Draft Generic Plan

**Transportation and Storage
of Foreign Spent Power Reactor Fuel**

Prepared for

U.S. Department of Energy

Contract Number DE-AC09-79-ET47922

DO NOT MICROFILM
THIS PAGE

September 30, 1979

**BOEING
ENGINEERING &
CONSTRUCTION**
THE BOEING ENERGY
AND ENVIRONMENT DIVISION

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

BEC/ISFP--79001

DE83 017031

DEC 1979 79001

Draft Generic Plan

Transportation and Storage of Foreign Spent Power Reactor Fuel

Prepared for
U.S. Department of Energy
Contract Number DE-AC09-79-ET47922

September 30, 1979

**BOEING
ENGINEERING &
CONSTRUCTION**
THE BOEING SAFETY
AND ENVIRONMENT DIVISION

NOTICE
PORTIONS OF THIS REPORT ARE ILLEGIBLE.
It has been reproduced from the best
available copy to permit the broadest
possible availability.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process developed, or represents that its use would not infringe privately owned rights.

DO NOT MICROFILM
THIS PAGE

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
Table of Contents	ii
List of Figures	iv
List of Tables	v
1.0 Introduction	1-1
1.1 Purpose	1-1
1.2 Scope	1-1
2.0 U.S. Policies and Strategies with Respect to International Spent Fuel Management	2-1
2.1 Introduction	2-1
2.2 Relationship of International Spent Fuel Management to U.S. Energy and Nuclear Non-Proliferation Policy Objectives	2-1
2.3 U.S. International Spent Fuel Management Policies and Strategies	2-3
References for Section 2	2-10
3.0 Generic Plan	3-1
3.1 Introduction	3-1
3.2 Generic Plan - Bilateral Cooperation Related to Expansion of Foreign National Storage Capacities	3-2
3.3 Generic Plan - Multinational and International Cooperation Related to Development of Multinational and International Spent Fuel Storage Regimes	3-3
3.4 Generic Plan - Fee Based Transfers of Foreign Spent Power Reactor Fuel to the United States for Storage	3-4
3.5 Generic Plan - Emergency Transfer of Foreign Spent Power Reactor Fuel to the U.S. for Storage	3-7
APPENDIX A	
A1.0 Policy Objectives	A1-1
A2.0 Technical Description of Proposed Modes of Transportation and Storage	A2-1
A3.0 Summary of Transportation and Storage Facilities	A3-1
A4.0 Proposed Geographic Sites	A4-1
A5.0 International Accords, Agreements	A5-1

TABLE OF CONTENTS (continued)

<u>SECTION</u>	<u>PAGE</u>
A6.0 Potential Costs	A6-1
A7.0 Research, Development and Demonstration Required	A7-1
A8.0 Proposed Pricing Approach	A8-1
A9.0 Cost Benefit Analysis of Interim Storage of Spent Fuel	A9-1
A10.0 Legal and Regulatory Considerations	A10-1
A11.0 Proposed Procedures for Obtaining Public/Local/ State Approval	A11-1
A12.0 Environmental Impact	A12-1

LIST OF FIGURES

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
A2-1	Functional Flow	A2-2
A2-2	Simplified Schematic of the AFR Storage Basin Process	A2-4
A2-3	Plot Plan for a Basin Storage Facility for Unpackaged Spent LWR Fuel	A2-4
A2-4	Simplified Spent Fuel Trans- portation Cask	A2-6
A6-1	Fuel Storage Facility Cost	A6-5

LIST OF TABLES

<u>TABLE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
2-1	Strategy Summary	2-9
A2-1	Summary Comparison of Spent Fuel Interim Storage Alternatives	A2-3
A3-1	Foreign Casks Available	A3-4
A3-2	U.S. Casks Available	A3-5
A5-1	Agreements for Cooperation in the Civil Uses of Atomic Energy	A5-2
A6-1	Foreign Spent Fuel Delivered to United States	A6-3
A6-2	U.S. Regional AFR Storage of Foreign Fuel - Six Facilities	A6-7
A7-1	Interim Storage Facility Re- search and Development Costs	A7-3

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to inform Congress of the Administration's policies and generic plans with respect to the transportation and storage of foreign spent power reactor fuel. Submission of this report is in response to the requirements of Section 303 of the Nuclear Non-Proliferation Act of 1978 (Public Law 95-242) and Section 107 of the Department of Energy Act of 1978 (Public Law 95-238).

1.2 Scope

This report describes the generic actions to be taken by the Department of Energy, in cooperation with other U.S. government agencies, foreign governments and international organizations, in support of the implementation of Administration policies with respect to the following international spent fuel management activities:

- 1) Bilateral cooperation related to expansion of foreign national storage capacities.
- 2) Multilateral and international cooperation related to development of multinational and international spent fuel storage regimes.
- 3) Fee-based transfer of foreign spent power reactor fuel to the U.S. for storage
- 4) Emergency transfer of foreign spent power reactor fuel to the U.S. for storage

2.0 U.S. POLICIES AND STRATEGIES WITH RESPECT TO INTERNATIONAL SPENT FUEL MANAGEMENT

2.1 Introduction

U.S. policies and strategies with respect to international spent fuel management are closely linked to U.S. policy objectives with respect to energy and nuclear non-proliferation. A synopsis of specific U.S. policies and strategies with respect to international spent fuel management and their linkage to U.S. energy and nuclear non-proliferation policy objectives are presented herein.

2.2 Relationship of International Spent Fuel Management to U.S. Energy and Nuclear Non-Proliferation Policy Objectives

A principal goal of the U.S. non-proliferation policy is to develop an international framework that will minimize both the incentives and opportunities for nuclear proliferation while helping to ensure that nuclear power is available to help meet the world's energy needs. To that end, the U.S. is working toward the development of an international regime of norms and institutions that will provide the widest possible separation between potential weapons uses and peaceful applications. Timely management of the spent fuel from nuclear reactors is part of this regime.

