH. Dr. Colglazier?

Dr. COLGLAZIER. I have two quick questions.

The capital costs of building reactors has changed considerably in the last few years, and Mr. Jones mentioned that they consider something like 10 percent of the capital costs to be the right amount of money to put aside, at least at present, for decommissioning.

With capital costs for reactors that are now in operation, that amount of money is probably consistent with the numbers that you have given, but with present costs of around $1 million to build a 1,000-megawatt plant, that would be $100 million if you took the 10-percent figure which is considerably larger.

Do you have any comment? Do you think it is not wise to take a percentage of capital costs, but that you should take a fixed cost?

Mr. LARSON. As he said, I think, he came out with his analysis in the course of an adversary hearing which he admitted was not maybe the best time to do it.

We feel that our costs, which are 1975 dollars, of course, based on the approximate capital costs of plants at this time, and the way they are designed—his number comes out close to ours for a 1,000-megawatt plant; it is $31 million, but the plant that he was looking at is a $310 million capital cost plant.

As I said, I think the area of 3 to 5 percent is probably a more reasonable cost estimate of the initial capital costs for the total cost of decommissioning a plant.

Mr. Garrett?

Mr. GARRETT. His number is more in line with earlier estimates.

This study was a first approach at looking at a plant in detail, looking at the piping inventori , and such, and sort of building up the costs from scratch. A similar study is being done by Battelle Northwest Labs for the NRC, and they are in fact reviewing this study in some detail, and I think where the number actually will fall will depend on further studies to see if we have overlooked something, misjudged some costs—the demolition of concrete, for example. We may have underestimated that. There may be certain things that we have left out. So far we have not identified any.

But a thorough evaluation of this study and other studies similar to it will help give us confidence if this, what seems to be a lower number, is nearer the mark, or if it should be closer to $50 or $60 million to decommission a plant.

Dr. COLGLAZIER. I gather you would generally feel that the inflation and the costs of decommissioning would not be as great as the inflation that is taking place in the capital costs of building the plant.

Mr. GARRETT. There are certain costs involved in the quality assurance—the "N" stamp that goes into nuclear facilities—that I think escalates the costs of them more so than would the dismantling of them.

It does not matter what quality steel you have in a plant when you tear it down compared to the costs involved in constructing it.

Mr. LARSON. We tried to take a look at where the low-level waste burial grounds would be where we could ship this waste, to get some idea of what distance, because we are talking of several hundred shipments of low-level radioactive wastes from the site to the burial ground.

We took a look and drew a 500-mile radius around the burial sites to see whether that includes most of the reactor sites in the country, and it did.

So we used a distance of 500 miles to ship the low-level waste. We said, well, how close to us could we get suitable fill to put in, to replace this hole that we have dug to take this stuff out? We generally felt that usually within 3 miles, of an average, of most of the sites because they are fairl[illegible]note, that we could get suitable fill and return not only the fill area but the reactor site itself to a suitable, esthetic, environmentally acceptable area. That is what we meant by generic.

Mr. SMITH. I think an important part of this is that as far as the engineering costs, this was done on a unit cost basis, that is, number of feet of pipe of a certain size, and cubic yards of concrete, and it was done by the tedious adding up of all of the numbers involved in what was physically in the plant.

Perhaps this is the first time that this detailed engineering approach has been made in such a study. This may give some greater confidence to the engineering costs which formed the basis of the report.

Dr. COLGLAZIER. I have one last, quick question.

We heard from a utility commission, from their perspective. In the case of utilities, they will probably be around for a long time and unable to walk away from any site. So in most cases they will have to pay sooner or later for the costs of decommissioning.

Do you have anything to add about the perspective of decommissioning from the point of view of utilities?

Mr. LARSON. No.

I think the question was sort of raised that you have sort of answered. Perhaps the light water reactor business would go out of business, but another exotic or different form of energy generation would come along to produce electricity.

I guess I sort of inherently believe that electricity will probably be around for a long time, even though it is recognized by everyone that the lifespan of light water reactors is probaly finite, but that there will be electrical utilities that will be generating electricity from some source. That is one of the points we tried to make there in the end, that there are going to be a limited number of suitable sites in this country for power generation, and that these sites that maybe will be decommissioned from a light water reactor suitability standpoint will probably be used for other sources of generation, and that, as you

pointed out, utilities will be here generating electricity, and that the sites will probably have additional uses.

Mr. WIRTH. Has AIF taken a position on how the costs of decommissioning ought to be proportioned or financed?

Mr. LARSON. No; we have not.

This was purely a technical engineering study, and we have not looked into that at all. That is something that I think each of the utilities and their utility commissions like to work out together and handle. They know their own means of accounting so we do not even attempt to get into that or even analyze it.

Mr. WIRTH. Do you all have a position on the recommendation made by GAO this morning on the role of NRC?

Mr. LARSON. We heard it for the first time, as you did. I do not think we have any particular desires. We certainly do not have any position. We have never really looked at whether there should be a lead agency.

I think in the Reorganization Act of 1974 there are precedents for that, and the breeder, even though it is being developed by ERDA, must be licensed by the NRC, and I think the same thing applies in that legislation to high-level waste management. ERDA will develop some aspects of it, and the NRC will be responsible for reviewing their concept from a public health and safety viewpoint.

Mr. WIRTH. Thank you very much for being with us.

We appreciate your input.

[The prepared statement of Mr. Larson follows:]

STATEMENT OF HOWARD J. LARSON, VICE-PRESIDENT OF THE ATOMIC INDUSTRIAL FORUM, INC.

Mr. Chairman, I appreciate this opportunity to be present at this subcommittee hearing. I intend to outline the major findings of a recently published Atomic Industrial Forum funded study on the decommissioning of commercial nuclear power reactors.

My name is Howard J. Larson and I am the Vice-President, Technical Programs, of the Atomic Industrial Forum. The Forum is comprised of over 600 domestic and foreign organizations, including electric utilities, manufacturers, mining and milling companies, nuclear fuel service companies, financial institutions, labor organizations, universities, and legal firms. We are an international management association interested in the peaceful uses of nuclear technology. We work to support the public's needs for nuclear energy, and we try to solve and prevent problems facing the peaceful applications of nuclear energy. Toward these ends, the Atomic Industrial Forum catalyzes the consensus of its member groups on policies and technical issues, provides a mechanism for the industry to interact with the government, and collects information for the industry, the mass communications media, and the public.

The title of the work I wish to address is "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives." This investigation was funded through the Forum's National Environmental Studies Project (NESP) and was performed by Nuclear Energy Services, Incorporated, a division of Automation Industries, Incorporated, Danbury, Connecticut. The principal investigator was Mr. William J. Manion, President, Nuclear Energy Services, Incorporated. Mr. Manion has had some 20 years' experience in the nuclear industry, and, more specifically, insofar as power reactor decommissioning experience he had held the Project Manager position for two noteworthy decommissioning programs. One involved the entombment of the BONUS[1] nuclear reactor (50 Mwe) in Puerto Rico, and the other field experience related to the prompt and complete dismantling of the Elk River power reactor (58 Mwe), Elk River, Minnesota. In addition to Mr. Manion and his staff, the Study benefited

[1] Boiling Nuclear Superheat Reactor.

from the participation of 14 industry representatives who served on a Forum task force established to oversee this investigation. The Study required more than a year to complete.

While no large commercial power reactor has yet been decommissioned, there has been a broad experience with the decommissioning of relatively small ones. In the United States alone over 65 experimental and demonstrational reactors have been either mothballed, entombed, or dismantled. Mothballing has been the most frequently selected mode of decommissioning in this country to date. The Elk River facility is unique because it is the only nuclear power reactor that has been completely dismantled and removed from its site.

Although the size of these plants is significantly smaller than the commercial power reactors that have been used as a point of reference for this study, they have served to demonstrate the basic approaches and technologies that might be applicable to future decommissionings of much larger facilities. In this regard, the primary purpose of this study was to investigate the feasibility and practicability of decommissioning large commercial power reactors.

The study addressed pressurized and boiling-light water reactors (PWR's and BWR's) as well as high temperature gas reactors (HTGR's). For each of these three reactor types, the three primary decommissioning alternatives and the two combination decommissioning alternatives that were evaluated are: (*a*) mothballing; (*b*) entombing; (*c*) prompt removal/dismantling; (*d*) mothballing-delayed removal/dismantling combination; and (*e*) entombing-delayed removal/dismantling combination.

The study's scope included the following objectives: (*a*) detailed descriptions of the work procedures and end products; (*b*) detailed estimates of costs including sensitivity and reliability analyses; (*c*) detailed estimates of occupational radiation exposures; (*d*) the identification of generic environmental effects; and (*e*) the identification and definition of pertinent regulations and guidelines.

The study is primarily an investigation of the generic aspects of decommissioning and as such, it identifies the kinds of detailed information that are required for evaluating power reactor decommissioning on a site-specific basis. Because of the significant differences that exist between the accounting and other financial aspects of individual utilities, and because of certain site-specific variables, especially those of an environmental nature, the study's scope excluded economic analyses and detailed environmental impact assessments. Nonetheless, much of the study, while generic in scope, is directly applicable or readily adaptable to site-specific analyses.

From a regulatory point of view, the objective in decommissioning a power reactor is to place it in a condition which adequately protects the public health and safety and which would eventually result in the termination of the licensee's responsibilities to the Nuclear Regulatory Commission. This objective can be accomplished by a number of different approaches to decommissioning, which include mothballing, entombing, removal/dismantling, or some combination of these primary modes. Hence, termination of a reactor license can be achieved provided the licensee demonstrates that the retired facility poses no radiological hazard to the public.

At the outset of a decommissioning campaign, the reactor operating license remains in force, which includes the relevant technical specifications. The licensee must continue complying with these operating license requirements from the point in time when the reactor is shut down for the purpose of decommissioning until issuance of the possession-only license. A possession-only license allows a licensee's possession of but prohibits his operation of the reactor being decommissioned.

After completion of the decommissioning work activities, certain post-decommissioning possession-only license requirements are applicable to the mothballing and entombing alternatives. Once work activities are completed for the prompt removal/dismantling mode, the possession-only license can be terminated. The possession-only license for mothballing and entombing remains active until certain criteria are met. The regulations affecting the post-decommissioning period are primarily related to the implementation of the security requirements and periodic environmental surveys that are stipulated in the possession-only license.

Mothballing is defined by the Nuclear Regulatory Commission as consisting of:

". . . Putting the facility in a state of protective storage. In general, the facility may be left intact except that all fuel assemblies and the radioactive fluids and waste should be removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures should be established under a possession-only license to insure that the health and safety of the public is not endangered."

In contrast to the common meaning of the term "mothballing," it is not intended that a mothballed power reactor would be reactivated and placed into commercial operation at some later date. Also, it should be noted that while the Nuclear Regulatory Commission's definition of mothballing is silent on the duration of this alternative, the findings of this study indicate that permanent mothballing would not be a cost-effective approach to decommissioning.

Entombing is defined by the Nuclear Regulatory Commission as consisting of:

". . . sealing all the remaining highly radioactive or contaminated components (e.g., the pressure vessel and reactor internals) within a structure integral with the biological shield after having all fuel assemblies, radioactive fluids and wastes, and certain selected components shipped offsite. The structure should provide integrity over the period of time in which significant quantities of radioactivity remain with the material in the entombment. An appropriate and continuing surveillance program should be established under a possession-only license."

It should be pointed out that the entombing alternative described in this study does not correspond to the solid concrete structure that is usually associated with entombment. Rather, it is a form of protective storage of the residual high activity sources that is designed to permit removal of the very long-lived radioactive materials (nickel–59, nickel–63, and carbon–14) 100 to 150 years beyond shutdown with limited entombment structure demolition work being required. This is in contrast to the extensive work that would be necessary to remove the radionuclides from a solid entombment structure. In other words, the entombing alternative presented in this study lies between mothballing and a mausoleum or massive concrete block type of entombment; it provides a greater degree of protective storage relative to mothballing, and in the future, removal of the remaining radioactive materials would not be difficult in comparison to a massive concrete entombment structure.

Prompt removal dismantling is defined by the Nuclear Regulatory Commission as follows:

'All fuel assemblies, radioactive fluids and waste, and other materials having activities above accepted unrestricted activity levels should be removed' from the site. The facility owner may then have unrestricted use of the site with no requirement for a license. If the facility owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed and disposed of."

Although the Nuclear Regulatory Commission does not require that the nonradioactive portions of a facility be dismantled and shipped off-site in order to terminate a possession-only license, the prompt removal/dismantling decommissioning alternative as it is presented in this study includes the complete dismantling of the facility to below grade.

With the mothballing-delayed removal/dismantling combination alternative, a facility is placed in a state of protective storage according to the mothballing alternative described above and, after a period of time, the facility is dismantled as outlined in the removal/dismantling option above. Although the duration of the mothballing period is not fixed by regulation or engineering considerations, there are specific time dependent breakpoints where significant cost reduction can be realized because radioactive decay permits use of manual rather than remote removal procedures. Similarly, the entombing-delayed removal/dismantling combination consists of sequentially entombing and then removal/dismantling a facility after a period of time.

The cost estimates in 1975 dollars for the three primary decommissioning alternatives, which are mothballing, entombing and prompt removal/dismantling, are as follows:

	Millions
Mothballing	$2.5
Entombing	6–8.0
Removal/dismantling	27–31.0

These cost estimates vary somewhat depending on the reactor type and location; they are based on a reactor capacity of about 1150 Mwe.

These cost estimates for the mothballing and entombing options are initial costs only and do not include certain annual maintenance and surveillance costs. For mothballing, the additional costs are estimated to be $88,000/year if a 24-hour manned security force is not required (e.g., a site with continuing operations) and $167,000/year if such a security precaution was found to be necessary. In the case of entombing, the annual maintenance and surveillance costs are estimated at $58,000 for the duration of the entombment period. These estimates of the annual costs exclude charges for major structural repairs that would probably be

necessary if the mothballing or entombment period extended much beyond 100 to 150 years. There are no annual costs associated with the prompt removal/dismantling alternative.

For the primary mothballing and entombing alternatives, this study has found that the termination of a possession-only license would require the passage of about 505,000, 234,000 and 51,350 years for PWR's, BWR's, and HTGR's, respectively. These very long durations of the mothballing and entombment periods are due to the time that is necessary for nickel-59 (for LWR's) and carbon-14 (for HTGR's) to decay to acceptably low activities. Even though it would probably be demonstrated that permanent mothballing and permanent entombing are feasible alternatives for reactor decommissioning. They are unlikely to be practical solutions for the permanent disposition of such facilities.

For the prompt removal/dismantling alternative as it is defined in this Study, it was assumed that the entire power plant would have to be dismantled to below grade, which would include cooling towers, turbine and administrative buildings, the reactor vessel containment, and other non-radioactive structures. Again, however, it is important to recognize that Nuclear Regulatory Commission regulations pertaining to the termination of a possession-only license do not in any way require the dismantling of any non-radioactive structures. Whether or not such structures are demolished is an option open to the licensee. Therefore, the $27 to $31 million range for the prompt removal-dismantling option exceeds the minimum cost to terminate a possession-only license by $5 to $11 million, depending on the reactor type. Hence, the range of costs associated with Nuclear Regulatory Commission requirements for terminating a possession-only license is $17 to $26 million.

The results of this Study suggest that while the prompt removal/dismantling mode is feasible, its selection would probably not represent the best choice of the decommissioning alternatives available to the licensee because of costs, occupational radiation exposure, and environmental considerations.

The cost estimates for the two combination alternatives are as follows:

	Millions
Mothballing-delayed removal/dismantling	$13
Entombing-delayed removal/dismantling	15

Again, these cost estimates vary somewhat depending on the reactor type and location. They include the annual surveillance and maintenance charges, but exclude the costs of a manned security force, which may be necessary for the mothballing option only, and the removal of the non-radioactive structures. If these additional two costs are included where appropriate, the cost estimates are:

	Millions
Mothballing-delayed removal/dismantling	$32
Entombing-delayed removal/dismantling	25

Of the five decommissioning alternatives considered, the most cost-effective means of terminating a possession-only license would probably involve either the mothballing-delayed removal/dismantling or the entombing-delayed removal/dismantling combination modes. From a cost perspective, a licensee would probably select the mothballing-delayed removal/dismantling combination, but would stop short of completing the alternative by leaving the non-radioactive structures in place.

While this investigation did not identify any reasons to suspect that mothballing a retired reactor for about 100 years would be considered unacceptable by regulatory agencies or the public, there may exist site-specific situations which would call for selecting the entombing-delayed removal/dismantling combination. For example, a utility with a single reactor station and no planned continuing use of the site may have to provide a manned security force unless the entombing mode is selected.

The preferred approach to the entombing phase of this second combination mode would likely consist of entombing the highly radioactive materials that lie within the reactor containment building and mothballing the balance of the facility. For example, it should be adequate to mothball the radwaste system and the turbine building (including BWR's) as a part of the entombing-delayed removal/dismantling combination. This approach would provide a suitable restriction to public access to the really hazardous radioactive materials (the reactor and its components) and yet it would keep the costs of decommissioning in balance with the relative risks.

The estimated occupational radiation doses for the two combination alternatives range from 215 to 460 man-rems. For the prompt removal/dismantling option, the range is 550 to 1,690 man-rems. These results indicate that occupational radiation doses can be controlled to level comparable to occupational doses experiences with operating reactors through the use of appropriate work procedures, shielding, and remotely controlled equipment. The largest doses, which are associated with the prompt removal/dismantling alternative, can be reduced if the reactor is first mothballed or entombed to allow the cobalt-60 activity to decay to levels that permit manual removal (as opposed to remote removal) of the reactor vessel and its internals.

The estimated airborne radiation doses (lung) to an individual stationed continuously at the controlled access fence of a facility decommissioned by the prompt removal/dismantling alternative are estimated to be about four orders of magnitude less than the recommended level in Appendix I to 10 CFR 50.

This Study did not identify any significant generic environmental impacts that might result from the mothballing, entombing, or prompt removal/dismantling of a large commercial power reactor. This determination is based on the identification of and, to the extent practicable, the quantification of the non-radioactive liquid and gaseous effluents; the consumption of water and other resources; the land commitment at the decommissioned site and radioactive waste burial ground, the noise generated; the economic and social effects to the community; the use of public roads; and the aesthetic effects that can be expected before termination of a facility's possession-only license. It should be noted, however, that the prompt removal/dismantling of a retired power reactor would cause relatively greater environmental impacts as compared to the other alternatives available, and that therefore, selection of the prompt removal/dismantling option should be given careful consideration with regard to environmental concerns.

Although the availability of new sites for future power stations in this country was not investigated in this Study, it should be anticipated that consumers will someday value the sites of existing steam-electric power plants as irreplaceable national resources; the likely consequence of which will be the indefinitely continued use of such land and water resources for the siting of future electric power generating stations. In this regard, society should give careful consideration as to whether it is cost effective to completely dismantle a retired facility for the sole purpose of marginally improving the visual aesthetics associated with these relatively isolated industrial structures.

In conclusion, the findings of this Study show that the decommissioning of large commercial power reactors is feasible and practical from the standpoints of costs, occupational radiation exposures, and environmental impacts. While the Forum task force and the contractor recognize that the cost and occupational radiation dose estimates are significantly lower than many earlier estimates, it should be noted that the estimates in this Study are based on detailed engineering analyses and not primarily extrapolations, which have been the bases of the earlier estimates. The Study is currently undergoing extensive scrutiny by industry and government, but at this time it would be premature to draw any conclusions from these independent reviews.

I have attached a copy of our Study to my testimony and presented it to the Recorder. Mr. Smith and I will be pleased to answer any questions you might have on this subject, which is within the scope of our Study. Thank you.

Mr. WIRTH. Our next witness is Commander Albert Arcuni, who is Special Assistant for Nuclear Programs to the Commander, Naval Facilities.

Mr. BROWN. We are happy to have you here, Commander Arcuni, and I notice that you have one of your colleagues with you.

STATEMENT OF COMDR. ALBERT A. ARCUNI, SPECIAL ASSISTANT FOR NUCLEAR PROGRAMS, NAVAL FACILITIES ENGINEERING COMMAND

Mr. ARCUNI. He is Lt. Cmdr. Thomas Crane, the officer in charge of the Naval Nuclear Power Unit in Port Hueneme, Calif.

Mr. BROWN. Welcome. You may proceed.

Mr. ARCUNI. I am Commander Arcuni, Special Assistant to the Commander, Naval Facilities Engineering Command for Nuclear Programs. As such, I am responsible for formulating overall technical policies and providing direction, management, and coordination for the Navy nuclear shore power program. This includes the direct headquarters supervision of the Naval Nuclear Power Unit which is located at Port Hueneme, Calif.

The program includes responsibility for nuclear reactor shore power; radioisotope power generators for total Navy, undersea, and terrestrial application; and the radiological affairs support program. Since we have no operating reactors in our program at present, the nuclear shore power porition of our mission is totally committed to the dismantling and removal of the PM–3A nuclear power plant from Antarctica.

The PM–3A was designed as a portable nuclear powerplant and was installed at McMurdo Station, Antarctica, in early 1962. The plant systems were designed under the concept that disassembly, packing, and transportation could be accomplished with minimum difficulty. By today's standards, the reactor was a very small one. The power output was only 2 megawatts as compared to today's 1,100-megawatt plants.

The plant was successfully operated by the Navy providing electricity and fresh water to McMurdo Station until September 1972. At that time, a failure of the insulation canning around the primary reactor piping was discovered, and subsequent inspections indicated a potential existed for chloride stress corrosion failure of the primary reactor system.

After studying alternative plans, it was determined that the PM–3A should be shut down permanently and, in order to comply with the regulations of the Antarctic Treaty, that it should be dismantled and removed from the Antarctic.

Commencing in October 1973, and through the present, the Naval Nuclear Power Unit has been tasked with removing the PM–3A and all related radioactive wastes from the Antarctic. With me today is the officer in charge of that unit, Lieutenant Commander Crane, who developed the PM–3A removal plan and directed the initial phases of the decommissioning at McMurdo Station. All major reactor and radioactive power plant components were transported from the Antarctic and buried at licensed radioactive burial sites in the continental United States by April 1976.

Due to the severe Antarctic climate during the winter months, the removal effort has been principally carried out during the austral summers, October to February annually. Until January 1976, the dismantling and removal of the plant was completed as planned.

Approximately 900 tons of radioactive materials and 115 tons of noncontaminated material were removed from the PM–3A site. The principal task remaining at this point is the removal of approximately 10,000 cubic yards of contaminated crushed rock in the area of the plant effluent discharge.

This was especially important with the PM–3A, being located 12,000 miles from headquarters.

Two areas of paramount importance that had to be addressed in the planning were the environmental concern for compliance with the Antarctic Treaty which prohibits disposal of radioactive waste on the

continent and the health and safety of our personnel. Some other areas that had a major impact on our plan were the following:

1. Solving the engineering problem involved with the removal and shipment of the large, highly irradiated reactor components.
2. Manpower requirements driven by radiation exposure limits.
3. Sequential removal of equipment in order to maintain radiation monitoring and decontamination control.
4. Definition of radioactive contamination in soils since national regulations for certain fission product radionuclides do not exist.
5. The final consideration was to optimize the above factors to reduce cost and complete the project in a timely manner.

Gentlemen, this concludes my brief formal comments, and I would be glad to answer questions with regard to our experience and knowledge gained by this decommissioning.

Mr. BROWN. Thank you.

Although it is probably not your responsibility, do you know of the existence of plans for similar activity with regard to our nuclear submarine power plants?

Mr. ARCUNI. You are correct, sir. That is not in my area of experience, but I do know that two plants, two ships have been presently mothballed. They have not been decommissioned or decontaminated, but I cannot speak to the Navy policy of the future.

Mr. BROWN. With the experience that you have had with the McMurdo Sound plant, would that experience be pertinent to the power plants on nuclear submarines?

Mr. ARCUNI. I think it would be to some degree, yes, sir.

We had a rather unique problem in the Antarctic because of the environment that we worked in, and the Antarctic Treaty which required complete removal.

Mr. BROWN. Can you give use the location of the permanent burial site at which the material was disposed of?

Mr. ARCUNI. Yes, sir.

There are two sites that were used. In 1974, Maxiflats, Ky., which is a commercial, licensed burial site, was used. A small quantity of approximately 13½ curies were buried at that site.

In 1975 and 1976, Barnwell, S.C., another commercial site, was used. Approximately 44,000 curies were buried at that site.

Mr. BROWN. Did you encounter any unanticipated problems in connection with this exercise that might have some relevance to the larger problems that we are trying to address here with regard to nuclear power plants?

Mr. ARCUNI. I do not think we encountered too many problems when we finally got down to the Antarctic, but during the advance planning a great deal of effort had to go into solving all of these problems since we deployed such a small crew to the Antarctic to do the job.

One of the biggest problems that we had to solve before we got into the actual decommissioning was the determination of radioactivity in soil. There are no regulations at this time, national regulations that state this level.

If you want me to further expound on that, I could have Commander Crane speak to that.

Mr. BROWN. This would be a problem that would occur with the conventional nuclear power plants that we face today, would it not?

Mr. CRANE. Yes, sir, it would.

Mr. BROWN. Would you elaborate on that a little bit?

Mr. CRANE. Yes, sir, I would be glad to.

We used the U.S. national standards to operate the nuclear powerplant in the Antarctic, even though it was under an international treaty.

As Commander Arcuni said, there are no national standards that we could find that define what is radioactive waste in soil. We do have standards for air and water.

We then went to the International Agency for Atomic Energy, the IAEA, which lists regulations for various nations, signatory nations, and is also a cosigner of the Antarctic Treaty, and found that the U.S.S.R., has a regulation regarding wastes in soil, radioactive wastes in soil.

Because we were on international territory and under international treaty, we decided to apply their standards and found that at the time we had no indication of how much that would be in the way of our soil.

We published the fact that we would apply those standards and could not survey the site because the instruments that you need to survey the site—effluent areas near the plant—are so sensitive that you have all the high radioactive materials out of there before you can actually see what you have in the soil around the site.

That was an unanticipated problem which has caused us some difficulty.

We feel that it would have been beneficial to us had we had a U.S. standard for small quantities of radioactive material and large quantities of soil.

Mr. BROWN. Do you have any questions, Dr. Colglazier?

Dr. COLGLAZIER. No.

Mr. BROWN. Mr. Spensley?

Mr. SPENSLEY. No.

Mr. BROWN. The McMurdo installation is one of the few plants I have ever visited, and I find the history of that plant interesting, and how you have handled your problem there.

I think that it would be pertinent at some future time if we could review the Navy's plans in connection with the nuclear submarine power plants, but I will not attempt to do that with you gentlemen at the present time.

I have one final question. Did you come up with cost figures that you might be able to give us with regard to this exercise?

Mr. ARCUNI. Yes, sir.

The actual cost plus estimated cost right now is $1.6 million. That does not include military labor costs. Military labor costs, we estimated, and as you know it is difficult to use the cost of military labor—we used the NAV-COMP standards, and that is about another $700,000 in military labor costs.

Mr. BROWN. $2 million for two megawatts?

Mr. ARCUNI. Yes, sir, if you include military labor.

Mr. BROWN. Can we extrapolate that up to 1,100 megawatt power?

Mr. ARCUNI. No, sir, I do not think you can. I do not think it would be fair because of our remote location in the Antarctic. You are talking

about transportation of radioactive wastes 12,000 miles, and a considerable amount of those costs was transportation.

Mr. BROWN. Did you transfer it by commercial vehicle or by Navy vehicle?

Mr. ARCUNI. We used Military Transport Service ships.

Mr. BROWN. We would appreciate it if you could amplify on any further breakdown you have of these costs.

Mr. ARCUNI. Yes, sir.

Mr. BROWN. I think that would be very useful.

We have no further questions at the present time, gentlemen. I appreciate very much your being here this morning.

We hope we can keep in touch with you on this matter.

Mr. ARCUNI. Thank you, sir.

Mr. BROWN. Our last witness this morning will be Dr. James Liverman, Assistant Administrator for Environment and Safety, Energy Research and Development Administration.

He will undoubtedly have much wisdom to contribute on this subject.

STATEMENT OF JAMES L. LIVERMAN, ASSISTANT ADMINISTRATOR FOR ENVIRONMENT AND SAFETY, ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Dr. LIVERMAN. Thank you, Mr. Chairman.

I would like to introduce my colleagues. The man on my right is Mr. Robert Ramsey who works in our Division of Environmental Control Technology. On my left is Dr. Colin Heath who is from the Office of the Assistant Administrator for Nuclear Energy. They are the experts, and I am the generalist.

With your permission, Mr. Chairman, I would just as soon submit the statement for the record and summarize it.

Mr. BROWN. Without objection, the statement will be included in the record.

Dr. LIVERMAN. I have a few slides that may help to give us a picture of the program on decontamination and decommissioning.

I would like to make a general observation before I start my statement, which is, that in the case of wastes, it is always the last thing that anybody worries about, and that is true of nuclear, of fossil, and other technologies.

As I have testified earlier before this committee, we have instituted a planning process in ERDA in the last year which forces us to consider from the very beginning of the technology and all through it what you do with the wastes.

Hopefully, the impact of this approach, in the long run, will be to show, as Commissioner Jones of the Connecticut Public Utilities Control Authority said, that it is clear that fossil fuel plants are going to have decommissioning costs, also, to clean them up, and what we will try to force out into the open through this planning process is to take into account what our decommissioning picture is likely to look like.

SURVEY OF ERDA EXCESS CONTAMINATED FACILITIES AS OF JUNE 1976

	EXCESS	EXPECTED NEXT 5 YEARS
ALBUQUERQUE OPERATIONS		
LOS ALAMOS	12	5
MOUND LAB	3	0
OTHER AREAS	0	0
CHICAGO OPERATIONS	3	5
GRAND JUNCTION OPERATIONS	1	1
IDAHO OPERATIONS	9	0
NEVADA OPERATIONS	3	0
OAK RIDGE OPERATIONS	6	37
PITTSBURGH NAVAL REACTORS	0	0
RICHLAND OPERATIONS	272	67
SAN FRANCISCO OPERATIONS	10	1
SCHNECTADY NAVAL REACTORS	0	0
SAVANNAH RIVER OPERATIONS	1	0
TOTAL	320	116
THESE NUMBERS USUALLY ROUNDED FOR BUDGET AND PLANNING DOCUMENTS	300	100

SLIDE 1

The first slide (slide 1) summarizes for you the number of contaminated facilities and excess facilities that are at ERDA sites.

Mr. BROWN. These figures refer to sites; that is, geographical locations?

Dr. LIVERMAN. No; these are contaminated facilities on the various sites shown on the left of the slide which are now excess.

We started the study in 1972 and continued it in 1973, to list about 900 plus buildings in which radioactive material was being handled at that time. At that point, there were only 130 excess, but as of June 1976, when we reassessed the picture, there were about 300 which had been declared excess to our needs and have to be decommissioned and decontaminated, with 116 more expected over the next 5 years.

BUILDINGS AND FACILITIES ON THE HANFORD RESERVATION
CURRENTLY EXCESSED OR TO BE EXCESSED WITHIN 5 YEARS
As of June 1976

	Currently Excessed	Excessed Within 5 Years
100 Area	70	53
200 Area	29	14
300 Area	3	0
Cribs, Ponds, and Ditches	170	0
Total	272	67

Slide 2

The next slide (slide 2) indicates the nature of many of these that are on the Hanford site.

Mr. Brown. That is by far the largest number.

Dr. Liverman. Yes.

The Hanford site has a major segment of these localized on the one site.

CONTAMINATED FACILITIES AT HANFORD

- CONTAMINATED LIQUID DISPOSAL SITES
- CONTAMINATED SOLIDS STORAGE AND DISPOSAL SITES
- FUEL REPROCESSING FACILITIES
- FUEL STORAGE BASINS
- REACTORS
- REACTOR GAS AND EXHAUST AIR SYSTEMS
- RETENTION BASIN SYSTEMS
- TRANSURANIC FACILITIES
- URANIUM FACILITIES
- LABORATORIES
- WASTE MANAGEMENT FACILITIES

SLIDE 3

The next slide (slide 3) shows the general kind of things—liquid disposal sites, contaminated solid-storage disposal sites, fuel reprocessing facilities, and a whole laundry list of other kinds of things that we find as we have tried to inventory them.

There are basically four objectives that we are trying to achieve as we work on the radioactively contaminated facilities.

First, to reduce the potential risks from the various facilities; second, to plan for the disposition of those facilities to get them totally out of the environmental stream; third, to learn by the decontamination/decommissioning procedures how to minimize environmental contamination and get rid of the extremely costly continued surveillance and maintenance of the facilities over a period of time; and finally—which as we clean them up may be the most important one—to learn from what we are doing, to document our actions thoroughly in order that what we learn will be useful in the design of commercial facilities so that they can be decontaminated and decommissioned effectively, at minimum costs over a period of time.

The documentation on the facilities to be decommissioned and decontaminated, which has been studied in much detail at the Hanford site, is scheduled for completion by about the first of October of this year. We have done a fairly detailed study. It is unfortunate that the

GAO—I was here for Mr. Canfield's testimony—did not have time to look into the details of what is being done at one or two of the sites because I think we in ERDA, although having, perhaps, started late, for which one can have a finger pointed, have, nevertheless, on the Hanford site, done a fairly detailed study which is now computer-based and can tell us where we are and where we are going.

There are three of four basic methods, and Mr. Larson in his testimony covered some of those, for dealing with decommissioning and decontamination.

You can mothball it, which you need to do in some of the intensely radioactive areas for up to 50 to 100 years. So you mothball and control and monitor it, or entomb and monitor it until such time as the radioactivity has decayed to where it can be dealt with, and finally remove it, and use the facility for something else.

Those are the various means of dealing with that question.

I would like to run rapidly through now——

Mr. SPENSLEY. I would like to ask one question.

When you say "mothballing until we can do something," does that mean that there are no other technological solutions for the moment, or that there are no other cost-effective solutions to it?

Mr. RAMSEY. I think there are no other cost-effective solutions. You achieve a degree of immobilization of the material in place by mothballing and then allowing natural decay to take place and improve your situation in exposing workers who do the decontamination and decommissioning work.

Mr. SPENSLEY. In other words, we have the technology available to us for removing any facility that is now considered in excess or contaminated without mothballing?

Mr. RAMSEY. Yes. You can do that, but the expense that you face then is radiation exposure to workers which you may be able to reduce by mothballing.

Dr. LIVERMAN. Or by use of remote handling equipment.

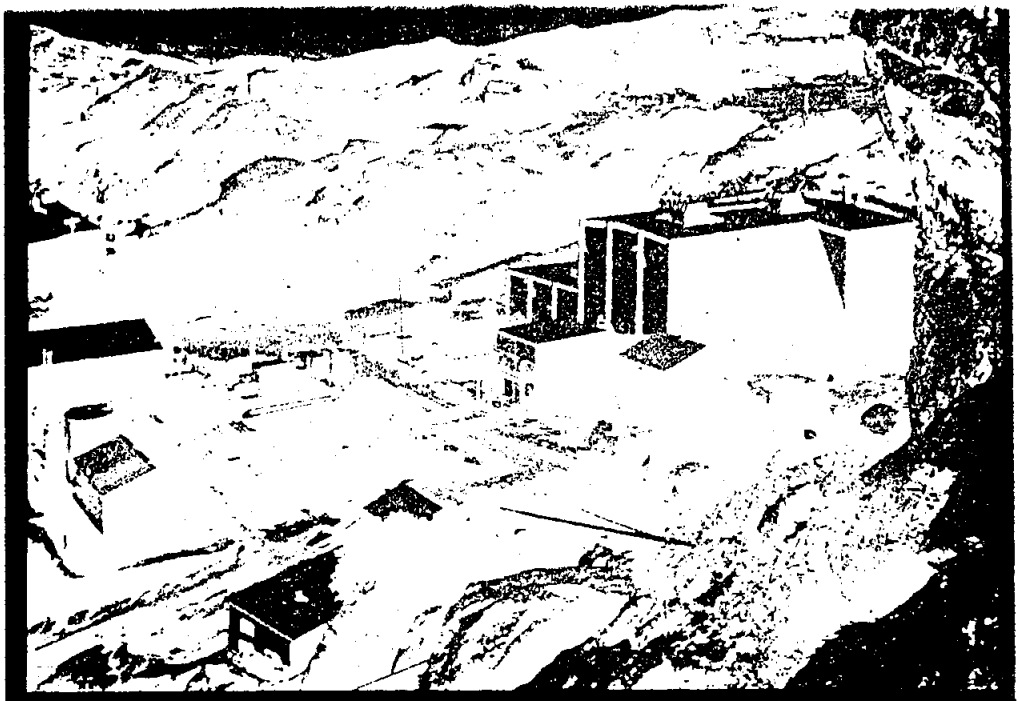
Now, the kinds of things that we try to keep in mind as we deal with the Hanford situation is to try to deal first with those which could result in offsite radiological hazards.

Second in priority is the radiological, physical, and chemical hazard to people and to reduce hazardous situations onsite.

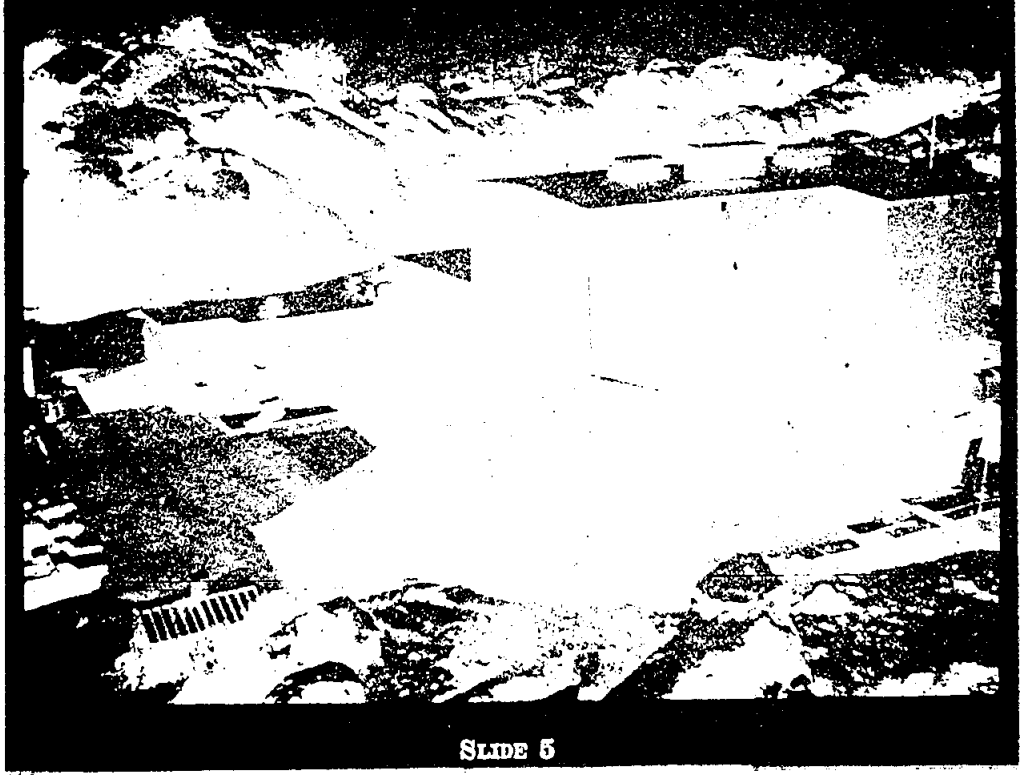
A third one is to minimize the cost of continued maintenance and surveillance.

If there is no real offsite hazards or onsite hazard for some considerable time, then one asks is the cost of maintenance and surveillance outweighed, or is it a minor component compared to dismantling it and disposing of it, and removing and cleaning up at that point in time? In addition, one must consider what is the compatibility with projected use of the site? Do you need to move it out of the way in order to use the site for other things?

In general, those are the kinds of things that are taken into account as we work on the problem of decommissioning and decontamination.



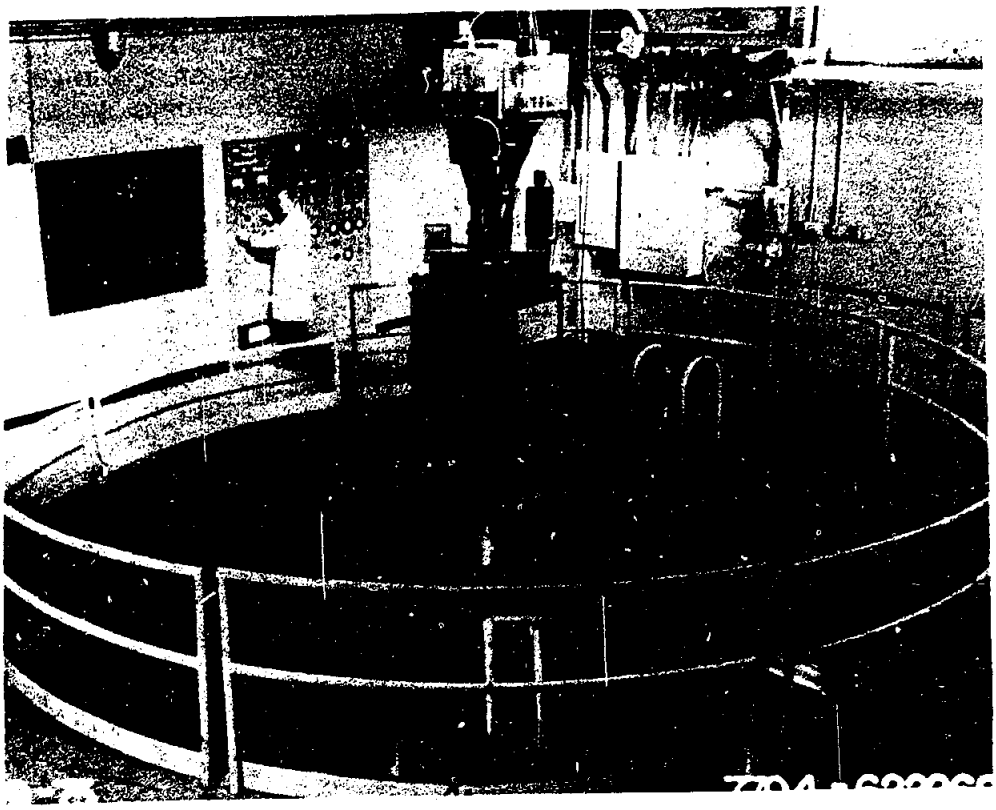
SLIDE 4



SLIDE 5

I would like to show you four or five examples of situations before and after decontamination. This slide shows the Sodium Reactor Experiment at Santa Susana, Calif., before it was worked on. (Slide 4.) The next slide (slide 5) shows how it looks from the outside as a result of decommissioning and decontamination.

SLIDE 6



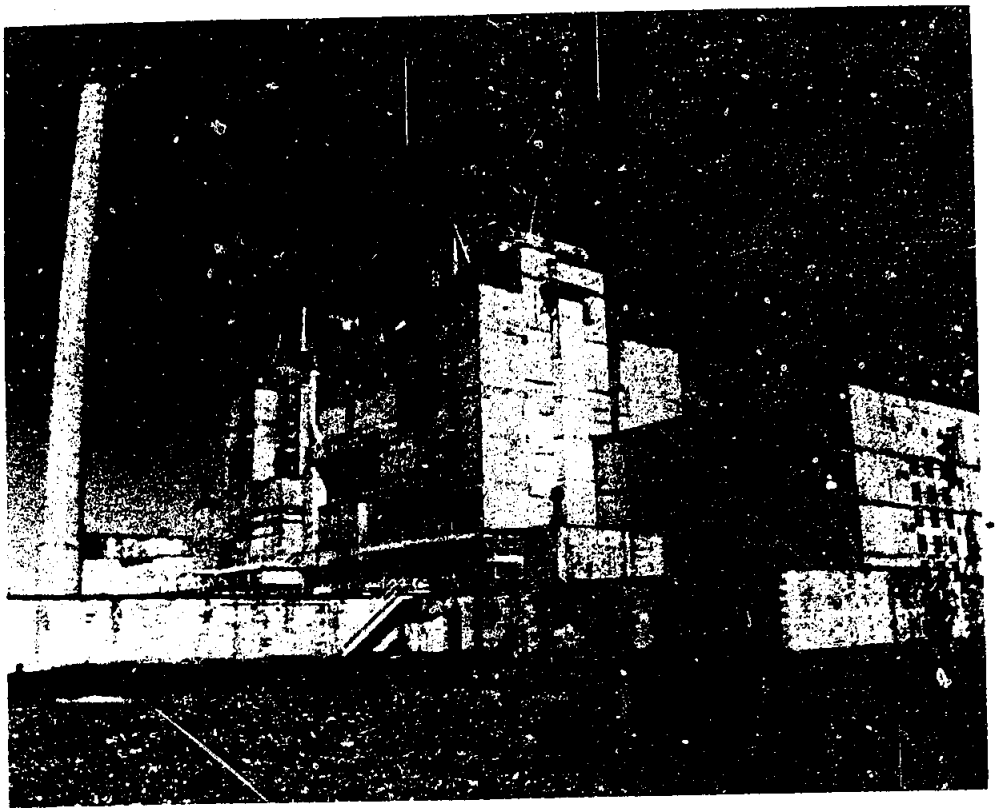
SLIDE 7

The next slide (slide 6) shows you the inside of the building. This was the hot cave before the decommissioning and decontamination took place. The next slide shows, obviously, the "after," (slide 7) in which the facility was turned into an engineering mock-up facility for testing equipment for remote dismantlement.

SLIDE 8

The next slide (slide 8) shows the shield test irradiation reactor before and after—on the left, before, and on the right, after.

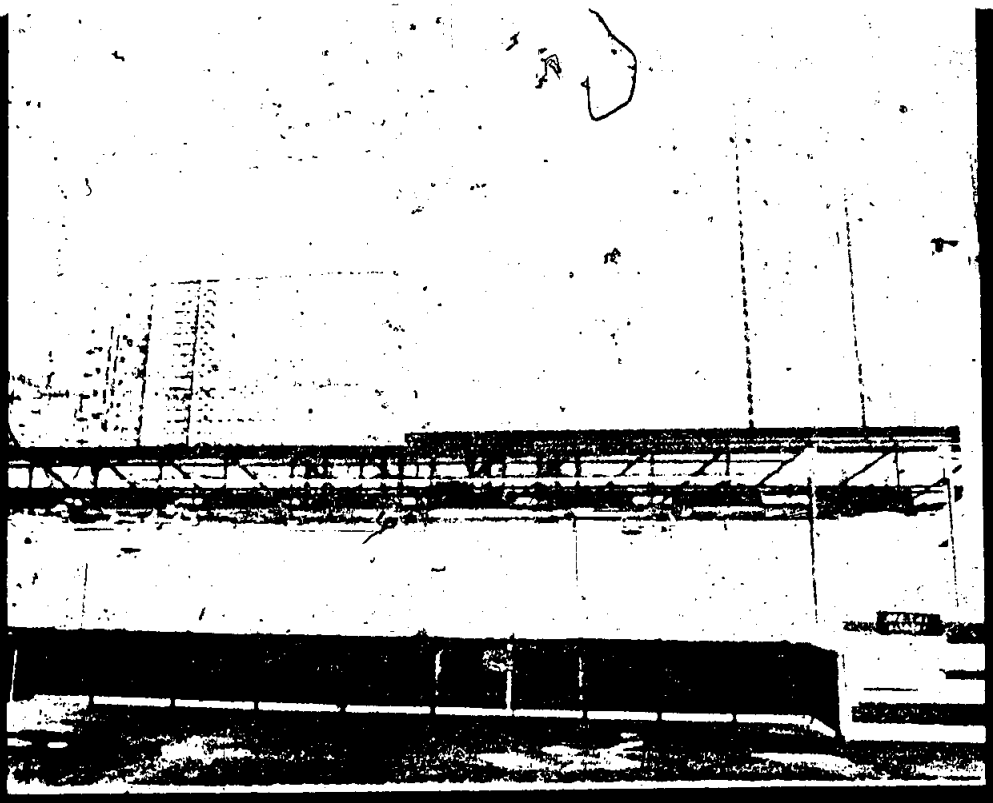
You can see a considerable amount of clean-up does take place and, therefore, it becomes obvious why there is considerable cost.



SLIDE 9

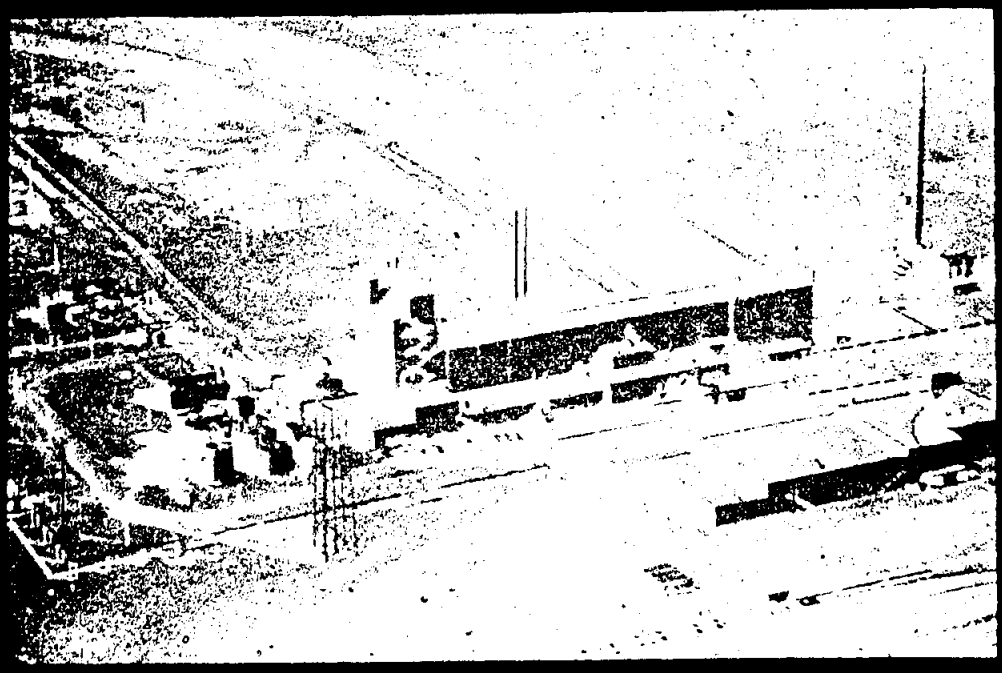
The next slide (slide 9) shows a reactor building at Hanford. If you have been out on that site, and I believe you have been there, Mr. Brown, haven't you?

Mr. BROWN. No, I have not.

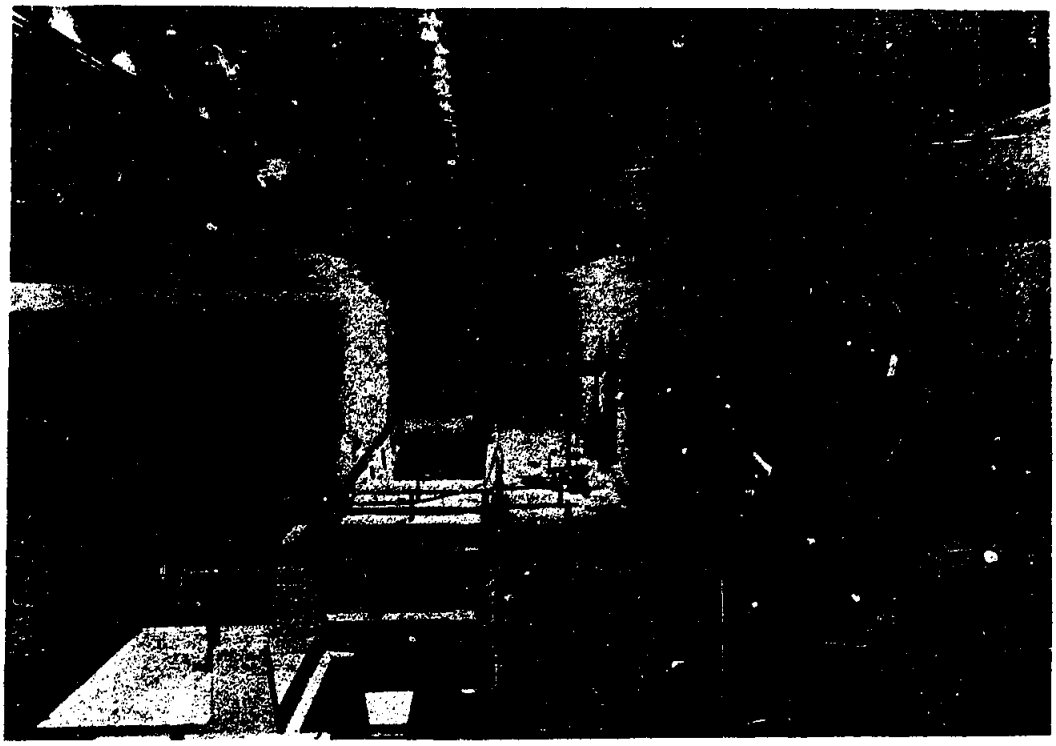


SLIDE 10

Dr. LIVERMORE. They look pretty bad—the old buildings that have been there for 30 years—from the outside. Inside, you can see the reactor face (slide 10). This simply gives you an example of the kind of problems that one is dealing with in decommissioning and decontamination.



SLIDE 11



SLIDE 12

The next slide shows you a fuel reprocessing plant (slide 11). Inside of that plant the hot cave—or hot canyon is perhaps a better description—is located (slide 12). When you get into decommissioning and decontaminating there, you begin to see the size and the enormity of the task confronting you.

D/D BUDGET HISTORY

(B/O IN THOUSANDS OF DOLLARS)

MANAGEMENT OF SURPLUS CONTAMINATED FACILITIES	DIVISION REQUEST	BRC MARK	OMB MARK	CONGRESS	ACTUAL
FY 1973*	–	$ 0	$ 0	$ 0	$2,107
FY 1974	–	380	380	380	2,923
FY 1975	$ 8,300	5,655	5,655	5,655	5,580
FY 1976	13,700	6,800	6,355	6,355	5,953
FY 1977	12,380	12,380	6,355	6,355	–
FY 1978	19,000	13,500	12,400	PENDING	–

* PRIOR TO FY 1973, D/D FUNDING WAS INCLUDED IN THE OPERATING BUDGETS

SLIDE 13

Mr. Canfield in his discussion, and you and Mr. Wirth both in the questioning, asked why haven't we done something earlier, and while I do not want to put myself in the position of pointing fingers, this slide (slide 13) is the budget history of what has happened since 1973, which is when I think we really started to give attention in the AEC and, subsequently, ERDA, to doing something about it.

In connection with my opening comment about waste being the last thing that people appear to worry about—the same is true not only here but also in the commercial wastes. It is easy to defer and delay. So therefore, the dollars that are really needed to address the question simply are not spent on it.

I am glad the committee is looking into this question, because it is certainly one that demands the attention of the executive branch, and the Congress also, because it is going to be expensive to deal with, but it must be dealt with in some timely and orderly manner.

That is all the slides, unless there are questions.

As you are well aware from earlier testimony before the committee, under the general area that one could call decommissioning and decontamination is the uranium mill tailings question, particularly the one in Grand Junction, Colo., in which, over a 5- or 6-year period, we will have cleaned up the mill tailings under 500 to 600 dwellings and schools, at a cost to the Federal Government of about $8 million. This represents about 75 percent of the cost of removing the tailings and putting those houses and schools back to where they can be used on an unrestricted basis.

In addition, we have been under congressional mandate now for about 3 years to survey all of the excess uranium mill tailing sites in eight Western States. Those surveys are now about finished. We are in the process right now of publishing the final report on them.

The best estimates we have now, considering that the States will be requested to fund a similar proportion—at least, that is the legislation that seems most likely to go into effect—the 75 percent share will probably cost the Federal Government somewhere between $80 and $100 million to clean up those mill tailing sites.

We have had a number of discussions with the Nuclear Regulatory Commission, the NRC. We are very happy to work with them and see that they are, and have been for some time, requiring all new plants and those that are coming into being to accommodate the decommissioning and decontamination factor as a condition of license so that hopefully, in the future, this problem of having owners walk away from mills and tailings, abandon them, and leave them to the Federal Government to take care of, will not reoccur.

As to whether additional legislation or additional regulations in that area are required, I think that is a matter that could better be addressed by the Nuclear Regulatory Commission.

There is yet another category of facilities to consider. During World War II, there were an enormous number of universities and companies brought into the development of atomic energy. We find now, in retrospect, that there were perhaps as many as 150 sites around the country that were, in the mid 1950's and early 1960's excessed and released to be used by the public in whatever way they saw fit. Relooking at the question of release with revised regulations now, it is clear that there is some contamination in some of those sites that will, perhaps, need to be cleaned up, and we are in the process of doing detailed surveys—the fiscal year 1978, and I presume the 1979, budget will carry funds, to define more clearly and precisely which ones need to be cleaned up and to finish estimating what it will cost.

There is a comment that I would like to make here, based on the observation of the 150 sites. One of the problems we found was that

records indicating the degree of cleanup had been destroyed. In spite of searching through the Federal record system and company records systems, it became totally impossible to locate records on about 60 or 70 of these sites.

The point I wish to make is that there needs to be spelled out somewhere, somehow, a requirement that when you have finally gotten those facilities to a state of cleanup where they are publicly acceptable, that some permanent record be retained that someone can go to and find, like in the Federal Register, or some other place, that is going to be around for a long time. It could save doing the same job again in 25 to 50 years when we might decide that because the regulation has been changed, the facility should have been cleaned up a little more.

I think that is an important issue that needs to get some attention as one goes along.

Clearly, a commercially licensed contaminated facility is not our problem, but in a sense, the technology which we are developing certainly should contribute to helping the NRC and others with that question. Our big problem results from the defense wastes which are highly radioactive, principally, at three sites—Hanford, Savannah River, and Idaho.

We are working on the problem now of what you do with that 70 or 80 million gallons of material. Some of this has been solidified and made into salt cake so it is immobilized as much as possible, so that it is stabilized, but it clearly is a question that has to be addressed. We currently have in preparation a series of what we call defense waste documents which will describe what the relative costs, risks, and uncertainties are of various alternatives for disposing of these wastes.

Those three sites are quite different from one another. The one at Hanford is isolated and in arid country. The one at Savannah River is very close to the water table. The one in Idaho is 600 to 700 feet above one of the major aquifers in that region.

The climates are very different. So the questions that have to be addressed at each one of these sites will be quite different. The defense waste documents are now being produced for the various sites by the field operations offices, and from them we will come up with environmental impact statements as to what we must do with the material and when.

As you are perhaps aware, in his energy plan, the President directed Dr. Schlesinger to address the question and review the entire ERDA waste management program.

I have no doubt but that over the next year the waste question is going to be addressed in much detail—both by this committee and, I am sure, by two or three other committees in the Congress, as well as by the Department of Energy. Certainly my programs will continue to update and aggressively pursue the documentation on all of our facilities, as we have done for the Hanford site.

That completes my statement, Mr. Brown.

If you have questions, I would be happy to either try to answer them or have my colleagues respond.

I would like to make one other comment. One of the discussions this morning, and with Mr. Wirth pursuing the cost and other aspects, leads me to suggest that the committee might like to have in its

record a paper that was put together for a recent International Atomic Energy Agency symposium, entitled "Technical and Economic Aspects of Nuclear Power Plant Decommissioning."

Mr. BROWN. Without objection, that will be made a part of the committee record.

[The paper follows:]

TECHNICAL AND ECONOMIC ASPECTS OF NUCLEAR POWER PLANT DECOMMISSIONING

(By Harold Glauberman, U.S. Energy Research and Development Administration and William J. Manion, Nuclear Energy Services, Inc.)

INTRODUCTION

Nuclear power reactors as well as other fuel cycle facilities will eventually reach the end of their useful life either due to obsolescence or adverse economics of continued operation. Ultimately, it will be necessary to provide for the disposition of these facilities in a way that assures protection of public health and safety and permits the facility and land to be released for other nuclear use or unrestricted use.

The decommissioning of retired nuclear power plants is an area that is receiving increased attention. A 1974 Ford Foundation Study—"A Time to Choose" [1] addressed the need for study of the decommissioning problem. The study stated, "A full assessment of the decommissioning problem should be carried out—promptly—before the new reprocessing plants coming on line are fully contaminated, and before reactors proliferate throughout the country. Institutional and economic questions are at least as important as technical ones." The Ford Study further asks, "Who should be responsible for decommissioning? How should decommissioning be paid for? How will decommissioning costs affect the economics of the nuclear fuel cycle?" We are in agreement with the study's contention regarding the importance of institutional and economic questions and in this presentation will attempt to provide answers to them, specifically for nuclear power plants.

First, it should be noted that in October 1973, the IAEA held a consultants' meeting in Vienna, Austria, to consider the problem of decommissioning nuclear facilities. The consultants advised that the IAEA should include decommissioning in its program and promote the formulation of guides, recommendations and standards. They also prepared a report, "Decommissioning of Nuclear Facilities: A Review of Status." [2] The report discussed extensively the responsibilities associated with decommissioning which are similar to those already established for the construction of nuclear facilities. In this connection, the plant owners must assume the technical and economic responsibilities of the decommissioning, while the public authorities must define what will be acceptable toward the future use of the facility and enforce the standards relative to environmental, health and safety, and waste management to protect the public. Emphasis was also placed on the point that decommissioning can involve long-term responsibilities similar to waste management and that long-term responsibilities for decommissioning be given to appropriate public authorities since the assumed permanent existence of commercial organizations may be unrealistic. The establishment of financial arrangements for decommissioning, which will be discussed later, could alleviate this concern.

In October 1975, the IAEA held a Technical Committee Meeting to continue the considerations of decommissioning resulting from the 1973 consultants meeting. The report of this meeting was issued as an IAEA technical document.[3] A number of conclusions and recommendations were stated; however, only a few that are relevant to the remainder of this paper are noted:

There are no insurmountable technical problems to decommissioning to any stage, but considerations with respect to policy, planning, timing, costs, waste disposal, safety criteria and regulatory aspects need further development; and

Experience and cost data need to be accumulated so that realistic planning for decommissioning can be instituted.

---

[1] Ford Foundation Study, "A Time to Choose." Ballinger, Cambridge, Mass. (1974).
[2] "Decommissioning of Nuclear Facilities—A Review of Status", Atomic Energy Review, 12, No. 1, IAEA, Vienna (1974).
[3] "Decommissioning of Nuclear Facilities", IAEA–179, Vienna (1975).

Regarding this latter point, establishing the future costs and obligations of decommissioning large reactors is one of the principal concerns of industry, utilities, government and the public. Most discussions of cost have relied on past decommissioning experience of small reactors as the basis for extrapolation to arrive at conclusions about large reactor decommissionings. In order to better define decommissioning requirements, the Atomic Industrial Forum (USA) recently sponsored a study[4] of decommissioning alternatives for a 1100 MW(e) light water reactor (LWR) and a similarly sized high temperature gas cooled reactor (HTGR). This paper reflects the information developed in the AIF study. Basic data such as reactor structure radioactive inventory, component contact radiation dose rates, number of cuts required to remove vessel internals, number of feet of various size pipes to be decontaminated, volume of contaminated or activated concrete to be removed and buried, were specifically calculated for each reactor type. This information led to the definition of the individual work activities including required equipment and personnel resources, determination of program schedule, calculation of activity duration, program costs, and other impacts such as occupational radiation exposures, effluent releases and non-occupational exposures.

DEFINITION OF DECOMMISSIONING ALTERNATIVES

The United States Nuclear Regulatory Commission (NRC) Guide 1.86[5] describes methods and procedures currently considered acceptable by the NRC staff for decommissioning alternatives leading to either a terminated or an amended license. The guide presents three primary decommissioning alternatives, namely, mothballing, in-place entombment, and removal of radioactive components and dismantling.

Mothballing.—Consists of putting the facility in protective storage. The facility may be left intact except that all reactor fuel, radioactive fluids and wastes should be removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures must be established to ensure public health and safety. The existing license is then amended to prohibit operation of the reactor.

Entombment.—Consists of removing all fuel assemblies, radioactive fluids and wastes, and selected components shipped off-site, followed by the sealing of all remaining highly radioactive or contaminated components (e.g., reactor pressure vessel and materials) within a structure integral with the biological shield. An appropriate and continuing surveillance program is required to assure the structural integrity over the period of time in which significant quantities of radioactivity remain with the material in the entombment.

Removal/Dismantling.—Requires removal from the site of all fuel assemblies, radioactive fluids and wastes, and other materials having activities above acceptable surface contamination levels established in U.S. NRC Guide 1.86. Materials which contain induced radioactivity are evaluated on a case-by-case basis. The facility owner may than have unrestricted use of the site with no requirement for a license.

1100 MW(E) REACTOR RADIOACTIVE INVENTORY

A realistic evaluation of how the various decommissioning methods, or combinations thereof, can be applied to reactors is dependent on accurate knowledge of the quantities of radioactive material induced by neutron activation during the operating life of the reactor. Most of this material will be an inherent part of the metal structures within the reactor vessel internals, the reactor vessel, and the structures surrounding the vessel. Radioactive contamination will also be deposited throughout the reactor cooling system as a result of coolant circulation during operation.

The quantities of activation products produced in the concrete structures adjacent to the reactor vessel are dependent on the composition of the aggregate and sand used in the original mix. These may vary from reactor to reactor; therefore, it will be necessary to analyze the actual activated concrete of the shutdown reactor to obtain an accurate estimate of the quantities present. In any event, the activated concrete is not expected to be a controlling factor in selecting a decommissioning alternative.

---

[4] Manion, W. J., and Laguardia, T. S., "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives", AIF/NESP–009, to be published.

[5] U.S. Nuclear Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors" (June 1974).

Initially after shutdown the reactor vessel and its internal components together will contain greater than 99 percent of the total activity. Therefore, it is these components which are of primary concern for a mothballed or entombed plant and also dictate the method of component removal in a dismantling program.

The five radionuclides which are of greatest significance during decommissioning are iron-55, cobalt-60, nickel-59, nickel-63, and carbon-14. Over 90 percent of the activation product inventories for a PWR, BWR, and HTGR will consist of the shorter-lived isotopes of cobalt-60 and iron-55.

In the Atomic Industrial Forum study, the inventory by component in typical 1100 MW(e) reactors was calculated with time, beginning at shutdown and continuing for 200 years. Each reactor type was assumed to operate at full power for 80 percent of the time during its 40-year life. The fuel and control rods were excluded from the inventory since their disposition will not be unique to decommissioning. Based on these assumptions, the largest total inventory at shutdown will occur in a PWR, and will be about 15 million curies. At the end of 100 years this decreases by a factor of 35 with over 90 percent of the remaining inventory being nickel-63.

In carrying out the decommissioning, the radiation dose rates associated with the activated reactor components is another important consideration. Maximum contact dose rates expected as a function of time were calculated at 2, 50 and 100 years after shutdown. The most significant gamma ray emitter over this time span is cobalt-60; therefore, any plans for vessel internals or vessel removal work must accommodate the hard radiation fields from this isotope. Gamma dose rates at two years after shutdown would be in the range of 10^5 rad/hr in an LWR and 10^3 rad/hr in a HTGR.

Because of the high contact dose rate level shortly after shutdown, any removal of vessel internals for an LWR would require sophisticated underwater cutting and handling equipment. A delay period of about 100 years would permit sufficient decay of the cobalt-60 to allow manual removal techniques with local personnel shielding. Thus, the complexity of the operation would be greatly simplified.

Of interest is the contribution of nickel-59 and nuckel-63 to the total dose rate. While the contact dose rate due to nickel-59 at shutdown was calculated to be only 30 mrem/hr, because of its 80,000 year half-life, the reduction in dose rate will require a long time. As a result, this will have to be taken into consideration for future LWR decommissioning involving protective storage alternatives. In prior decommissionings of small reactors, nickel-59 has not been a limiting nuclide since the operating periods were not long enough to generate a significant amount of this nuclide.

EFFECTS OF RADIOACTIVE INVENTORY ON DECOMMISSIONING

The magnitude and composition of the radioactive inventory bears directly on all three primary decommissioning alternatives. For example, the period of time during which significant quantities of radioactivity remain will determine licensing requirements for both mothballed and entombed facilities. One criteria that has been used in prior decommissionings for activated material control is the maximum allowable beta-gamma surface dose rate. In this study a limit of 0.4 mrem/hr has been assumed to be an acceptable level. It should be noted this is not being suggested as a limit, but is used only as an assumption to calculate effects. The immediate question is how long does it take for the activated components of the reactor to decay to that level? The hard gamma radiation field due to cobalt-60 will decay in 100–160 years while the contact dose from nickel-59, which was noted before, will require about 500,000 years to decay to 0.4 mrem/hr. The dose from nickel-63 would require 1,000–2,000 years and the carbon-14 dose from HTGR graphite blocks would require 65,000 years.

Some interesting conclusions can be drawn from the required decay periods.

To mothball or entomb a large reactor with all components in place, after it has operated for 40 years will require surveillance and maintenance cost for many thousands of years. For such facilities, this exceeds what can be considered a credible period of assured control for public acceptance.

Mothballing or entombing could be a credible form of permanent disposition if the vessel internals were removed and, for an LWR, the beltline region of the vessel cladding removed to eliminate the nickel-63 concern. Of course, this is almost as much work as complete removal of radioactive material and is not considered to be a logical approach.

If a plant were placed in a state of protective storage (mothballing or entombment) for about 100 years, the cobalt-60 maximum contact dose rate decays to about 300 mrem/hr. This level permits manual operation with local shielding. Therefore, a potential approch to decommissioning of a large reactor is to mothball or entomb for these periods of time and then remove the remaining radioactive material for disposal. The license requirements can then be terminated and, if desired, the remaining non-radioactive structures dismantled..

The entombment form typical of past decommissionings, e.g., BONUS [6], Hallum [7], which were intended as a permanent mausoleum-type structure, is not practical for large reactors. An entombment of simpler construction which is amenable to demolition after the necessary delay period needs to be considered. This structure would preclude personnel access to the entombed material. All openings to the entombment boundary would be sealed closed; for example, by concrete walls and caps, but the void volumes within the entombment boundary would be left as is.

ESTIMATED COSTS OF DECOMMISSIONING

The estimated costs associated with achieving each decommissioning alternative and combinations are summarized in Table I. The costs in 1977 dollars represent the summation of many different work activities and includes a contingency factor of 25 percent.

The total cost of mothballing includes such expense items as engineering, supplies and equipment, waste disposal, utility staff, and nuclear insurance. Entombing cost would include each of the above and additional cost for the predecommissioning period, decontamination, and the entombing structure. The removal/dismantling costs would include added costs for vessel and vessel internals removal and disposal and structure removal and disposal, backfilling and landscaping. The combination alternatives involving periods of protective storage include the expense of maintenance and surveillance prior to removal/dismantling.

The major cost for mothballing is the operating staff that will perform the actual activities. The period of accomplishing the mothballing phase is estimated to be about 10 months.

The annual post-mothballing cost of maintaining the reactor installation is estimated to be about $185,000 in 1977 dollars for all three reactors types. This cost includes periodic inspections, a full-time security force, and an allowance for plant maintenance.

The estimated costs for the entombment alternative use the simple construction approach which involves construction of a barrier around the reactor vessel and internals within the original containment building. Entombment is estimated to require two to three years to complete. The annual estimated cost of maintaining the entombed facility is about $65,000 in 1977 dollars for all three reactor types. The lower annual maintenance cost is based on the assumption that a security force is not required and less building maintenance will be required.

The estimated cost presented for the removal and complete dismantling alternative assumes that it takes place shortly after shutdown. The period of time to accomplish the program is estimated to be about five to six years. When the reactor is dismantled, a license will not be required and there will be no annual surveillance costs at the reactor site.

The estimated costs of the two potential combination modes of decommissioning are also presented, and for these, it is assumed that the reactor is mothballed or entombed for a period of time followed by removal/dismantling. The time period for which the reactor is mothballed or entombed is assumed to be 108, 104, and 65 years for a PWR, BWR, and HTGR, respectively. During these time periods, the residual radioactivity will have decayed to levels which permit relatively inexpensive removal and disposal. The total costs of these alternatives include the accumulated cost of maintenance and surveillance for the protective storage period prior to removal/dismantling. All costs assumed to be in 1977 dollars with no allowance for escalation.

---

[6] "Boiling Nuclear Superheater Power Station Decommissioning," Docket 1154–2, Puerto Rio Water Resources Authority and United Nuclear Corp. (September 1970).

[7] "Report on Retirement of Hallum Nuclear Power Facility", AI–AEC–12709, Atomics International, Canoga Park, California (May 1970).

COMMENTS ON DECOMMISSIONING ALTERNATIVES

A conclusion that can be drawn from the information presented is that a logical approach to decommissioning is to place the shutdown reactor in protective storage for about 100 years and then remove the residual radioactive components and dispose of them in an approved burial ground. The selection of the form of protective storage, i.e., mothballed or entombed, may be based on economic and other considerations. For example, if the shutdown reactor is on a multi-reactor site that has a continuing requirement for a full-time security force, then mothballing may be the preferred choice since there is no added cost for security. It should be remembered, however, that in actual fact, there may be environmental, societal, or political issues which may be more significant than cost and will dictate the choice of alternative and timing for decommissioning.

Mothballing and entombing do not require any unique or unsual technical activities. Mothballing primarily involves cleanup of accessible plant area, but extensive decontamination of plant systems is not necessary because the entire site is under surveillance. Entombing will require decontamination or removal of contaminated components external to the entombment barrier, to levels compatible with unrestricted access to these areas.

If a reactor is required to be dismantled shortly after shutdown, technically sophisticated procedures will be needed due to the high radiation levels. These will involve: remote underwater cutting of vessel internals, remote in-air cutting of the reactor vessel, and controlled explosive demolition of heavily-reinforced activated concrete.

Experience gained in dismantling the Elk River Reactor [8] indicates that remote operation of a plasma arc torch is a feasible technique for cutting heavy steel. However, the technique needs further development for application to large reactors which have steel components that are two to three times thicker than those cut at Elk River. The technology exists, but the tooling and larger torches must be demonstrated. Controlled explosive demolition of activated reinforced concrete including control of contaminated dust, concrete separation, and rebar cutting, has also been adequately demonstrated at Elk River. Although large reactors will have many times the quantity of concrete to remove, the techniques developed for the Elk River biological shield will be applicable.

FINANCIAL CONSIDERATIONS OF DECOMMISSIONING

The costs of decommissioning a large reactor, although significant, can be accommodated in a manner which would have little impact on either construction or operating costs. In order to achieve this, decommissioning cost must be included in the initial financial planning of the reactor. For example, decommissioning activities costing $40 million in 1977 dollars but not requiring expenditure for 40 years from now, would require the establishment of a $18.9 million sinking fund assuming the rate of return on investment funds is two percent greater than an assumed inflation rate of six percent. If the rate of return is assumed to be three percent greater, then $13.1 million would be required. The required costs could also be established by providing an annual contribution of $1.6 or $1.2 million over 40 years for the respective interest percent differentials. If the plant were shut down at a time prior to the 40-year operating life, the latter method would not permit accumulation of the required funds. In comparison to initial construction costs of a large reactor, the one-time single construction period sinking fund contribution would represent modest cash requirements. Although at present there is no such requirement, serious consideration should be given by regulatory authorities and reactor owners to the establishment of a sinking fund for decommissioning at the time a new reactor is licensed to operate. This would assure that the necessary financial resources would be available to carry out the decommissioning responsibility.

As an additional thought on decommissioning costs and philosophy, we believe it is correct to say that nuclear power reactors have been designed by architects and engineers for safety and efficiency of operation without specifically considering eventual decommissioning requirements. It is reasonable to hope that the same philosophy applied to decommissioning could lead to great reductions in the costs of complete dismantling of reactors. The physical separability of shielding

[8] "Final Elk River Reactor Program Report," C00-651-93 (September 1974).

and contamination control barriers is one principle that needs to be looked at. Another is the principle of modular shielding, which obviously may require trade-offs with the desire for monolithic construction to provide structural strength. Designing reactors with three goals instead of two will not be easy, but it may well turn out to be a better choice than the expenditures now postulated for unrestricted release of sites or the requirement for long-term surveillance.

FUEL REPROCESSING AND FABRICATION PLANT DECOMMISSIONING

Up to this point this presentation has been focused on nuclear power plants. The decommissioning costs and procedures applicable to reprocessing and fuel fabrication plants are also of major concern and should not be overlooked. Current experience for decommissioning commercial size reprocessing plants is limited; however, applicable experience has been obtained at a number of sites using operations common to reprocessing plants. In addition, a great deal of experience has been found in decontaminating and dismantling of plutonium facilities using techniques which would be used for mixed oxide fuel fabrication plants and fuel reprocessing plants. These have been reported in a number of recent publications and annotated bibliographies.[9] [10] [11]

A few of the reported efforts are briefly summarized:

At Savannah River five modules of a hot canyon of one of the chemical processing plants for irradiated fuel were decontaminated for reuse.[12] The activities included removal of processing equipment, remote decontamination of canyon walls and floors using the hot canyon crane; isolation of the five modules to be cleaned from the rest of the canyon: penetration of the 1⅔ meter thick wall for personnel entry; and direct decontamination as required. The work was completed in one year at a cost of about $150,000.

A small prototype reprocessing plant at the Fontenay-aux-Roses Nuclear Research Centre in France was totally dismantled.[13] The decommissioning was completed in about three years and required 150,000 man-hours. The components removed were decontaminated, baled, and shipped to Saclay for storage with the contaminated soil and building rubble.