The U.S. has taken a number of steps to redirect U.S. domestic nuclear policy and to strengthen international cooperation in controlling proliferation risks of the nuclear fuel cycle. The Administration's approach seeks to find ways to strengthen the foundation for support of the Nuclear Non-proliferation Treaty and international safeguards, as well as of the international exploitation of the benefits of nuclear power. Two major elements of this strengthened foundation are:

- Limiting the number and dispersal of national sensitive fuel cycle facilities, as well as the size of national plutonium stockpiles, to a minimum consistent with real needs; and
- Using to the widest extent practicable, institutional and, where effective, technical arrangements designed to increase resistance to proliferation.

The U.S. and the world have the incentive and should be given the time to build a better technical and institutional basis for dealing with the nuclear future. This would include specifically those situations where plutonium might eventually be put to use. The Administration remains firmly against the recycle of plutonium in thermal reactors as presenting a clear and present proliferation risk for only marginal economic and resource gains at the very best. The Administration believes that uranium resources are adequate to support projected nuclear power requirements well beyond the end of the century without recycle. Should this projection change and recycle become advantageous at some point, the option could still be chosen. The residual energy value of spent fuel would not be diminished by avoiding a premature start or certainly by interim storage.

The Administration recognizes the potential for breeder reactors to play a possible long-term energy role in certain circumstances. The Administration policy accommodates the research activities currently underway in a number of the advanced industrial states with large nuclear energy programs; however, it nevertheless retains strong reservations about the premature commercial deployment of such an advanced nuclear fuel cycle.

Plutonium use for fast reactor R&D is, in the Administration's judgement, only appropriate in countries where projected nuclear energy requirements in the next several decades, and economic and resource considerations, clearly support the potential deployment of a substantial number of breeder reactors. These are countries where the economy can support the technology needed to develop breeders and where the electrical grid is or will become large enough and well enough developed to do so.

If plutonium is to be one of the fuels of the future, the international system needs time to establish better mechanisms to deal with its dangers. Widespread recycle at an early date will not provide adequate time. On the other hand, if reprocessing and plutonium use for at least the next decade is generally restricted to R&D for breeders and a few other advanced types of reactors, the problems are much more likely to be manageable. The key to this strategy is the

availability of adequate interim spent fuel storage capacity throughout the world.

Interim spent fuel storage is a step toward resolution of the nuclear waste problem in the United States and abroad. In accordance with the plan described in the Interagency Review Group (IRG) report (Reference 1) the United States is developing plans for a terminal geologic waste disposal facility for the 1988-1992 period. Interim spent fuel storage is required until this facility is ready and final decisions have been made concerning closure of the back end of the nuclear fuel cycle. Similar needs exist abroad. Public acceptance of nuclear power in the United States and other nations will depend in part on the timely completion of orderly and effective plans for the disposal of nuclear wastes.

Whatever the course of future fuel cycle plans, substantial interim spent fuel storage capacity is required for the near and medium term. Additional interim spent fuel storage capacity can be developed at reactor sites, at away-from-reactor storage facilities (AFR's), and through international spent fuel storage facilities. Much work has already been undertaken by many countries to expand storage capacity through reracking and, in some cases, initial development of AFR's.

2.3 U.S. International Spent Fuel Management Policies and Strategies

The Administration has enunciated a policy approach with respect to international spent fuel management consisting of two principal elements; namely:

- (1) Advocacy of international cooperative initiatives to alleviate the spent fuel storage problem.
- (2) An offer to accept and store in the United States limited quantities of foreign spent fuel, where such action would advance U.S. non-proliferation objectives.

A timely and prioritized international spent fuel management program is being implemented by the Administration in support of the above policies. The authority, priorities, and strategies underlying this program are described below.

2.3.1 International Cooperative Initiatives to Alleviate the Spent Fuel Storage Problem

The Administration's authority with respect to international cooperative initiatives on spent fuel management is as follows:

- Section 107 of Reference 2 authorizes the Department of Energy "to undertake studies, in cooperation with other nations, on a multinational or international basis designed to determine the general feasibility of expanding capacity of existing spent fuel storage facilities; to enter into agreements, subject to the consent of the Congress (by joint or concurrent resolution or legislation hereafter enacted), with other nations or groups of nations, for providing appropriate support to increase international or multinational spent fuel storage capacity; to conduct studies on the feasibility of establishing regional storage sites; and to conduct studies on international transportation and storage systems."
- Section 104 of Reference 3 urges the President "to institute prompt discussions with other nations, including both supplier and recipient nations, to develop international approaches for meeting future worldwide nuclear fuel needs. In particular, the President is authorized and urged to seek to negotiate as soon as practicable with nations possessing nuclear fuel production facilities or source material, and such other nations and groups of nations, such as the IAEA, as may be deemed appropriate, with a view toward the timely establishment of binding international undertakings provided for:
 - devising, consistent with the policy goals set forth in section 403 of this Act, feasible and environmentally sound approaches for the siting, development, and management under effective international auspices and inspection of facilities for the provision of nuclear fuel services, including the storage of special nuclear material;
 - the establishment of repositories for the storage of spent nuclear reactor fuel under effective international auspices and inspection;
 - the establishment of arrangements under which nations placing spent fuel in such repositories would receive appropriate compensation for the energy content of such spent fuel if recovery of such energy content is deemed necessary or desirable."

Two types of international cooperative efforts are envisioned in support

of the above authority; namely:

A. Bilateral Cooperation

U.S. support of the expansion of foreign national spent fuel storage capacities, where such expansion is consistent with nuclear non-proliferation objectives, is viewed as a high priority area of international cooperation. In a larger number of cases, expanded national storage may be the only available option, pending the establishment of multinational facilities or in a very limited number of cases, the transfer of spent fuel to another country or to the United States. The United States believes that each nation has primary responsibility to arrange for the disposition of their spent power reactor fuel in a manner which takes into account non-proliferation considerations. Expanded national storage would support implementation of this responsibility by providing concerned nations with alternatives to premature reprocessing. Overall, bilateral cooperation is directed towards resolving short and medium term spent fuel storage needs while longer range multinational and international programs go into effect.