The Eurochemic demonstration reprocessing plant in Mol, Belgium, stopped operations in December 1974 after approximately eight years of operations.[14] Initial plant cleaning and rinsing, and plant decontamination has been completed so that access to all process cells is possible to permit dismantling operations. The facilities are to be decommissioned for restricted use with the option for further removal and dismantling to release the site for unrestricted use at a later date. Cost estimates for the dismantling operations based on 1976 U.S. dollars were about $35 million, representing about 45 percent of the value of the initial investment. An additional $5 million has been estimated for disposal of the conditioned waste (15,000 drums of 200 liters each) based on information from the European countries with advanced disposal programs. The Experience gained in the Eurochemic decommissioning program will be of considerable value to others involved in the planning for decommissioning commercial size reprocessing plants. It should be noted that in one respect decommissioning of reprocessing plants will require greater precautions and controls for personnel protection than reactor facilities due to the potential for plutonium inhalation and the spread of area contamination during dismantling operations.

As we have indicated for nuclear power plants planning for decommissioning during the initial design stage could also substantially reduce the costs of terminating operations at fuel reprocessing plants and fuel fabrication facilities. Financial arrangements similar to those recommended for nuclear power plants should also be considered for new major fuel cycle facilities to insure that the

---

[9] USERDA. "Proceedings of the Conference on Decontamination and Decommissioning (D/D) of ERDA Facilities". Idaho Falls, Idaho (August 19–21, 1975), CONF–750827.

[10] Sande, W. E., et al., "Decontamination and Decommissioning of Nuclear Facilities—A Literature Search", Battelle Pacific Northwest Laboratories, BNWL–1917 (May 1975).

[11] Paschall, R. K., "Decontamination and Decommissioning Criteria for Use in Design of New Plutonium Facilities", Atomics International, AI–ERDA–13156 (June 1975).

[12] Moore, P. R., "Decontamination of a Highly Radioactive Chemical Processing Facility", in Proc. of the Conference on Decontamination and Decommissioning (D&D) of ERDA Facilities. Idaho Falls, Idaho (August 19–21, 1975), USERDA. CONF 750827.

[13] Cerre, P., "D'emantelement de l'usine pilote d'extraction du plutonium de Fontenay-aux-Roses", Bull. Inf. Sci. Tech., Paris 70 (1963).

[14] Detilleux, E. J., "Status of the Decommissioning Program of the Eurochemic Reprocessing Plant", Proc. of the International Symposium on the Management of Wastes from the LWR Fuel Cycle, Denver, Colorado, (July 11–16, 1976), CONF–750827.

burden of decommissioning potential nuclear monuments will not be left to future generations.

TABLE I.—ESTIMATED DECOMMISSIONING COSTS

[1977 dollars times 10^3]

Alternative	PWR	BWR	HTGR
Mothballing	3,200	3,400	3,100
Annual surveillance	185	185	185
Entombment	10,200	10,400	7,800
Annual surveillance	65	65	65
Removal/dismantling	37,000	42,900	38,500
Annual surveillance	0	0	0
Mothballing with removal/dismantling [1]	38,300	38,700	36,400
Entombment with removal/dismantling [1]	32,300	33,300	33,300

[1] Mothballing or entombment period in years, PWR-108, BWR-104, HTGR-65.

Mr. BROWN. As you said, Dr. Liverman, the major part of the immediate problem does seem to involve the very large inventory of radioactive military wastes which have accumulated for 30-odd years.

That has seemed to be particularly pertinent to the problems faced at West Valley, where they seem to have some waste disposal problems.

Does your presentation include any time frame within which you expect these documents to be completed? Is it within the next year or so?

Dr. LIVERMAN. Dr. Heath?

Dr. HEATH. The defense high-level waste document for Savannah River was issued in May. I am sure that we can make that available.

Mr. BROWN. Last month?

Dr. HEATH. Yes, sir, May of 1977.

The schedule for the remaining documents at the other two sites, at Idaho and Hanford, is within the next year.

Draft programmatic environmental impact statements are scheduled to be produced in 1978.

Mr. BROWN. The documents will present options, but they will not in themselves constitute a decision document as to what will be done. Is that right?

Dr. LIVERMAN. That is right.

The environmental impact statement has to be put together, and from that plus other economic and other considerations one can make the decision about what is the best way to go, but I suspect, and, Colin, you may wish to comment, that even at this stage of the game, certainly with the Savannah River plant and others, that one begins to get a feeling for what the best way to go is. Trying to balance everything, however, clearly, the decision cannot be made——

Mr. BROWN. Who will be responsible for making the decision?

Dr. LIVERMAN. I suppose the Secretary of the Department of Energy, if we are in existence by then. I think everybody hopes we will be.

What additional assistance he may require, I do not know, but clearly it will involve—being a major policy decision—the various Assistant Secretaries in that Department as well as perhaps the Treasury and others.

Mr. BROWN. In listening to the testimony yesterday with regard to West Valley, and hearing only one side of it, one got the impression that there was a maze of unsolved technical problems in connection with the disposal of those 600,000 gallons of high-level radioactive

waste, including the apparently unanticipated problem of sludge formation as a result of neutralization of the waste, and the possibility that the sludge was becoming affixed to the tank itself in such a fashion as to make it difficult to remove, and the problem of the physical manipulation of that waste due to the design of the tank.

Are these all the kinds of problems that your defense waste documents will address and hopefully present options toward a solution?

Dr. HEATH. I do not believe that the defense waste document in itself will go to that level of detail, but those problems are being addressed, and the formation of sludge from neutralization is a phenomenon that also occurs at the defense waste sites.

The documents do address the treatment of the sludge in addition to the salt cake, but the specific problems in specific tanks, I imagine, will be the subject of follow-on studies.

Mr. BROWN. We were informed that there is not even definitive information as to the composition of the sludge. Obviously, you cannot make much of a plan for transformation of it if you do not even know what the precise composition of it is.

Is that your understanding of the situation?

Dr. HEATH. I am not exactly sure what the state of knowledge is on the sludge at NFS. I think there may have to be some additional work done. That certainly is a question that has to be addressed.

Mr. BROWN. You do not have a similar sludge problem, but you have a salt cake situation at Hanford; is that correct?

Dr. HEATH. There is a sludge that is formed during the neutralization process, so we do have sludges in addition to the salt cake, but specific mechanisms for handling those sludges are included in the analyses and are discussed in the defense waste documents.

Mr. BROWN. Do you have wastes that are stored in both an acid solution and a neutral solution at Hanford?

Dr. HEATH. No, sir. It is neutralized at Hanford.

We have some acid waste at the Idaho facility, so we do have some experience with acid waste.

Mr. BROWN. Does your plan for waste handling contemplate a situation that would exist after the tanks have deteriorated and it becomes necessary to remove the waste to another tank or otherwise dispose of it?

Dr. HEATH. Yes, sir.

During the interim management phase where the material is being handled in the tanks, there is a continual monitoring of the tanks, and provisions are made for transferring the waste if that becomes necessary.

One of the options that is analyzed in the defense waste document is to continue to manage the waste in that fashion, namely, if one decides that the exposure and the cost is such that the best thing to do is to continue to hold it in some form in the tanks—that is an alternative that is also analyzed in the document.

Mr. BROWN. In connection with West Valley, and although I recognize that these are possibly details that are not of great significance, I ask them from the standpoint of trying to evaluate the extent of the prior planning for future contingencies that develop in these situations, it seems that they did not even have the mechanical facilities for pumping the wastes into alternate storage containers designed into the original system.

That is not the case at Hanford, is it?

Dr. HEATH. No, sir. We do have the capability to transfer them.

Mr. BROWN. A few years back you had a leak problem at Hanford which came to the attention of the public. Could you indicate the nature of that situation and how it was corrected?

Dr. HEATH. We can supply detailed information on all leaks that have occurred for the record. However, I can summarize the fact that, yes, there have been a number of leaks, and the material that did escape from the tanks has been monitored. They know exactly where it is, and, as Dr. Liverman described, the climate in the Hanford area is a very dry climate, and the material has moved on the order of a maximum of 200 feet, and because of its radioactive nature it is possible to monitor the exact location.

Mr. BROWN. It did not by any chance get into the river—your identification is not that it is out in the south Pacific Ocean, is it?

Dr. HEATH. No, sir.

As Dr. Liverman indicated, the water table is several hundred feet below the surface in that area, and the material is in the immediate vicinity of the tank, in the dry desert soil. In terms of corrective measures that have been taken, the cause of the cracking of the tank was identified; replacement tanks are being built which are of a double-shell construction which the early tanks were not. We now have a monitoring system so that if waste material enters into the region between the two tanks, it is immediately detected.

As we said, there are provisions to remove material from tanks that do become weakened.

Dr. LIVERMAN. A decision was made about 4 years ago on the part of the AEC, because of the kind of situation that evolves over 30 years of storage, to go in and convert the waste to salt cake to get as much liquid out as possible. The feeling was that this is a far safer way to store it. Even if the tank corrodes, the liquid is gone, and it does not leave the immediate site.

That does not get around the question which is, as I understand it from reading the papers and testimony concerning West Valley, how do you deal with the sludge and, in order to get it redissolved, do you destroy the integrity of the tank? Part of that question will certainly be addressed in these documents, but whether there is a specific answer at that site without looking in more depth at the nature of the sludge is an open question.

Mr. BROWN. If you can reacidify the sludge, you can pump it out. But of course, in the process, if you liquify the tank you are not much better off.

Dr. LIVERMAN. That is the problem.

Dr. HEATH. I might add, Mr. Brown, that ERDA, in response to a request from the Nuclear Regulatory Commission, is providing technical support to the NRC in examination of the West Valley situation.

In response to a request from NRC, the Savannah River site people have been involved in aiding NRC in determining the adequacy of existing tanks, and we have also received a request from NRC to supply support in planning technical alternatives which could be considered.

Mr. BROWN. I would say the thrust of yesterday's testimony was that even though there may be no direct legislative authorization for ERDA, for the Federal Government to take a role in the West Valley

situation, that pure reason would demand that that be done, and, if there is lack of legislative authority, that it be created in the very near future.

Of course, that was the purpose for providing additional resources for your assistance in that situation, and if there is a gap in the legislative framework we would hope to correct that through the appropriate legislation.

I am sure you heard or are aware of the possibility expressed by one witness, that we might end up 100 years from now without even a nuclear industry, yet with the nuclear waste hazards that continue to exist, and with judgment-proof entities that originally were given the responsibility for managing that problem.

That kind of a situation requires, beyond a shadow of a doubt, a Federal role because it is the only agency which does have relative permanence. We cannot even be sure that the Federal Government will be here 100 years from now, but there has to be an acceptance of that responsibility on behalf of all the people in this country. It is a little worrisome to contemplate that possibility.

With regard to the situation of the tanks at Hanford, you mentioned that some of those liquids have been reduced to salts. Does that preclude the possibility of future glassification of those wastes?

Mr. RAMSEY. It should not preclude the possible further processing to a glass form although it will be more involved than processing acid-type waste.

I might mention that the first step in any of these programs to improve the storage of waste in tanks is to remove the material from the tanks for processing. That is part of the technology being developed, including for example, sludge pumping. That work is being done at Savannah River. They do have sludges at Savannah River.

Mr. BROWN. And they are doing the necessary R. & D.?

Mr. RAMSEY. They are developing the processes and techniques to pump sludge from the tanks at Savannah River.

There is a particular problem at NFS, in the tank design, which makes it difficult to use this kind of equipment. So further development has to be done to address the NFS situation in particular.

Mr. BROWN. It was also stated in previous testimony that the nature of the wastes at West Valley are such that they can no longer be glassified, yet NRC regulations require glassification as the permanent disposal method.

Mr. RAMSEY. It takes a special procedure, different from that used on acid wastes, to solidify these wastes. But a technology is being developed at Savannah River, for example, of converting the sludge to glass.

Mr. BROWN. So there is a program to solve the technical problems involved in glassification, whether the waste is acidic, neutral, sludge, salt cake, or whatever form it may be in.

Mr. RAMSEY. The salt cake may be a more serious problem because of its very large volumes and the large fractions of nonradioactive chemical constituents in the waste itself.

Also, the possibility exists of having to dry-mine salt cake from the tank.

Mr. BROWN. Of course, it is reassuring to know that R. & D. is being done on solving that particular technical problem. But the question arises as to the time schedule and the level of effort. We have a situa-

tion in West Valley where testimony indicated that it would be 5 to 7 years before the technology is in place to solve the waste problem there, and, in the meantime, they are under a requirement to use that technology, which is a kind of Catch-22 situation.

I know there are rational explanations for this, but I pose these questions to try to straighten out the various aspects that seem puzzling.

Dr. HEATH. I think one can characterize the situation by saying that there is R. & D. going on at Savannah River which is directly applicable, and that the schedule addressed in the defense waste document suggests that, if the decision is made to, indeed, turn Savannah River high-level waste into solid material for ultimate disposal, the design work on the solidification facility could begin as early as 1978. They believe, at Savannah River, that if that option is selected, they could be producing time final form of the waste in the mid–1980's.

In other words, they believe that the R. & D. is in sufficient shape that they would be able to proceed with design if that option were selected.

I believe, in defense of the NRC with regard to NFS, when the regulation which required the solidification of high-level waste was issued in 1970, the existence of NFS was recognized, and the regulation, the notice in the Federal Register, recognized that fact and said there would be future rulemakings on that specific issue, and so the NRC is addressing this as a separate issue.

I do not believe it is correct to characterize it as saying that they are necessarily being forced to do something. The NRC is addressing that issue and trying to find a particular solution to that particular problem.

Mr. BROWN. I would hope that would be the case.

The added emphasis given to this program as a result of the President's directive will, of course, be effective only if there is an adequate legislative framework and if adequate resources are provided. Is it too early to ask whether the prospects appear reasonable in these two areas?

You were told to come up with some answers to waste disposal problems. Are you going to be able to do it with the resources that you have and the existing legislative authorities?

Dr. LIVERMAN. If we put aside West Valley for a moment and the commercial area, I think that for ERDA's own facilities that there is certainly plenty of legislative authority for us to do what needs to be done.

The question of resources is always a balancing act. The Congress plays an important role in that. If they decide not to have it done, then it does not get done.

At this time, that whole matter is in a state of flux. As you know from the budget history and programs I showed you, we are going to clean up the backlog. I suspect that Mr. Canfield's estimates are in the right ballpark. We are talking about possibly $3 to $5 billion. What it takes in my view is a dedication to the objective that we are going to clean it up.

Mr. BROWN. Did you say $3 to $5 billion?

Dr. LIVERMAN. Yes; for ERDA's own facilities and the ones that will be coming on. I do not know whether it has come out in this hearing at all, and I do not think it has come out in our correspondence

with you, but about 9 months ago Dr. Seamans, who was Administrator of ERDA at that time, did issue a directive which made the following split in responsibilities—that my programs in Environment and Safety would be responsible for those not-now-belonging-to-anybody facilities, and we would seek the authorization and appropriation to handle that problem, but anybody in the program area with facilities that are to be excessed in the future would include in their budgets in the last 2 or 3 years of the lifetime of that facility the funding for the cleanup.

We are in the process now of trying to work out with the program divisions exactly how we estimate that and what the time frame is for wrapping it into the budget process. It still has to be done, but at least the intent and the directive to move in the direction of planning well in advance for decontamination is recognized as important.

Mr. BROWN. We had testimony from the two naval witnesses who just preceded you that they were unable to even evaluate the scope of the problem with regard to the radioactivity of the soil until they had removed the equipment, and that there were no soil radioactivity standards, forcing them, or at least leading them to adopt Russian standards.

Is that your understanding?

Dr. LIVERMAN. I do not know the Navy situation but, in general, the standards for cleanup are not as well backed up by scientific information and data as they need to be.

Perhaps you are aware that EPA has been charged by Congressman Wirth, because of the Colorado situation, to come up with soil standards. The difficulty with soil standards is that you cannot directly relate concentrations in soil to an acceptable condition that you know anything about.

For example, how much gets into the human body and what are the factors that get it there? How much gets into the environmental chain through uptake by plants? You do not have any basis for tying it down. It depends a lot on whether an area is wet or dry and the nature of the soil.

To come up with a soil standard is very difficult. It is much easier to come up with the required level to clean up a piece of equipment so you can deal with it. In both of these, it is a very difficult type of thing that requires more than arbitrariness which is mostly what we have in place now. There are some standards, but they are not based upon all the scientific facts that one needs to have.

Mr. BROWN. Are you familiar with the standards that were mentioned, the Russian standardss?

Dr. LIVERMAN. No; I am not.

Mr. BROWN. Have you looked at the soil problem in the Hanford situation where you had this leak? You probably have soil, as you indicated, within a 200-foot area that has been contaminated and which you keep under surveillance, but have you made any effort to identify the nature of the radioactivity *in situ*, and the prospects for further migration of that radioactivity into the water table, plants, animals, and so on?

Dr. LIVERMAN. We have made and continue to make those evaluations on the Hanford site.

We know pretty well what is there. Unfortunately, in retrospect, we did such things as to actually dispose of some wastes into the soil

and cribs, and what have you; we have stopped that activity now, but among the list of facilities are a number of cribs in which radioactivity is held in the soil. We will be working on defining the cleanup procedures and how we do it. The question is, Do we need to dig up that soil and do something with it like burial at another location?

We are monitoring the sites continuously for dispersion by any means—wind blowing, animal tracking. We found radioactive rabbit pellets for a while that came from rabbits licking leaking pipes. You find this kind of an anomaly, but we are much more on top of that situation now, and we are trying to keep tight control over where it is, how it is moving, how fast it is moving, where it is going, if anywhere, and, if necessary, moving in to stabilize it.

Mr. BROWN. Dr. Colglazier, do you have any questions?

Dr. COLGLAZIER. No; I do not.

Mr. BROWN. Mr. Spensley?

Mr. SPENSLEY. I have a couple of questions.

First of all, has your division or anyone at ERDA assessed the AIF study that was referred to earlier this afternoon?

Mr. RAMSEY. Yes, sir.

In fact, the paper that we are submitting for the record is an assessment of the results of that study by one of our staff, Mr. Glauberman.

Mr. SPENSLEY. OK.

Mr. RAMSEY. The paper is a collaborative summary of that study that was done by an ERDA representative and Mr. Manion, who is the author of the AIF study, in order to give it an international perspective.

Mr. SPENSLEY. In your testimony, Dr. Liverman, you indicated that it might be desirable to refocus some of the thrust of H.R. 6181 into the policy and financial implications of D. & D. relative to commercial nuclear facilities.

In light of that, Mr. Canfield's testimony of June 15, yesterday at the hearings, made a number of recommendations with regard to some of the issues that might hinge on the financial or policy implications.

Since I think it would be helpful for our records, perhaps with the permission of the chairman we could ask that you give us a point-by-point response to the recommendations in Mr. Canfield's testimony of yesterday and today as it applies to ERDA. That would be useful.

Dr. LIVERMAN. Fine.

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION,
Washington, D.C., August 31, 1977.

Hon. GEORGE BROWN, Jr.,
Chairman, Subcommittee on the Environment and the Atmosphere, Committee on Science and Technology, House of Representatives.

DEAR MR. CHAIRMAN: During the hearings before your Subcommittee on June 16, 1977, we asked for the opportunity to respond to earlier testimony by Mr. Monte Canfield, General Accounting Office, concerning the West Valley facility and cleaning up other nuclear facilities.

I am enclosing two statements: one prepared by the Division of Waste Management, Production, and Reprocessing pertaining to the June 15 testimony of Mr. Canfield on the West Valley facility; and a second prepared by my office concerning the general subject of decontamination and decommissioning of nuclear facilities.

We appreciate the opportunity to offer this information for the record and your courtesy in allowing us to do so.

Sincerely,

JAMES L. LIVERMAN,
Assistant Administrator, for Environment and Safety.

Enclosures.

STATEMENT BY THE DIVISION OF WASTE MANAGEMENT, PRODUCTION, AND REPROCESSING ON THE GAO TESTIMONY ON THE WEST VALLEY, NEW YORK, REPROCESSING PLANT PRESENTED JULY 15, 1977

As noted in the statement, it is very similar to GAO's presentation in March 1977 before the Ryan Subcommittee (Environment, Energy, and Natural Resources Subcommittee of the House Committee on Government Operations). Prior to its formal submission, we had reviewed the latter statement with GAO staff since we did not agree with several statements in it. However, we could not discern that our comments had been accommodated when the statement was provided to the Subcommittees. On these points, Dr. Cunningham, in his March 10 testimony before the Ryan Subcommittee, made the statement:

"Late in February, ERDA reviewed a draft GAO report on issues related to the closing of the NFS reprocessing plant at West Valley. On March 2, ERDA and GAO representatives discussed the draft report. Generally ERDA's comments were that ERDA had no objections to GAO's conclusions but ERDA did point out certain inaccuracies in the report concerning amount and nature of the base load fuel provided by AEC to NFS, and the fact that contrary to a statement in the draft report, many of the modifications originally proposed by NFS have been, or are on-site ready to be, installed. ERDA particularly expressed its disagreement to the speculation in the draft report that the plant could not be operated."

We would also like to comment on two points in Mr. Canfield's testimony presented to your Subcommittee.

1. Continued surveillance of the West Valley storage tanks has shown no sign of presenting an immediate or near term hazard to the public. At present, cooperative efforts between NFS, NRC, and ERDA are underway to develop and apply increasingly sophisticated analyses of the tank's condition to assure that they maintain their integrity to store the waste. Also, should some of the contents leak out, a vault surrounding each tank, with specifically designed devices and equipment to detect and handle leaks, is provided. NRC has concluded that the properties of the soil, impervious silty till, provide additional protection to the tanks and their surrounding vaults.

2. At present, ERDA's role at West Valley is providing technical assistance, as requested, to New York State and the Nuclear Regulatory Commission. Any increased role is dependent on pending developemnts in the U.S. Congress, N.Y. State, NRC, and possibly others such as EPA.

The initial phase will probably be a study by ERDA of possible options at West Valley as delineated in anticipated Congressional legislation. When an option is selected after review of the study, the ERDA role with respect to West Valley should become more clear.

STATEMENT BY THE ASSISTANT ADMINISTRATOR FOR ENVIRONMENT AND SAFETY ON GAO TESTIMONY OF JUNE 16 REGARDING THE DECONTAMINATION AND DECOMMISSIONING (D/D) OF ERDA EXCESS FACILITIES

The management of excess radioactively contaminated facilities in an active ERDA program which satisfies several objectives. These include removing radioactive sources insofar as practical, taking prudent measures to minimize the deterioration of structures that might lead to the spread of contamination, securing the facilities against inadvertent or willful intrusion, and planning the progressive decontamination and decommissioning actions consistent with objectives of minimizing potential hazards and rendering conditions acceptable for alternative use. The management consists of balancing resources and priority of need. In no case has this management jeopardized the safety of workers or the public nor has it interfered with the responsible use of sites or facilities.

As Mr. Canfield notes, every industry faces conditions where facilities are shut down, replaced, or become obsolete. The nuclear operations of ERDA, as well as the nuclear industry, have responded to unique requirements for shutdown of radioactive facilities by recognizing and developing processes and plans for D/D. A strategy consisting of responsible current management, careful evaluation of future imperatives for restoration, establishment of plans and procedures (including priorities and estimates of cost) and finally, implementation of the projects to meet end-use specifications is being carried out by ERDA at the present time.

We do not agree with the statements that imply inadequate knowledge, inadequate management or mismanagement on the part of ERDA towards its excess facilities. ERDA has decontaminated and decommissioned numerous facilities and buildings and in so doing has gained considerable experience in the operations involved and the costs of those operations. Some of this experience is not specifically associated with decommissioning of a plant. For instance, buidlings 776 and 777, which housed plutonium fabrication operations at the Rocky Flats Plant and which were badly contaminated during an industrial fire in 1969, now have been decontaminated and decommissioned to the point that they are suitable for new operational uses. The SM building at Mound Laboratory now has been partially decontaminated and is in a standby condition awaiting further disposal actions. A portion of building 2345Z at the Hanford Plant, which had contained an operational plutonium processing facility until 1967, now has been decontaminated and decommissioned, and a portion of the vacated space is being fitted out for use in connection with other radioactive materials processing. Building 231Z at the Hanford Plant, which had been used for research and light industrial operations in connection with plutonium fabrication, now is being cleaned to as low a level as practicable and ultimately it will be utilized as a clean laboratory for nonradioactive work.

Because of the experience accrued by ERDA in decontaminating and decommissioning these and other facilities. ERDA has a considerable capability for planning and accomplishing similar activities in the future.

Three questions posed by Mr. Canfield are worthy of discussion because his testimony implies that the lack of specific answers indicates poor management and alarming conditions.

1. How much will it cost to decommission nuclear facilities?

This of course depends on what is to be accomplished by decommissioning. We have developed methods for making estimates based on past experience to acquire an ability to estimate the cost of a given result on a given facility. However, all the estimates on all the facilities have not been totaled. It is acknowledged to be a large number and likely multibillion in magnitude, but the important question is how can the greatest benefit (or minimum risk) be acquired for the lowest cost. This requires an analysis of each project to be undertaken and many of the individual decisions on what constitutes acceptable risk or desired benefit have not yet been made. In most cases we believe it is useful to be able to alter or tailor the scope of decommissioning to allow several alternative end-use scenarios to be evaluated. Hence it is difficult to realistically bracket the cost without the preparation of individual cost estimates. We are working to define projects and estimate their costs at each ERDA site.

2. Who will pay these costs?

The tax revenues of the U.S. Government are the only source of funds to pay the costs of decommissioning excess ERDA facilities, so everyone pays. An uncertain aspect is how the costs will be paid—specifically who will be a party to the cash flow as the projects are undertaken. The simple philosophy of "user pays" has been instituted as ERDA policy for all projects and excess facilities since October 1976. However, many projects have no "user" any longer and no program to budget costs. Hence ERDA has assigned the function of D/D of excess facilities in past inventory to a programmatic division for this specific purpose—the Division of Environmental Control Technology. This is the organization that currently budgets funds, manages activities of R&D and excess facility surveillance and maintenance, and plans and executes D/D projects as needed.

3. How many facilities need or will need to be decommissioned?

All of the contaminated facilities that are excess to current use now need some kind of decommissioning attention, and all those currently in use or to be built in the future that become contaminated will require such attention in the future. D/D is a part of the life history of every technical facility of the nuclear program and must be taken into account from its origin. We can provide numbers and lists and can give assurance that these are accurate as of the time they are generated.

Mr. SPENSLEY. Lastly, in light of Dr. Seamans' directive which you alluded to earlier, I would like to ask Dr. Heath if you could tell me what are some of the specific environmental aspects that you are looking at in terms of eventually decommissioning the excess facilities within the jurisdiction of the nuclear program?

Dr. HEATH. Mr. Spensley, I will have to beg off that question for the moment and agree to supply that material for the record.

Mr. SPENSLEY. OK, and with that material could you provide whatever dollar-amount commitments are being made for this fiscal year and the next fiscal year? That would be helpful as well.

Lastly, with regard to that request, please inform us of any kind of arrangements which the nuclear program has made with Dr. Liverman's program in terms of cooperation and assessment of those environmental impacts. That would also be helpful.

ADDITIONAL INFORMATION ON DECONTAMINATION AND DECOMMISSIONING (D/D) FOR THE RECORD OF THE SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE

An Action Memorandum dated October 1, 1976, describes the assignment of responsibilities for decontamination and decommissioning (D/D) of current and future surplus radioactively contaminated ERDA facilities. According to this memorandum, the Assistant Administrator for Environment and Safety (AES) will manage the D/D program for the current backlog of surplus facilities including development of criteria, cost estimates, schedules and budgets. The D/D program for those facilities declared surplus after October 1, 1976, will be managed by the responsible program assistant administrator.

The total number of radioactively contaminated ERDA facilities associated with the nuclear energy program, both excess and currently in use, its about 1,000. Of these, approximately 300 had been declared surplus as of October 1, 1976. The AES is in the process of conducting an updated inventory of all radioactively contaminated facilities, both excess and in use, which are currently owned or controlled by ERDA. A base list is scheduled to be available by December 1, 1977.

The present program for management of surplus contaminated facilities provides for surveillance and maintenance to assure that surplus facilities remain in an environmentally safe condition, development of plans for the orderly reduction of the inventory of surplus facilities, development of new and improved disposition methods, and the disposition of selected facilities. Projects currently underway include the salvage of fuels from the nuclear rocket program at the Nevada Test Site, and D/D of the Space Nuclear Auxiliary Power Reactor and the Sodium Reactor Experiment at Santa Susana, California. The budgets for this program for fiscal year 1977 and fiscal year 1978 are $6.4 million and $13.4 million, respectively.

Essentially, all of the AES program can be considered to be environmentally related since it is designed for the orderly disposition of potential environmental hazards. Many of the techniques developed and much of the experience gained under this program will be applicable to the D/D of nuclear facilities that are declared excess in the future.

Mr. BROWN. I have just glanced at your schedule for the defense high-level waste disposition, and if anyone thought that we did not engage in long-range planning in the Government, why, they were mistaken.

It is a little disturbing, in view of the fact that the permanent disposition of high-level radioactive waste is a major, controversial item, to note that this chart shows that it will be approximately 10 years before we actually get to the point of disposing of the wastes from the Savannah River, and that it will be even longer than that before we begin to dispose of the wastes at Richland and Hanford.

Is there any possibility of reanalysis of the priorities on this so that we could telescope the schedule a little bit?

Dr. LIVERMAN. Let me make one comment, and then I think Dr. Heath probably should comment.

I suspect that the time frame is related to how long it takes to get a facility in place and once you have decided how you are going to deal with it, and where you are going to take it. We are actively in the

process now of addressing the commercial issue, and obviously with the President's change in the program addressing the question of reprocessing, we have the new question of how do you handle, store, or dispose of the spent fuel elements. I suspect that that is part of the reason behind this long deferral.

Dr. HEATH. I think that is definitely true with regard to the first point that you made, sir, which is that it will be 10 years before we are actually putting into final disposal the material from Savannah River.

If the option is chosen to go to geologic disposal, as I am sure you are aware, the commercial program calls for an operating repository by 1985, and you previously asked about evaluating that and what some of the restrictions are. I think it has to be admitted that that is a difficult job in terms of all of the people you have to convince that it is a good idea to site in a particular location.

I think it would be unrealistic to claim that that is not a problem which we have to keep everybody aware of.

In terms of the various things that are required of us to make a major Federal decision, and to acquire the funding, and to do a capital project, I believe that 1985 is the earliest possible date within the existing framework, and so if the Savannah River people are projecting, as you point out, 10 years from now, I think that is realistic.

Mr. BROWN. It may be realistic in light of existing constraints, but what I am seeking to understand is whether a change in the constraints can take place, or whether something else can be done to speed up that process.

Has there been some general type of cost estimates made on this process, so that there is an even reasonable guess as to what is involved from the standpoint of budgetary resources?

Dr. HEATH. Yes, sir.

The Defense waste documents do make an attempt at that, although they say in the foreword that no claim is made that these are budgetary quality numbers, but they do show some figures for purposes of comparison, cost comparisons, of various ways of handling the wastes.

With regard to the cost of a geologic repository, in the civilian program at the present time we have conceptual designs under way by two separate architect/engineers, and, as you know, one needs to go to that level of detail to get a reasonable cost. We hope to have cost estimates based on this architect/engineer work by this fall, by about October. We hope at that time that we will be in a much better position to put a number on the cost of the repository which we would have some confidence in.

Mr. SPENSLEY. Are those site-specific estimates?

Dr. HEATH. No; these are general, conceptual designs for the purpose of obtaining the quality of the estimate that we are at right now; you do not need to get site-specific.

Mr. BROWN. I appreciate very much your testimony. It has helped me to understand the problem quite a bit more.

I hope that we can bring some of these problems into focus in the reasonably near future from the standpoint of the Congress, and hopefully it will aid in the solution of some of them.

Mr. Wirth, would you care to address any further questions?

Mr. WIRTH. Thank you very much. By chance, I do have a couple of questions.

I am sorry not to have been here earlier, Dr. Liverman, but we are also in the throes of a variety of other things like natural gas. I do not know if you have commented on this before, but, if not, could you tell us what you think of the GAO recommendation about the NRC and its relationship to ERDA?

Dr. LIVERMAN. Do you mean as to the whole study?

Mr. WIRTH. The decommissioning activities, giving NRC the authority to approve and monitor decommissioning——

Dr. LIVERMAN. Our agency has not yet established any position on that.

I think I would be stepping a little far out to profess an agency position right now. I would like to answer that for the record. In fact, one of the requests that was posed was to respond to Mr. Canfield's comments of yesterday and today in writing, point by point.

Mr. WIRTH. In particular, I think the point is made in the GAO report that ERDA really lacks the necessary information to plan the task of decommissioning or decontamination of obsolete facilities.

Dr. LIVERMAN. I would guess on that point, if we lack it then I think the world lacks it. I think if anybody has the information that is necessary to work that porblem, that it has to be ERDA.

Mr. WIRTH. That begs the issue; does it not? I mean, we should do everything we can to collect the information. If we do not have it, we should go out there and get it.

Dr. LIVERMAN. Yes; we are in the process of doing that now.

We have in place R. & D. programs, perhaps not as aggressive as they might be, but we have had in place R. & D. programs and through actual experience, as I outlined in some of my testimony, we are documenting all of the activities that we carry out and are trying to pull together that which the Soviets and other people are doing, to bring together the world's information on decommissioning and decontamination.

Mr. WIRTH. In your testimony, you pointed out that ERDA, starting in 1972, identified all contaminated buildings and sites at AEC facilities; is that right?

Dr. LIVERMAN. Yes, sir.

Mr. WIRTH. Does that include Rocky Flats?

Dr. LIVERMAN. Yes, sir.

Mr. WIRTH. OK.

Now, if that is the case, why did ERDA just start at Rocky Flats to look for other places where radioactive materials had been illegally buried, if in fact this survey is supposed to have started in 1972? It is my understanding that at Rocky Flats—which as you know is in the district that I represent—ERDA has just begun the task of trying to figure out where further materials were buried, not just in the so-called path, but outside of the path.

Mr. RAMSEY. The surveys that we have done, of course, have been guided by some definition of the structures or buildings, or designations of that types that are catalogued to identify the facility, and it may be that some were not so designated.

Mr. WIRTH. What other things would not have been catalogued that contain radioactive material? That is the logical next question, is it not?

You know, by the definition of what you were doing in 1972, some things were not covered, and some of those were burial sites at Rocky

Flats. Now, what other kinds of sites are around the country that you do not know about or that are contaminated and are not being pursued by ERDA?

Dr. LIVERMAN. You mean did that list include, for instance, all the burial grounds?

Mr. WIRTH. Do you see where you are going with that statement?

Mr. RAMSEY. I do not think that it includes all of the burial grounds It was buildings and structures that were initially assessed.

The most recent assessment does, however, include cribs, ditches, ponds, and other locations where there is contamination and those are identified as facilities now. There has been a redefinition of what a facility is from the standpoint of project planning.

Mr. WIRTH. And would that definition include burial sites?

Mr. RAMSEY. Yes, sir.

Dr. LIVERMAN. Let me comment on that also.

Beginning about 4 years ago, when I entered the picture, it appeared to me to be like an elephant walking slowly through the forest because every week there was another hot spot that somebody had discovered somewhere.

Mr. WIRTH. I feel that way about Rocky Flats.

Dr. LIVERMAN. Yes. I feel no differently from you. I was able to persuade the Commission at that point in time that we needed to use our ARMS program, which is the airplane that flies over and maps radioactivity in the areas, to survey every site that we had, including its environs. We did those surveys and, as a result, picked up an enormous number of little spots here and there on the sites that were not known, and some, in fact, off the sites. The Savannah River area had some off the site. We picked up one or two spots in Rocky Flats. But that by no means indicates that we will pick up all such occurrences because the level of radiation may not be detectable—you cannot pick up tritium by that means.

We attempted at that time to begin exactly that kind of task—to reconstruct the history to see if we can find out where we are.

We are trying, as rapidly as funds and other resources become available, to actually mark out on every site every contaminated spot, whatever reason there may be for its being there—where is it, what is there, what is its danger of movement, how much is there, and those kinds of questions.

I do not think we have any particular time frame for completing that, but we are attempting to document as thoroughly as we can these clandestinely buried materials, or whatever they may be, because that is history and we want to bring us up to date.

Mr. WIRTH. I appreciate what you are saying; it has to with history, and I am very sympathetic to that. It is a very difficult job.

I am particularly sympathetic to an outfit like Rockwell coming in after Dow Chemical, and being a very different kind of contractor, in a difficult situation, but I would not like us, however, to be here 5 years from now or 10 years from now, and have you be here with my successor who was able to say everything was just fine in Rocky Flats, and so on, and be in a situation where we did not know in 1977 where things were buried and taken care of.

Are you absolutely convinced that you know at this point that we do not have any clandestine burial at sites like Rocky Flats or Savannah River, going on in 1977?

Dr. LIVERMAN. I cannot give you that assurance.

The studies underway have not been completed, obviously.

Mr. BROWN. He is referring to current burial practices.

Dr. LIVERMAN. Oh, from now forward, if there is any way I can bring force to bear, there will not be such things happening again.

Mr. WIRTH. Are you 100 percent convinced that that cannot happen?

Dr. LIVERMAN. I am never 100 percent convinced of anything.

Mr. WIRTH. Are you bumping up against that point of absolute certainty?

Dr. LIVERMAN. Within reasonable limits, reasonable human endeavor limits, I would say that we should never again have any more of that kind of thing happening.

Mr. WIRTH. Do you have specific procedures at ERDA now to assure that that does not happen? I mean, this is an issue that we discussed at Rocky Flats a great deal, as to whether you can account for the material. Realizing some of the problems at Rocky Flats and some of the problems of accounting for all of this material—I understand that—I felt after we had gone through that exercise at Rocky Flats with the help of GAO, that we were bumping up against that point of certainty, that as close as one could technically and physically do the job we were accounting for the material at Rocky Flats from 1976, on; I think it was the spring of 1976.

Now, that got an awful lot of attention from GAO, and from your friendly local congressman, and so on. There are a lot of other facilities around the country that have not gotten that kind of attention.

Dr. LIVERMAN. We have tried to bring such attention to bear in each of the other facilities; however, I would question whether it has had the aggressive pursuit that has come about at Rocky Flats because of your personal interest, as that always does get a lot of attention.

Mr. WIRTH. The point is, let's do it procedurally and institutionally. Can we build that goal in administratively so that that kind of pursuit and that kind of care occurs at all of the other facilities?

Dr. LIVERMAN. The best answer I can give is that we are pushing very hard; I am writing action memos constantly, to try to force into being precisely the kind of thing you are talking about.

Mr. WIRTH. I want to underline that. I am sure that the members of the subcommittee would agree with that, that we want to be absolutely sure as we possibly can be that we know where the material is.

Dr. LIVERMAN. I think the action of this committee on the authorization bill will make that problem move a lot faster. I was happy to see that the Appropriations Committee went along with your recommendations of the additional funding for precisely the kind of thing you are talking about.

Mr. BROWN. I am sure that you will regard this as sympathetic pressure because it is in the long-range best interests of the whole nuclear program.

Mr. WIRTH. I would underline that, Mr. Chairman, completely. We have worked together in a very sympathetic way, despite the fact that we often get into adversary discussions. I think we have come a long, long way in the last 2½ years.

I have one more question. What happens at the end of Rocky Flats? We have talked about what happens at the end of a project in Connecticut; you know, how do you decommission that? Do you mothball it?

Dr. LIVERMAN. I do not know what the answer is.

Mr. WIRTH. "Entomb" is the term. Are we going to mothball Rocky Flats, or are we going to entomb Rocky Flats, or are we going to disassemble it?

Dr. LIVERMAN. I cannot answer the question specifically about Rocky Flats. It seems to me there are two kinds of facilities.

I may be hanged for bringing up this particular case, but the Hanford site has an enormous amount of wastes on it. My guess on that particular site is that it is going to be a partially restricted use site for as long as man is around.

The question of Rocky Flats, I suppose, is an open question. If the contamination levels are such that they constitute a hazard, because there are things that we are not aware of that cannot be cleaned up and moved away somewhere else, or something else done with them, then obviously that will be one that will be entombed.

So, I think you will have those that can be cleaned up, but I suspect that there will be major Federal facilities like the Nevada test site that are going to be dedicated as monuments to humanity and restricted for a long, long time.

I do not see much else.

Mr. WIRTH. The Nevada test site fits that definition. The Hanford site fits that definition.

Dr. LIVERMAN. Pretty much.

Mr. WIRTH. What else fits that definition?

Dr. LIVERMAN. I really do not know offhand—none come immediately to mind.

Mr. WIRTH. Are we adding to the number of facilities that might fit into the category?

Dr. LIVERMAN. Hopefully not.

We are trying to restrict it to the current facilities, and are in fact withdrawing from some like the Mound Laboratory—all of the plutonium and weapons-related activities involved at that site. We are trying to prevent the further spread, even in my own programs where we are working with very low levels of radioactive materials, of the kind that stay around a relatively long time. We are trying to restrict to the currently existing experimental sites and facilities the use of those kinds of materials and say, no, we will not approve that program because it moves this material into another area. We are trying to restrict the spread.

Mr. WIRTH. Do you have an analytic group working for you that looks at this kind of an issue, that makes sure we are not getting into the kind of situation where we are contaminating an area?

Dr. LIVERMAN. I guess across the whole agency, the answer would have to be no, but in my own programs that I fund out of my budgets, we do make that judgment.

That is a good point. I think it is worth pursuing.

Mr. WIRTH. How can that be pursued to make sure that it is happening across the whole agency?

Dr. LIVERMAN. In my overview responsibility and the compliance responsibility in the agency, it is a question that certainly can be addressed, but I question whether it has been addressed in exactly the framework in which you are placing it.

Mr. WIRTH. Should we leave the record open, Mr. Chairman, so that Dr. Liverman and Mr. Fri might respond to the committee about what they are doing to assure that across the whole agency they are

looking very carefully at every site currently being used, and those projected to be used, so that we do not get into a situation like Hanford or the Nevada Test Site?

Mr. BROWN. The record will be open for that purpose.

Mr. WIRTH. The committee will look forward to receiving that.

Thank you very much, Dr. Liverman.

Dr. LIVERMAN. You realize that we are going to create geologic disposal sites that will become monuments too.

Mr. WIRTH. I realize that, but none of those will be in Colorado so it is all right with me. [Laughter.]

This is in response to the Subcommittee's request for additional information about what ERDA is doing to assure that throughout the agency we are looking very carefully at existing and proposed sites to avoid repetition of our past experiences and prevent future adverse impacts.

One important tool for doing this is by following the requirements of the National Environmental Policy Act (NEPA).

About four years ago, ERDA's predecessor, the Atomic Energy Commission, initiated a program aimed specifically at assessing the environmental impact on the ongoing operations at all the major laboratory and production sites. This program was to assure compliance with NEPA and its implementing guidelines issued by the Council on Environmental Quality (CEQ) on August 1, 1973. NEPA requires that major Federal actions significantly affecting the quality of the human environment must have a detailed environmental impact statement prepared and issued for public review and comment. The CEQ guidelines mandate that such actions not only include new projects and programs included in legislative proposals to the Congress for funding, but continuing and new activities in the same geographic area in order to determine the cumulative effects of the activities.

ERDA's implementing regulations (10 CFR 711) permit the preparation of environmental impact assessments to determine the significance of environmental impacts in order to permit a decision as to the need for an environmental impact statement. To date, assessment and/or statements have been prepared to cover either the environmentally significant operations or the total site operations at the major ERDA sites. These documents serve as baseline environmental input into decisions regarding operations at the sites.

New sites that come under the jurisdiction of ERDA are also assessed and appropriate NEPA documentation prepared to cover the operations. These include pilot or demonstration plants used in the development of new energy technologies.

We feel that such a program of assessing environmental impacts in advance can go a long way toward preventing adverse environmental impacts.

Environmental monitoring

ERDA is directed to carry out effluent and environmental monitoring and reporting through a management directive (ERDAM 0513). The responsibilities for carrying out and assuring that the activities are carried out are vested in the Division of Operational and Environmental Safety and heads of program divisions and managers of operations offices. The management directive includes the official policy and objectives, and assigns responsibilities, authorities, and basic requirements.

It requires preoperational surveys in advance of start-up of new facilities and new operations at existing facilities. More detailed guidelines for environmental monitoring are contained in ERDA 77-24, "A Guide for Environmental Radiological Surveillance at ERDA Installations."

The monitoring program covers new and existing sites and applies to both radioactive and nonradioactive pollutants. There is included a requirement for reporting potential doses to the general public. Another portion of the management directive includes guidelines for monitoring; e.g., monitoring location, type, and frequency of sampling, record-keeping, and reporting of monitoring data.

In addition to the activites of ERDA in this area, the Environmental Protection Agency has the rsponsibility to monitor the environment, including air and water quality in the environs of ERDA facilities. In some cases, State and local entities also have monitoring programs.

[The prepared statement of Dr. Liverman follows:]

STATEMENT OF DR. JAMES L. LIVERMAN

Mr. Chairman and Members of the Committee, I am pleased to participate in the Subcommittee Hearings regarding decontamination, decommissioning, and disposal of nuclear facilities. I wish to summarize the ERDA objectives, experiences, and plans for the management of ERDA excess radioactively contaminated facilities and the management of radioactive wastes from nuclear defense and commercial nuclear power programs.

ERDA, as successor to the AEC, owns the sites and facilities that have been constructed over the past 34 years for the production, development, and utilization of nuclear defense, and various nuclear power demonstration facilities. As with any fast moving technology, the nuclear program has rapidly developed new processes and divergent applications that have rendered many of the facilities obsolete and therefore excess to the ongoing programs. Unique to nuclear operation is the necessity to isolate the radioactive materials associated with these facilities.

MANAGEMENT OF ERDA SURPLUS RADIOACTIVELY CONTAMINATED FACILITIES

The overall objectives of the management of ERDA surplus contaminated facilities are: (1) to reduce potential risks from the various facilities currently regarded as excess to ERDA operations and those that may be added in the future; (2) to plan the disposition of such facilities so as to allow the release of land for unrestricted use whenever possible; (3) by the decontamination procedures, to minimize the potential for environmental contamination and the need for perpetual surveillance and maintenance; and (4) to document the experience in the ERDA program so as to assist and guide the future construction of commercial nuclear power facilities so that they ultimately can be disposed of in a safe and environmentally acceptable manner.

Inventory of contaminated buildings and facilities

Each of ERDA's operating sites maintains an inventory of facilities, including building identifications, coordinate locations of facilities, construction drawings and modifications, and records of the type of radioactive contamination.

In 1972, we launched, through our Field Operations Offices, a broad program to develop Radioactive Waste Management Site Plans, including data on the status of contaminated buildings and facilities for each AEC site. The Waste Management Site Plans and the status of contaminated buildings and facilities, including planned decontaminated and decommissioning, is updated annually and submitted to Headquarters for consideration in integrated planning and budget preparation. In 1973, a survey was made of all ERDA owned and operated contaminated buildings. The survey lists some 941 buildings of which 130 were excess of ERDA (AEC) programs at that time, with an additional 69 buildings identified to be excessed within the next 5 years. This survey has been used as a basis to begin the development of an ERDA-wide decontamination and decommissioning (D. & D.) plan.

In June 1976, the Field Operations Offices were requested to update the listing of excess contaminated buildings and facilities, including cribs, ponds, pits, and ditches. This listing included some 320 excess buildings and facilities with an additional 116 expected to be excessed within the next 5 years. The majority of these facilities are located on the Hanford Reservation (272 currently excessed with 67 expected to be excessed within 5 years).

Surveillance

In the near term, we must provide surveillance and maintain the existing facilities in a safe condition as well as prepare for surveillance of facilities expected to be excessed in the future. Such operations are currently being provided for surplus facilities at Idaho National Engineering Laboratory (INEL), Hanford, Oak Ridge National Laboratory (ORNL), Argonne National Laboratory (ANL), Savannah River, and facilities at other ERDA sites. Surveillance and maintenance of these facilities will be continued indefinitely or until they have been decontaminated to safe levels or disposed.

Planning for disposition of contaminated facilities

Major planning studies were initiated in fiscal year 1975 at Hanford, INEL, and ORNL. At Hanford, because of the large number and variety of excess facil-

ities, a computer-assisted decision method is being developed to organize facilities listings and group them into projects, select possible disposal modes, decontamination procedures, estimated costs, timing requirements, and establish priorities. The methods developed from these planning studies will be useful in establishing total ERDA priorities and budgets for future disposition actions at all sites.

The D. & D. study at Hanford is scheduled to be completed by the end of fiscal year 1977. It has the potential to be expanded to include the development of D. & D. planning on an ERDA-wide basis.

Disposition R. & D.

Research and development efforts stress methods for decontamination of equipment and buildings, volume reduction of large process equipment that must be disposed of as waste, and the economical means for recovery of metals.

For example, methods of dismantling and cutting up of large equipment items have been developed and demonstrated. In addition, nonradioactive demonstration of volume reduction by melting of a variety of metals is proceeding. These data will be evaluated for design of a facility for radioactive material. Also other efforts will lead to the preliminary design of a portable smelter for decontamination and recovery of metals contaminated with uranium, a decommissioning handbook, and the development of design criteria for nuclear plants in order to facilitate eventual decommissioning.

The R. & D. knowledge, as well as the experience gained from the decontamination and decommissioning of the nuclear power demonstration reactors such as Hallam, Piqua, Elk River, and Sodium Reactor Experiment, will provide guidance to the construction and eventual decontamination and decommissioning of commercial nuclear power plants.

D. & D. activities

Three methods for decontamination and decommissioning are in use. These are as follows:

1. *Mothballing.*—consisting of removing all fuel and selected components and placing the facility in protective storage. This necessitates establishing adequate radiation monitoring, environmental surveillance, and appropriate security procedures to ensure public health and safety.

2. *Entombment.*—consisting of removing all fuel and selected components, followed by the sealing of the remaining major radioactive and contaminated components within the shielding structure. An appropriate and continuing surveillance program is required to assure public health and safety.

3. *Removal/dismantling.*—consisting of removing from the site all fuel and components having radioactivities above predetermined acceptable levels. The facility or site could then be released for unrestricted use.

Combinations or sequential application of these are also possible, such as mothballing or entombment followed by removal/dismantlement after significant radioactive decay time (50–100 years). This has the advantage of reducing the radioactive inventory and the radiation exposure risk to the workers at the time of dismantlement.

ERDA's D. & D. efforts include experience in each of these areas. For example, a number of power testing reactors at ERDA sites are currently mothballed and under surveillance, such as the Heavy Water Components Test Reactor (HWCTR) at Savannah River, the Plutonium Recycle Test Reactor (PRTR) at Hanford Reservation, and the Experimental Boiling Water Reactor (EBWR) at Argonne National Laboratory.

Methods of entombment have been applied to the power demonstration reactors at Hallum, Nebraska, Piqua, Ohio, and the BONUS reactor in Puerto Rico.

The Elk River reactor in Minnesota has recently been completely dismantled and all radioactive materials shipped offsite. The site is now in unrestricted use. The disposition of waste from this reactor has been sent to licensed commercial burial grounds or to ERDA operating sites.

Each of these D. & D. projects has been documented and made available to the commercial nuclear industry to assist them in planning or conducting such operations on their licensed facilities.

REMEDIAL ACTION OF GRAND JURY AND FORMER AEC CONTRACTOR SITES

We are continuing to provide remedial action for those facilities in the Grand Junction, Colorado, area where uranium mill tailings were used extensively in construction, including houses, schools, and commercial buildings. Remedial action has been completed on about 250 of a total of 500–600 locations that are expected to qualify for remedial action. However, this is contingent on Congressional approval of changes in Public Law 92–314 and the $3 million requested in the fiscal year 1977 authorization bill to continue the work. When this effort is completed, probably in fiscal year 1980, the Federal Government will have funded about $8 million or 75 percent of the total cost.

We are also conducting engineering surveys on 22 inactive uranium mill tailings sites. Five surveys have been published and the remainder will be completed in the next few months. On the basis of this information, we plan to present recommendations for remedial action at the sites to the Congress in the near future.

A number of facilities and sites previously owned or used by the Manhattan Engineering District and the AEC were declared excess, decontaminated, and released for unrestricted use. In 1974, as a result of continuous rediscovery of sources of contamination, AEC undertook a survey of the radiological records on all facilities and sites previously declared excess and which had been released for general use. This survey yielded information on some 140 sites. In some cases, the existing radiological data were insufficient or lacking to confirm the radiological condition of the sites and to give assurance that health and safety problems do not exist. A number of these properties are being resurveyed in fiscal year 1977 to determine if further decontamination efforts will be required under today's more stringent requirements. Based on preliminary evaluations, additional cleanup will probably be required at some of these released sites, funds for which have been requested in ERDA's fiscal year 1978 budget.

MANAGEMENT OF COMMERCIALLY LICENSED RADIOACTIVELY CONTAMINATED FACILITIES

Under the Energy Reorganization Act of 1974, which established the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA), Congress charged NRC, through the licensing process, to assess the environmental, health, and safety aspects of commercial nuclear facilities, to establish guides and standards for decontamination and decommissioning of licensed facilities, and to assess the financial capability of the licensee to meet the licensed obligations.

The NRC Regulatory guides describe methods and procedures currently considered acceptable by the NRC for decommissioning alternatives of commercial licensed facilities. The guide includes the three methods mentioned earlier—namely, mothballing, in-place entombment and removal of radioactive components, and dismantling.

NRC regulations applicable to D. & D. provide rules by which a licensee may apply to NRC for authorization to dismantle a nuclear facility and terminate its license upon satisfactory completion of dismantlement. As noted before, the technology of D. & D. and all aspects of the experience gained in ERDA programs are documented for use in the programs of commercial nuclear power.

DEFENSE WASTE MANAGEMENT

ERDA must also manage the accumulated waste inventory from the weapons production and research programs conducted on its sites. Major inventories of high level waste are stored at the Hanford Plant in Washington, Savannah River Plant in South Carolina, and the Idaho Chemical Processing Plant in Idaho. The volume of the current waste inventory is shown in Figure 1. A program to reduce the volume of liquid in storage is underway and plans are being developed at each of the sites to adopt methods for final disposition of the waste.

FIGURE 1

CURRENT INVENTORY

HIGH-LEVEL RADIOACTIVE DEFENSE WASTE
(MILLIONS OF GALLONS)

SITE	JANUARY 1, 1977 LIQUID	SOLID	TOTAL
IDAHO	2.3	0.4	2.7
RICHLAND	20.7	29.6	50.3
SAVANNAH RIVER	11.9	9.0	20.9
	34.9	39.0	73.9

FIGURE 1

The emphasis of current activities involves the selection of viable alternatives for long-term management. The options being considered for the waste forms and storage modes for the long-term disposition of defense waste at each of the ERDA production sites will be described in detail in forthcoming Defense Waste Documents (DWD's) produced by each of the field operations offices. These DWD's will assess the relative costs, risks, and uncertainties of the various alternatives for the disposal of high-level waste.

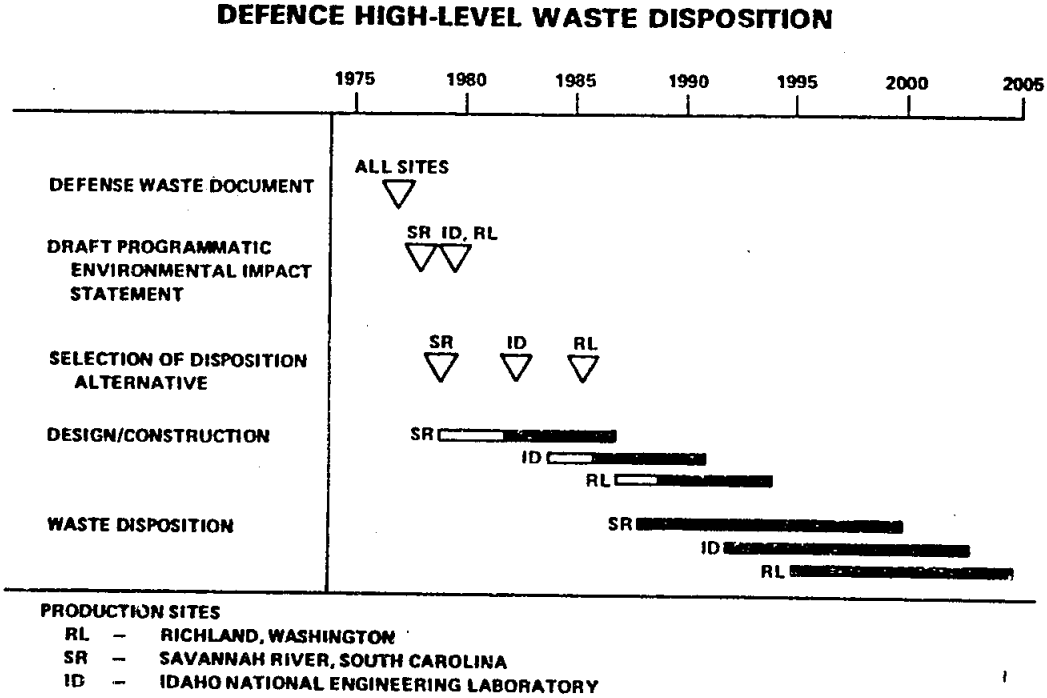


FIGURE 2

Key milestones for ERDA's long-term high-level waste management program (from fuel reprocessing plants) are shown in Figure 2.

Pending ultimate disposition, these wastes are held under surveillance at the operating sites to assure that the materials do not pose a hazardous condition to the public or onsite workers.

these operations has application to the commercial nuclear industry.

For example, the development of incinerators for the volume reduction and passivation of contaminated combustible materials provides technology and experience that will be directly applicable to the waste management of fuel recycle operations in the commercial nuclear industry.

Low-level defense waste

Low-level defense waste also arises from ERDA's nuclear materials production, utilization, and R. & D. activities. Typical solid low-evel wastes are discarded equipment and contaminated trash such as paper, rags, glasswares, and protective clothing. Solid wastes are buried in specifically constructed trenches except for wastes contaminated by plutonium and other transuranic (TRU) wastes which since 1970 have been packaged separately and stored in a retrievable manner.

Commercial-waste management

The objective of ERDA's commercial waste management program is to provide the facilities and waste processing technologies (consistent with environmental, health, and safety requirements) to meet Federal responsibilities for long-term management of high-level radioactive wastes from the nuclear fuel cycle of commercial nuclear power reactors in use and those that may be introduced in the future.

Recently President Carter announced basic changes in the Nation's nuclear policy which have significant impact on the commercial waste management program. The Presidential policy proposed indefinite deferral of commercial reprocessing and recycling of plutonium produced in nuclear power reactors. As a result, no commercial high-level radioactive waste identified for ERDA custoday and disposal is expected for an extended period. Accordingly, it is proposed that ERDA research and development has been redirected to alternative nuclear fuel cycles which minimize the risks associated with nuclear weapons proliferation. In addition, in the National Energy Plan, the President has directed his assistant, Dr. Schlesinger, to review the entire ERDA waste management program.

Summary

In summary, the legacy from the development of the nuclear arsenal and the development of nuclear power provides a challenging and complex problem for the management of the radioactivity in the waste materials and contaminated buildings and facilities.

The variety and complexity of contaminated buildings and facilities and the large inventory of wastes requires new techniques of management and unique commitments of resources and capabilities. The programs to face this challenge must be carefully designed to produce the desired result with efficiency and economy but also with the appropriate recognition of its priority relative to other undertakings.

Long-range planning for management of ERDA excess radioactively contaminated facilities is nearing completion. As an example, because of the complexity and variety of ERDA's excess facilities, at Hanford, a computer-based tabulation of facilities, conditions, options, costs, and priorities is expected to be completed this fiscal year. This system has the potential to be used in establishing overall ERDA priorities for future disposal actions. Thus, it is felt relative to ERDA the studies called for in H.R. 6181 can be met through the ongoing and planned activities. In this regard, ERDA will be happy to work closely with the Congress to ensure that their desires are accommodated. It may be desirable, however, to refocus the thrust of H.R. 6181 to address the policy and financial implications of D. & D. relative to the commercial nuclear sector.

Mr. Chairman, this concludes my statement. Thank you for this opportunity, and I will be happy to respond to any questions you may have.

Mr. BROWN. Gentleman, we appreciate the time you have spent with us this morning, and, again, I want to thank you for your contribution.

The hearing will be adjourned.

[Whereupon, the hearing was adjourned at 1 p.m.]

APPENDIX I

ADDITIONAL STATEMENTS FOR THE RECORD

STATE OF NEW YORK,
DEPARTMENT OF LAW,
New York, N.Y., June 23, 1977.

Hon. GEORGE BROWN,
Chairman, Subcommittee on the Environment and the Atmosphere of the House Committee on Science and Technology, Washington, D.C.

DEAR MR. CHAIRMAN: I submit the enclosed as my statement for the record of the Subcommittee's hearings on the need for Decontamination and Decommissioning of the Nuclear Fuel Services reprocessing plant in West Valley, New York. I previously submitted this testimony to the Nuclear Regulatory Commission's GESMO Hearing Board which is assigned the task of conducting the proceedings on the question of whether or not the Nation should allow the licensing of plutonium recycle and nuclear fuel reprocessing.

I now submit it to you because its topic, the financial and public safety impacts of decontamination and decommissioning of nuclear facilities, is the focus of the Subcommittee's hearings. The Attorney General applauds your efforts to help resolve the difficult problems nuclear fuel reprocessing has presented to the State of New York.

Sincerely yours,

PETER N. SKINNER, P.E.,
Environmental Engineer.
(For Louis J. Lefkowitz,
Attorney General).

Enclosure.

State of New York
Witness P. Skinner
March 4, 1977

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE GESMO HEARING BOARD

---X

IN THE MATTER :

OF : Docket No. RM-50-5

GENERIC ENVIRONMENTAL STATEMENT ON MIXED OXIDE FUEL (GESMO) :

:

---X

TESTIMONY OF PETER N. SKINNER P.E.

ON BEHALF OF

THE STATE OF NEW YORK

State of New York
Witness P. Skinner

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE GESMO HEARING BOARD

---X

IN THE MATTER :

OF : Docket No. RM-50-5

GENERIC ENVIRONMENTAL STATEMENT ON MIXED OXIDE FUEL (GESMO) :

---X

TESTIMONY OF PETER N. SKINNER P.E.

ON BEHALF OF

THE STATE OF NEW YORK

My name is Peter N. Skinner. I maintain offices at the Department of Law, State of New York, Two World Trade Center, New York, New York, 10047.

I prepared this testimony and will be available for questioning concerning it. The following people assisted me. They also provided the interface between our office and the State's expert witnesses:

James Beaver
Hilary Cooke
Joshua Cohn
Steven Hackmyer
Martin Horowitz
James Lang
Geraldine Santoro
Janet Willen

TABLE OF CONTENTS

LONG TERM MANAGEMENT OF WASTES FROM AND DECOMMISSIONING OF COMMERCIAL NUCLEAR FUEL REPROCESSING FACILITIES - A STATUS REPORT

State of New York
Witness P. Skinner

I. Introduction

The decision on the GESMO concerning plutonium recycle will have a multitude of impacts. Some of these impacts include the dollar costs, technical difficulties, person rem costs, disposal costs, institutional difficulties and disruptions caused by decommissioning the facilities required for the recycle option. This testimony will consider the dollar costs of decommissioning for the Nuclear Fuel Services (NFS) West Valley Facility, other commercial reprocessing facilities, production separations facilities and nuclear reactors. It will also discuss the consideration of this issue in the GESMO and demonstrate GESMO's shortcomings in that regard.

To proceed with recycle of uranium and plutonium on the projected scale until the year 2000, a large number of relatively new and sophisticated chemical and mechanical facilities will have to be constructed. (See Table 1).

State of New York
Witness P. Skinner

TABLE I

FACILITY TYPE	NO. OF PLANTS	COST OF FACILITIES EACH
Separations (P-VI-9)	5-7 (P-VIII-18)	GESMO RANGE (XI-21)
UF_6 plants	5-7	$500-600 million
PUO_2 plants	5-7	(B. SMERNOFF)
Waste Solidification	5-7	$1.5 Billion
MOX Fuel Fabrication	8 (P-VI-9) ----------	(?)

State of New York
Witness P. Skinner

Each plant will have to be decommissioned in order to meet the requirements of 10 CFR part 50 governing the management of such sites. Decommissioning requires very detailed site specific plants to properly accomplish this goal without jeopardizing the health and safety of the work crews involved and the public off site. These considerations are discussed in my testimony below.

II. GESMO Discussion of Decommissioning to Date

GESMO I discusses the need for and difficulty of decommissioning only briefly. Decommissioining of MOX fuel fabrication plants is discussed on page VI-9 for half a page. The need for "strict criteria" is noted and three major approaches to decommissioning are discussed there. However, no specific details of methodology or financial cost are discussed.

Similar generality in the discussion on the subject can be found on page VII-14 regarding the need for pre-design planning of such recycle facilities to facilitate decommissioning.

Brief discussion of this subject can also be found on page IV-H-21 regarding an allocation of 10% of the volume of TRU wastes delivered to the repository. Even though it is highly likely that significant areas of land will be permanently set aside for decommissioned or entombed facilities, no discussion can be found in GESMO I, chapters X or XI.

State of New York
Witness P. Skinner

A number of intervenors in the GESMO proceeding filed questions in this regard. The answers to these questions are discussed throughout this testimony.

III. Decommissioning of Model Facilities

(A) Technical Considerations

At the present time there is very little experience in the nuclear industry on which to base a realistic assessment of the difficulties and extent of decommissioning of reprocessing plants. Goals for such activities have only recently been proposed and discussed by knowledgeable parties. The types of decommissioning modes are described below (NUREG 0043, Page 145):

> "Determining which decommissioning mode should be chosen for a given nuclear facility involves the careful weighing of technological, economical, societal, and political factors. The final choice of a decommissioning mode depends upon the complex interplay of these factors which deeply involve the governing regulatory agencies of Federal and state governments and the nuclear facility owner or operator. In light of past experience, decommissioning decisions are being expanded to consider long-term factors such as the worth of the site and its resources, population growth, genetic effects, cumulative health effects, and a host of sociopolitical factors.

State of New York
Witness P. Skinner

1. Layaway - Offsite disposal of radioactive materials from the site and controlled access for authorized persons only. Particularly applicable to sites where future nuclear efforts are contemplated.

2. Protective Storage - Same procedure as the layaway mode but necessitates "erection of physical barriers to prevent entry into contaminated zones." This allows for reduced maintenance costs while awaiting permanent disposal of the site.

3. Entombment - This semi-permanent mode calls for decontamination of the site; offsite disposal of all radioactive materials and unsalvageable uncontaminated equipment; filling or covering of all contaminated equipment and process cells with concrete which will last at least 100 years.

4. Dismantling - This mode calls for removal of everything from the site so that anyone can have unrestricted use of the site.

State of New York
Witness P. Skinner

Layaway and protective storage are generally inexpensive modes in the short term and provide a modicum of protection to the health and safety of the people in that area. Entombment provides a higher degree of protection to the environment for at least the lifetime of the concrete. The degree of permeability of the foundations and concrete materials determines the duration of such protection. Dismantling provides the ultimate in protection to the public and the environment.

Of the proposals for decommissioning being discussed today for nuclear fuel reprocessing plants, entombment unfortunately appears to be the favored method. The American National Standards Institute first published "General Design Criteria for Nuclear Reprocessing Facilities" in 1972, based in part on a study made in Europe on the Eurochemic Facility. Since that time changes have been proposed, some of which are embodied in new standards (N300) by the same name published by ANSI (October, 1976).

These standards define decommissioning as:

> "2.1.8 Decommissioning: the planned and orderly execution of a program devised by a nuclear facility licensee to achieve a substantial and permanent improvement in the status of a shut-down facility. The program includes (1) decontamination of the structures and equipment, (2) removal of sources of radioactivity, (3) return of the site to a condition wherein it may safely be returned to unrestricted surface use, and

> (4) maintenance under the minimum surveillance required for the protection of public health and safety for a specified time if it is shown to be technically or economically infeasible to decontaminate the site to levels acceptable for unrestricted use."

The Code of Federal Regulations which apparently provides for this type of protection is 10 CFR part 50, Appendix Q. As of this writing, the appendix has not been incorporated into the Code. According to Mr. H.B. Graham, in CONF 750827, the code will not contain Appendix Q until "results from their contract with Batelle Northwest Laboratories are obtained." This report, preliminarily titled by Batelle Laboratories as "Technology, Safety, and Cost of Decommissioning of Reference Light Water Reactor and Nuclear Fuel Separation Facilities," was received by the Nuclear Regulatory Commission late in February, 1977. Some 700-800 pages in length, it is supposed to cover all aspects generic to decommissioning including, costs, feasibility of and justifications for this activity. The NRC indicated that the report would not be made available to the public in its draft stage, and that it might be published late in 1977 (Telephone communication, February 23, 1977). Presumably this report will provide the basis for NRC rules and regulations, governing ultimate disposition of reprocessing plants and other back end fuel cycle facilities (contemplated as of January, 1977 to be promulgated no sooner than 1981).

Until that time however, we can only speculate as to what decommissioning will ultimately be needed to clean up NFS, Barnwell, and the other 4-6 reprocessing facilities and the 8 MOX fuel fabrication plants contemplated by GESMO.

Entombment has become the nuclear industry's favored method for final disposition of reprocessing plants. Gauging by the justifications presented for use of this mode and its inconsistency with the goals of 10 CFR part 50, appendix F, it is not the most satisfactory method from engineering, public health or safety standpoints. It has been chosen because it is the only affordable method. In August of 1975 at the first conference on decommissioning at Idaho Falls, Mr. H.B. Graham of the Holifield National Laboratory discussed the genesis of the current decommissioning philosophies. He traced the original ANSI design criteria to a report by the operator of the Eurochmic reprocessing facility. This report called for dismantling of the facility as the appropriate decommissioning mode. He stated that:

> "The study concluded that dismantlement of a facility of the type of Eurochemic, which handles large quantities of irradiated fuel elements in solution, is technically possible. Nonetheless, we are speaking of a difficult undertaking, full of risks, which necessitates putting to work large efforts whose financial magnitude should not be underestimated.

> It was this last statement that the industrial members on the subcommittee could see more vividly. When you mention risks and financial objectives of untold magnitude, they retrench to the most conservative position. In this study they were talking about a force of 40 to 50 people working 3 to 4 years dismantling the Eurochemic facilities. The facilities in the U.S. have a large capacity, shorter-cooled material, and higher-burnup fuels to reprocess. The thesis that a nuclear fuel reprocessing facility should be designed so that it could be completely dismantled some 40 years in the future was entirely unacceptable. It was not practical. With the high-level concentration of radioactivity and contamination and removal of all activity would be most difficult."

The concept of entombment was supported by Mr. Robert E. Brooksbank, formerly of the USAEC, in testimony in the NRC Barnwell proceeding, Docket # 50-332 filed in September, 1974. On page 11 Mr. Brooksbank states that:

> "The complete dismantling of the facility (Barnwell) is probably possible at a price. The requirement of no release of airborne activity, or of no release of activity leached by rain to the ground during the dismantling operation, would probably make this operation economically unfeasible. Even if it were possible to remove all radioactivity from the site, only 90 acres would be returned to productive use."

State of New York
Witness P. Skinner

Very similar decisions about the type of decommissioning needed for the site were made at a number of other installations. Two such facilities were nuclear reactors, known as the Hallam and Piqua reactors. Both reactors were decontaminated and after some equipment and all radioactive residue were removed from the site, the reactors were sealed up to prevent access forever. A short report by W.F. Heine and B.F. Ureda of Atomics International, in CONF 750827, on these two reactors, discusses the programs undertaken in each case. In the Hallman case the authors state that:

> "The heat exhangers have been removed. Removal of the massive concrete 7 foot thick walls was economically prohibitive."

Since similar decommissioning efforts were made at the Piqua reactor, we can conclude that economics dictated the course of activity there as well. Several other efforts at decommissioning have been made in the United States utilizing similar programs as apparently dictated by the same financial justification:

EBR 1 Reactor -- some highly contaminated parts

Mound Laboratories -- Radium 227, and Actinium 227 facilities

It is important to note here that the levels of contamination in nuclear reactors which were entombed were a mere fraction of levels normally encountered at reprocessing plants.

State of New York
Witness P. Skinner

These decommissioning actions and the ANSI criteria are inconsistent with the perpetual protection required for the public and the environment with 10 CFR part 50 Appendix F:

> "4. A design objective for fuel reprocessing plants shall be to facilitate decontamination and removal of all significant radioactive wastes at the time the facility is permanently decommissioned."

Since reprocessing plants and their appurtenances such as waste tanks, listed in Table I, come in contact with massive amounts of toxic and long-lived radionuclides, they will present a hazard to man and his environment for thousands of years. Clearly these materials are "significant radioactive wastes" under Appendix F. Removal from the site to a safe repository will be needed to protect the public. Of course, the present proposed criteria defining so-called TRU waste as 10 nanocuries per gram or more of transuranics, will place some limitation on the total amount of materials to be disposed of. There seems to be no question that a large amount of demolition will be needed at reprocessing plants to meet the mandate of Appendix F.

Mr. A. Thomas Clark, Jr. of the NRC in a January 17, 1977 memorandum to Mr. R.M. Berner (p. 9) expressed the purpose of this portion of the CFR. He stated that semi-permanent storage of the high level waste in the tanks at NFS, West Valley, would

State of New York
Witness P. Skinner

> ". . . not conform to the criterion of Appendix F to avoid the proliferation of perpetually committed nuclear sites."

In that same memorandum he stated that the ORNL shale fracturing method for disposal of radioactive waste is an option which (p. 11):

> ". . . is somewhat at odds with Appendix F criteria in that the site then becomes a committed repository for high-level waste. The site is [already] committed to the perpetual care of low-level and intermediate level wastes in two burial grounds onsite. These lower level wastes may be considered retrievable, albeit at substantial costs, whereas, the shale fracturing method is essentially non-retrievable. This method would cost the least to implement."

There is a strong justification to complete dismantling and removal of all TRU contamination from the site. At this time no regulatory scrutiny has been focussed on the long-term fate of TRU contaminants inside or around reprocessing and MOX fuel fabrication facilities. To my knowledge no detailed studies or cost-benefit analyses have been undertaken to determine the public health danger posed by maintaining TRU contaminated buildings, waste tanks, and grounds encased in concrete, whose permeability and resistence to weather is unknown or unspecified. Materials thus treated will become an ongoing fiscal liability and public hazard for generations to come.

TRU wastes should not be scattered around the country in areas of varying hydrogeological and climatic environments which are not fit for long-term repositories.

Entombment is not the proper method of decommissioning for TRU contaminated fuel cycle facilities for a number of other reasons. This conclusion was reached by the NRC after an extended period of analysis in Idaho where concerns arose over storage of TRU waste which began in earnest in 1969.

> "The AEC made a committment that the wastes in question would be directed or transferred to the Federal Repository in salt (then being planned) when it should become available." (WASH 1539, Sept. 1974, page 1.2-12)

It was also stated that the anticipated regulations for commercial plutonium contaminated solid wastes would:

> ". . . prohibit the disposal by burial in soil of transuranium-contaminated solid waste and require that transuranium-contaminated waste be transferred to AEC custody (after solidification, if orignially liquid) as soon as practicable after generation, but in any event within five years. A fee would be charged which, like the fee for high level waste, would include costs of later transfer to permanent disposal."

State of New York
Witness P. Skinner

In a more recent document it is stated that:

> "TRU contaminated waste materials are assumed to be disposed of at a federal repository . . . TRU waste comprise the material(s) from the nuclear fuel cycle which have sufficiently persistent biological hazards that they require special long-term considerations." (NUREG 0116, page 2-9)

GESMO itself assumes that the wastes from decommissioning will be shipped to federal repository. (Page IV-H-20). It is inconceivable that entombment, with its cement covered kilocurie quantities of TRU waste, could be the logical choice for the decommissioning mode.

In contrast to the decommissioning modes decided upon for reactors, described previously, and the entombment mode presently favored for reprocessing plants, the owners of the Elk River Reactor took the necessary steps to protect the public and the environment. They completely dismantled the reactor and its internals, removing it from the site entirely. The motivation for this action is at least partially explained by the following quotation from the report CONF 750827 on the reactor written by Mr. Bobby J. Davis of the USERDA in Illinois.

State of New York
Witness P. Skinner

"For obvious economic reasons, it was desirable to dispose of as much demolition debris as possible in local landfills. Because there were no burial facilities for radioactive materials in the State of Minnesota, a lack of disposal standards for activated materials, and because of existing adverse public reaction to the nuclear industry from certain sectors, great pains were taken to insure that no radioactivity above background, remained in the structures that were disposed of in Minnesota."

(B) Financial Arrangements

In order to develop the agreements between States and operators of reprocessing plants which would ultimately provide the necessary protection to the public, costs must be determined with some degree of certainty. Because of the lack of meaningful regulations it is presently impossible to arrive at reasonable estimates for these costs. The NRC Staff, after persistent questioning by the Board, has offered ball-park estimates for the costs of decommissioning. However, all such costs are based on the assumption that entombment is the proper method for this activity, though the regulations defining such activities won't even be proposed until 1981. The Staff quotes 5-10% of original capital cost as the cost of entombment decommissioning. Other estimates, as high as 25-100%, have been advanced for the complete dismantling of similar facilities. This section discusses the impact on reprocessing costs of the additional payments into escrow funds necessary to finance a range of possible decommissioning alternatives.

State of New York
Witness P. Skinner

Perpetual Care Costs

Costs associated with perpetual care of decommissioned facilities are very difficult to ascertain. Since there are no guidelines which are specific enough to define the length of time needed for surveillance or the degree of protection needed for specific sites or for specific degrees of D & D, it is virtually impossible. However, States, faced with the reality of such facilities within their boundaries, have been forced to attempt to estimate these costs, and incorporate them into working agreements between themselves and the operators of the facilities. All the agreements we have analysed and discussed in chapters IV, V and VI fell dismally short of the needs of these facilities for such perpetual care.