Bilateral cooperation and assistance with respect to expanding foreign national spent fuel storage capabilities will be provided, where appropriate, in the areas of technology transfer; exchange of information; assistance in establishing regulatory guidelines and procedures; assistance in conducting feasibility and design activities; and assistance in provisioning and constructing the subject facilities.

B. Multinational and International Cooperation

U.S. support of multinational and international spent fuel storage initiatives is viewed as a high priority area in the context of resolving long range nuclear non-proliferation needs. In many instances the multinational storage of spent fuel could be the most desirable solution. It offers a valuable service to countries in which the projected size of the nuclear power program may make purely national storage efforts less economic. For many countries, multinational arrangements could provide a contingency storage

capability for unexpected needs. In other instances, such arrangements could provide a repository for spent fuel generated in regions of the world in which its long term presence could contribute to international tensions. By reducing the number of sites at which fuel is stored, multinational arrangements can also contribute to increasing the effectiveness of international safeguards.

U.S. cooperation with respect to multinational and international spent fuel storage initiatives will emphasize participation with other nations and international organizations, such as the International Atomic Energy Agency, in such activities as (a) evaluation of the need for and approach to international spent fuel management; (b) technology transfer programs; and (c) conceptual design and engineering studies of multinational spent fuel storage regimes.

2.3.2 Fee-Based Transfer of Foreign Spent Power Reactor Fuel to the United States for Storage

In October, 1977, President Carter announced the proposed U.S. Spent Fuel Policy. Under this policy the United States would accept and take title to spent nuclear power reactor fuel from domestic utilities and limited amounts of spent nuclear power reactor fuel from foreign utilities where such action advanced U.S. non-proliferation objectives. In either case, whether the fuel was foreign or domestic, the U.S. Government would charge a fee for the services such that full cost recovery by the U.S. Government would be achieved. The Spent Nuclear Fuel Act of 1979 (Reference 4), submitted to the Congress by DOE on February 26, 1979, would provide DOE with the authority to implement this policy subject to the requirements of the Nuclear Non-Proliferation Act of 1978 (Reference 3).

Return of foreign spent fuel to the United States would, in most instances, be a last priority action in U.S. international spent fuel cooperation except in cases in which the continued presence of spent fuel would contribute to international tensions within a given region of the world, or instances in which its removal from on-site storage would contribute to international confidence in the observance of non-proliferation undertakings.

In other instances, the United States would consider spent fuel returns only in accordance with the following conditions:

- when storage in the U.S. offers the nation concerned an alternative, on a case-by-case basis, to early reprocessing;
- when storage in the U.S. provides an interim solution to a nation's needs, pending the availability of national or multinational spent fuel storage facilities. The United States would expect the shipping nation to make good faith efforts toward establishing such facilities;
- when storage in the United States can assist nations which would like to reduce their national inventories of spent fuel as a contribution to easing international tensions in their respective regions;
- when storage of foreign spent fuel in the United States is required to assist the United States in responding to an emergency situation abroad.

Cooperating nations would be expected to make good faith efforts toward resolving their spent fuel problems under conditions most supportive of our non-proliferation efforts. In most cases, this would mean good faith efforts toward establishing adequate spent fuel storage capacity, either on a multinational basis or, where prudent, on a national basis.

Normally, acceptance contracts with particular countries would cover a few reactor years during the 1980-1990 period, but with some flexibility possible, depending on the particular circumstances involved. In all cases, total foreign fuel accepted for storage in the United States through the year 1988 would range between 10-20% of domestic spent fuel placed in storage in the AFR program proposed in the Spent Fuel Act of 1979.

In summary, U.S. objectives in the non-proliferation area would be achieved in relation to the degree to which the storage of foreign fuel in this country promoted the deferral of premature reprocessing abroad and contributed to continued foreign reliance on the once-through fuel cycle for the light water reactor as the appropriate approach to meeting nuclear energy needs in the short and medium term.

2.3.3 Emergency Transfer of Foreign Spent Power Reactor Fuel to the United States for Storage

Emergency transfer of foreign spent power reactor fuel to the United States may occur, as provided for in the Nuclear Non-Proliferation Act of 1978 (Reference 3), if:

"the President determines that (a) a commitment under section 54 or 55 of this Act of the United States for storage or other disposition of such limited quantities in the United States is required by an emergency situation, (b) it is in the national interest to take such immediate action, and (c) he notifies the Committees on International Relations and Science and Technology of the House of Representatives and the Committees on Foreign Relations and Energy and Natural Resources of the Senate of the determination and action, with a detailed explanation and justification thereof, as soon as possible."

The Administration plans to undertake those activities necessary to insure that an appropriate emergency transfer capability exists.

2.3.4 Strategy Summary

Table 2-1 summarizes the actions, priorities and timing associated with Administration policies with respect to international spent fuel management.

TABLE 2-1
STRATEGY SUMMARY

PRIORITY	ACTIONS	TIMING
1st	<p>Support establishment of multinational or international spent fuel regimes:</p> <ul style="list-style-type: none"> a. Feasibility Studies b. Arrangements/Implementation 	Intermediate and Long Term
2nd	<p>Assist selected countries in expanding national storage capacity:</p> <ul style="list-style-type: none"> a. Feasibility Studies b. Technology Transfer Arrangements 	Near to Intermediate Term
3rd	<p>Accept "limited amount" of foreign spent fuel for storage in United States:</p> <ul style="list-style-type: none"> a. Evaluation and Selection b. Arrangements 	Near to Intermediate Term
Contingency	<p>Emergency removal of spent fuel from a foreign country when in interest of U.S. non-proliferation objective</p>	As soon as possible

REFERENCES FOR SECTION 2

1. Report to the President by the Interagency Review Group in Nuclear Waste Management, TID-29442 (March 1979)
2. Department of Energy Act of 1978 - Civilian Applications, Public Law 95-238 (February 25, 1978)
3. Nuclear Non-Proliferation Act of 1978, Public Law 95-242 (March 10, 1978)
4. Spent Nuclear Fuel Act of 1979, (Senate Bill S-797, introduced on March 27, 1979)

3.0 GENERIC PLAN

3.1 Introduction

This section describes the Department of Energy's (DOE) generic plan associated with implementing Administration policies - as discussed in Section 2.0 - with respect to international spent fuel management activities. The Administration plans to take action within four programmatic areas, namely:

- 1) Bilateral cooperation related to expansion of foreign national storage capacities.
- 2) Multilateral and international cooperation related to development of multinational and international spent fuel storage regimes.
- 3) Fee-based transfer of foreign spent power reactor fuel to the U.S. for storage.
- 4) Emergency transfer of foreign spent power reactor fuel to the U.S. for storage.