For example, the costs just to guard facilities around the clock presently comes to almost $70,000 each year. The iteration provided in the discussion of the Midwest Fuel Recovery Plant shows graphically what little distance escrow funds will cover. The money the State of Illinois would have had for perpetual care of GE would have lasted only 9 years. New York will have no money for this activity at the NFS West Valley site because all the money earned under the agreement will be consumed by maintenance of the low level waste area alone. There won't be enough money for perpetual care to either

the low or high level waste areas. South Carolina's position is impossible to assess at this time because no agreement has been reached. Kentucky will run out of money in their account in a few years, again because maintenance of the Maxey Flats site is so expensive.

Decommissioning Costs

The number of dollars required for decommissioning is very difficult to determine as the NRC Staff state ". . . there has been little experience in decommissioning fuel cycle facilities . . ." (Written Answers, February 11, 1977 Attachment 1-17). They go on to say that there are ". . . no detailed estimates of decommissioning costs." (Ibid., Attachment 1-22). They even admit that the "GESMO report did not consider the environmental impacts of decommissioning in detail." They do, however, indicate that this hitherto untouched area of technology is ". . . a matter of research and development by the NRC." (Written Answers, February 4, 1977, Attachments 1-85). They even go on to say that rules and regulations may be proposed as early as 1978.

The NRC Staff glibly state their position on the probable costs of decommissioning. They claim that NUREG 0116 has covered the issue (Written Answers, February 11, 1977, Attachment 1-15) and that costs generated therein are "adequately covered by the unit costs of the industry." (Ibid., Attachment 1-15). NUREG 0116 presents figures for costs which

range from 10 to 20% of cycle facility construction costs (pp. 4-131). These numbers are based on a subreport by H.K. Harmon, et al., contained in "Proceedings of the International Symposium on the Management of Wastes . . . etc." July, 1976, pages 394 to 412. The NRC Staff in written answers to questions viewed the report differently. They stated that dismantling costs for a reprocessing facility would equal 10% of the construction costs, citing page 412 of The Symposium document. (January 28, 1977, Attachments 1-65). In fact, Page 412 merely contains a question posed by a MIT student with an answer which is not ascribed to any one of the authors of the paper under consideration. Similar baseless estimates can be found by the NRC Staff in other written answers to questions.

The percentages cited by the NRC are very unspecific as to their origin. It is not indicated whether the construction costs used as a basis of comparison included interest during construction, or were discounted for present or future dollars. None of them detail the level of D and D work covered by the quoted figures. The only carefully researched document on this subject presently available is NUREG 0043. In the cost analysis section on pages 140 and 141, the authors state that a "firm basis for estimating decommissioning costs or time of implementation is not available at present. <u>But costs were assumed to range from 25% to 100% of original facility capital, depending on the level of decommissioning desired</u>." (Emphasis supplied).

State of New York
Witness P. Skinner

It is a shame that the extensive data and analyses made by Batelle and now held by the NRC cannot be made available to the Board and intervenors for elucidation of the decommissioning cost issue.

In the matrix below I have presented various possible costs associated with decommissioning of contaminated fuel cycle facilities. These financial commitments are of a size that demand careful consideration prior to construction as the owners of reprocessing and other backend fuel cycle facilities are not protected by a guaranteed rate of return that will cover decommissioning. The unit cost add on proposed by the NRC Staff in the written questions, (FP-5-18, Attachments 1-65, 1977), are based on tonnage processed. It is too risky an approach for any State to accept. The NFS experience, where miniscule throughput was experienced has taught us that up-front guaranteed escrow accounts are necessary. The amounts to be held in escrow for various facility cost projections are presented below:

State of New York
Witness P. Skinner

Percent Const. Costs for D & D	FUEL CYCLE FACILITY CONSTRUCTION COST					
	600 Million		1.0 Billion		1.5 Billion	
	3%	5%	3%	5%	3%	5%
10%	$17.7*	$ 28.7	$ 29.5	$ 47.8	$ 44.2	$ 71.8
25%	$44.2	$ 71.8	$ 73.7	$119.6	$110.6	$179.4
100%	$77.0	$287.1	$295.0	$478.5	$442.5	$717.7

*All numbers in this matrix are in millions of dollars.

$$\text{Escrow \$} = \frac{(D\%) \quad X \quad (FC)}{(1 + I\% - INF\%)^{t}}$$

Escrow funds needed up front to guarantee money available for D & D work 20 years in the future therefore ranges for the assumed scenaries between about $18 and 718 million dollars payable upon commencement of operation of the fuel cycle facility in question.

where: D% = Percent of original construction costs needed for D&D work.

FC = Fuel Cycle Facility Construction cost.

I% = Assumed interest rate for long-term funds. (8%).

INF% = Inflation rate, high was taken at 5% and low was taken at 3%.

t = Number of years before the money was needed for D & D work. (15 years of operation and 5 years for planning of D & D).

State of New York
Witness P. Skinner

These figures are large indeed. They do not, of course, cover any of the expenses of perpetual care, monitoring, or periodic maintenance needed at various sites. The level of such funding will depend on the level and mode of decommissioning provided at each site. Nor do these expenses include environmental costs and occupational exposure occasioned during decommissioning activites. NUREG 0116, on page 4-135, states that "Occupational exposure of workers is a significant impact of these activities."

Lastly, the above figures do not even reflect the large costs of both interim storage and final repository charges for the many boxes of TRU waste generated by decommissioning.

(C) Institutional Arrangements

In order to prevent entry to the facility by unauthorized individuals, arrangements must be made at all sites for guards and protective barriers. The mix of round the clock guard surveillance, fences, walls and the like depend on the radioactivity of the site and the particular mode of decommissioning underway at the time. These arrangements must be maintained for long periods. Institutions to provide this care are hard to find. The States in which plants are located have been charged with the responsibility so far. In the case of NFS, at West Valley, the New York State Atomic and Space Development Authority, contracted with the W.R. Grace Co. to

take on this responsibility, in perpetuity, for $4,000,000. The State of Illinois, home of the General Electric Morris Plant, took on the burden at the price of a performance bond of $750,000 plus interest. The State of South Carolina is discussing a more complex agreement with Allied General Nuclear Services to provide perpetual care for the Barnwell site. In return, South Carolina may be paid a lump sum and a fixed fee per metric ton of heavy metal processed.

According to conversations with NRC counsel during the week of February 21-25, 1977, State ownership of the land and perpetual care are not legally necessary to the location of reprocessing plants, though this cype of arrangement is characteristic of the relationships at the three plants built so far. This situation is in direct contrast to that of low level waste burial dumps. Title 10 CFR part 20.302, subsection (b) states that

> "the Commission will not approve any application for a license to receive licensed material from other persons for disposal on land not owned by the Federal Government or by a State government."

Licensed material here means source material, special nuclear material, and by product material. A burial site is not allowed under part 20.304 of this title to take more than 1000 times the values presented in Appendix C to part 20 of this section. These rules define what is known as "low level waste" as that term applies to land burial.

State of New York
Witness P. Skinner

It would seem to be consistent with the above regulations that land on which a reprocessing facility exists should itself be owned by either the Federal government or the State government. At the very least, if, as the NRC states, low level waste burial sites need the protection that governmental institutions supposedly can provide, then reprocessing plants need such protection all the more. In spite of this logic the NRC Staff states that:

> "With regard to the reprocessing facility, the high level waste solidification facility and the high level waste tanks, the licensee will be responsible for the long-term surveillance costs if the facilities are licensed by the NRC." Written Answers January 24, 1977 (Attachments 1-22).

The NRC Staff states that the MOX fuel fabrication plant licensee (Ibid.):

> ". . . will be considered by the NRC to be responsible for the costs of long term surveillance of the site, if required after decommissioning."

These statements point out the naivete with which the NRC approaches the problems of long-term care of fuel cycle facilities. It is hard for me to believe that if the States are having difficulty in protecting their citizens over long periods of time in this area, that companies like NFS, teetering on the brink of insolvency after a disasterous experiment in nuclear facility technology, will be able to

carry on the responsibility for massive quantities of TRU waste in such facilities.

Another question is whether the protection supposedly provided by government is sufficient for the duration of the radioactive hazard. To properly answer such a question we must study several items:

1. What materials are left on the site to be protected?

2. What construction, exhumation, decontamination, dismantling, or similar physical activities will be needed to properly maintain the site on a long-term or short term basis through possible scenarios of:

   a. All environmental conditions or seismic events?

   b. Regulatory changes?

3. How much will the above efforts cost?

4. What guard protection, monitoring, and maintenance will be necessary to protect the public in perpetuity?

Considering the number of years for which the facility must be guarded, the astronomical cost of containing the wastes properly, and infeasibility of actually carrying out proposed steps such as high level waste solidification, no organization, at least no state government, can presently

be expected to carry out the obligations of "perpetual care" of an FRP.

Discussion of projected cost figures for decommissioning are provided in Table 1 for each commercial reprocessing plant now built in the United States. We should not forget that these plants, as well as the ERDA production plants, have either not operated at all, or have operated, for the most part, with low-burnup fuel at what were low throughputs when compared to the model facility in the GESMO. The difficulties envisioned for decommissioning these sites and their radioactive inventories will be dwarfed by the difficulties to be faced in the future at GESMO model facilities. It is unlikely that the States can provide the protection needed or bear the escalating costs and difficulties occasioned by such plants. The recent history of New York described in the next section demonstrates this contention very graphically.

NFS provides a perfect example of the impact of the D & D cost uncertainties. On July 20, 1970 NFS told members of the Joint Committee on Atomic Energy that:

> "Because of the extremely favorable geological conditions in West Valley, however, -- such as seismological conditions, available disposal formation and impermeable cap rocks -- a deep well seemed ideal for West Valley."

State of New York
Witness P. Skinner

This optimism regarding geologic waste disposal at NFS turned out to be unfounded. The USAEC turned down NFS' request to dispose of radwaste in this manner.

In 1976, the NRC decided to require that the new NFS plant be built to withstand .2 g acceleration instead of the .1 g design criterion for the earlier plant. This action was due to concerns about the long history of significant earthquake activity in the area (NUREG 0043, page 135). The change in seismological rating was a key factor in the NFS decision to give up building a new plant.

Kentucky's "Low Level Waste" burial site demonstrates similar difficulties. Originally licensed by the State of Kentucky in 1963 to accept low level waste (as it was defined in those days), the Maxey Flats site grew to contain an estimated quantity of rad waste equal to 26.9 X 10 E5 Curies of which some 27.3 kilograms were Plutonium 239 (pages 2-13 and 2-14 of the Dames and Moore Maxey Flats Assessment, December 1976). Water infiltration to the trenches and some offsite movement of radionuclides to ground water and in streams have occurred. The operator of the site has installed pumps to control build up of water in the trenches and an evaporator to reduce the volume of the water pumped from the trenches and capture the radionuclides therein.

State of New York
Witness P. Skinner

The agreements between the State of Kentucky and the Nuclear Engineering Co., Inc. have been amended several times to provide for changing conditions at the site. They have so far provided (as of November 1976) only $24,175 in the escrow account for maintenance and surveillance of the property in perpetuity. During fiscal year 1976-77 alone, some $102,242 (44%) of the escrow fund has been appropriated for remedial work on the site by the State. The State has been unable to develop an agreement to protect itself from the costs of decontamination, maintenance, and long-term care at a nuclear waste facility.

Each State in its own way has tried, with the help of either the AEC or the NRC, to develop legal mechanisms to surmount this range of uncertainty and insure that there will be enough money available to take necessary action when the plant operator leaves the site.

As can be seen by the discussions of the agreements governing the three existing commercial reprocessing plants in Sections IV, V, and I herein, the States have taken different approaches to this task with varying degrees of failure. It is clear that no one standard legal mechanism has been developed to meet the needs of such facilities for long-term surveillance and care. Unless the range of uncertainties characteristic of this aspect of operation of the back end of the fuel cycle are resolved, it is clear that the GESMO decision, if it is pro-recycle, will obligate State after State to undertake programs beyond their financial means and technical capabilities.

State of New York
Witness P. Skinner

IV Decontamination and Decommissioning Status of Nuclear Fuel Services, West Valley.

The Nuclear Fuel Services Fuel Reprocessing Plant at West Valley, New York, was the centerpiece of the Western New York Nuclear Service Center. The Service Center included a Low Level Waste Burial Area which was managed for the State of New York by Nuclear Fuel Services, a New York State supervised Plutonium Storage Facility, a High Level Waste Tank Farm to accomodate neutralized liquid high level wastes and acid thorium high level liquid wastes ("HLW") and a burial area for supposedly retrievable high level solid wastes. Only the perpetual care of the Tank Farm was considered prior to licensing, and experience is now proving that arrangements for the high level liquid wastes, once considered satisfactory by the United States Atomic Energy Commission, are now inadequate for proper disposal of these wastes. In fact, decontamination and decommissioning were inadequately considered by Nuclear Fuel Services and the United States Atomic Energy Commission. It appears that the State alone may be held responsible for the hundreds of millions of dollars of Decontamination and Decommissioning costs at West Valley.

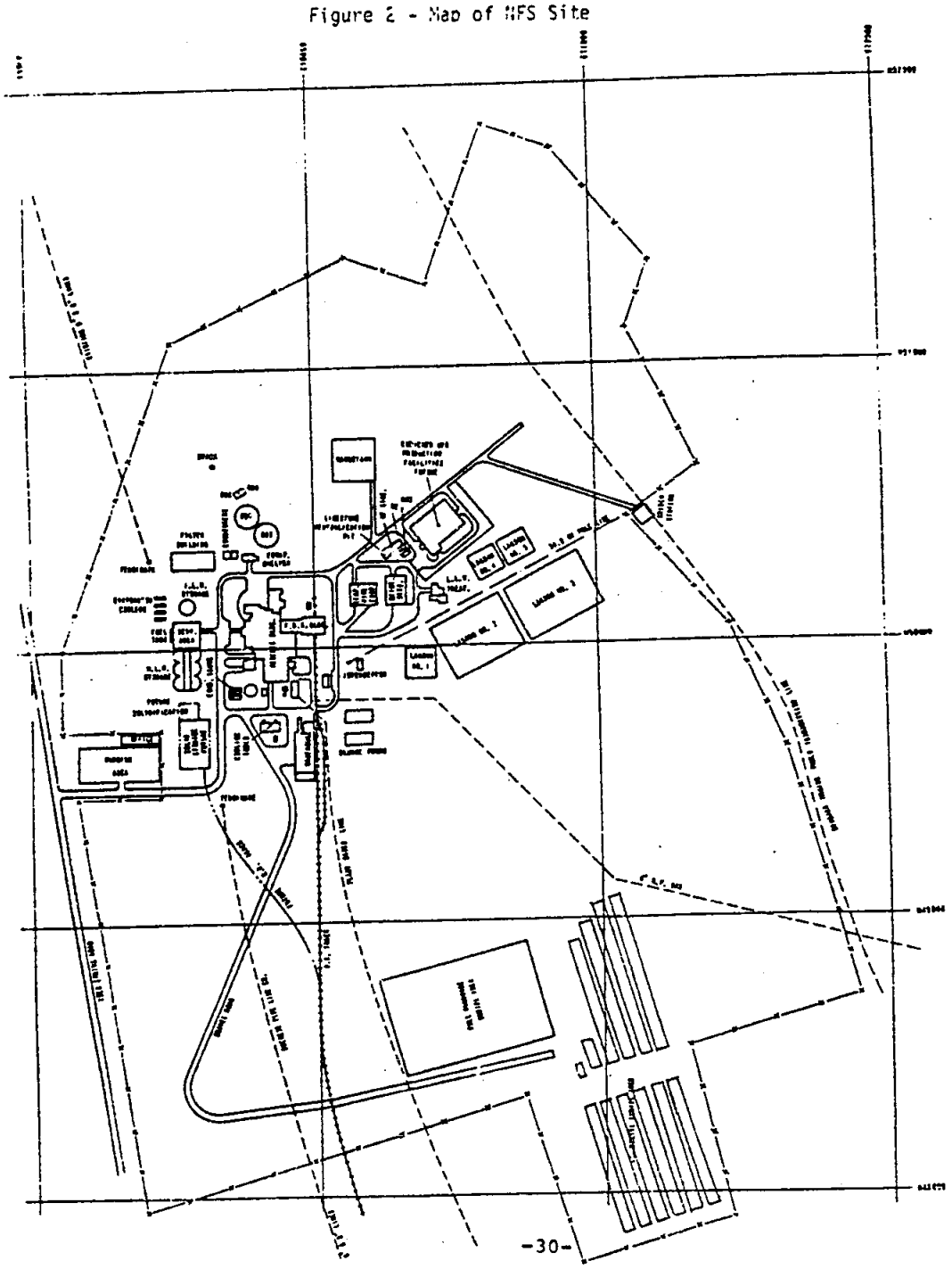
The future of the Nuclear Service Center is now being decided. NFS has chosen to quit the site and the reprocessing business. According to Section 4.10 of the 1963 NFS Waste Storage Agreement, NFS is purportedly not required to reimburse the State for any contaminants generated in the legitimate course of its activities. According to NFS this agreement allows NFS to simply leave all facilities as long as they are decontaminated

to "unattended standby condition."

The Fuel Reprocessing Plant is the heart of the Service Center's complex of contaminated facilities. (see map). It is a reinforced concrete building, equipped to process 300 metric tons of spent fuel yearly. However, it only processed 625 metric tons over its six year operating life. The Fuel Reprocessing Plant was built after an "AEC conceptual model" (Sec. III, Proposal of Nuclear Fuel Services, Inc. to the U.S. Atomic Energy Commission, June 18, 1962) and incorporated AEC experience which proved inadequate. Radioactive contamination of both the structures and personnel were high and mechanical problems were plentiful.

Before licensing NFS. the AEC thought that there would not be enough power reactors in operation to supply NFS with spent fuel reprocessing contracts. Determined to create commercial reprocessing experience, the AEC negotiated a baseload contract to keep NFS going through its early years. In fact, 61% of the total fuel processed at NFS was low burnup, non-enriched fuel from the AEC's plutonium production reactor at Hanford. (Report of the New York State ERDA With Respect To Federal Acquisition of the West Valley Facility p.22). Considering that more than half of the NFS' throughput was N fuel, NFS' contamination problems reflect poorly on all the plant's designers. By the time sufficient power reactors were on line to supply NFS with spent fuel, prospective competitors were entering the reprocessing market. AGNS and Exxon, each in the midst of designing plants with greater throughput than NFS', were able to underbid NFS on future reprocessing contracts. The AEC and its successor, the NRC, revised their

Figure 2 - Map of NFS Site



reprocessing plant specifications, and NFS, no longer able to meet Federal requirements with its suddenly obsolete plant, closed for expansion and renovation. After remaining closed for four years, NFS decided to abandon its investment at West Valley. (Letter from Ralph Deuster to Kenneth R. Chapman, Sept. 22, 1976) It is reported that NFS lost upwards of $40 million on its nuclear fuel reprocessing venture. (Empire State Report, Vol. 3, No. 1).

The only substantial funds available for maintenance of the Nuclear Service Center are those specifically earmarked for "perpetual care" of the liquid high level wastes stored in carbon steel and stainless steel tanks. "Perpetual care" means continued tank storage. According to the 1963 Waste Storage Agreement, NFS was required to provide a Replacement Fund and a Maintenance Fund for the high level waste tanks. Both funds will total approximately $3.7 million upon surrender of the facilities. This sum is a negligible contribution to ultimate disposal of the wastes. According to 10 CFR 50, Appendix F, wastes must be solidified and transported to a Federal repository within five years of their generation. NFS' wastes were grandfathered from the time requirements of the Appendix, but solidification and repository disposal are their ultimate fate.

The importance of waste management was realized by both the AEC and NFS prior to NFS reprocessing operations, however, the costs of decommissioning were not considered. In 1965, in his presentation to the Second Power Reactor Fuel Reprocessing Symposium, the AEC's Dr. W. Kenneth Davis offered criteria for

"Evaluation of Proposals Received" for reprocessing plants.

Criterion 4 was titled Responsibility for Disposal of Wastes.

> "Since the development of economical waste disposal methods, or the exploitation of the use of fission products, is one of the principal long-range goals of the chemical separations development program, the manner in which the waste disposal problem will be handled will be of major importance."

Nuclear Fuel Services' approach to the problem, found in Section III of the Proposal of Nuclear Fuel Services to the U.S. Atomic Energy Commission, June 18, 1962 was as follows.

> "While we accept the position that tank storage of radioactive wastes is not likely the best long term answer to the problem, our analysis of experience over the past twenty years is that this approach is technically sound and, if approached rationally, is economically feasible within the limitations of competitive nuclear power."

This discussion of waste management alternatives evidently satisfied the AEC which approved the Waste Storage Agreement proposed by Nuclear Fuel Services, and licensed the NFS reprocessing operation. The AEC disregarded decommissioning.

ERDA 76-43 compares high level liquid waste managment alternatives. The ERDA alternative with fewest drawbacks is vitrification of wastes and transportation to a Federal repository. (ERDA 76-43, Table 6.8) The Nuclear Regulatory Commission recently sponsored a study of "Alternative Processes for Managing Existing Commercial High Level Radioactive Wastes" (NUREG 0043) The report is specific as to NFS liquid HLW and produced rough order-of-magnitude costs and completion schedules for disposal of the NFS liquid wastes. According to this report, vitrification and

transportation of the wastes would require 25 years, 14 years of research and development, 5 years of actual processing time and 6 years for decommissioning of the solidification facility (NUREG 0043, p. 139).

NFS built two stainless steel tanks for high level liquid thorium waste and two 750,000 gallon carbon steel tanks for storage of high level neutralized liquid waste. It is presently unknown how anyone can decommission these tanks. The presence of large quantities of sludge in the carbon steel tanks and internal obstructions prevent complete cleanout with present technology.

At the Savannah River Laboratory, 95% removal of sludge from tanks has been accomplished with the use of high pressure jet pumps (Memorandum of Clark to Bernero, USNRC, January 19, 1976) At NFS, approximately 30,000 gallons of sludge exist in the HLW tanks (NUREG 0043, page 15). A removal efficiency of 95% here would still leave 1500 gallons of highly radioactive transuranic contaminated sludge that would include Sr - 90, Cs - 137, plutonium, and many other radiotoxins. Assuming that this level of removal can be accomplished and that there is a homogeneous distribution of radioactive elements in the sludge, 95% removal would leave about 1.4 X 10E7 curies in the tank due to the presence of this sludge (NUREG 0043, page 15). At present, there appears to be no demonstrated method for resolving this problem.

Also, "the internal stucture of the high level radioactive waste storage tanks will make decontamination by flushing difficult. Dismantling may require special techniques which have

not yet been demonstrated" (ERDA 76-43, page 15.11). Synergistic difficulties from refractive sludge and internal tank structure pose unknown costs in terms of occupational exposure, effluent releases to the environment, and financial costs for the decommissioning of high level waste tanks.

Total costs, including the cost of the research and development necessary to adapt ERDA processes to NFS wastes and the cost of decommissioning the solidification facility (25% to 100% of capital cost) range from $50 - 110 million dollars discounted at 10% (NUREG 0043, p. 143). Strangely these costs are stated to be for a commercial solidification operation (NUREG 0043, p. 139), though it is inconceivable that a corporation might seek a profit in the high level waste solidification business.

The Low Level Waste Burial Site, managed for New York State by NFS was closed in 1976 when it was discovered that several trenches were leaking. The area contains 1.8 million cubic feet of waste, holding 300,000 curies of radioactive materials, including: plutonium, uranium 235, cesium 137, strontium 90, etc. According to the U.S. Environmental Protection Agency's 1977 Summary Report on the Low-Level Radioactive Waste Burial Site, West Valley, New York, the waste trenches are eroding and filling with water. Radioactive material is leaking through the soil and a nearby stream has been contaminated. "If the goal of shallow land disposal is 100 percent retention of the waste for the duration of its hazardous lifetime, the goal cannot be met under present conditions at West Valley" Executive Summary, p. VI. No estimates have been made for the costs of decommissioning the Low

State of New York
Witness P. Skinner

Level Burial Site.

Nuclear Fuel Services, as contractor for the management of the Low Level Waste Burial Site, collected a per cubic foot charge for wastes accepted for burial. For most of the operating life of the Site, NFS was restricted to collecting no more than 80.5 cents per cubic foot from customers under the original Waste Storage Agreement. Of the money it collected, it only payed the State of New York 8 cents per cubic foot. This money was to be paid into a fund which now totals approximately $200,000, which the State was to be able to apply to perpetual care of the Site. The New York Department of Environmental Conservation and NFS agreed to suspend burial at the site in April, 1975 because of the discovery of leaks in several trenches. It has been estimated, that the cost to pump out one trench alone will be $100,000. As leakage continues in the trenches, the costs will climb.

The high level hardware burial area is another feature of the NFS, West Valley site. This area, lying just to the north of the low level waste burial area, was established under AEC license for materials generated by the reprocessing plant which could not qualify for low level burial. At the half acre site, 151 holes, fifty feet deep were dug for receipt of the discarded junk from the reprocessing plant. <u>According to a New York report, this material included TRU contaminated piping, filters, tools, process equipment and even spent fuel rods encased in concrete.</u> Though our investigation of this part of the facility is not yet complete, there are indications that the State received between

2 and 19 cents per cubic foot for perpetual care of waste placed in these pits; 87,778 cubic feet were buried there. Recent changes in NRC opinion have indicated that this method of disposal of TRU waste is no longer considered adequate for the protection of the public and the environment. In the future, such waste must be transferred to a federal repository for long-term storage. NUREG 0116 (page 4-63) assumes that the interim storage of such wastes at reprocessing plants will be for no more than 20 years, and that the wastes will be contained in welded steel containers or 55 gallon drums. Other reprocessing sites have special storage facilities for such waste. If the NRC means what it says, someone will have to exhume and package New York York's high level waste and any contaminated soil and ship it to an offsite repository.

Who will pay for this activity? Assuming the State was paid an average price of 10.5 cents per cubic foot and the charges were paid on a yearly basis to the State at an average dumped volume of 14,630 cubic feet during each of the six years NFS operated, and that the escrow fund earned 6% interest each year, the escrow fund would have only $22,850 dollars in 1985 (repository availability date). This pitifully small fund will be of no value for exhumation, recontainerization, shipment to the repository, or repository charges. The stability the AEC and the NRC claimed could be established by making states responsible for nuclear facilities has not been supported in reality.

State of New York
Witness P. Skinner

To summarize, New York State is now burdened with:

- a Low Level Waste Burial Area, for which approximately $200,000 may exist for maintenance or decommissioning; the site is leaking and eroding

- a High Level Waste Burial Area, for which a $22,000 decommissioning fund should exist.

- a Waste Tank Farm, for which a $4 million perpetual care fund will exist, but which requires at least $110 million (1976) dollars for final decommissioning

- an obsolete and contaminated reprocessing plant for which no decommissioning funds exist.

Reprocessing plants are finding new host states in spite of the NFS experience because the states lack any information on long-term costs of perpetual care. The NRC has failed miserably in this regard. In truth, the reprocessing situation has not changed so drastically since New York State entered it. Essentially the same problems exist, and the same solutions are lacking. New York has simply illustrated the folly of proceeding with commercial reprocessing without proven waste management and decommissioning methods.

State of New York
Witness P. Skinner

V. Midwest Fuel Recovery Plant in Illinois

The General Electric Midwest Fuel Recovery Plant at Morris, Illinois, was roughly the same size as the Nuclear Fuel Services plant, but it incorporated different technology. The 300 metric ton per year plant was designed to use the aqua fluor separations process, followed by calcination of high level wastes. The plant as built contained a fuel receiving and storage facility, a separations facility, waste solidification system, evaporation pond and high level hardware interim storage pad. (See maps attached).

The plant failed cold testing and never became operational, despite the fact that the AEC had already issued a "go ahead" environmental impact statement. The plant is presently being used as a spent fuel storage facility.

The Summary and Conclusions of the AEC's Final Environmental Statement on the Midwest Plant read, in part, "On the basis of the analysis and evaluation set forth in this statement... it is concluded that...the action called for is the issuance of a facility operating license..."

The following paragraph was part of the evaluation in the approving AEC text:

> "If the plant is deactivated and a requirement is not imposed on the applicant to ship off-site all solid radioactive wastes, the area covered by the processing building, sand filter, and waste storage vaults would require perpetual care and surveillance. However, for this eventuality the applicant has concluded a contract with the State of Illinois Department of Public Health to provide for

> site deactivation, perpetual care and surveillance. Funds for such have been provided through a $750,000 reserve fund and performance bond."
> (Midwest FES, p. 62).

General Electric was to pay into an escrow account $250 per metric ton of fuel reprocessed. GE would cease making these payments as soon as the fund balance reached $750,000. Thus, the precise amount that would have been available at the end of plant operations is unknown. If the plant had operated for 15 years at full throughput and the escrow account earned a 6% yearly, the fund would contain $1,120,000. The contract stipulated that $500,000 of the total fund was earmarked for General Electric's use in decommissioning the plant prior to its transfer to State custody. No specific General Electric decommissioning plans were ever even outlined. The State of Illinois, therefore, would receive $620,000 for "perpetual care" of:

- -a Processing Facility in an unspecified state of contamination
- -an unknown quantity of calcined high level wastes and solid high level wastes in storage pools
- -an unknown quantity of low level dry solids in a vault
- -an evaporation pond.

State of New York
Witness P. Skinner

There is no telling the extent of work that might have to be done with the $620,000. At the very least, the site would have to be guarded 24 hours a day. Assuming that a single guard is constantly on site, seven days a week, at a total cost of $70,000 a year (3 guards plus administrative costs), and assuming that the Cost of Living Index rises at 4% a year and that the escrow funds remain in the 6% per year account, the $620,000 would provide guard services for only nine years. Under the AEC approved plan there would be essentially no funds available for any other decontamination, decommissioning or maintenance work at the Midwest FRP site.

It is extremely fortunate for the State of Illinois that the General Electric plant never functioned.

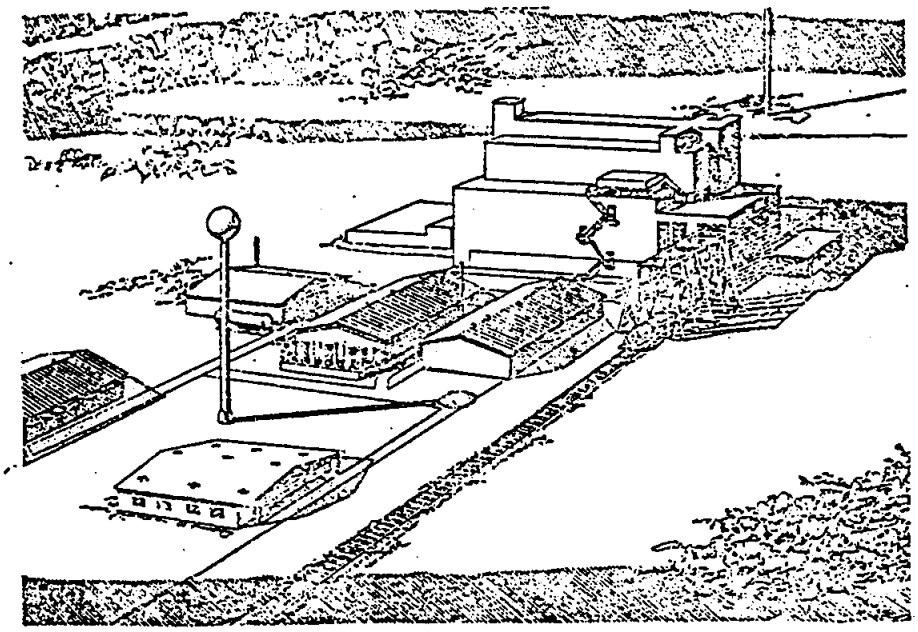


Fig. II4-1

View of General Electric Midwest Fuel Recovery Plant

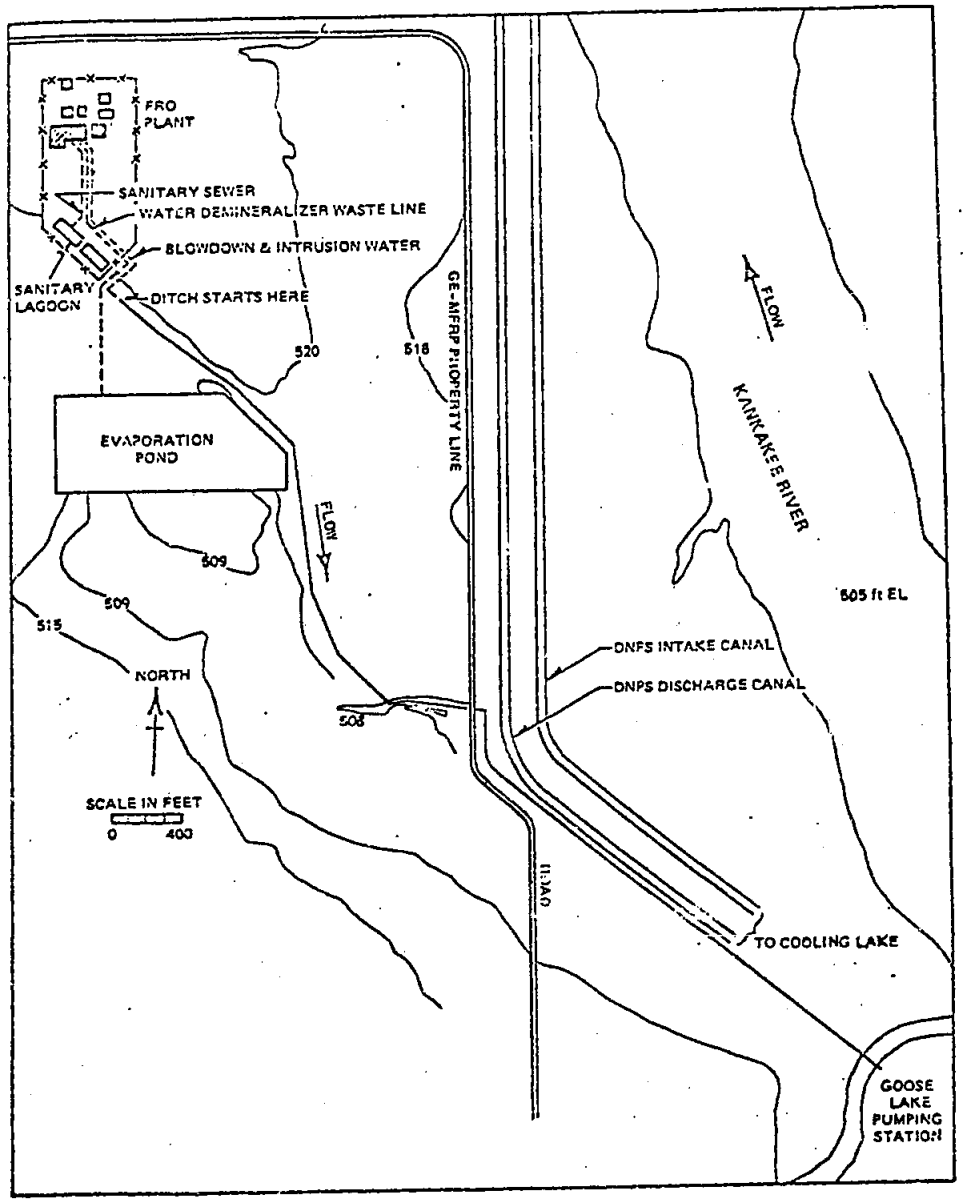

FRO PLANT
SANITARY SEWER
WATER DEMINERALIZER WASTE LINE
BLOWDOWN & INTRUSION WATER
SANITARY LAGOON
DITCH STARTS HERE
520
518
GE-NFRP PROPERTY LINE
FLOW
KANKAKEE RIVER
EVAPORATION POND
FLOW
509
509
515
NORTH
505 ft EL
DNPS INTAKE CANAL
DNPS DISCHARGE CANAL
508
SCALE IN FEET
0 400
TO COOLING LAKE
GOOSE LAKE PUMPING STATION

Figure II-2

State of New York
Witness P. Skinner

VI. Decontamination and Decommissioning the Barnwell FRP

The Barnwell FRP is a complex of facilities, many of which will become contaminated during the life of the plant and will require decontamination and decommissioning after operations cease. The heart of the plant is the separations facility. It will be a highly reinforced concrete structure containing process cells capable of treating 1500 MT of high burnup, irradiated nuclear fuel per year (5MT per day.) The separations facility itself will certainly demand D & D work. The following other Barnwell facilities will also require extensive decontamination and decommissioning:

-- a UF_6 facility
-- a Pu product facility of unspecified design
-- a waste solidification facility of unspecified design incorporating as-yet unknown technology
-- high level waste storage tanks
-- a waste storage - burial area
-- intermediate level waste storage facilities
-- TRU waste incinerators and compactors
-- decommissioning waste evaporators and off-gas treatment systems.

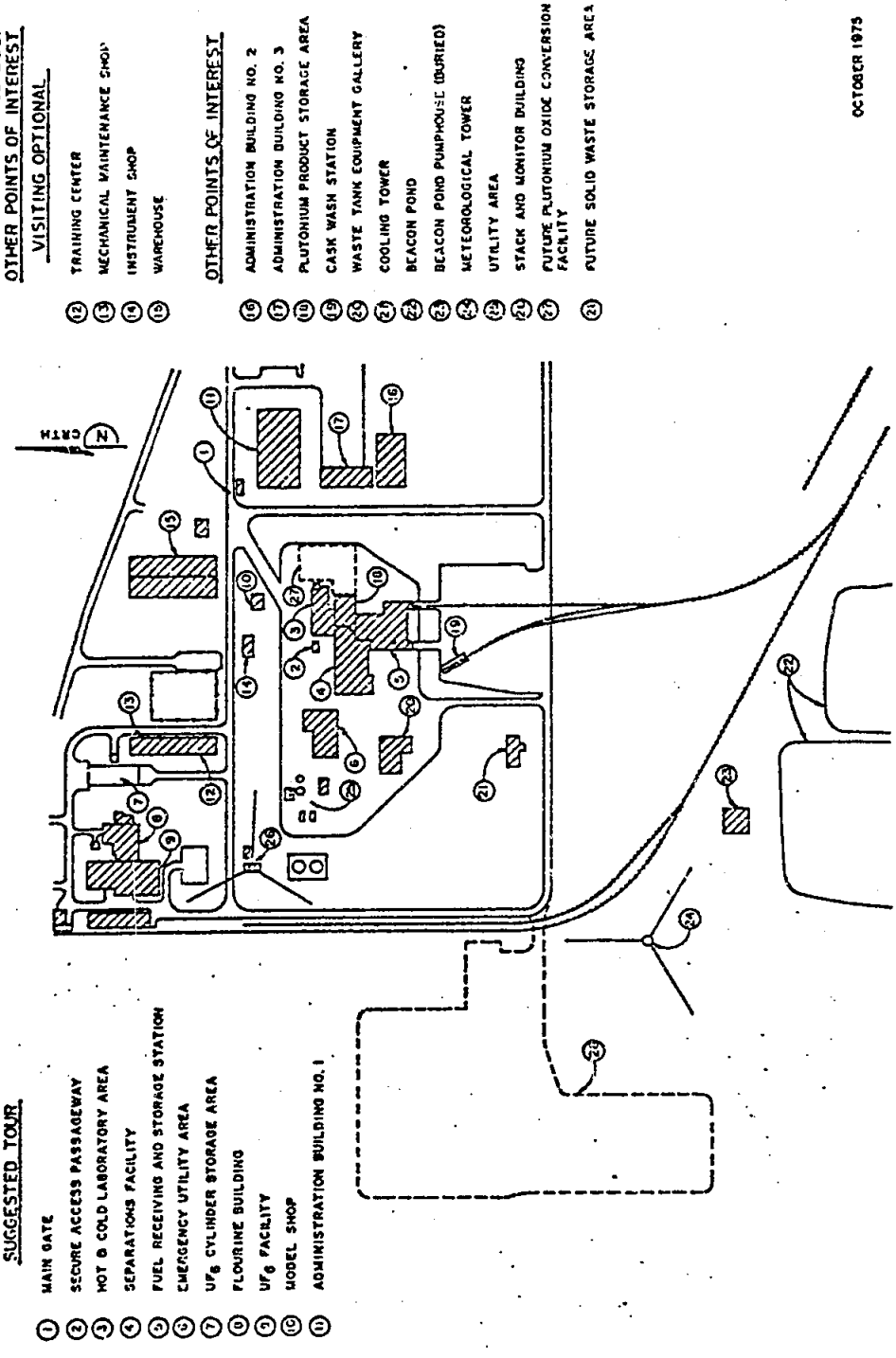


Fig. III-2. Diagram of existing BNFP layout.