Primary U.S. Government organizational relationships for the subject program area will be as follows:

- 1) The Department of Energy (DOE) will act as the lead programmatic agency with responsibilities for accomplishing planning and implementation tasks.
- 2) The Department of State (DOS) will have the primary responsibility for negotiations with other countries and will be supported by DOE as required during negotiations.
- 3) The Arms Control and Disarmament Agency (ACDA) will prepare the Nuclear Proliferation Assessment Statement and will provide appropriate programmatic support related to non-proliferation considerations.

The Department of Energy will keep the Congress informed of program status and legislative needs on a timely basis. This will include:

- 1) Preparation and submittal of necessary legislation and agreements.
- 2) Provision of detailed descriptions of agreements, supporting data, and effects of agreements upon non-proliferation policy. This data will support the Congress in considering specific authorizing legislation, funds allocation, and approval of new international agreements.

The following subsections define the generic activities and tasks associated with each of the above program areas.

3.2 Generic Plan - Bilateral Cooperation Related to Expansion of Foreign National Storage Capacities

The Department of Energy's program for bilateral cooperation and assistance with respect to expansion of foreign national storage capacities will include the following activities:

- 1) Establish requirements for U.S. cooperation and assistance with respect to expansion of foreign national storage capacities.
 - a) Establish, in conjunction with the Department of State, the nature and extent of interest by other nations to seek U.S. cooperation and assistance in expanding their national storage capability.
 - b) Establish priorities for U.S. cooperation and assistance in expanding foreign national spent fuel storage capabilities. Program priorities will be established on the basis of need and compliance with U.S. non-proliferation objectives.
 - c) Conduct technical and economic studies that will result in specific proposals for storage expansion. This will include: Surveys of existing storage facilities; development of technical concepts for expansion including costs and schedules; and assessments of needs for technology transfers and assistance by the United States.
- 2) Conduct negotiations with selected foreign countries leading to the establishment of agreements with respect to technical cooperation and assistance in expanding foreign national storage capacities.

NOTE: In most instances, agreements for assistance would be reached pursuant to agreements for cooperation in the peaceful uses of atomic energy between the United States and the country concerned, or would be concluded pursuant to the agreement concerning the peaceful uses of nuclear energy between the United States and the International Atomic Energy Agency. Such agreements would take the form of technical exchange agreements and would constitute subsequent arrangements as defined in the Nuclear Non-Proliferation Act of 1978.

- a) Provide data and proposals for evaluation by foreign countries; evaluate data and proposals provided by foreign countries.
- b) Support Department of State during negotiation activities by preparing and/or evaluating technical material included in agreements.
- 3) Provide technical cooperation and assistance in support of established agreements. Assistance will include the following, as applicable to specific agreements:
 - a) Exchange of technical information.
 - b) Transfer of technology.
 - c) Assistance in establishing regulatory procedures and guidelines for storage.
 - d) Development of technical designs.
 - e) Provision of tools, racks, equipment or construction services as required. This assistance will be provided through international organizations, by private firms under contract to foreign organizations, by private firms under contract to the U.S. Government, or by the Department of Energy and its associated laboratories.
- 4) Prepare appropriate environmental review as required in Executive Order 12114 and as defined in DOE guidelines issued pursuant to this executive order.

3.3 Generic Plan - Multilateral and International Cooperation Related to Development of Multinational and International Spent Fuel Storage Regimes

The Department of Energy's program for multilateral cooperation with respect to the development of multinational and international spent fuel storage regimes will include the following activities:

- 1) Provide continued support of currently initiated planning and evaluation activities through international organizations. Specifically, DOE will support (a) Working Group 6, Spent Fuel Storage, of the International Nuclear Fuel Cycle Evaluation (INFCE) in the evaluation of technical and institutional considerations associated with international spent fuel storage and transportation and (b) IAEA sponsored activities on international spent fuel management.

- 2) Conduct intensive technical, institutional, and economic studies to develop feasible and acceptable methods for multinational spent fuel storage regimes. These studies will include investigations of the following:
 - a) Requirements for multinational storage regimes.
 - b) Harmonization of regulatory guidelines for multinational transportation and storage of spent fuel.
 - c) Feasibility of various technical and institutional concepts for international and multinational transportation and storage.
 - d) Costs of multinational and international transportation and storage.
 - e) Criteria for selection of multinational or international storage sites.
 - f) Research and development required to support multinational transportation and storage.
- 3) Provide support to Department of State negotiations with international organizations or groups of nations. DOE will provide the following support:
 - a) Supply of technical, institutional, and economic data to negotiating organizations for their evaluation.
 - b) Evaluation of technical, institutional and economic data received from negotiating organizations.
 - c) Development of plans for U.S. participation in multinational or international storage activities.
- 4) Provide support of multinational or international organizations in developing the necessary facilities in accordance with negotiated agreements. This support will take the form of the following, as appropriate:
 - a) Transfer of information to appropriate international organizations.
 - b) Transfer of technology to appropriate international organizations.
 - c) Arrangements for support in licensing and safeguard procedures.
 - d) Other assistance as required to assure effective planning and expeditious completion of planned programs.

3.4 Generic Plan - Fee-Based Transfer of Foreign Spent Power Reactor Fuel to the United States for Storage

The Department of Energy's program for fee-based transfer of foreign spent power

reactor fuel to the United States for storage will include the following activities:

- 1) Establish requirements for fee-based transfer of foreign spent power reactor fuel to the United States for storage. This will include the following activities:
 - a) Establish, in conjunction with the Department of State, the nature and extent of interest by other nations seeking spent fuel transfer privileges.
 - b) Establish transfer priorities based on need and compliance with U.S. non-proliferation objectives.
- 2) Conduct technical and institutional evaluations that will examine specific proposals for fee-based transfer of foreign fuel. The following areas will be examined for each proposal.
 - a) Analysis of policy objectives to be achieved by the subject transfer.
 - b) Detailed technical description of proposed modes of transportation and storage, and analysis of any technical alternative thereto.
 - c) Summary of available domestic and international transportation and storage facilities and capacities.
 - d) Discussion of proposed geographic sites for such storage, including any alternatives thereto.
 - e) Identification and discussion of all proposed or potential international accords, agreements, arrangements, understandings, or any other direct or indirect form of conditional, discretionary, or mandatory arrangement with one or more foreign legal entities, government or nongovernment, or international or multinational organization for such repurchase, storage, or transportation, directly or indirectly.
 - f) Discussion of all potential costs, direct and indirect, for that fiscal year and the following 10 fiscal years, on an annual basis, and 5-year increments beyond through the end of the century, including, but not limited to, all management and administrative costs, the value of any required U.S.-owned facilities or equipment, and all required payments to any legal entity for spent fuel, for facilities or equipment outside the United States, or for any supporting services.

- g) Discussion of any and all research, development or demonstration funds, personnel or facilities, which directly or indirectly will be required to support the technical implementation of the plan over the life of the proposed program.
- h) Discussion of the justification for the basis of the price proposed to be paid for the foreign spent fuels, in terms of the remaining unburned fissionable fuel or other reusable fuel assembly component or element, or any amount considered to be an incentive payment for inducing the sale to the United States, any imputed value as a result of a particular policy objective, any amount related to alternative costs for storage or reprocessing by the foreign entity, or any other factor.
- i) Preparations of a cost/benefit analysis of such repurchase, transportation or storage, taking into account the factors discussed in previous subsections, and including a specific cost comparison analysis of the proposed disposition with other alternatives, including but not limited to, reprocessing and recycling the spent fuel.
- j) Discussion of all legal and regulatory considerations and requirements for the proposed actions under any applicable local, state or Federal law or regulation, or under any international law, accord, agreement, understanding, arrangement or any other form of conditional, discretionary or mandatory arrangement with one or more foreign entities, government, or nongovernment, or international or multinational organization.
- k) Discussion of the proposed procedures for seeking and obtaining the comments and approval of the public and any local or state jurisdiction, as may be required by Federal law, in which or through which the foreign spent fuel will be transported or stored.
- l) Preparation of an environmental impact statement for any Federal actions in the United States.
- m) Discussion of the impact that the proposed fee-transfer action would have on the U.S. domestic nuclear waste alternatives.

Appendix A provides summary generic evaluations of the above areas.

- 3) Assist the Department of State in negotiations of specific agreements for transfer. This assistance will include:
 - a) Announcement of details of the program and specific criteria and fees associated with foreign spent fuel transfer.
 - b) Preparation and/or evaluation of texts of specific agreements with individual countries.
 - c) Preparation and/or evaluation of technical and institutional data presented for discussion during negotiations.
- 4) Implement foreign fuel transfers in accordance with the negotiated agreements. Implementation activities will include:
 - a) Preparation of site-specific environmental impact statements, including the effects of foreign spent fuel on the environment and the population of the United States. These statements will be based upon the draft generic environmental impact statement for foreign fuel and upon the specific spent fuel conditions and quantities, transportation systems and routes, and storage facilities used for the transfer of foreign fuel.
 - b) Provision of interim storage facilities within the United States.
 - c) Assistance to foreign countries in arranging necessary transportation capability.

3.5 Generic Plan - Emergency Transfer of Foreign Spent Power Reactor Fuel to the U.S. for Storage

The Department of Energy's program for emergency transfer of foreign spent power reactor fuel to the U.S. for storage will include the following activities:

- 1) Conduct technical and economic studies to determine the requirements for equipment, facilities, and support services required to provide adequate capability to affect an emergency spent fuel removal. These studies will include the following activities:
 - a) Acquisition of the technical data base required to plan and accomplish emergency removal. This data base will be obtained as part of the basic contacts with foreign governments associated with the other activities

to develop the Foreign Spent Fuel Program. Data that will be obtained includes reactor plant characteristics, fuel quantities and locations, fuel and cask handling capabilities, cask availabilities in the country in question, external cask transfer methods, and harbor capabilities.

- b) Development of a general basic technical concept for removal of the fuel and requirements for supporting equipment. This concept will include the definition of the methods of spent fuel shipment, the transport casks to be used, the time required for removal and removal costs.
- 2) Acquire the capability for emergency transfer. Emergency transfer capability will require that certain equipment, facilities, and services be prearranged such that the transfer can begin with short lead time. Activities to acquire the emergency transfer capability include the following:
- a) Arrangement with the Department of Defense and private contractors for services required to remove the fuel.
 - b) Acquisition of unique equipment required for the transfer and placement of equipment in ready storage.
 - c) Development of general criteria for emergency removals and review of these with the Nuclear Regulatory Commission, the Department of Transportation, and the International Atomic Energy Agency. Negotiation or assistance in negotiations with these organizations for any participation required in support of emergency removal.
 - d) Development of country-specific procedures for emergency removals. These procedures will identify technical, manpower, and equipment requirements for emergency removals. The required logistics and supporting systems will also be identified.
- 3) Accomplish emergency fuel removals if the need arises. The fuel removal actions will include the following:
- a) If an emergency situation is detected, the Department of State will arrange with the country in question for emergency removal. The Department of Energy will support these arrangements by defining the needs for country support, describing the means to be used in fuel removal, and assisting in the formulation of any agreements.

b) Initiate fuel removal. Fuel removal will be conducted as follows:

- A predesignated project manager will be requested to initiate action within a specific country and to use approved procedures - as discussed in (2) above. Upon equipment arrival at the reactor site, an inspection team will identify the subject fuel and a search for missing fuel will be initiated if required. Inspections will be by the DOE and by the IAEA as appropriate.
- A DOE representative and a Department of State representative will be sent to supervise the removal. The transport craft will not enter the country until these representatives arrive. The Department of State will also arrange for an appropriate individual from the country involved to participate in the initial entry.
- Spent fuel will be loaded into casks by reactor operators under DOE and IAEA supervision (as appropriate) on a three shift basis. Land transportation will use local railroads, trucks, and operators to the extent possible. Any special U.S. equipment will be operated by U.S. Nationals. All transfer operations will be under DOE supervision aided by experienced consultants and contractors.
- When the fuel is in U.S. owned craft and clear of the territorial boundaries of the involved country, the DOE will take title to the fuel.
- When the fuel is received in the United States, it will be handled and stored the same as domestic fuel with the possible exceptions of additional IAEA inspection and surveillance.