State of New York
Witness P. Skinner

The decontamination and decommissioning methods and specifications to be applied at Barnwell are not defined in the AGNS FSAR or in either the Final or Supplemental Environmental Impact Statements. It is uncertain, as yet, what structures will remain permanently on-site or whether they will be entombed or dismantled. Safeguard mechanisms are equally uncertain. It is obvious that the costs of decommissioning and perpetual care must be determined and provided for before any decommissioning plan can have any credibility. The only area of the Barnwell site for which such financial arrangements have been made is the waste burial area to be managed by Chem-Nuclear Systems, Inc.

According to the Lease Agreement between the State of South Carolina and Chem-Nuclear, the latter procured and conveyed the waste burial area to the State. Thus, ultimate responsibility for the site resides with the State regardless of Chem-Nuclear's activities. In fact, the State grants itself various monitoring and oversight privileges with the Lease, though the exact nature of Chem-Nuclear's on-site activities are not to be found within the Lease.

97-393 O - 77 - 14

State of New York
Witness P. Skinner

The State receives token payment for the site, only $50 per year. It also receives $ .16/cubic foot of radioactive waste buried at the site within each quarter. The $.16 per cubic foot figure is to be adjusted every three years in accordance with the Consumer Price Index of the South. The money yielded from this arrangement is to go into an escrow fund previously established for perpetual care of buried wastes. ($50,000 downpayment by Chem-Nuclear, April 21, 1971).

It is stipulated in the lease that "upon expiration or earlier termination of this lease, all materials buried at the Site prior to such expiration or termination shall remain so buried and shall be thereupon owned by and the sole and exclusive responsibility of Lessor . . ." The State squarely shoulders the burden of perpetual care of the wastes. It can be supposed that the State will be responsible for exhuming solid wastes, a procedure that could be needed if the soil fails to contain the wastes or if the NRC decides to end shallow land burial of radioactive waste.

According to the Barnwell FES (P III-8) a maximum of 83,000 cubic feet of solid wastes would be produced each year of operation. This includes low, medium and high level waste. All solid radioactive waste will be stored within a fifty acre fenced area. All plutonium containing wastes (TRU) will be buried in retrievable concrete containers with water-tight seals. The position of the containers will be marked and recorded.

State of New York
Witness P. Skinner

If "required at a later date, these containers could be recovered from the ground and placed in shipping casks for transfer to an ultimate disposal site" (p. III-9, Barnwell FES). Contaminated (non-TRU) trash will be buried in 55 gallon drums in trenches that can be monitored and pumped.

South Carolina optimistically believes that the Waste Burial Area will only need to be guarded for thirty years. This is based on the intent to bury only short lived radionuclides in the soil. Money for surveillance will be derived from the 16 cents per cubic foot burial charge. The State feels that no guards will ever be needed to patrol the reprocessing plant.

Money for environmental monitoring of the reprocessing plant will, if an agreement with AGNS is reached, come from a tax levied on throughput tonnage. This could turn into a terrible bargain. If the plant's throughput were to turn out to be half the design throughput over the fifteen year economic life of the plant, the State would garner only half the expected surveillance money, yet the cost of monitoring the decommissioned plant would remain the same as if the plant had functioned successfully. The State of South Carolina has said that it is looking for insurance to cover this possibility.

State of New York
Witness P. Skinner

The agreement governing the Barnwell Waste Burial Area is supposed to serve as the model for an AGNS reprocessing plant agreement which has not yet been negotiated. The Chem-Nuclear agreement cannot give us much confidence that adequate moneys will be available for decontamination and decommissioning of the reprocessing facility. The Waste Burial Agreement does not provide for possible exhumation or trench pump outs, actions which are already necessary at the NFS and Maxey Flats sites. These low level waste exigencies could be paralleled at the reprocessing plant by the need for environmental monitoring, patching of failing concrete, contamination clean-up, or even decontamination of the entombed mass in case of unforeseen deterioration.

Not only is it probable that an agreement will not provide enough money for proper perpetual care, but it is also possible that escrow accounts may not be properly safeguarded. A recent $20,000 Chem-Nuclear raid on the Waste Burial escrow account (for so-called site improvements) indicates how easily a fund can be depleted prior to completing its long term function. If funds on the order of hundreds of millions of dollars are needed for proper decommissioning, the temptation will be great for both industry and the State to use the money for other such "improvements" or, worse yet, to borrow against the fund for other purposes.

State of New York
Witness P. Skinner

In some respects perhaps South Carolina has profited from other states' experiences. In South Carolina, TRU waste will be buried in what appears to be a better semblance of "retrievable" form and will be better segregated from low level wastes. South Carolina is insisting upon a fully decommissioned plant (i.e., entombment) before it will take custody. However, the State and AGNS have reached no final agreement, while the reprocessing plant rapidly approaches completion. The NRC has orally promised the State that it will withold AGNS' operating license until such time as a perpetual care agreement has been ratified.

If South Carolina is to achieve a reasonable perpetual care agreement, it may have to indefinitely pospone the opening of the Barnwell plant until regulatory guides exist for reprocessing plant decommissioning. Otherwise the State will have to process an agreement now and risk the same failures encountered by the States of Illinois, New York, and Kentucky.

State of New York
Witness P. Skinner

VII Decontamination and Decommissioning:

Actual Experience

It is instructive to consider past experience in order to evaluate costs and difficulties of decommissioning back-end fuel cycle facilities. The following table lists U.S. experience categorized by D & D mode. The table was assembled from available literature in the area. Dismantling has been the most frequently used D & D mode. Dismantling experience demonstrates that sites may be cleared and returned to normal use, after all radiation and radiotoxins have been removed from the environs. Unfortunately, this is the most expensive D & D mode. The cost of dismantling could make of this method difficult for large, complex, and highly contaminated facilities such as those proposed by the GESMO statement.

In looking at the type of facilities listed on the table and in examining the decriptive literature on each site, we have discovered that experience has been gained in varying degrees of D & D work on a wide variety of small contaminated facilities. However, no large fuel reprocessing plant has been dismantled or entombed, no large MOX fuel fabrication facility has been decommissioned at all, and only the little used Elk River Reactor has been completely excised from its site. The paucity of actual large scale D & D projects in back-end fuel cycle facilities reveals the high degree of uncertainty regarding costs, occupational exposure, and environmental hazards for all GESMO created D & D work.

ACTUAL D &D EXPERIENCE IN THE U.S.

LAYAWAY

1. Indian Point 1 (reactor)
2. NFS West Valley (FRP)

PROTECTIVE STORAGE

1. Hanford Production (reactor)
2. Fermi 1 (reactor)
3. ORNL Metal Recovery (FRP)
4. Hanford Modules (FRP)
5. Mound Lab, Pu 238 facility (Lab)

ENTOMBMENT

1. Hallam (reactor)
2. Piqua (reactor)
3. EBR 1 (reactor)
4. Mound lab-Radium 227 and Actinium 227 Facility (Lab)

DISMANTLING

1. Elk River (reactor)
2. EBR (part only) (reactor)
3. SRP (5 modules in one canyon) (FRP)
4. ORNL Pilot Systems (FRP)
5. P11 facility, Hanford (small building)
6. Los Alamos Building (Pu filter facility)
7. Overhead Working Reservoir (tank)
8. LASL Pu contaminated Lab (TA-33-21)
9. Polonium 210 facilities (Labs) (Mound Labs)
10. Alpha Contaminated Facility SRP (Recovery room and cell)

State of New York
Witness P. Skinner

Of the ten facilities listed in the dismantling column of our table, only the first three qualify as large facilities envisioned by GESMO. Only one of the facilities was highly contaminated (SRP 221-F canyon cells). Of the four facilities listed under the entombment mode, the first three are relatively large. None of these (except for entombed sections of EBR-1 reactor) were highly contaminated. Of the five facilities listed under the protective storage modes, the first four are relatively large, and all five have fairly high levels of contamination. The list of facilities under protective storage and layaway is clearly incomplete. A great number of facilities on government reservations and in universities are unknown to the general public and have not been listed. To our knowledge, no complete inventory of decommissioned facilities exists as yet.

The conclusions we can draw from this information are as follows:

1. If the facility is small, dismantling is feasible.

2. If the facility is not highly contaminated and not too large, dismantling is still preferred.

3. If the system is large, entombment is preferred by industry and the NRC.

4. If the system is large and highly contaminated, protective storage or lay away is preferred by the industry and the NRC.

Thus, the larger and more contaminated a plant is, lesser effort has been made to thoroughly decommission it.

These conclusions are provisional. At some facilities, decisions have not been made as to the proper final long-term disposition of the site. Some facility owners are no doubt awaiting

mature guidelines for D & D work. However, the huge costs, occupational exposure, and environmental hazards of D & D all limit motivation towards proper dismantling of a site. Decommissioning plans will remain unresolved at all proposed facilities until adequate information becomes available to guide owners and the States so that necessary up-front escrow funds to guarantee complete decommissioning may be established.

State of New York
Witness P. Skinner

VIII CONCLUSIONS AND RECOMMENDATIONS

A. Although the NRC staff predicts that entombment will be the preferred mode of decommissioning for back-end fuel cycle facilities, this mode is clearly at odds with the opinions of scientists at several laboratories. (See New York testimony by Smernoff.) Entombment is also at odds with anticipated NRC TRU waste guidelines which are expected to demand geologic repository disposal of TRU waste. An entombed GESMO facility will be nothing more than a huge concrete wrapped package of TRU waste subject to the same environmental pressures as segretated TRU waste in soon-to-be-forbidden shallow burial.

B. Actual practise and development of D & D guidelines have been shaped not by what decommissioning mode is needed, but by limits on costs and occupational exposure.

C. The preferred D & D modes for fuel cycle facilities are only now under study. They are not likely to be finally determined until the 1980's.

D. The past institutional arrangements governing decommissioning and perpetual care have failed to meet the needs of the contracting parties and of the public.

E. The financial arrangements to provide money for D & D and perpetual care have been and continue to be insufficient to meet even initial D & D expenses.

F. The NFS experience displays failures of every type--institutional arrangements, financial preparations, technical considerations, and

most importantly, failure of AEC - NRC guidance in pre- and post-operational activities at NFS and other facilities.

G. It is fortunate that the GE - Morris facility never operated, as the financial and institutional arrangements would not have been able to withstand the eventual costs and difficulties of perpetual care at the site.

H. The arrangements for decommissioning the GESMO "model FRP" are still in the planning stage and are unreliable bases for GESMO decision making.

I. Actual experience in D & D has not provided the knowledge needed to predict the costs, occupational exposure, or environmental hazards involved in decommissioning any one of the back-end fuel cycle facilities contemplated in the GESMO.

Peter N. Skinner, P.E.

PETER N. SKINNER, P.E. ENVIRONMENTAL ENGINEER

PROFESSIONAL EXPERIENCE AND RESPONSIBILITIES 1970 - 1977
N.Y.S. LAW DEPARTMENT, BUREAU OF ENVIRONMENTAL PROTECTION

Employment

As Associate engineer, I share direct participation with the lawyers in our office in the litigation and/or settlement of environmental controversies. I initiate investigations, represent the Attorney General at public hearings, legislative fora, and other proceedings. I write technical affidavits, articles, and comments on impact statements and appear as an expert witness./

Major Cases - Developed and presented technical support for the following environmental issues. Initiated office participation and obtained favorable determinations in most of these topics:

Pollution - Concorde SST noise, Lake Champlain sludge bed (U.S. Supreme Court), PCB's in the Hudson, organics in groundwater.

Hazard Control - LNG tankers and port facilities, plutonium air transport, leakage and safeguards at nuclear fuel reprocessing plants and burial sites in N.Y. and nationwide.

Energy Systems - Offshore oil leases and tanker loading docks, plutonium recycle in reactors (GESMO), solar energy equipment performance and legislation, reactor effluents and safety.

Resource Management - Tocks Island Dam on the Delaware, N.Y.C. water systems and the Corp's NEWS Study, protection of Hudson fisheries from the Storm King, Indian Point, and High Flow Skimming plants, management of Catskill and East-of-Hudson watersheds for water supply and recreation optimization.

SUMMER JOBS 1966 - 1970 Vermont, Colorado, Pennsylvania

Route and land surveying, general engineering, and bridge const. Performed metal fatigue testing and recycling feasibility studies.

Education

LEHIGH UNIVERSITY - B.S., Civil Engineering, 1969; A.B. Arts, 1970; Independent studies in 1970 included: computer and field analyses of airport noise levels; evaluation of nuclear plant radioactivity hazards; an ecological survey of Saucon Creek.

SEMINARS - AEC Biological Studies, ORNL, 1974; National ASCE Environmental Seminars, 1973, 1974; National Air Pollution Conference, Univ. of Tenn., 1973; Nuclear Safety Systems, UCLA, 1973.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
Albany, N.Y., July 8, 1977.

GEORGE E. BROWN, Jr.,
Chairman, Subcommittee on the Environment and the Atmosphere, Committee on Science and Technology, U.S. House of Representatives, Washington, D.C.

DEAR MR. BROWN: The enclosed statement submitted at your request attempts to place in perspective the problems associated with the low level waste burial site operated by Nuclear Fuel Services, NFS. This was done by comparison with the other wastes at the site and by comparison with one federally operated site.

The experience with environmental surveillance of the liquid wastes from the reprocessing facility has gone through a full cycle. Originally, the reprocessing facility was approved on the basis that discharges of radioactivity would be very low. The State's surveillance program found that discharges to the streams were substantially higher than predicted but were within the NRC technical specification limits. The surveillance program then found increasing levels of radioactivity in fish and deer and recommended that action be taken to reduce the discharges of radioactivity. The NRC ordered NFS to substantially reduce the discharges to the watershed and in 1971 the low level waste treatment (LLWT) facility was placed in operation. The LLWT facility only operated the latter portion of the year and the reprocessing facility shut down in early 1972.

As part of the NRC licensing procedure for the increased plant capacity, NFS requested NYS D.E.C. to provide a 401 Certification in regard to the applicable State stream standards. This application was denied and in 1976 NFS proposed further waste treatment in order to meet the maximum permissible concentrations for all radionuclides except tritum at the point of release from the main plant lagoon. This would have brought the strontium-90 levels, for example, much closer to the original predicted levels. The revised application for the 401 Certification was being considered in 1976 by NYS D.E.C. when NFS withdrew the application.

The most significant findings of the surveillance program in regard to gaseous releases was the detection of iodine-129 in milk and low levels of plutonium-238 and 239 in the air particulate samplers. These matters were to have been considered in the NRC hearing on the increased plant capacity.

I am sending under separate cover the two referenced documents (D.E.C. burial site inventory and EPA report) as well as copies of the Annual Report of Environmental Radiation in New York State for 1970 through 1974. A copy of the Conference's 1973 Waste Management Task Force report referred to in my statement will also be provided for your information.

Very truly yours,

THOMAS J. CASHMAN,
Director, Bureau of Radiation.

Enclosure.

STATEMENT OF THOMAS J. CASHMAN, DIRECTOR, BUREAU OF RADIATION, NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

INTRODUCTION

There are five distinct decommissioning and disposal problems involving the reprocessing facilities and the radioactive wastes at the Nuclear Fuel Services site in West Valley, New York. These problems have been identified at the Subcommittee's hearing on June 15 and 16.

For purposes of this statement the waste disposal and decommissioning categories are identified as follows:

1. High Level Liquid Wastes;
2. Transuranic Solid Wastes;
3. Spent Fuel;
4. Reprocessing Buildings and Equipment; and
5. Low Level Solid Wastes.

The low level waste burial site is subject to regulation by the State. The other four categories are under NRC regulatory control.

The primary purpose of this statement, submitted at the request of the Subcommittee, is to review the operating history, problems, and corrective actions at the low level waste burial site. A brief discussion of the other waste disposal and decommissioning categories is included to place the problems at the low level waste burial site in perspective. Table I summarizes the volume and curies of radioactivity in the three waste categories at NFS.

HIGH LEVEL LIQUID WASTES

This category includes 600,000 gallons of neutralized waste in a carbon steel tank and 12,000 gallons of acid waste in a stainless steel tank. The neutralized waste includes some 30,000 gallons of sludge on the bottom of the tank.

The high level liquid wastes contained some 310 million curies in 1973 and are considered to be the major potential health and safety problem at the site.

These wastes also present the major financial problem in achieving an environmentally acceptable disposal of the wastes at NFS. U.S. ERDA has estimated costs up to $600 million for solidification and transportation to a Federal repository.

To cope with the potential threat from high level liquid wastes, the NRC regulatory policy for such future wastes calls for solidification within five years after they are produced and transportation to a Federal repository within ten years. The NFS wastes were exempted from this requirement pending a separate rulemaking.

NYS ERDA, NRC and NFS are evaluating the integrity of the waste tanks to verify that this threat to the environment is kept to a minimum pending final disposal of the wastes. Continued surveillance of the waste tanks and vaults, further evaluation of the geological and hydrological factors affecting retention capability of the soil, and technical resolution of the optimum procedure for final disposal of the high level liquid wastes should have the highest priority.

TRANSURANIC SOLID WASTES

The transuranic (TRU) waste category includes the "hulls" (spent fuel cladding) and contaminated equipment from the fuels reprocessing facility. The hulls are placed in metal drums and buried in holes that are approximately 50 feet deep. It is estimated that over 87,000 cubic feet of wastes were in this NRC regulated burial site at the end of 1972. This waste includes 550,000 curies other than plutonium and has a significant plutonium contamination. This waste also includes 41 ruptured fuel assemblies that contained 457 kilograms of uranium and 819 grams of plutonium. The assemblies were encased in concrete in 1969 and buried in hole number 48. Burial of fuel elements was subsequently prohibited by the NRC technical specifications.

Transuranic nuclides such as plutonium-239 have long half-lifes and high toxicity. In 1970 U.S. ERDA banned the non-retrievable burial of transuranics at levels greater than 10 nanocuries per gram of waste at their facilities such as Hanford and Savannah River. Five of the six States with low level burial sites have banned burial of TRU wastes at those sites. NRC proposed such a ban but has withdrawn the proposed regulation pending further studies. The need for retrievable storage of the TRU wastes was to have been considered in the NRC hearing for the NFS plant expansion.

The TRU wastes do not pose an immediate threat to the environment. Nevertheless, the retention capability of the site for hundreds to thousands of years needs re-evaluation. Cost estimates for retrieval and shipment off-site should be developed for these wastes. Exhumation of TRU wastes at the U.S. ERDA site in Idaho should provide a basis for procedures and costs of retrieving the TRU wastes on the NFS site.

The geological and hydrological factors affecting retention capability of the NRC regulated TRU burial site should be evaluated by additional studies. A decision is needed in regard to the alternatives of leaving the TRU wastes on-site or retrieving the TRU wastes and shipping them to a Federal repository in accord with the previously proposed NRC regulation on TRU wastes.

SPENT FUEL

Since the decision has been made to defer reprocessing the spent fuel itself is now considered a waste.

The NFS plant is presently being used to store approximately 150 tonnes of spent fuel. Typically a metric tonne of spent fuel will contain 2 million curies one year after discharge from a reactor. The spent fuel in storage at the NFS site would therefore be somewhat less than 300 million curies as some decay will have occurred in storage.

The packaging and shipping of spent fuel in casks has been carried out as a routine practice. The removal of the spent fuel from the NFS site can be accomplished with less environmental impact than the comparable transportation

impact resulting from one year of normal spent fuel shipments to the NFS site. The cost for such packaging and shipment can be determined when the Federal repository or a commercial storage site is identified.

The possibility exists that the nation's energy needs in the future may require the recovery of uranium and plutonium from the spent fuel. Therefore, a national policy decision is needed on whether spent fuel is to be placed in permanent disposal (throw-away cycle) or is to be placed in long term retrievable storage (stowaway cycle).

REPROCESSING BUILDINGS AND EQUIPMENT

Decommissioning of the NFS fuels reprocessing facilities may be far more difficult than indicated by the small size nuclear power reactors decommissioned to date. This results from the contamination with transuranics and the high levels of radiation in the reprocessing cells. NUREG–0216 states "Radiation levels in reprocessing cells currently range from $0.7–1.8 \times 10^3$ R/hr in the general purpose cell down to 0.5 mR/hr in the plutonium product and uranium cells." The general purpose cell, GPC, was designed for remote (non-contact) maintenance and replacement of equipment in anticipation of high levels of radioactivity. The present lethal dose levels will require extensive decontamination by remote methods or will require entombment of the GPC to allow radioactive decay for many years prior to the removal and dismantling of the facilities.

A further complicating factor in decommissioning of the NFS site is the existing contamination of the shallow groundwater at the main plant site.

This is not considered hazardous from the off-site levels resulting from the discharge of the groundwater to the on-site streams. The contamination will need to be considered in the overall site decommissioning evaluation. Continued monitoring of the groundwater is required until the source of the contamination is determined and eliminated.

An Atomic Industrial Forum study on decommissioning nuclear power plants had an estimated range of $27 to $31 million for prompt removal and dismantling. The estimated cost of entombing-delayed removal/dismantling was $25 million. A U.S. ERDA study has estimated that it would cost from $19.7 million to $65.7 million to decommission a reprocessing plant at Barnwell, South Carolina.

A specific study on decommissioning the NFS facilities should be made to evaluate the several options and to estimate the cost. Pending decommissioning of the facilities, access control as well as in-plant and environmental radiation surveillance must be continued.

LOW LEVEL SOLID WASTE

This category of wastes includes 2.3 million cubic feet of wastes buried in trenches approximately twenty feet deep, thirty-five feet wide and six hundred feet long. The low level solid wastes contain 345,000 curies based on shipping records. A total of 4.39 kilograms of plutonium, predominantly plutonium-238 in terms of curies, were buried in the trenches prior to the ban on such burial in October 1973. A detailed report on the burial site inventory was prepared by the Department of Environmental Conservation in 1973 under an ETA grant.[1] The method of operation, plot plan of the site and cross-sectional views of a typical trench as described in the 1973 report are included as Appendix A. An updated plot plan is also included.

The burial site began operations under State control in 1963. The State has also provided-monitoring of the streams adjacent to the site. The site was selected because of the low permeability and absorbtive capacity of the clay soil. In the initial years of operation accumulation of water in the trenches was observed in the monitoring well at one end of each trench. Concern for the continuing increase in the level of water in trenches 1 through 5 resulted in the State requiring NFS to modify the method of burial in 1968. The approved engineering plans and procedures became effective for trench No. 8. This was the first trench in the south portion of the burial site that now contains trenches 8–14.

It is significant that the site problems to date involve the pre-1968 or north portion of the site. The corrective actions required in 1968 required a rework and mounding of the soil cover over existing individual trenches in the north

[1] "Low Level Radioactive Waste Burial Site Inventory for the West Valley Site, Cattaraugus County, N.Y." by W. J. Kelleher and E. J. Michael, June 20, 1973.

portion of the site. This was done to reduce infiltration and minimize soil erosion, the two major problems at the site. The approved plans required surface preparation, greater separation between trenches, increased depth of cover, and compaction of the cover over future trenches in the south portion of the site.

The water levels in the trenches in the south portion of the site stabilized at low levels after an initial rise and have remained stable. This indicates that the action taken in 1968 was effective for trenches constructed since 1968.

The water levels in trenches 1–5 in the north section also stabilized after 1970 for 1½ years. The levels again began to increase in the fall of 1971. In March of 1975 seepage out of the soil cover over trenches 4 and 5 was detected and confirmed by D.E.C.'s environmental surveillance program.

D.E.C.'s 1972 Annual Report of Environmental Radiation in New York State noted some increases in tritium levels in the streams adjacent to the burial site. The increases in one stream could have been caused by either surface runoff or underground migration. It was recommended in the report that a migration study be initiated of soil samples adjacent to the trenches to determine if tritium was migrating through the soil. The National Conference of Radiation Control Program Director's Task Force on Radioactive Waste Management also recommended in their 1973 report that field studies be made at existing low level burial grounds to determine the extent or potential for radioisotope migration after several years of operation.

Federal agencies have responded to these recommendations. When EPA funding was not initially available, NYS ERDA undertook the migration study in 1973. EPA subsequently provided funding and participated in the study. EPA is presently funding a major study by State Agencies of environmental pathways at the NFS site. The USGS is conducting, with the State's cooperation, an extensive hydrological and geological study at the NFS low level waste burial site and burial sites in other states. The USGS work at NFS started in 1974. The EPA and USGS studies have been designed to complement each study.

It was anticipated that the studies would provide information to assist in determining whether the increase in the water levels in the trenches was from continuing infiltration through the cover, from waste compaction and displacement of water in the trenches at the time of the 1968 cover modification or from infiltration of an underground water source. The seepage of trench water out of the cover of trenches 4 and 5 in 1975 required prompt corrective action prior to completion of the studies. Trenches 3, 4 and 5 were pumped down in three stages during 1975 and 1976. The water pumped from the trenches was subsequently treated in the NFS low level waste treatment facility and released from the NFS lagoon under controlled conditions. This action has substantially reduced the possibility of the release of large volumes of untreated trench water even if one speculates that a landslide type erosion occurs at the steep slopes on the north portion of the site.

Such erosion has been observed in the Erdman Brook and Buttermilk Creek valleys. While predominantly of long range concern, it is conceivable that this could result in exposing the end of a trench in the north end of the site in 3 to 5 years. Specific corrective action to control this problem is now in the planning stage. The likelihood of erosion breaching a trench is very small as the site operator, NFS, is required to provide needed maintenance of the site until the site is transferred to the State. The State is then committed to provide perpetual care and maintenance to assure the site integrity.

An evaluation of the operation of the site through 1975 was included in the detailed EPA report on the burial site history.[2] The EPA report stated "At present, radioactive material that has seeped or been pumped from the burial area does not appear to have significant health implications in terms of offsite dose levels."

A summary by year of the radioactive material leaving the reprocessing facility is provided in Table II. The sharp increase in the tritium levels in 1975 and 1976 are a direct result of the pumping and treatment of the burial site trench water. The treatment does not remove tritium but removes varying percentages of other more hazardous radionuclides such as strontium-90. The effectiveness of

[2] "Summary Report on the Low-Level Radioactive Waste Burial Site, New York (1963–1975)" by U.S. Environmental Protection Agency, Region II, New York, February 9, 1977.

the treatment is clearly shown in the low level of strontium-90 released in 1975 and 1976. This is the total for the reprocessing facility and the treated trench water.

The release of strontium-90 from the burial site is very low when compared with the annual releases of strontium-90 from the Oak Ridge National Laboratory burial grounds No. 4 and No. 5 as reported by ORNL. The data from ORNL reports is included for reference purposes as Tables III and IV. The ORNL burial grounds have the same problem of buildup and overflow of water from trenches that occurred in the pre-1968 trenches at the NFS site. The ORNL reports describe actions being taken to correct the problem at the ORNL burial ground. On a comparative basis there has been a maximum of 0.04 curies of strontium-90 released from the NFS site from 1963 to 1976 while the ORNL releases of strontium-90 have totaled 47.74 curies from burial grounds No. 4 and No. 5 from 1963 to 1976. This emphasizes the importance of site selection, trench design and operating procedures in areas subject to heavy rainfall.

The on-going USGS and EPA studies at the NFS site have produced and will produce information of value in assessing the retention capabilities of the NFS site, in determining the additional short range corrective actions needed at the burial site, and those actions needed to assure the continued long range protection of the environment. These studies are being augmented by a study for NYS ERDA by Dames & Moore that should be available for review by late July 1977. This later study will include specific recommendations and cost estimates on procedures to reduce water infiltration through the cover of the trenches, to reduce the slope erosion problem at the north portion of the site and to improve the monitoring of trench water levels.

Preliminary results from the USGS study have confirmed that the movement of water downward through the clay to a horizontal water bearing strata and the subsequent movement through this strata to the environment will be in the time span of 300–500 years.

The USGS study has also confirmed that water is still infiltrating through the cover of the trenches in the north portion of the site. The study demonstrated that the infiltration was the primary source of water entering the trenches. This infiltration, buildup and overflow of trench water within 12 years in trenches 3–5 obviously by-passed the retentive capability of the clay soil.

The EPA environmental pathway study placed initial emphasis on the water pathway but also has measured the concentration of radioactive gases such as carbon-14 and tritium in methane within the trenches and escaping from the surface of the trenches. The on-going EPA study is expected to quantify these gaseous releases.

It is the purpose of the past corrective actions, the on-going studies, and the proposed corrective actions to achieve the basic objective of retaining the radioactivity on-site. A cycle that requires pumping and testing of trench water every 10 to 15 years to prevent overflow does not meet this objective. Experience with the trenches installed in 1968 and subsequent years indicates the objective may be met with planned surveillance and routine maintenance.

Priority should be given to reducing infiltration of water through the soil cover of the pre-1968 trenches at the burial site. This corrective action should factor in methods to reduce soil erosion on both the soil cover over the trenches and the steep slopes at the north end of the site. Action is also needed to improve the long range (700–1,000 years) slop stability to assure the retention of the radioactive wates on site. If these actions are effective it is unlikely that the radioactive wastes will need to be exhumed unless it is decided to remove the plutonium wastes in the future.

Environmental monitoring of radioactivity is being provided and should be continued to assess the effectiveness of the actions taken to establish and maintain the radioactive waste integrity of the site.

In summary the low level waste burial site has a far smaller potential environmental and health impact than the high level liquid wastes at the NFS site. The costs of corrective actions still required at the low level waste burial site will be far less than those projected for the high level wastes and the facility decommissioning. They will also be far less than the cost of exhuming and shipping the TRU wastes if this should be required. Nevertheless, the 345,000 curies of radioactivity in the low level waste burial site demand continued regulatory control and monitoring of the site.

97-393 O - 77 - 15

TABLE I.—NFS WASTE CATEGORIES

[Volumes and curies]

	Volume	Curies
1. High-level liquid wastes:		
A. Neutralized	600,000 gal	310,000,000
B. Acidic	12,000 gal	2,500,000
2. Transuranic solid wastes	87,000 ft³	550,000
3. Low-level solid wastes	2,300,000 ft³	345,000

Note: High-level liquid wastes as calculated for 1973. The curies will be somewhat less in 1977 because of radioactive decay. Transuranic solid wastes information based on records through 1972. Additional material buried in years 1973–76. The 550,000 curies are activity other than transuranics. The waste has a significant plutonium contamination and is classified as transuranic wastes. The low-level solid wastes activity in curies is based on shipping records information. The curies will be somewhat less in 1977 because of radioactive decay. The low-level solid wastes includes 4.39 kg of plutonium buried prior to the ban on such burial in 1973.

TABLE II.—ANNUAL LIQUID EFFLUENTS FROM NFS PLANT

[In curies]

Date	Gross alpha	Gross beta	Tritium	Sr–90
1966	0.038	8.0	290	
1967	.056	31.0	4,200	4
1968	.140	46.0	2,600	5
1969	.380	104.0	6,000	10
1970	.100	87.0	4,500	13.3
1971	.060	77.0	3,800	7.8
1972	.024	43.0	605	.7
1973	.002	1.4	75	.05
1974	.007	.7	43	.03
1975	0.001	.5	1,400	.02
1976 [1]	.002	.4	2,317	.02

[1] Includes 1st week of 1977.

AMOUNT OF RADIOACTIVITY FROM COMPLETED TRENCHES [1]

Date	Number of pumpout	Volume (gallons)	HTO (curies)	Gross beta (curies)	Gross alpha (curies)	Sr–90 (curies)
Mar. 22, to Apr. 13, 1975	1st pumpout	220,000	737	0.26	0.006	0.11
Oct. 1, to Nov. 10, 1975	2d pumpout	363,000	1,140	.44	.008	.19
July 7, to Oct. 16, 1976	3d pumpout	1,000,000	3,473	1.10	.027	.47
Total, 1975–76		1,583,000	5,350	1.80	.041	.77

[1] Before treatment in low-level waste treatment facility.

TABLE III.—DISCHARGE OF ^{90}Sr FROM BURIAL GROUND 4 AND PRECIPITATION DATA FOR WATER YEARS 1963 THROUGH 1975

Water year [1]	Precipitation (inches)	Total ^{90}Sr discharge (Ci)	Discharge of ^{90}Sr (Ci/inch)
1963	55.33	4.82	87.1
1964	42.09	2.71	64.4
1965	51.98	3.10	59.6
1966	40.85	2.52	61.7
1967	60.54	2.72	44.9
1968	45.01	2.04	45.3
1969	40.07	2.08	51.9
1970	47.93	1.60	33.4
1971	48.26	1.18	24.5
1972	47.40	2.36	49.8
1973	71.27	1.58	22.2
1974	68.76	5.22	75.9
1975	57.73	3.22	55.8

[1] Water year is Sept. 1 through Aug. 31.

Source: "ORNL Burial Ground Investigations and Corrective Measures" by J. O. Duguid.

TABLE IV.—DISCHARGE OF ^{90}Sr FROM BURIAL GROUND 5 AND PRECIPITATION DATA FOR WATER YEARS 1967 THROUGH 1975

Water year [1]	Precipitation (inches)	Total ^{90}Sr discharge (Ci)	Discharge of ^{90}Sr (mCi/inch)
1967	60.54	0.99	14.7
1968	45.01	2.84	63.1
1969	40.07	.88	22.0
1970	47.93	.93	19.4
1971	48.26	.58	12.0
1972	47.40	.81	17.1
1973	71.27	1.43	20.1
1974	68.76	1.39	20.2
1975	57.73	2.07	35.9
1976	52.90	.77	14.5

[1] Water year is Sept. 1 through Aug. 31.

Source: "ORNL Burial Ground Investigations and Corrective measures" by J. O. Duguid.

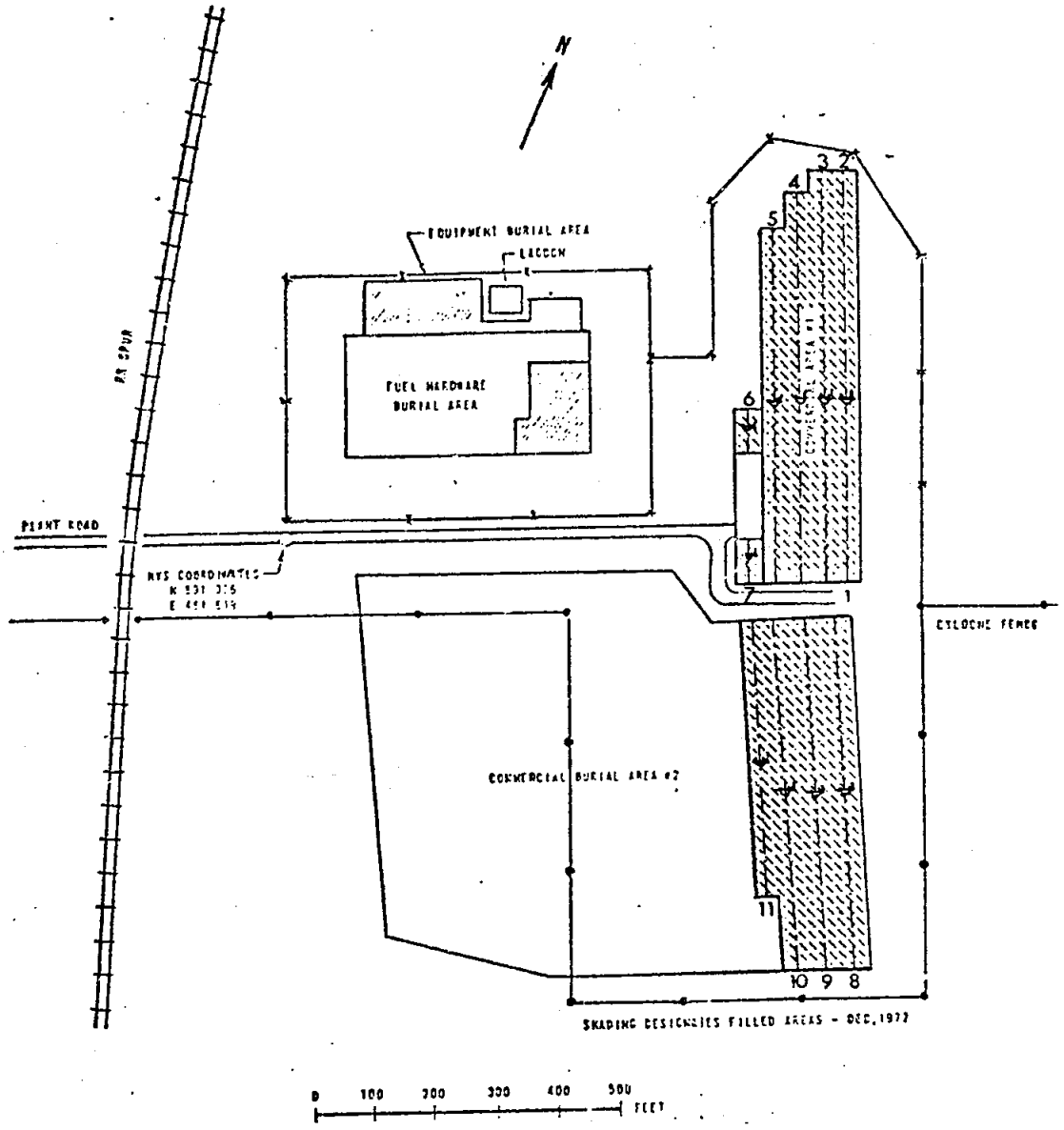
METHOD OF OPERATION

The trench type of sanitary landfill operation is used without compaction or daily covering. A typical trench is approximately 35′ in width, 20′ deep with some trenches being as long as 700′ in length. A trench is opened from 100′ to 200′ in length at a time. Containers holding radioactive wastes such as 55 gallon steel drums and other types of packaging are laid one on top of the other to the original ground surface. Backfill is then placed to a depth at least four feet above original grade. Once a trench is completed for its full length, an additional mounded cover is provided. Also, the surface is periodically smoothed to eliminate settlement cracks and holes. Excavation and backfilling of trenches and repairs of the cover are all done with a bulldozer. A sump with a riser pipe packed in sand and gravel at the bottom has been provided at the end of each trench for purposes of routine observations of water levels in the trenches. A plot plan in Appendix A shows the location of the various trenches and the location of the NFS operation for burial of hulls and other materials which is licensed by the Atomic Energy Commission. Also in Appendix A are longitudinal and cross sectional views of a typical trench.