4) Notify appropriate Congressional committees of the action before the first shipment reaches the United States. This will be accomplished jointly by letter by the Department of Energy and the Department of State. A report will follow within 60 days.

APPENDIX A

Note: The purpose of this appendix is to provide generic evaluations of the points of interest raised by Senator McClure during Congressional debate* on the Nuclear Non-Proliferation Act of 1978 and later incorporated as informational requirement within Section 303 of that Act.

*Reference: Congressional Record - Senate, dated February 7, 1978/
pages S1322 and S1323

A1.0

POLICY OBJECTIVES

Provide exact policy objectives intended to be achieved by such repurchase, transportation, or storage, including the relation of such objectives to domestic and international energy policy, domestic and international nuclear power policy, and nuclear non-proliferation policy.

A1.1

Introduction

Section 2.0 of this report describes U.S. policies and strategies with respect to international spent fuel management and thus is responsive to the above required information. A summary of Section 2.0 is provided below.

A1.2

Goals

A principal goal of the U.S. non-proliferation policy is to develop an international framework that will minimize both the incentives and opportunities for nuclear proliferation while helping to ensure that nuclear power is available to help meet the world's energy needs. The Administration's approach seeks to find ways to strengthen the foundation for support of the Nuclear Non-Proliferation Treaty and international safeguards, as well as of the international exploitation of the benefits of nuclear power.

Two major elements of this strengthened foundation are:

- Limiting the number and the dispersal of national sensitive fuel cycle facilities, as well as the size of national plutonium stockpiles, to a minimum consistent with real needs; and
- Using to the widest extent practicable, institutional and, where effective, technical arrangements designed to increase resistance to proliferation.

A1.3

Policies

The Administration has enunciated a policy approach with respect to international spent fuel management consisting of two principal elements, namely:

- 1) Advocacy of international cooperative initiatives to alleviate the spent fuel storage problem.

- 2) An offer to accept and store in the United States limited quantities of foreign spent fuel, where such action would advance U.S. non-proliferation objectives.

A1.4 Programs

In support of the above policies, the Administration advocates the following programmatic actions:

- 1) Bilateral cooperation and assistance with respect to expanding foreign national spent fuel storage capabilities will be provided where such expansion is consistent with U.S. nuclear non-proliferation objectives.
- 2) U.S. support in developing appropriate multinational and international spent fuel storage regimes is viewed as a high priority area in the context of resolving long range nuclear non-proliferation needs.
- 3) Appropriate fee-based and emergency return foreign spent fuel transfer programs will be initiated subject to the following conditions:
 - a) When storage in the U.S. offers the nation concerned an alternative, on a case-by-case basis, to early reprocessing.
 - b) When storage in the U.S. provides an interim solution to a nation's needs, pending the availability of national or multinational spent fuel storage facilities. The United States would expect the shipping nation to make good faith efforts toward establishing such facilities.
 - c) When storage in the United States can assist nations that would like to reduce their national inventories of spent fuel as a contribution to easing international tensions in their respective regions.
 - d) When storage of foreign spent fuel in the United States would be required to assist the United States in responding to an emergency situation abroad.

A2.0 TECHNICAL DESCRIPTION OF PROPOSED MODES OF TRANSPORTATION AND STORAGE

Provide a detailed technical description and discussion of the proposed mode or modes of transportation and storage and an analysis of any technical alternative thereto.

A2.1 Introduction

Figure A2-1 describes the proposed generic functional mode associated with routine transfer and storage of spent fuel from foreign nuclear power reactors to potential U.S. interim spent fuel storage facilities. The principal technical systems associated with the above flow include the following:

- (1) Interim spent fuel storage systems
- (2) Spent fuel transportation casks
- (3) Spent fuel vehicular transport systems
- (4) Miscellaneous spent fuel handling facilities and equipment

A technical description and synopsis of the state-of-art for each of the above is provided below.

A2.2 Interim Spent Fuel Storage Systems

Away-from-reactor (AFR) spent fuel storage can be used for the interim storage of a limited amount of foreign spent fuel. Table A2-1 describes possible interim storage alternatives.

Modular water-basin storage of unpackaged spent fuel was selected in Reference 1 as the generic method for interim storage because it is a proven concept that is acceptable to the NRC. The same type facility is assumed for this generic plan for the interim storage of foreign fuel. A schematic representation of the major process steps in water basin storage in an AFR facility is shown in Figure A2-2. Figure A2-3 is a plot plan for a generic AFR facility. The facility is designed to receive, handle, decontaminate, and reship spent fuel casks; to remove irradiated fuel from casks; to place the fuel in a water basin; and to cool and control the quality of the water. The facility is also

A2-2

FUNCTIONAL FLOW

FIGURE A2-1

TABLE A2-1

Summary Comparison of Spent Fuel Interim Storage Alternatives

<i>Storage Alternative</i>	<i>Confinement Barriers in Addition to Cladding</i>	<i>Means of Heat Removal</i>	<i>Method of Controlling Fuel Cladding Corrosion</i>	<i>Maintenance Requirements</i>	<i>Surface Land Use</i>
Unpackaged Storage					
Water-cooled basin	Water ^a	Forced circulation of basin water	Low-temperature and water quality control	High	Low
Air-cooled vault	Filters	Forced circulation of air	Low temperature	Moderate	Moderate
Packaged Storage					
Water basin	Water and package ^a	Forced circulation of basin water	Packaged in inert or noncorrosive medium	High	Low
Air-cooled vault	Package	Natural circulation of air	Packaged in inert or noncorrosive medium	Low	Moderate
Concrete surface silo (surface storage cask)	Package	Natural circulation of or conduction to air	Packaged in inert or noncorrosive medium	Low	High
Geologic formations	Package hole liner ^a	Conduction to earth	Packaged in inert or noncorrosive medium	Moderate	Low
Near-surface caisson	Package, hole liner	Conduction to earth	Packaged in inert or noncorrosive medium	Low	High

^a. Filtration of effluent ventilating air may be used to provide an additional confinement barrier.

FIGURE A2-2 Simplified Schematic of the AFR
Storage Basin Process

FIGURE A2-3 Plot Plan for a Basin Storage Facility
for Unpackaged Spent LWR Fuel

designed for removing spent fuel from storage basins, loading the spent fuel into shipping casks, decontaminating loaded casks and shipping spent fuel. Modular construction allows facility expansion with a minimum of additional support facilities and services. Additional technical details about the generic facility and its operation are provided in References 1 and 2.

The state-of-art and technical description associated with other interim storage alternatives shown in Table A2-1 is provided in Reference 3.

A2.3 Spent Fuel Transportation Casks

Spent fuel transportation casks will be used to package and contain spent fuel elements during all modes of transporting foreign irradiated nuclear fuels. Irradiated nuclear fuel has been safely transported since the mid-1940s in numerous kinds of spent fuel casks. The numerous cask designs were developed because of the variety of AEC (ERDA) (DOE) military, research, and commercial nuclear reactors in service. Experience gained in the design and use of these casks, plus comprehensive NRC and Department of Transportation (DOT) regulations have led to the present generation of spent fuel casks.

Figure A2-4 schematically illustrates the physical elements of a generic spent fuel cask, namely:

- (a) Radiation protection system including neutron and gamma shields
- (b) Heat removal system including cask coolant and cooling fins
- (c) Structural protection system including inner and outer shell, impact limiters, cask closure, etc.

Additional technical details regarding spent fuel casks are presented in references 2 and 3.

A2.4 Spent Fuel Vehicular Transport Systems

As shown in figure A2-1, three basic types of vehicular transport modes may be used in transferring spent fuel from foreign power reactors to interim spent fuel storage locations in the United States. In each case, a compatible spent fuel cask will be used to contain the spent fuel elements. A brief technical description of each type of vehicular system is provided below.

Typical characteristics

Item	Legal truck size	Overweight truck size	Full size
Length	16 ft	16 ft	17 ft
Diameter	4 ft	6 ft	8 ft
Loaded weight	25 tons	40 tons	100 tons
Number of fuel assemblies carried	1 pwr or 2 bwr	3 pwr or 7 bwr	10 pwr or 24 bwr

FIGURE A2-4 Simplified Spent Fuel Transportation Cask

A2.4.1 Truck Transport System

A truck transportation system generally consists of a standard tractor-trailer rig which has been outfitted for tiedown of the cask to the trailer bed. Escort vehicles may also be used to carry cask support equipment, communications or personnel. As shown in figure A2-4, two general sizes of casks have been transported by truck. The larger cask sizes have had limited use in the United States due to highway restrictions. Unrestricted use of highway transporters, throughout the United States, is limited to 25 tons gross vehicle weight. Federal highway limits allow transportation of 40 tons gross vehicle weight. Legislation is being pursued at the state level to make state laws consistent with federal laws. Several states allow transport of overweight transporters (heavier than noted above) over their roads. However, these overweight transporters require special tariffs and handling conditions to be imposed on their movement. These tariffs and conditions will minimize large scale use of overweight vehicles for transfer of foreign fuel to interim storage in the United States.

A2.4.2 Rail Transport System

Weight restrictions are higher on railroads than on highways. Larger casks have been designed to take advantage of this capability. These rail size casks are transported on special rail cars outfitted for the casks. Outfitting of these cars includes installation of protective barriers, attachment of cask tie-downs, and inclusion of cask cooling systems. These cars are self contained and may be included in standard commercial trains with the railroad companies acting as common carriers. Recent legal actions have directed that railroads act as common carriers. However, continued railroad resistance, potential deregulation of railroads, and new regulations for safeguarding spent fuel in transit may result in use of special trains for transport in the United States. If special trains are used, they will consist of one or more cask-carrying cars, a caboose, an engine, and other cars for personnel, communications, and as buffers. Special trains would operate at track speeds lower than regular trains but in-transit layovers should be minimized by special routing.

A2.4.3 Ship Transport System

One element of the transfer of foreign fuel to the United States includes overseas transportation. Ships are the most likely mode of transport for this element. Two shipping options exist. These are: use of commercial ships as common carriers and use of dedicated ships for spent fuel transportation. Regulatory bodies in the United States and other countries have licensed casks to be carried on common carriers (except airplanes). With these casks, sea transport can be made with existing ships. The advantages of use of common carrier shipping is immediate availability of ships, and no capital investment for ships. This option is considered most probable for early spent fuel shipments involving small quantities of fuel.

Some countries, notably Japan and the United Kingdom, who have done the most extensive sea transport of spent fuel, have used dedicated ships. Japan has developed specific design requirements for these dedicated ships. Any dedicated ships operating in Japanese waters are required to meet these requirements. Advantages for use of dedicated ships are significant and include:

- 1) Personnel can be trained specifically for spent fuel operations and these trained personnel will be available for all transportation trips.
- 2) Heavy lift cranes can be installed on the ship, thus making many port facilities usable as ports of entry or embarkation without provisioning of dockside cranes.
- 3) Dedicated ships can be designed to nuclear standards which will enhance both safety and safeguard aspects of fuel transportation.
- 4) Schedules of dedicated ships can be managed to minimize cask wait time and thereby reduce cask inventory and costs.