Shipping records are required by NFS as shown in Appendix B indicating volume and types of radionuclides present plus chemical form. However, the description of chemical form in most cases was incomplete. Each package in the shipment is examined for leaks of liquids and for external radiation levels by the operator. The operator keeps a log book showing the location of each shipment in a particular trench, the number of curies, the number of cubic feet buried, plus a special notation on the amounts of special nuclear material that may be present.

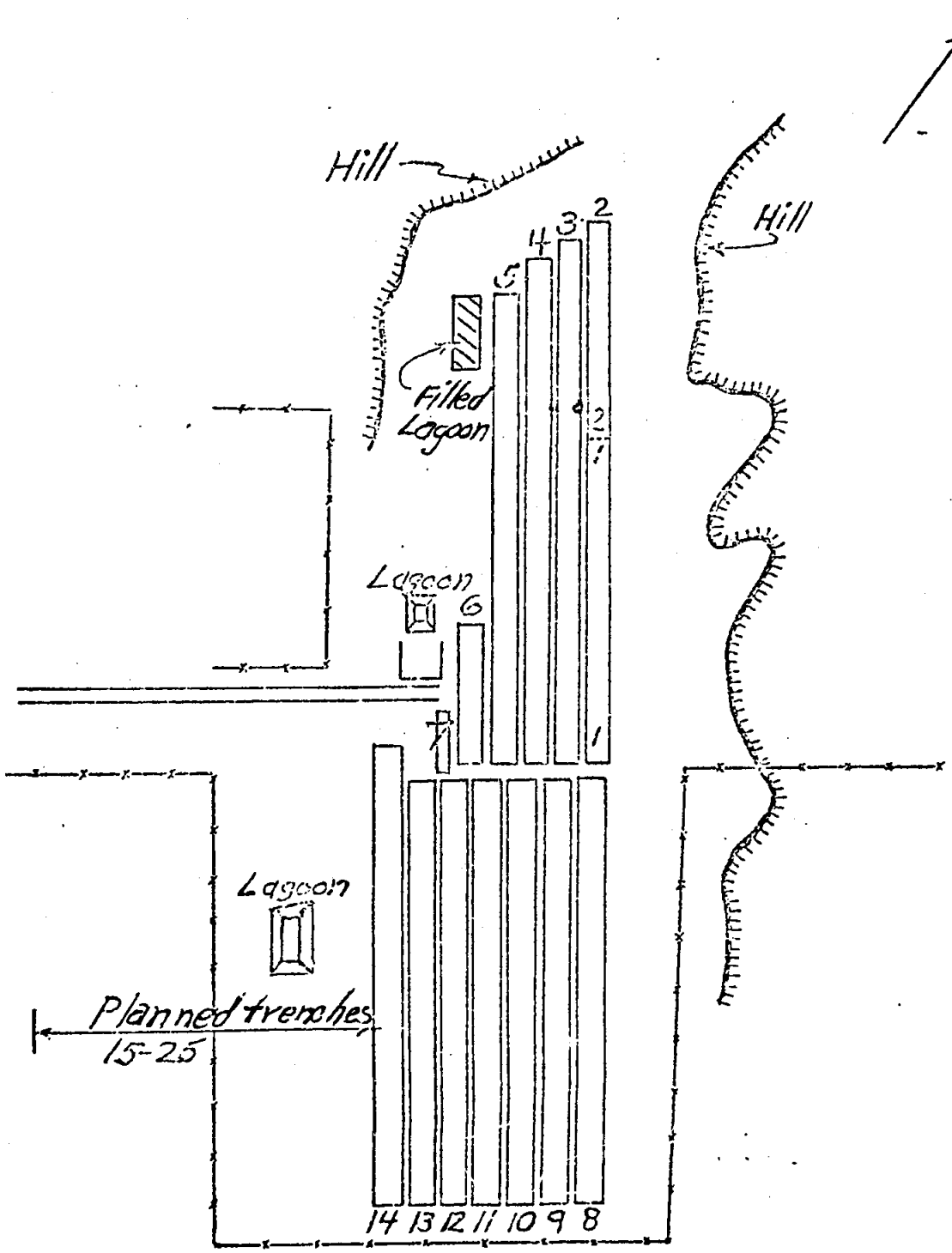
Trenches one and two are the same trench. Trench seven is a small trench where shipments were encased in concrete. The area for trench six was set aside for individual holes for high external radiation shipments.

The operator, Nuclear Fuel Services, only allows the burial of spent resins from nuclear power plants when incorporated in concrete or equivalent concrete containers. A copy of the present regulations of the operator are enclosed in Appendix C. It should be noted that this resulted in some nuclear power plants shipping resins to Kentucky although the NFS site in closer and the transportation costs would be less.



WHYNOT BURIAL AREA

FIGURE 1



BURIAL SITE TRENCHES

FIGURE 1A

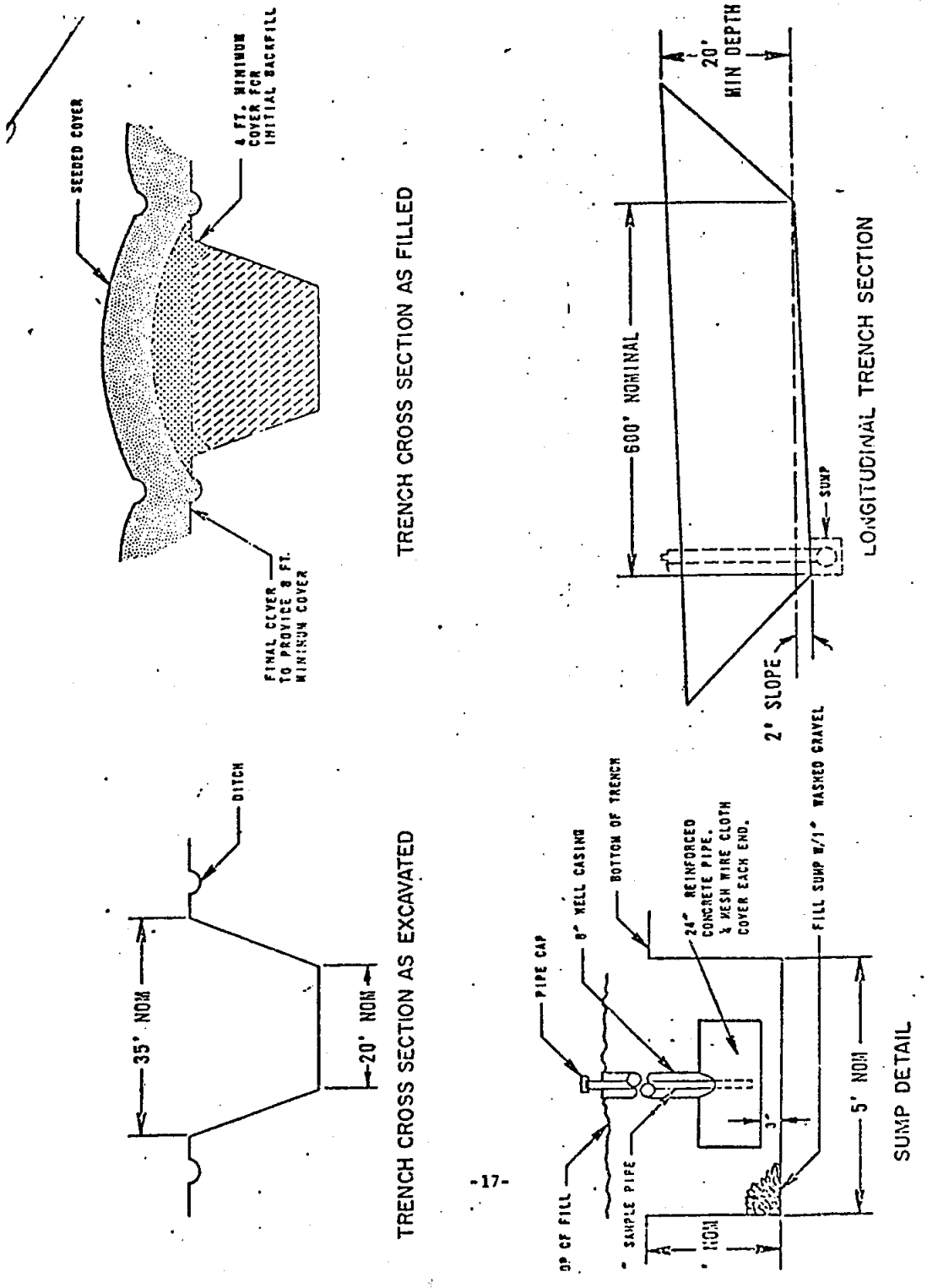

SEEDED COVER
4 FT. MINIMUM COVER FOR INITIAL BACKFILL
FINAL COVER TO PROVICE 8 FT. MINIMUM COVER
TRENCH CROSS SECTION AS FILLED
DITCH
35' NOM
20' NOM
TRENCH CROSS SECTION AS EXCAVATED
600' NOMINAL
20' MIN DEPTH
SUMP
2' SLOPE
LONGITUDINAL TRENCH SECTION
PIPE CAP
6" WELL CASING
BOTTOM OF TRENCH
24" REINFORCED CONCRETE PIPE. ½ MESH WIRE CLOTH COVER EACH END.
FILL SUMP W/1" WASHED GRAVEL
SAMPLE PIPE
3'
5' NOM
SUMP DETAIL
COMMERCIAL BURIAL TRENCH

FIGURE 2

APPENDIX II

ADDITIONAL MATERIAL FOR THE RECORD

NFS

Nuclear Fuel Services, Inc. 6000 Executive Boulevard, Suite 600, Rockville, Maryland • 20852

A Subsidiary of Getty Oil Company (301) 770-5510

Ralph W. Deuster
PRESIDENT

July 6, 1977

The Honorable George E. Brown, Jr., Chairman
Subcommittee on the Environment and the
Atmosphere
2342 Rayburn House Office Building
Washington, D. C. 20515

Dear Mr. Chairman:

This letter is to clarify and correct two statements made by Dr. Resnikoff in his June 15, 1977 testimony before The Environment and the Atmosphere Subcommittee of the House Science and Technology Committee. We ask that you include this letter as a part of the record of those hearings.

1. In his testimony Dr. Resnikoff states that Nuclear Fuel Services, Inc. did not comply with Schedule 3A of the Waste Storage Agreement and, therefore, should be responsible for part of the costs of resolving the waste problem at West Valley. Dr. Resnikoff is incorrect because Schedule 1 - not Schedule 3A - is the schedule which contains the contract requirements for the tank in which the waste is presently stored at West Valley and NFS has fully complied with the requirements of Schedule 1. Furthermore, Dr. Resnikoff's understanding of Schedule 3A is erroneous.

The tank in which the waste is stored at West Valley is defined under Section 2.01 of the Waste Storage Agreement as one of the "Initial High Level Storage Facilities" and was constructed on behalf of the Authority. Section 2.02(b) of the Waste Storage Agreement provides that the Storage Parameters for the Initial High Level Storage Facilities are as set forth in Schedule 1, entitled "Storage Parameters for Initial High Level Storage Facilities." Schedule 1 delineates very specific requirements (Storage Parameters) including actual design drawings for the various tank components. Neither Section 2.02(b) nor Schedule 1 contain any reference to the terms of Schedule 3A or to the buildup of sludge. Schedule 1 provides for construction in accordance with detailed specifications and drawings and leaves no room for discretion in meeting general guidelines such as those set forth in Schedule 3A.

Schedule 3A to the Waste Storage Agreement applies to "Carbon Steel Facilities" and provides a broad outline which was to serve as a general guide in developing the Storage Parameters for future carbon steel facilities in accordance with Section 2.02(c). Section 2.02(c) requires that the Storage Parameters for future facilities are to be the subject of future agreement between NFS and the Authority, and, in the absence of agreement on the first two future carbon steel tanks, Schedule 1 was to apply again.

Finally, Dr. Resnikoff misunderstands the purpose of Schedule 3A. There was not then and there is not now any known way of preventing the formation of sludge or its settling to the bottom of the tank. The reference to the agitation of the sludge by compressed air relates to the experience gained at AEC sites in connection with a phenomenon known as bumping. Severe bumping had occurred on some occasions at the AEC sites, creating concern over excessive off gas releases. It was considered desirable for the tanks constructed at West Valley to contain a means of agitating by compressed air to control the temperature buildup as the solids in the sludge settled. The requirements of Schedule 1 incorporated such an agitation feature into the tank in which the waste is presently stored at West Valley and it was intended, as evidenced by Schedule 3A, that such features be incorporated in future tanks.

2. Dr. Resnikoff also suggests that the utility companies may have a responsibility for the wastes at West Valley. His suggestion is based on an October 14, 1970 contract between NFS and Consumers Power Company which has nothing to do with the waste presently stored at West Valley. No fuel was reprocessed nor was any waste ever generated under that contract. All the waste stored at West Valley was generated under the AEC Baseload Contract and utility contracts containing specific disclaimers of any responsibility by the utility for the waste.

Sincerely yours,

Ralph W. Deuster

Ralph W. Deuster

RWD:jnw

STATE OF NEW YORK
DEPARTMENT OF LAW
TWO WORLD TRADE CENTER
NEW YORK, N.Y. 10047
TELEPHONE: 212-488-7562

LOUIS J. LEFKOWITZ
ATTORNEY GENERAL

PHILIP WEINBERG
ASSISTANT ATTORNEY GENERAL
IN CHARGE OF
ENVIRONMENTAL PROTECTION
BUREAU

July 7, 1977

Hon. George E. Brown, Jr.
Chairman
Subcommittee on the Environment
and the Atmosphere of the
Committee on Science and Technology
Room 2342 Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Brown:

The Attorney General has followed with great interest the hearings conducted by your Subcommittee on H.R. 6796 (to authorize appropriations to the Energy Research and Development Administration ["ERDA"] for the fiscal year 1978) and the testimony presented on the need for decontamination and decommissioning ("D & D") of the Nuclear Fuel Services ("NFS") reprocessing facility in West Valley, New York.

The Attorney General wishes to make several comments and recommendations in connection with Section 105.(a) of H.R. 6796. That Section directs the Administrator of ERDA to prepare and submit a report to the Congress, within one year of the bill's enactment, which considers the several options open to the federal government to resolve the problems of the West Valley facility.

At the outset it should be remembered that a significant effort has already been made by the Battelle Pacific Northwest Laboratory to assess some of the methods, costs and impacts of decontaminating and decommissioning a fuel reprocessing facility. Obviously, this work, which has been incorporated into a draft report entitled "Technology, Safety and Costs of Decommissioning a Reference LWR Nuclear Chemical Separations Facility" (January, 1977) and is being reviewed by the Nuclear Regulatory Commission, should not be duplicated by ERDA.

Quite the contrary, the ERDA study of NFS should build on it and any other technical studies bearing on D & D which may surface prior to work commencing at NFS.

The ERDA report is to form the basis for future Congressional decisions on the federal role, if any, in West Valley. In order to prepare an adequate report for such use by Congress, ERDA must assess a number of key issues. The $1,000,000 being appropriated for this work will go very fast. It will be important, therefore, to generate a report with such a degree of specificity as will give the Congress a clear perspective on the options for future federal action.

Obviously, the study must start from the premise that the long term goal of all parties is to return the NFS site to a safe and acceptable condition from the standpoints of the public health and the environment. ERDA, however, must first determine what steps for interim protection of health and safety will be necessary during the period of planning for, and execution of, D & D of the NFS facilities and radioactive wastes.

To be able to do this, ERDA must describe in detail the existing facilities and wastes. In connection with this "inventory", ERDA must assess the present environmental impact of the facility and wastes and make specific proposals for an interim facility surveillance and monitoring program.

Next, the Congress must be informed as to the full range of possibilities for future site use and must further be apprised of the range of available alternative modes for D & D including, for example, protective storage or dismantling. In connection with a discussion of D & D modes, ERDA must, with some precision, project the costs of each alternative mode and the environmental impact of the D & D itself. Extremely important is the determination of which types of site use would be possible after each alternative mode of D & D. Additionally, the occupational exposure from the various D & D Modes should be projected.

Naturally, consideration must be given to the applicable federal regulations and existing technological constraints. Congress must know what can be done under the relevant health, safety and environmental laws and, moreover, what can be done with today's technology. We cannot rely on projected technologies which may become available 10 years from now. It would be helpful to consider the possibilities of public acceptance of, or resistance to, various D & D modes. ERDA should consider what criteria will be necessary to assure quality control in terms of health, safety and the environment during D & D. Finally, the most important substantive section of ERDA's report to Congress should be an evaluation of the D & D alternatives based on all of the factors previously mentioned. This section must include a specific recommendation of a D & D mode accompanied by a statement of the reasons for the ERDA recommendation and a detailed D & D program plan for its execution.

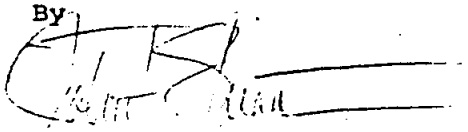
If this study is prepared in accordance with the above recommendations, Congress will then be able to make a truly educated choice among the options for federal action. The report will further serve as a useful technical reference for the entire Nation and the nuclear industry.

The importance to the Congress and the State of New York of the ERDA report cannot be overemphasized. Time is running short in certain legal respects because of the stated intention of NFS to surrender all wastes and facilities by 1980. It would be tragic if, after a year of anticipation, the ERDA report proved to be superficial, duplicative of existing knowledge, or otherwise inadequate for the needs of Congress.

Your consideration of these comments and recommendations is greatly appreciated. If you, the other members of Subcommittee, or your staff have any questions regarding this submission, please contact this office and we will make our resources in this area available to you.

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
By



JFS:rab

JOHN F. SHEA, III
Assistant Attorney General

REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Cleaning Up The Remains Of Nuclear Facilities-- A Multibillion Dollar Problem

Energy Research and Development Administration
Nuclear Regulatory Commission

The problem of protecting the public from the hazards of radiation lingering at nuclear facilities which are no longer operating needs Federal attention if a strategy for finding a solution is to be developed.

The solution doubtless will be expensive--but the expense should be known so the responsible parties can plan for the inevitable cost. A strategy to clean up these privately and federally owned nuclear facilities, which continue to accumulate, cannot be developed until basic questions on the magnitude of the problem, such as costs, radioactivity, and timing, have been answered.

EMD-77-46

JUNE 16, 1977

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-164052

To the President of the Senate and the
Speaker of the House of Representatives

This report discusses the Nuclear Regulatory Commission's and the Energy Research and Development Administration's programs for disposing of nuclear facilities after these facilities are no longer needed.

We made this review as a part of our evaluation of the effectiveness of the Commission's regulatory activities, as required by the Energy Reorganization Act of 1974 (42 U.S.C. 5876). The Administration was included because of similar program activities.

We are sending copies of this report to the Chairman, Nuclear Regulatory Commission, and to the Administrator, Energy Research and Development Administration, and to interested committees of the Congress.

Sincerely yours,

Comptroller General
of the United States

Enclosure

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

CLEANING UP THE REMAINS OF NUCLEAR FACILITIES--A MULTI-BILLION DOLLAR PROBLEM

Nuclear Regulatory Commission
Energy Research and Development Administration

D I G E S T

Sixty-four commercial nuclear powerplants are now licensed to operate in the United States. By the year 2000, there may be about 235. The licenses for commercial nuclear activities in areas such as medicine and industry, now stands at about 19,000. Numbers of other kinds of nuclear facilities have also been increasing and still are. (See pp. 4 to 8.)

As with every industry, nuclear facilities and equipment may be shut down, replaced, or become obsolete. Cleaning up the remains of nuclear activities, however, presents special problems because of radioactivity and contamination which can endanger public health and safety. Some radioactivity remains hazardous for thousands of years making final and absolute disposal at best a difficult and expensive task. (See p. 3.)

Responsibility for seeing that this is done rests primarily with two Federal agencies with additional help from a third and the 50 states:

The Energy Research and Development Administration is responsible for disposing of, or decommissioning, the radioactive facilities it owns.

The Nuclear Regulatory Commission is responsible for regulating private users of nuclear materials, including powerplants, uranium mills and processors of nuclear fuel.

The 50 States have traditionally been responsible for controlling the hazards of using accelerators and radium.

The Environmental Protection Agency has overall responsibility for issuing standards for the protection of the environment from all sources of radiation. But to do this it must have cooperation from the other two agencies identified.

THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

This agency has not paid enough attention to its facilities that are now obsolete. It has not compiled relevant

details of the facilities it owns--obsolete or operating--which would permit it to assess the magnitude of the decommissioning problems they pose. (See p. 17.)

Funds for decommissioning have been used for several specific projects. One project involved sites used for radiological operations 20 to 30 years ago that were released for unrestricted use by the general public. An attempt is being made now to identify any of these sites that are still contaminated and to do what is necessary to eliminate remaining radiation. (See pp. 9 and 10.)

Meanwhile, this agency's facilities in need of decommissioning have been accumulating. Reliable estimates have not been made but it seems probable that the cost to decommission federally-owned nuclear facilities will run into billions of dollars. One of its contractors estimated it could cost as much as $4 billion to decommission the facilities at the largest of this agency's 26 reservations. (See pp. 17 and 18.)

THE NUCLEAR REGULATORY COMMISSION

The Commission has done relatively little to plan for and to provide guidance for decommissioning of commercial nuclear facilities. Studies sponsored by the Commission on acceptable alternative methods to decommission are several years from completion. It does not require owners of nuclear facilities--except for uranium mills--to develop plans or make financial provisions to cover the cost for future decommissioning. Consequently, the true cost of nuclear power is not being reflected in the cost to the consumer of nuclear power. Without this financial provision, the Federal or State Governments can be asked to pay for problems that rightfully should be paid by private industry. (See pp. 11, 12, and 15.)

Situations where this has happened, or may, have already arisen. For example, the Federal Government will pay about $85 million to clean up residues from inoperative uranium mills that were privately owned. Also, as much as $600 million may be needed to decommission a privately owned nuclear fuel reprocessing plant at West Valley, New York. The State Government is responsible for cleaning-up the plant but has asked the Federal Government for assistance. In a case at Clinton, Tennessee, the Federal and State Governments shared the cost--approximately $110,000--to decontaminate a facility that the owners walked away from in 1971. (See p. 15.)

Although cost estimates to decommission private facilities have not been developed by the Commission, a recently completed study by a private organization estimated the cost to decommission a commercial nuclear reactor to be as much as

$39 million. No cost data, except for wide-ranging estimates, is available for decommissioning other facilities, such as uranium mills or fuel fabrication plants. (See pp. 13 and 14.)

STATE GOVERNMENTS

A conference of State officials has recommended that States protect themselves from financial loss should a company not be able to pay to decommission its facilities. However, only seven States require some form of bonding or advance accumulation of funds for decommissioning. (See p. 23.)

The problem of protecting the public from the hazards of obsolete nuclear facilities needs Federal attention if a strategy for finding a solution is to be developed. The solution, in all likelihood, will be expensive--but the expense should be known so the responsible parties can plan for the inevitable cost.

A strategy cannot be developed until certain basic questions have been answered.

--How much will decommissioning cost and who should pay?

--How should nuclear reactors be decommissioned?

--What is the extent of the decommissioning problem for accelerators?

--Are standards needed for induced radiation?

--What should be the limits on acceptable radiation levels?

--What more should States do to plan for decommissioning?

(See pp. 13 to 24.)

A bill (H.R. 6181) has been proposed directing the Energy Research and Development Administration to study decommissioning comprehensively. This study should provide basic information needed to develop a strategy toward solving decommissioning problems.

RECOMMENDATION TO THE CONGRESS

Because of the magnitude, cost and time already lost, the Congress should designate one lead Federal agency--the Nuclear Regulatory Commission--to approve and monitor an overall decommissioning strategy.

The Nuclear Regulatory Commission is uniquely suited for this role because of its charter to independently regulate commercial nuclear activities to assure public health and safety. This position is consistent with a previous GAO report and testimony. Placing this responsibility with the Commission would, in addition, increase the credibility of Federal regulation over nuclear energy.

The Energy Research and Development Administration should continue its research and development efforts aimed at finding alternatives for decommissioning and decontamination of nuclear facilities.

Recommendations

The Administrator of the Energy Research and Development Administration as part of his research and development responsibility, should

- --determine alternative methods of decommissioning, acceptable levels for induced radiation and surface contamination, and the extent of the decommissioning problem for accelerators;
- --expand and accelerate a program to decommission nuclear facilities currently excess to its needs; and
- --require that program managers plan for future decommissioning and include such cost information in their program budgets.

The Chairman, Nuclear Regulatory Commission, should for those facilities he regulates

- --require specific plans for decommissioning at the time of licensing, including the decommissioning method to be used and a funding mechanism to assure that facility owners pay the costs of decommissioning;
- --determine the acceptable levels for induced radiation and surface contamination consistent with environmental standards being developed by the Environmental Protection Agency; and
- --encourage States to follow the lead of the Commission in adopting comprehensive decommissioning planning for facilities under States' control.

AGENCY COMMENTS

The Energy Research and Development Administration was unable to furnish written comments in time to be finalized in this report. However, GAO met with Energy Research and Development Administration officials and obtained their oral comments which have been incorporated in this report. These officials disagreed with giving the Commission responsibility over Energy Research and Development Administration facilities. However, they will consider this matter further and will provide written comments in the near future.

The Nuclear Regulatory Commission's comments on the report are contained in a letter dated June 10, 1977. (See appendix I.) The letter describes the actions the Commission is taking or plans to take to develop methods and criteria for decommissioning nuclear facilities.

Because of time constraints and the report's relatively limited treatment of the Environmental Protection Agency, its comments were not sought.

Contents

ABBREVIATIONS

AEC	Atomic Energy Commission
ERDA	Energy Research and Development Administration
GAO	General Accounting Office
NRC	Nuclear Regulatory Commission

CHAPTER 1

INTRODUCTION

Before 1954, nuclear activities were confined largely to the Federal Government and to military applications. In that year, legislation was enacted permitting commercial firms to use nuclear materials and operate nuclear facilities. The uses for nuclear material and facilities then began to expand, reaching farther into such areas as medicine, industry, and electrical production.

As the uses increased, so did the equipment and facilities involved in the uses. Equipment and facilities in the nuclear industry, as in any other, become obsolete, break down, or are replaced or abandoned for a variety of reasons. This report discusses the problems in making sure that the facilities, equipment, and materials involved in nuclear activities are disposed of in a way that precludes any health or safety hazards--now or in the future.

FEDERAL AND STATE RESPONSIBILITIES

The Energy Research and Development Administration (ERDA) is responsible for the radioactivity in facilities it owns, leases, and controls. This includes facilities such as reactors and accelerators located both on nonfederal and on ERDA-owned property--commonly referred to as ERDA reservations.

The Nuclear Regulatory Commission (NRC) is responsible for regulating private uses of nuclear materials. This responsibility covers nuclear powerplants, uranium mills, facilities which make or process nuclear fuel, and the regulation of users of source, byproduct, and special nuclear material 1/. NRC fulfills its responsibility through a system of licensing and inspection.

The Environmental Protection Agency has overall Federal responsibility for issuing standards for the protection of the environment from all sources of radiation. To carry out this responsibility, however, the Environmental Protection Agency must have the cooperation of other Federal agencies. Therefore, ERDA and NRC are primarily responsible for

---

1/Source material is naturally occurring radioactive material such as uranium and thorium. Byproduct material is radioactive material created during a nuclear reaction. Special nuclear material is enriched uranium and plutonium.

developing, implementing, and enforcing radiation standards for individual nuclear facilities.

States traditionally have been responsible for protecting the public health and safety and controlling the hazards of radium and naturally occurring radioactive materials which are not subject to NRC control. In addition, 25 States have signed agreements with NRC whereby they control the source, byproduct, and small quantities of special nuclear materials located within their boundaries.

The remaining chapters of this report discuss

--the facilities and activities that present a problem;

--the past and current efforts to solve the problem;

--the major questions that remain unanswered; and

--our conclusions, observations, and recommendations.

CHAPTER 2

FACILITIES AND ACTIVITIES

THAT MUST BE CLEANED UP

While a nuclear activity is ongoing, the materials, equipment, and facilities that come into contact with a nuclear reaction or radioactive material could become contaminated or radioactive. Once the activity is ended, disposing of these items presents special problems. Facilities once used for nuclear activities cannot be abandoned if radioactive materials remain that present a radiation hazard. Structural materials or equipment cannot be recycled if they have been made unsafe by contact with a nuclear activity. A nuclear operations building cannot be reused for other purposes unless radioactive materials and contamination have been removed or reduced to acceptable levels.

Many types of nuclear facilities must be prevented from endangering public health and safety. Each type will have to be handled, or decommissioned, in a different way. A major factor in determining the best way is the nature of the radiation hazard at the facility.

Two types of hazards could be involved in a nuclear facility: induced radioactivity and surface contamination. Induced radioactivity results from a nuclear reaction and is embedded in the equipment or material coming into contact with the nuclear reaction. This induced activity cannot be cleaned-up and can remain dangerous for thousands of years. For this reason, a structure containing induced radioactivity should be dismantled at some point in time. This should be done before the structure begins to deteriorate, thus permitting the radioactivity to enter the environment.

Surface contamination results from facilities or equipment coming into contact with radioactive material. As opposed to induced activity, material having surface contamination can often be cleaned up by scrubbing and washing.

In describing the cleaning-up process, the words decontamination and decommissioning are often used. In this report, decontamination denotes the process of cleaning-up surface contamination. Decommissioning is a term used by NRC and ERDA to indicate the closing or shutting down of a facility with some actions taken to prevent--at least temporarily--health and safety problems. It does not necessarily denote a permanent solution to cleaning-up the facility.

This chapter discusses the major types of nuclear facilities that will have to be cleaned up.

REACTORS

Nuclear power reactors, which have an estimated useful operating life of about 40 years, are a major decommissioning problem because of their enormous size and their large inventory of induced radioactivity. In May 1977, 64 commercial nuclear power reactors were licensed to operate. By the year 2000 an additional 175 may be operating. NRC regulates these commercial reactors.

NRC also regulates more than 73 other so-called nonpower reactors, which are used for tests, research, and university application. ERDA owns about 80 such nonpower reactors. These are much smaller than the commercial power reactors. The military owns an additional 174 reactors, in operation or under construction. Most of these belong to the Navy and are used in nuclear submarines and carriers.

There are generally four recognized methods for decommissioning reactors--dismantlement, entombment, mothballing, and a combination of either entombment or mothballing with subsequent dismantling.

Dismantlement involves the total removal of the facility from the site to radioactive waste burial grounds. The land is then restored to its original condition and released for unrestricted use. The largest problem involved in immediate dismantlement is contending with the radiation hazards from the large amounts of induced activity. To prevent the workers engaged in the dismantling activities from receiving excessive doses of radiation, much of the cutting of the reactor parts must be done by remote-controlled equipment underwater--a costly and time-consuming process.

Entombment consists of sealing the reactor with concrete or steel after all liquid waste, fuel, and surface contamination have been removed and sent to fuel storage facilities or burial grounds. NRC does not require an entombed facility to have security systems to protect against intrusion. However, it does require annual surveillance for possible radiation leaks. Also, periodic maintenance is required to insure the integrity of the entombed structure.

Mothballing is simply removing the fuel and radioactive waste and then placing the facility in protective storage. A mothballed facility requires a security intrusion system, annual radiological surveys, and periodic maintenance.

The fourth method is a combination of either mothballing or entombment with subsequent dismantlement. This method offers the advantage of placing the facility in an entombed or mothballed status for about 65 to 110 years, until the induced activity decays to a level which permits dismantling without undue radiation danger to the workers. The entombment and mothballing methods and, to a lesser extent, the combination methods, would limit the use of the affected land.

ACCELERATORS

An accelerator is a device used to increase the velocity and energy of particles like electrons or protons. They are used in physical, medical, and biological research, as well as for commercial purposes. Acclerators may be a problem at the time of decommissioning depending on (1) the type, (2) the size, and (3) the usage--including length of time operated. High levels of radioactivity may be induced in target materials, structural walls, or in the experimental equipment used during the operation of the accelerator. This induced radiation requires special attention at the time of decommissioning.

Large accelerators may have to be completely dismantled because of the large amounts of induced activity. For example, a large, federally owned accelerator located at Carnegie Mellon University has been dismantled at a cost of about $485,000.

States are responsible for registering and inspecting privately owned accelerators. In fiscal year 1968 there were about 580 accelerators reported as owned by various private concerns and universities under State jurisdiction. This number had increased to about 1,000 at the end of fiscal year 1975. In addition, ERDA officials told us ERDA now owns about 45 large accelerators.

FUEL FABRICATION FACILITIES

Fuel fabrication facilities are used to process and make nuclear fuel. These facilities have only surface contamination to contend with at the time of decommissioning. It seems probable, therefore, that these facilities could be cleaned-up at less cost than reactors. However, to our knowledge, no studies of methods and associated costs to decommission these facilities have been done.

There are 21 commercially operating fuel fabrication plants. We contacted all owners by questionnaire to obtain comments on anticipated problems and costs to decommission. Six of the 14 respondents indicated they did not anticipate

significant problems. One thought there could be a problem because of regulations on decommissioning becoming more stringent in the future. The remaining seven had no comment.

URANIUM MILLS

Uranium mills are used to refine and process the uranium ore that is mined. They too have only surface contamination to contend with at the time of decommissioning. Therefore, the plants themselves can be cleaned-up at much less cost than a reactor. However, uranium mills have a problem with stabilizing uranium mill tailings 1/. This problem is discussed in more detail in chapter 3.

To our knowledge, no studies have been made on decommissioning uranium mills. We sent questionnaires to all uranium mill owners for the 20 licensed mills. Of the 13 who responded, 8 said they did not anticipate any decommissioning problems, 3 said there would be some type of problem because of changing or uncertain NRC regulations, and 2 had no comment.

FUEL REPROCESSING PLANTS

Fuel reprocessing plants are used to separate unused uranium and plutonium from fuel that has been used in nuclear reactors. ERDA is now operating three reprocessing plants. ERDA has one more plant on standby and five plants that were shutdown in the 1950s and 1960s but that have not been decommissioned.

The only commercial reprocessing plant that ever operated in the United States is the Nuclear Fuel Service, Incorporated, plant at West Valley, New York. This plant was shut down in 1972 and has not yet been decommissioned.

VARIOUS USERS OF RADIOACTIVE MATERIALS

Various organizations use source, byproduct, and special nuclear materials for industrial, medical, and educational applications. These organizations vary from firms that use nuclear materials to check the adequacy of welds made on construction projects to physicians and medical organizations that use radioisotopes for therapeutic and diagnostic purposes.

1/Uranium mill tailings are sand-like radioactive waste materials resulting from the extraction of uranium from uranium ore.

Decommissioning facilities and equipment in which radioactive materials were used could be a problem depending on (1) the type of material and form it was in, (2) how it was used, and (3) the half-life 1/ of the material. The radiation hazard is in the form of surface contamination which often can be cleaned at a fairly low cost by scrubbing and washing with acids and water.

The potential for radiation hazard is high if unsealed radioactive materials were used for manufacturing or research and development. On the other hand, the potential radiation hazard is quite small if the user was working only with sealed sources 2/ or with radioactive materials having short half-lives.

As of June 30, 1968, there were 15,913 material licensees --9,257 under NRC control and 6,656 under agreement State control. By December 1975 this number had increased to 19,102--8,468 and 10,634 for NRC and agreement States, respectively.

WASTE HANDLING AND STORAGE

Many operations that produce or use nuclear materials generate radioactive waste. This radioactive waste is usually classified as "high-level" and "low-level". High-level waste is generated during the chemical reprocessing of used or spent fuel. High-level waste has intense radiation, generates heat and is very hazardous.

Low-level waste, in most cases, is less intense but may contain long-lived radiation. For this reason, it is buried underground and monitored indefinitely.

Both types of waste present a problem. High-level waste that has already been produced is stored in large tanks which provide only an interim solution to the disposal problem. At the end of the tanks' useful lives, the waste must be moved to other (new) tanks, or be removed, solidified, and transported

---

1/The time in which half the atoms of a particular radioactive substance disintegrate to another nuclear form. Measured half-lives vary from millionths of a second to billions of years.

2/Sealed source means any radioactive materials that is permanently encased in a container or matrix designed to prevent the leakage or escape of such radioactive material under foreseeable conditions of use and wear.

to burial grounds. The old tanks have to be removed, cut up, and also transported to burial grounds. ERDA, on its Hanford reservation alone, has 156 high-level storage tanks. Some of these tanks have already leaked 1/.

There are presently six commercial and five Federal disposal sites containing more than 91 million cubic feet of other-than-high-level waste. These burial grounds require monitoring for centuries and may present future costly problems.

In a January 1976, report 2/ to the Congress we noted that some radioactive migration has occurred at several of these burial sites. If the situation worsens, it may entail exhuming the waste. If this is required it can be quite expensive running into hundreds of millions of dollars.

1/We are now preparing a report on the subject of high-level waste which we expect to issue during the summer of 1977.

2/Improvements Needed in the Land Disposal of Radioactive Waste--A Problem of Centuries (RED-76-54, January 12, 1976).

CHAPTER 3

PAST AND CURRENT EFFORTS TO SOLVE THE PROBLEM

The Nuclear Regulatory Commission and the Energy Research and Development Administration are aware of the hazardous and long-term nature of nuclear radioactivity and contamination. In view of the accumulation of nuclear facilities, what have these agencies been doing to assure that the facilities do not endanger public health and safety now or in the future?

ERDA'S EFFORTS

ERDA has sponsored many experimental and demonstration projects located on nonfederal property. These projects included power reactors, university reactors, and accelerators. Some of the more notable power reactors which have been decommissioned are listed below. They were decommissioned between 1969 and 1974.

Decommissioned ERDA power reactors

Facility	Location	Size (megawatts electric)	Method	Cost (millions)
Piqua	Ohio	45	Entombment	1.0
Elk Riv r	Minnesota	58	Dismantlement	6.2
BONUS	Puerto Rico	50	Entombment	1.6

These three reactors were funded by the Atomic Energy Commission (AEC) to demonstrate the feasibility of producing electrical power by different types of reactors. The plants were operated by commercial utility companies, but through contractual provision, AEC was responsible for their decommissioning. These plants are much smaller than the commercial power reactors now operating and being built. Most reactors now being built are in the 1,100 megawatt range.

As noted in the table, only one of the reactors was dismantled. The other two reactors were entombed. ERDA provides for radiological monitoring of these entombed plants and is responsible for any future radiation problem that might occur.

ERDA has a limited budget for decommissioning activities, having received a total of $14,300,000 in fiscal years 1976

and 1977. Of this amount, $3,000,000 was used to decommission a nuclear rocket development station facility in Nevada and $5,500,000 was used to decommission a sodium reactor experiment in California, which was located on land that is going to revert to private ownership. Decommissioning work on these projects is continuing.

Much of the remaining funds are being spent on planning, on research, and on past problem areas. One such problem area relates to the old facilities or sites used by the Manhattan Engineering District--which developed the first atomic bomb--and by AEC for various radiological operations. When these operations ceased, AEC released the sites for unrestricted use. In 1976, ERDA's field offices had identified 49 such sites and ERDA was planning to survey them for possible contamination that had not been cleaned up when AEC released them. ERDA's plan called for completing surveys of all 49 sites in 1980.

In an April 9, 1976, letter to the ERDA Administrator, we recommended that ERDA expedite and complete the surveys as soon as possible to protect the public health and safety. ERDA agreed. Since it has accelerated its program, ERDA identified about 35 additional potentially hazardous sites and has completed surveys at most of them. As a result of the surveys, ERDA has identified about 10 sites which will require further effort and remedial actions. ERDA says these 10 sites contain only low-level radioactivity and do not pose an immediate hazard to public health.

ERDA also has two separate programs underway to remedy a radioactivity problem resulting from uranium mill tailings. Unless tailing piles are effectively controlled and stabilized, radium can be spread to the environment by wind and water erosion. One program is in Grand Junction, Colorado, where tailings used in construction were found to be radioactive. Legislation (Public Law 92-314) authorized $5,000,000 in Federal funds to provide financial assistance to the State of Colorado to limit the exposure of individuals to this radiation. Work under this program is continuing.

The second program--an offshoot of the Grand Junction problem--concerns the radioactivity associated with 21 inactive uranium mill tailing sites in the western States. Exact cost estimates have not been prepared, but ERDA estimates that stabilizing these tailing piles will cost the Federal Government $80,000,000.

NRC'S EFFORTS

NRC has certain requirements that licensees must follow at the time of decommissioning. When shutting down a nuclear reactor, uranium mill, or fuel fabrication facility, the licensee must submit a plan and make a final radiological survey. NRC procedures call for visiting the site to confirm the licensee's survey.

Upon termination of a materials license (where the licensee uses source, byproduct, or special nuclear materials), the licensee certifies that the facility has been decontaminated to acceptable levels. The acceptable levels of surface contamination are set forth in NRC's guidelines. NRC may perform a radiological survey of the site if it is believed necessary after considering the type of material at the facility, what was done with it, and the licensee's past performance under the license. No written procedures exist, however, for selecting the sites to be surveyed. An NRC official told us that a very small percentage of sites, perhaps less than 1 percent, are surveyed by NRC.

We performed a limited amount of work to determine if any contamination problems might still exist at commercial facilities which were closed down in the late 1950s and early 1960s, in other words, whether a situation existed which was analogous to ERDA's problem with sites used in the Manhattan Engineering District. The possibility exists for these situations because the care and precautions that are now taken in decontaminating facilities often did not exist in those earlier years.

From the information available in NRC's files, we could not determine whether all defunct commercial facilities had been properly decontaminated. On September 17, 1976, we sent a letter to the Chairman, NRC, bringing this matter to his attention. In October 1976, NRC responded and stated there was little chance that any of these commercial facilities were contaminated but said it would reexamine the files in the ensuing several months to determine if there were any cases where a public health and safety problem might exist.

As of May 1977, NRC had not yet started its reexamination of the files. An NRC official told us that because of staffing limitations the work would probably have to be contracted out and started during fiscal year 1977.

NRC has contracted with Battelle Pacific Northwest Laboratories to study various aspects of decommissioning fuel cycle facilities and commercial power reactors. NRC

plans to use these studies to develop standards and criteria for decommissioning.

Battelle recently completed a draft study on decommissioning a fuel separation facility and has started studies on the decommissioning of uranium mills and fuel fabrication facilities. These studies are scheduled for completion in 1979.

For the reactor decommissioning study, Battelle is using information from a large operating reactor. It is using the blueprints of the plant, evaluating the structure, inventorying the volume of material, and considering the transportation of the material and the waste. The study's objectives include estimating the occupational hazards of decommissioning and the cost of the various decommissioning methods. This study should be completed by the end of fiscal year 1979.

Because of the past problems with uranium mill tailings, NRC is now preparing a generic environmental impact statement on uranium milling to examine mill tailings reclamation and financial surety arrangements. This statement is scheduled to be issued in August 1978. NRC has also recently instituted a new procedure to protect the public from the hazards of these tailings. NRC will no longer issue a mill license, or renew an existing license, unless the mill owner submits a reclamation plan for tailings and a bonding arrangement to finance the plan when mill operations cease. NRC estimates that by 1978 all operating mills will be covered by this requirement.

STATE EFFORTS

A State may assume responsibility for some of NRC's regulatory authority--if agreed to by the State and NRC. There are now 25 agreement States which regulate source, by-product, and small quantities of special nuclear materials. According to NRC officials, all agreement States have good radiological control programs but the nonagreement State radiological programs vary from virtually nonexistent to very comprehensive.

Generally, States do not have separate programs or plans for decommissioning. Instead, it is a part of their overall radiation control program. Most agreement States have a provision in their regulations which requires a licensee to contact the State and decontaminate the facility to accepted levels before vacating a site where radiological operations took place. The State may inspect the facility. The States' systems are similar to NRC's systems for closing out licensees.

CHAPTER 4

MAJOR QUESTIONS REMAIN UNANSWERED

To begin to grapple with the far-reaching problems of decommissioning requires answers to some basic questions. In our review, we found that the questions listed below and discussed in the following section have not been answered.

--How much will decommissioning cost and who should pay?

--How should nuclear reactors be decommissioned?

--What is the extent of the decommissioning problem for accelerators?

--Are standards needed for induced radiation?

--What should be the limits on acceptable radiation levels?

--What more should States do to plan for decommissioning?

DECOMMISSIONING--HOW MUCH WILL IT COST AND WHO SHOULD PAY?

Privately owned facilities

The total cost to decommission privately owned nuclear facilities in the United States is unknown. Very few studies have been made on the subject. In fact, to the best of our knowledge, only one major study on the cost to decommission commercial nuclear reactors has been done to date, and another NRC-sponsored study is in process. A study for fuel fabrication facilities and uranium mills is also in process but will not be available until 1979.

The study on reactors by the Atomic Industrial Forum, Incorporated 1/, was issued in November 1976. The study addressed pressurized and boiling light water reactors, as well as high temperature gas reactors. The cost to decommission each of these three reactor types using the three

---

1/An international association of utilities, manufacturers, labor unions, and other organizations in the nuclear area that is involved in peaceful uses of nuclear energy.

primary decommissioning methods and the two combination alternatives were evaluated. These are: mothballing, entombment, prompt dismantling, mothballing--delayed dismantling combination, and entombing--delayed dismantling combination.

The cost estimates are different for each type of reactor and vary depending upon the degree of security required. For example, a mothballed reactor at an isolated location will require security, whereas a mothballed reactor on a site that continues to have other ongoing activities will not. Moreover, an entombed facility will not require additional security.

The following chart developed from the Atomic Industrial Forum study provides some idea as to the decommissioning cost of an average reactor. However, the cost for an individual reactor will vary because of its unique characteristics. It is also important to note that these figures do not include the costs of the burial grounds or waste repositories where the spent fuel and radioactive materials from the reactors will have to be sent.

Decommissioning method	Cost estimate in 1975 constant dollars (millions)
Mothballing	$ 2.8 to $3.1
Annual surveillance with security	.21
Annual surveillance without security	.11
Entombment	7.1 to 9.5
Annual surveillance	.07
Prompt dismantlement	33.6 to 39.0
Mothballing--delayed dismantling	
With security	35.8 to 39.4
Without security	28.5 to 29.3
Entombment--delayed dismantling	30.0 to 31.0

Although there has been no generic study, fuel fabrication facility owners provided us with their cost estimates for decommissioning. They ranged from $100,000 to $6,000,000 1/.

1/Because of time constraints, we did not analyze these large ranges to determine their relationship to such factors as plant size.

Likewise, uranium mill owners provided us with their cost estimates for decommissioning. They ranged from $71,000 to $2,000,000 1/.

The only commercial reprocessing plant ever operated, Nuclear Fuel Services, Incorporated, at West Valley, New York, which was shut down in 1972, has not yet been decommissioned. 2/ However, it is estimated that it will cost from $90,000,000 to $600,000,000 to dispose of all the radioactive material, including dismantlement and removal of the structures.

There is no requirement for and generally no effort being made today, with the exception of uranium mills, to provide for the cost of future decommissioning of privately owned nuclear facilities. The failure to make such provision can result in the Federal and/or State Governments assuming responsibility that rightly belongs to private industry. Situations where this has happened or may happen have already arisen. For example, the Federal Government will be paying about $85,000,000 to clean up radioactive tailing piles at all inoperative uranium mills that were privately owned.

Another example is the West Valley, New York nuclear fuel reprocessing plant. When the plant owner decided in 1976 to transfer control of the site to the New York State Energy Research and Development Authority, it imposed a large financial burden on the State. Although the cost will undoubtedly run anywhere from the tens to the hundreds of millions of dollars, New York has set aside only $3,000,000 to take care of the problem. Because of this, the New York Authority has asked ERDA to completely take over the West Valley site. ERDA has not accepted this request, but has agreed to discuss the problem with the Authority.

We should quickly point out the cost to decommission private nuclear facilities may not be as high as these two unusual cases. There are no other privately owned fuel reprocessing plants, and the problem of uranium mill tailing piles was not discovered until after the mills were shut down.

1/Because of time constraints, we did not analyze these large ranges to determine their relationship to such factors as plant size.

2/We have issued a report entitled "Issues Related to the Closing of the Nuclear Fuel Services, Incorporated, Reprocessing Plant at West Valley, New York" (EMD-77-27, March 8, 1977).

Lesser amounts will be required to decommission smaller activities. Even so, these smaller activities--often owned by smaller companies--may be prone to financial difficulties that can result in the Government paying for the necessary decommissioning. For example, a company in Clinton, Tennessee --a manufacturer of sealed radioactive sources--went out of business in mid-1971. The owners walked away from the plant leaving a significantly contaminated area. The Federal and State Governments shared the cost--approximately $110,000 --to decontaminate the facility.

Regulations for funding decommissioning

With the exception of uranium mills, NRC has no requirement that licensees make specific financial provisions to cover the cost of future decommissioning. Instead, it determines, before issuing a license to operate, whether the licensee is generally financially responsible. This determination is based on an evaluation of the company's profit history and the proposed operating expenses for a facility to be licensed. NRC considers this information to be indicative of financial soundness and the ability of the company to pay for future decommissioning. Therefore, in the case of nuclear reactors, NRC makes a judgment, even before a powerplant begins to operate, that a utility can pay for decommissioning costs which will not be incurred for at least 40 years and possibly for as much as 150 years. That judgment is not based on a specific estimate of the anticipated cost of decommissioning.

Extent of efforts to fund decommissioning

Various approaches could be taken by private industry to provide today for future costs rather than saddling future generations with this responsibility. These approaches include:

--A direct charge to users or customers in the price of a product and depositing such funds into an escrow or trust fund.

--A system for recovering the cost of decommissioning nuclear reactors through depreciation accounts. This depreciation cost could then be passed on to users. The funds could be set up in special accounts to insure their integrity until needed.

--A bonding arrangement to protect the governmental bodies from a financial burden should a licensed nuclear facility not be able to decommission its activities.

We sent questionnaires to all companies with operating uranium mills and fuel fabrication plants and all utilities with operating or planned nuclear reactors. Of 9 companies with 11 operating mills, 3 companies are providing some form of bonding and 1 firm has established a $70,900 fund for future decommissioning. This company established the fund because of its inability to obtain bonding. Only 3 of the 14 fuel fabrication companies which responded to our inquires have established a fund to cover the cost of decommissioning.

Thirty-two utilities with 48 operating reactors responded to our questionnaire. Seventeen stated that they use depreciation accounts to reflect decommissioning costs which ultimately wind up in utility rates. However, even though funds collected through this method are an advance recovery of costs, these funds are not set aside in special accounts. Instead, the funds are used in current operations in lieu of borrowing. These utilities expect to be able to pay the eventual decommissioning costs from whatever future budget is affected. The 15 other respondents are presently doing nothing to accumulate funds for decommissioning.

Although the cost to decommission a nuclear reactor may be in the millions of dollars, the utilities do not consider these costs significant in relation to the construction costs for a reactor which are now about $1 billion. Consequently, they do not see a need for advance accumulation of funds.

ERDA-owned facilities

ERDA conducts most of its nuclear activities at 26 major sites or reservations. As structures, tanks, etc., become obsolete or are no longer needed, these facilities are placed in "excess" by ERDA. An October 1976, ERDA document stated there were 300 excess facilities and an additional 100 were expected to become excess by 1981.

ERDA is developing a computer data system to supply the information needed to plan for decommissioning its facilities located at Hanford reservation. The Hanford reservation--1 of the 26 sites--contains most of ERDA's excess facilities. This computer system, scheduled for completion in June 1977, will list 537 facilities, both operating and in excess, at Hanford. The system will include cost estimates for various decommissioning methods, priority schedules, and other information. None of the other reservations were included in the system because they have relatively small numbers of excess facilities. These other reservations do, however, include a significant number of operating facilities, that eventually have to be decommissioned.

ERDA officials told us they do not compile relevant details of the facilities it owns--obsolete or operating--which would permit it to assess the magnitude of the decommissioning problems they pose. Such details include the nature and extent of the radiation problems at these facilities, the decommissioning methods that would be feasible, the cost of the methods, schedules, and priorities. Efforts to develop these details have been plagued by a failure of ERDA to develop standard definitions and rules for the ERDA reservations to use in describing the facilities located there.

In a memorandum to the Office of Management and Budget, ERDA estimated it would cost $25,000,000 to $30,000,000 a year for the next 100 years--or a total of $2,500,000,000 to $3,000,000,000--to decommission its existing excess facilities. We do not believe this is a credible estimate because

--ERDA does not have sufficient data to support this estimate;

--ERDA does not have the information necessary to assess the magnitude of the problem posed by its excess facilities;

--ERDA lacks similar information for its operational facilities;

--an ERDA contractor estimated in 1972 that it would cost as much as $4,000,000,000 to decommission the Hanford facilities alone (exclusive of waste); and

--ERDA has not developed cost estimates for disposal of 71,000,000 gallons of high-level waste. The disposal of 600,000 gallons of high-level waste at West Valley, New York may cost as much as $565,000,000.

COMMERCIAL NUCLEAR REACTORS--HOW SHOULD THEY BE DECOMMISSIONED?

NRC regulatory guides permit three alternatives for decommissioning a nuclear reactor. It does not require that a plan for decommissioning be available at the time an operating license is approved or that a method be selected. Officials of utility companies told us there is a lot of uncertainty as to what will actually be required at the time of decommissioning some years in the future.

The Atomic Industrial Forum study recommended a combination method of temporary protective storage for 65 to 110 years with later dismantlement. The study showed that immediate dismantlement

presents a serious occupational radiation hazard to personnel doing the dismantling, as well as greater environmental impact. The occupational hazard is due primarily to the cobalt-60 in the reactor vessel which decays in approximately 100 years.

While other radionuclides in a reactor require many thousands of years to decay, these radionuclides present a lower biological hazard. Therefore, if the cobalt-60 is allowed to decay to safe levels, the radiation hazard would be sufficiently reduced to permit manual removal of the reactor vessel. The study also showed that temporary protective storage with delayed dismantling can be from $3,000,000 to $10,000,000 less expensive than immediate dismantlement.

Although the long-lived radionuclides present a lower biological hazard, it is important that they remain inaccessable to the public until they decay to a safe level. For this reason, permanent mothballing or entombment are not considered final or absolute decommissioning alternatives because of the need for perpetual surveillance and major structural repairs. Yet, NRC now permits utilities to select these alternatives.

A paper presented to the International Atomic Energy Agency by an ERDA official also concluded that the combination method is the logical approach to reactor decommissioning. Preliminary conclusions by a contractor currently studying decommissioning methods for NRC also support this approach. This study is expected to be completed in 1979.

We employed a consultant, a professor of nuclear physics and an authority on the environmental impact of nuclear power including waste disposal, to independently review the Atomic Industrial Forum study. He agreed with the study's conclusions. He also reviewed data on five previously decommissioned reactors now in protective storage. He concluded that cobalt-60 was the principal contaminant of any consequence and that between 70 and 110 years would be required before radioactivity would decay to safe levels.

A question arises as to whether the reactor structure would survive the 70 to 110 years until the primary radioactivity decayed to safe levels. We employed another consultant, a professor of civil engineering who is an expert on the structural integrity of concrete, to physically examine a decommissioned reactor to determine whether the structure could be expected to survive over the life of the cobalt-60. This consultant concluded that such a facility could easily last for that period of time.

ACCELERATORS--WHAT IS THE EXTENT OF THE DECOMMISSIONING PROBLEM?

The significance and extent of the problem of decommissioning particle accelerators in this country is not known. A complete inventory by size, type, and usage is not available, although their use partly determines the radiation hazard. These uncertainties do not permit adequate control over the decommissioning of accelerators.

Accelerators are measured in terms of electron volts and range in size from desk top models with less than one megavolt to the recently completed 200,000 megavolt, 4 miles in circumference, accelerator located in Batavia, Illinois.

Induced radiation causes decommissioning problems in accelerators and the amount of such radiation is determined by size, type, and usage. It is generally agreed that most accelerators 4 megavolts or less will not emit enough energy to produce any amount of induced radiation. Those units over 4 megavolts could present a problem, however.

State health agencies are supposed to submit an annual inventory of accelerators to the Food and Drug Administration, Department of Health, Education, and Welfare; but not all States provide this data. The ones that do, submit only the number of accelerators, not the size, type, or use. For fiscal year 1975 the number reported was 1,010.

We tried to obtain more definitive information, particularly the number of accelerators above or below 4 megavolts, by sending a questionnaire to each State health agency. Our efforts were unsuccessful. Some States did not respond. Some responded but did not provide data, and the data we did receive could not be reconciled to the Food and Drug Administration data. For example, one State reported to the Food and Drug Administration that 127 accelerators were located in the State in fiscal year 1975. The State officials informed us, however, that there are 36 accelerators in the State and only 5 have ever been decommissioned. We also visited several State health agencies and were advised by State officials that they did not know size, type, and usage of accelerators in their State.

ARE INDUCED RADIATION STANDARDS NEEDED?

NRC and ERDA both have guidelines for the unrestricted release of facilities and equipment containing surface contamination. These guidelines contain specific radiological levels to which facilities and equipment must be decontaminated before they can be used for any other purpose. However,

neither NRC nor ERDA has standards for unrestricted release of materials and equipment containing induced activity. This presents a problem at the time of decommissioning because if the equipment or materials contain even very low levels of induced activity, it is not known whether it is safe for unrestricted release. Generally, the current practice is to send any equipment or facility to a waste burial ground if induced activity is above natural radioactivity.

The dismantlement of an ERDA-owned reactor illustrated the problems that can occur due to the lack of induced standards. All concrete with any trace of radioactivity was removed from the site and transported to a burial site in another State. If there had been standards for material and equipment containing induced activity, perhaps much of this concrete could have been sent to a refuse area within the State at much less cost. This problem is generic to any future decommissioning project where induced activity is present.

In July 1974, we sent a letter to AEC spelling out problems presented by the lack of standards for induced radiation. The specific problems dealt with decommissioning a large accelerator. Tons of valuable copper, steel, and stainless steel containing radiation levels slightly above naturally occurring background radiation could not be released for unrestricted use by the general public because there were no standards for induced radiation.

AEC officials told us they would have such standards developed by about September 1975. As of June 1977, however, these standards had still not been developed. It is apparent that such standards would permit cost savings and more effective planning for decommissioning.

WILL CURRENT RADIATION STANDARDS CHANGE?

Because man can tolerate only certain amounts of radiation without ill effects, standards have to be set to limit his exposure from all sources. Since the first radiation standards were established--as long ago as 1902--they have grown progressively more restrictive. The first standard was established to protect against external radiation burns. As more was learned about the actual hazards of radiation, such as biological and genetic effects, the standards were changed. For example, as illustrated in the table below, the standard for maximum allowable whole body exposure of persons to radiation in restricted areas where radioactive materials are

present has been periodically reduced from 10 rem 1/ per day in 1902 to 1.25 rem per calendar quarter in 1976.

Occupational Standards

Year	Standard
1902	10.00 rem/day
1925	.20 rem/day
1936	.10 rem/day
1950	.30 rem/week
1964	5.00 rem/year
1976	1.25 rem/calendar quarter

Moreover, in January 1977, the Environmental Protection Agency, which is responsible for setting standards for protection of the environment from all sources of radiation, issued regulations to reduce, from 0.5 rem to 0.025 rem annually, the allowable radiation exposure to the general population from all nuclear fuel cycle activities. These standards are to be effective December 1, 1979.

There are currently no standards for induced radioactivity, but NRC has adopted standards for acceptable surface contamination levels. Logically, these standards, by their very nature, must correlate to whole body exposure rates and therefore have gradually become more stringent and refined with increased technical knowledge.

If the historical trend for radiation standards continues, then the rules that we now use to govern decommissioning and decontamination will likely be considered unsafe years from now.

WHAT ABOUT NAVAL REACTORS?

As of June 1976 the Naval Nuclear Propulsion Program had 127 reactors in operation and 43 under construction. Ships have been taken out of active status and the reactor fuel removed and sent to an ERDA facility. The ships themselves, which still contain the nuclear reactors, are in the reserve fleet in a mothballed status where they are continuously monitored.

It may be that the cost to decommission these reactors will not approach the cost for the average 1,100 megawatt power reactor. However, it is reasonable to assume that the

---

1/A rem is a measure of radiation dose to body tissue.

170 reactors will ultimately require decommissioning, and just as with power reactors, there will be a cost and a potential environmental hazard for this operation.

Naval program officials told us that they have developed plans and strategies for decommissioning and decontaminating naval reactors. They stated, however, that the technical details of these plans and strategies are classified. We are currently reviewing the naval plans and strategies for decommissioning and decontaminating reactors.

WHAT SHOULD BE THE STATES' ROLE IN DECOMMISSIONING?

The States are responsible for accelerators and naturally occurring radioactive material. Although many accelerators will not present a serious decommissioning problem, some of the large accelerators will. Some States do not have adequate controls over accelerators. There is also an increasing concern over the control of natural radioactivity such as the radium problem from uranium mill tailings.

States generally do not have a separate program for decommissioning. With few exceptions, there are no provisions or requirements which would protect the States from financial loss in the event of default.

In joint sponsorship with NRC and the Environmental Protection Agency, the National Conference of Radiation Control Program Directors investigated options available to States to assure licensee financial responsibility in the event of default. They issued a report in April 1976, which concluded that bonding for decommissioning and a trust fund for perpetual care would satisfy many of the situations that an individual State may encounter. Even though this body of State representatives made such recommendations over a year ago, only seven States told us through our questionnaires that they require an advance accumulation of funds or some form of bonding for decommissioning. The Conference is also studying control of natural radiation, and NRC is considering whether the responsibility for radium--produced by natural uranium--should be brought under Federal control.

WHAT DOES THE FUTURE HOLD FOR NUCLEAR POWER AND DECOMMISSIONING?

Until recently, the role of nuclear power as an electrical generating source for the future has been a clear and unchallenged Government policy. Light water reactors, and then breeder reactors with their ability to replenish their

own fuel, have been viewed as long-term, almost perpetual, energy sources.

The President is now trying to implement an energy program that would change the future of nuclear power. It is his policy to (1) defer the U.S. commitment to advanced nuclear technologies that are based on the use of plutonium, and (2) use more of the current light water reactors to meet our needs.

Light water reactors require a supply of natural uranium. How much natural uranium exists is a major question that, when answered, dictates the viability of light water reactors as an energy source. Estimates of U.S. uranium resources range between 1.8 and 3.7 million tons. This amount of natural uranium could fuel 240 large light water reactors--about the number expected to be operating in the year 2000--for 40 to 85 years.

Obviously, light water reactors cannot be expected to continue indefinitely. If another generation of nuclear reactors cannot be developed or is not needed because another energy source, such as solar energy, has been introduced, the end of light water reactors could also be the end of the commercial nuclear power industry.

The possibility of this industry ending raises questions as to whether there will be nuclear-related organizations, nuclear equipment, and individuals expert in the nuclear field that would be capable of dealing with the decommissioning and decontamination problems that could remain for about 100 years after the last reactor is shut down.

CHAPTER 5

CONCLUSIONS, OBSERVATIONS AND RECOMMENDATIONS

The problems that nuclear-related operations leave behind are increasing because of the expansion of nuclear technologies. All of those involved--the Energy Research and Development Administration, the Nuclear Regulatory Commission, State Governments, and industry--are partly to blame for what has happened.

ERDA has accumulated a large number of excess facilities which will involve a monumental clean-up effort. At this point in time, it lacks the necessary information to even plan this task. It does not know the radiation and contamination problems at its facilities, the decommissioning methods that should be used, the corresponding costs, or priorities. ERDA has begun to gather this information at one of its reservations, but this is only the beginning.

While elimination of these excess facilities is important, it is also important that ERDA begin to consider and plan for decommissioning in all future projects. This requires that decommissioning costs be recognized at the outset of a project.

Similarly, NRC, which has responsibility on the commercial side, has not developed cost estimates, acceptable methods, or standards needed by industry to plan decommissioning or disposal of their facilities. NRC has not paid much attention to one of the biggest problems that may confront the public in the future--that is, who will pay the cost of decommissioning nuclear power reactors. It has not made any plans or established any requirements for advanced accumulation of funds for decommissioning reactors or any facilities it licenses with the exception of uranium mills.

We believe the cost of decommissioning should be paid by the current beneficiaries, not by future generations. Just as ERDA should consider decommissioning costs in its projects, private companies have an obligation to accumulate funds for decommissioning during the life of their projects. NRC should make advance planning for decommissioning mandatory at the time of licensing, including provision for funding.

If the States are to maintain their responsibility over selected nuclear activities, they must be made aware of the problems with decommissioning and be encouraged to adopt legislation that will assure that proper decommissioning and decontamination is carried out.

Answers to basic questions are missing which preclude developing a strategy for solving a problem that we are losing ground on. The solution may very well be expensive--but the expense should be known so that it can be planned for and paid for by the responsible parties.

Although the task of cleaning up the present problem and preventing future problems will involve a concentrated effort by all those involved, the Federal sector must lead the way and set the example. In the past, the Federal Government has been shortsighted in its approach to solving decommissioning problems. The Federal agencies must now view decommissioning with an eye toward the future, particularly in the areas of financial responsibility, radiation standards, and capability to perform the needed decommissioning tasks.

A bill (H.R. 6181) has been proposed directing ERDA to comprehensively study decommissioning. The study needs to be done. Hopefully it can provide basic information needed to develop a strategy to solve decommissioning problems.

RECOMMENDATION TO THE CONGRESS

Because of the magnitude, cost and time already lost, the Congress should designate one lead Federal agency--the Nuclear Regulatory Commission--to approve and monitor an overall decommissioning strategy. ERDA should continue its research and development efforts aimed at finding alternatives for decommissioning and decontamination of nuclear facilities. However, we believe that NRC is uniquely suited for the lead role because of its charter to independently regulate commercial nuclear activities to assure public health and safety. This position is consistent with a previous GAO report and testimony wherein we advocated independent assessments by the Commission of certain ERDA operations. In addition, placing this responsibility with the Commission would, in our view, add to the credibility of Federal regulation over nuclear energy.

RECOMMENDATIONS FOR THE ADMINISTRATOR, ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION AND THE CHAIRMAN, NUCLEAR REGULATORY COMMISSION

We recommend that the Administrator, ERDA, as part of his research and development responsibility

--determine the (1) acceptable alternative methods of decommissioning, (2) acceptable levels for induced radiation and surface contamination, and (3) extent of the decommissioning problem for accelerators;

--expand and accelerate a program to decommission the nuclear facilities currently excess to its needs; and

--require that program managers plan for future decommissioning and include decommissioning cost information in their program budgets.

In addition, we recommend that the Chairman, Nuclear Regulatory Commission, for those facilities he regulates

--require specific plans for decommissioning at the time of licensing, including the decommissioning method to be used and a funding mechanism to assure that facility owners pay the costs of decommissioning;

--determine the acceptable levels for induced radiation and surface contamination consistent with environmental standards being developed by the Environmental Protection Agency; and

--encourage States to follow the lead of the Commission in adopting comprehensive decommissioning planning for facilities under States' control.

AGENCY COMMENTS

ERDA was unable to furnish written comments in time to be finalized in this report. However, we met with ERDA officials and obtained their oral comments which have been incorporated in this report. ERDA officials disagreed with giving NRC responsibility over ERDA facilities. However, they will consider this matter further and will provide written comments in the near future.

NRC's comments on the report are contained in a letter dated June 10, 1977. (See app. I.) The letter describes the actions NRC is taking or plans to take to develop methods and criteria for decommissioning nuclear facilities.

Because of time constraints and the report's relatively limited treatment of the Environmental Protection Agency, its comments were not sought.

CHAPTER 6

SCOPE OF REVIEW

We obtained the information contained in this report by reviewing documents, studies, reports, correspondence, and other records, and by interviewing officials at

--NRC headquarters, Bethesda, Maryland;

--NRC regional offices at Atlanta, Georgia; Glen Ellyn, Illinois; King of Prussia, Pennsylvania; and Arlington, Texas;

--ERDA headquarters, Germantown, Maryland; and

--ERDA operations offices at Chicago, Illinois; and Oak Ridge, Tennessee.

We also visited various States, utilities, uranium mills, accelerators, and universities. We sent questionnaires to all utilities with nuclear reactors currently in operation or under licensing review, uranium mill owners, fuel fabrication facilities, State rate-setting commissions, and State radiation control units.

APPENDIX I

APPENDIX I

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

June 10, 1977

Mr. Monte Canfield, Jr.
Director, Energy and
Minerals Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Canfield:

We have reviewed the GAO draft report entitled "Cleaning Up the Remains of Nuclear Facilities - A Multi-Billion Dollar Problem." We provided your representatives with oral comments on this draft report on June 7, 1977. The one day which we were given for our review was insufficient for a thorough review. As you know, due to your schedule for publishing this report, we did not have the opportunity to review a draft that incorporated any changes that were made in response to these oral comments. Therefore, the following comments are based on our understanding of how your final report reflects our oral comments.

The report as written, and particularly the Digest section, gives the impression that the NRC has done little or nothing to establish acceptable methods or criteria for decommissioning of nuclear facilities over which it has responsibility. In fact, the Commission has established acceptable methods for decommissioning nuclear facilities, i.e., dismantlement, entombment, mothballing, and combinations of these. Furthermore, it is continuing to study the problem to further refine the requirements for decommissioning. Rather conclusive evidence that acceptable methods for decommissioning nuclear facilities have been established is the fact that more than 50 reactor facilities have been successfully decommissioned and numerous licenses for other nuclear facilities and activities have been terminated. Furthermore, 10 CFR Part 50 §50.82 provides rules for dismantling a reactor facility and terminating the facility license, and the NRC has published a guide (Regulatory Guide 1.86) which describes conditions and procedures acceptable to the NRC for decommissioning reactor facilities.

The Commission is currently sponsoring a study by Battelle Memorial Institute - Pacific Northwest Laboratories (PNL) of the environmental effects, radiological effects, costs and appropriate radioactivity limits for each of the currently accepted methods of decommissioning nuclear reactor and fuel cycle facilities.

The NRC staff is now reviewing a report on the results of an Atomic Industrial Forum (AIF) study of the environmental effects, radiological effects and costs of different methods of decommissioning nuclear power facilities. The staff will perform an analysis of the AIF decommissioning data as a part of this review. The NRC has also initiated a review of the AIF report by Battelle-PNL as part of the Battelle-PNL study.

The GAO report questions who will pay for decommissioning nuclear power plants. It is NRC's view that the licensee is to pay for this activity. The cost to decommission has been shown by the AIF study and our independent evaluation referred to above to be a small factor in the overall cost of operating a nuclear power plant. The licensee should be able to fund these costs out of current revenue. Therefore, we do not perceive the cost of decommissioning nuclear power reactors -- which will likely be incurred for many reactors several decades from now -- as a crisis situation or a problem that requires crash efforts to resolve. We do believe that an orderly effort to establish procedures and requirements to provide greater assurance that these funds will be available should be initiated.

In addition, the GAO report does not recognize EPA's role in the process by which NRC and ERDA develop criteria for acceptable levels of contamination. EPA is responsible for developing generally applicable environmental standards. Any criteria which we develop must be consistent with EPA standards. 1/

The GAO report discusses nuclear facilities of all types, with the implication that all will have large future decommissioning problems and costs. Recognition was not given to the large variations in complexity among the various nuclear operations which range from nuclear power plants to possession of small amounts of short-lived radioactive materials for use in industry, medicine and education. The great majority of nuclear facilities are of the latter category and result in little or no technical or financial decommissioning problems for license termination.

With respect to nuclear power reactors it is true that, with the exception of dismantlement, the other methods of decommissioning (mothballing and entombment) that have been identified as being acceptable to the Commission are not final, in that they do not provide acceptable disposition of the facility for all time. However, the use of mothballing and entombment do not relieve the licensee of requirements for continued maintenance, access control, radiation monitoring, environmental monitoring, and inspections until residual activity is removed or decays to

---

1/ GAO note. The report was changed to reflect EPA's role.

levels acceptable for unrestricted access. For the large modern plants, it is clear that postponing the removal of certain components until the radioactivity has decayed to permit more direct access for dismantlement may prove to be the most desirable alternative with respect to the environment, radiological effects and cost for most facilities. Also, the degree of decommissioning effort required to protect the public health and safety and the environment will depend significantly on the site specific characteristics -- an observation not made in the report.

The Commission does examine various decommissioning plans and their costs and environmental impacts prior to issuance of an operating license for a commercial power reactor or test reactor. We assure ourselves in each case that feasible decommissioning alternatives, including alternatives for complete dismantling, exist and that the applicant either possesses or has reasonable assurance of obtaining the necessary funds, as required by our Regulations (10 CFR 50.33F). We do not require bonds or setting aside of any contingency funds at the operating license stage and do not impose any particular decommissioning plan as a condition of the operating license.

Federal and State regulatory commissions have historically treated plant decommissioning and maintenance costs as allowable operating expenses recoverable through rates chargeable to customers. It is therefor reasonable to assume that the decommissioning and subsequent maintenance costs would be charged to operating expenses either in the year they are incurred or amortized over a period of years according to the policy of the rate making regulatory authorities.

In the area of nuclear fuel cycle facilities, the NRC is currently preparing a Generic Environmental Impact Statement (GEIS) on uranium milling. This GEIS is to examine mill tailings reclamation and financial surety arrangements and will be the basis for NRC regulations and regulatory guides. The draft GEIS is scheduled to be issued in August 1978.

In this area, until the GEIS is issued and new regulations implemented, NRC is taking a conservative approach with respect to renewing licenses and granting new applications. For new applications, we are requiring applicants to develop and commit to a tailings management plan as a license condition. This reduces the impact of the tailings to essentially the same impact as occurs at that site with the material in its natural state. In addition, NRC is requiring that the applicant provide a financial surety arrangement to assure that the tailings management plan will be carried out. With regard to existing licenses, NRC is requiring that a tailings management plan and financial surety arrangement be committed to before license renewal as a license condition.

Also, for new major fuel cycle licenses and at the time of renewal for existing licenses, the licensee is being requested to provide decommissioning plans and financial arrangements for defraying these expenses. These will be made license conditions. Additionally, the staff is exploring what statutory or regulatory changes are needed. NRC does not plan to firm up details of financial arrangements until after a study on financial surety arrangements now being carried out as part of the GEIS on uranium milling is completed, since most of the considerations dealt with in that study will also be applicable to fuel cycle licenses. In addition, NRC feels that a few practical cases should be completed prior to rule making.

Thanks for the opportunity to comment on the report.

Sincerely,

Lee V. Gossick
Executive Director
for Operations

APPENDIX II

PRINCIPAL OFFICIALS
RESPONSIBLE FOR ADMINISTERING
ACTIVITIES DISCUSSED IN
THIS REPORT

	Tenure of office	
	From	To
Nuclear Regulatory Commission		
CHAIRMAN:		
Marcus A. Rowden	Apr. 1976	Present
William A. Anders	Jan. 1975	Apr. 1976
Energy Research and Development Administration		
ADMINISTRATOR:		
Robert W. Fri (acting)	Jan. 1977	Present
Robert C. Seamans, Jr.	Jan. 1975	Jan. 1977

SUGGESTED LANGUAGE FOR INCLUSION IN COMMITTEE REPORT TO ACCOMPANY H.R. 6181

With respect to economic consequences, there is a serious problem in the Federal income tax area relative to the appropriate tax accounting method of recognizing the costs of decommissioning nuclear power plants. It is generally conceded that the costs of decommissioning these plants at the end of their useful lives will be significant, regardless of the choice of the several procedures for accomplishing the actual decommissioning. A preferred book accounting treatment for such costs would be to accrue such costs over the normal useful life of the plant. This is also the desirable regulatory (ratemaking) treatment in that it is proper that the customers who are utilizing the electricity produced by a nuclear power plant, which is low in cost, should be charged with the full costs of the plant's operation including the eventual costs of decommissioning.

The income tax problem lies in the fact that the Internal Revenue Service ("Service") has never recognized the concept of accruing for future years' expenses when the amounts are not precise and the events are less than certain. Neither has the Service accepted the concept of "negative salvage value" in establishing depreciation allowances.

The economic consequences of an unfavorable Federal income tax treatment for costs of decommissioning are that the burden on the customers is greatly increased

during the period of years when reserves are being accumulated for the costs of decommissioning since the accruals to be proper must be sharply increased because of the Federal income tax effect. There should be a renewed examination of this matter in the light of the regulatory and Federal income tax frameworks. Such an examination may result in a recommendation of amendments to the Internal Revenue Code to recognize more currently income tax deductions for prospective costs of decommissioning.

SAUL J. HARRIS

NUCLEAR ADVISOR
NATIONAL ASSOCIATION OF ELECTRIC COMPANIES

202/223-3460
1140 CONNECTICUT AVENUE
WASHINGTON, D.C. 20036

○