Dedicated ships are not immediately available and will require added costs to meet nuclear design requirements. However, it is considered that these factors have minimum impact on programs involving transfer of relatively large quantities of fuel over long operational time periods. Because of the advantages, the precedents that have been set, and the quantities of fuel involved in transfer to temporary storage, it is postulated that dedicated ships

may be a major factor in spent fuel transport.

A2.4.4 Air Transport Systems

Air transport of spent fuel is a possible option to ship transport for overseas shipments. However, Public Law 94-79 restricts air shipments containing plutonium. As spent fuel contains plutonium, it is considered that this law applies to shipments of spent fuel; it includes the following provision:

"The Nuclear Regulatory Commission shall not license any shipments by air transport of plutonium in any form, whether exports, imports, or domestic shipments; provided however, that any plutonium in any form contained in a medical device designed for individual human application is not subject to this restriction. This restriction shall be in force until the Nuclear Regulatory Commission has certified to the Joint Committee on Atomic Energy of the Congress that a safe container has been developed and tested which will not rupture under crash and blast-testing equivalent to the crash and explosion of a high-flying aircraft."

Air transport is considered physically possible. That is, current aircraft have required payload-range capabilities, loading provisions in these aircraft are adequate, cask weight can be accommodated by aircraft structure, aircraft cooling is adequate for spent fuel heat loads, and aircraft routing can avoid overflight of populated land masses except near the airports. Economics of air transport appear reasonable if licensed casks similar to current casks are available. However, it is considered that air transport will not be used for normal transfer of foreign fuel to the United States due to the anticipated difficulty of licensing casks for this purpose.

A2.5 Miscellaneous Spent Fuel Handling Facilities and Equipment

A brief technical description of certain miscellaneous spent fuel handling facilities and equipment is provided below.

A2.5.1 Port Facility

A port facility is required for each country shipping spent fuel and for each temporary storage facility in the United States. The port facility should be

located to minimize land transportation distances. Otherwise, no special provisions are indicated. The facility requires only a dock and access to a road and/or a railways.

A2.5.2 Crane Equipment

Heavy lift cranes will be required to transfer casks from their transporters to the ship's hold. If large size rail casks are used, these cranes need to have an approximate lifting capacity of 125 tons. This is larger than ports normally have for commercial cargo handling. However, many of the larger ports have cranes of this size. The alternatives become to select ports that have adequate cranes, to provide cranes at selected ports or to include cranes on the ships. Shipboard cranes become particularly attractive if dedicated ships are used.

A2.5.3 Maintenance Facilities

Maintenance of casks and transporters will be an important element of the transport system. Some maintenance may be performed at the storage facilities. However, when full service is required these facilities will not be available for cask maintenance. Consequently, maintenance facilities will be required in support of spent fuel transfer. These facilities need to be provided by the owners of the shipping casks. Characteristics of these facilities are as follows:

- a) The general activities performed in a maintenance facility:
 - 1) Cask/transporter reconfiguration to account for different types of casks.
 - 2) Scheduled maintenance.
 - 3) Unscheduled maintenance.
 - 4) Response to emergencies and/or accidents.
- b) Typical maintenance functions include:
 - 1) Replacement of valves, seals, and pressure relief systems.
 - 2) Reconfiguration of casks.
 - 3) Structural proof tests.
 - 4) Decontamination.

- 5) Repair of cooling systems.
- 6) Refilling of liquids used in the cask.
- 7) Incorporation of design changes that might develop during the life-time of the cask complement.
- 8) Replacement or servicing of bearings on transporters.

c) Typical equipment required in the maintenance facility includes:

- 1) Hot and warm cells.
- 2) Radiation monitors.
- 3) Cranes
- 4) Portable shielding
- 5) Test sets for various equipment items
- 6) Storage racks

REFERENCES FOR SECTION A2

1. Draft Environmental Impact Statement - Storage of U.S. Spent Power Reactor Fuel. U.S. DOE Report DOE/EIS-0015-D, U.S. Department of Energy, Washington, D.C. (August 1978).
2. Analytical Methodology and Facility Description - Spent Fuel Policy. U.S. DOE Report DOE-ET-0054, U.S. Department of Energy, Washington, D.C. (August 1978).
3. Alternatives for Managing Wastes from Reactors and Post-Fission Operations in the LWR Fuel Cycle. U.S. ERDA Report, ERDA-76-43, Vol. 3 of 5, U.S. Energy Research and Development Administration, Washington, D.C. (May 1976).

A3.0 SUMMARY OF TRANSPORTATION AND STORAGE FACILITIES

Provide a summary of the domestic and international transportation and storage facilities and capacity for disposal of spent nuclear fuel.

A3.1 Introduction

Elements of the technical systems required for management of foreign spent fuel exist in various operational states throughout the world. However, many of these elements are in use or have insufficient capacity to provide ability to manage spent fuel beyond the near future. A summary of these technical elements is provided below.

A3.2 Storage Facilities

A3.2.1 Domestic

At present time there are no existing DOE licensed storage facilities that could serve as a U.S. Government owned AFR storage facility. However, two generic types of existing U.S. storage facilities could be modified and used for AFR storage of foreign fuel, namely:

- Those currently owned by private parties and originally intended to serve as receiving basins for reprocessing plants.
- Federally owned storage facilities.

The private away-from-reactor storage pools associated with reprocessing plants include those at the General Electric (GE) Morris Plant, the Nuclear Fuel Service (NFS) West Valley Plant and the Allied General Nuclear Services (AGNS) Barnwell Plant (not currently storing fuel). These AFR facilities, which are described below, have a combined capacity of between 500 and 1000 MTU of storage capacity.

- 1) GE Morris - This plant has been licensed as an ISFS (Independent Spent Fuel Storage) facility. The initial storage capacity of about 90 MTU has been increased to about 750 MTU. Presently, this basin is in use, has approximately 300 MTU of spent fuel in storage and has contracts to receive additional fuel.

- 2) NFS West Valley - The basins at this plant have a capacity of storing 260 MTU of spent fuel. This plant is now licensed and operating as an ISFS basin. This facility currently has 165 MTU of spent fuel in storage. NFS has announced its withdrawal from the reprocessing business and this plant is no longer receiving spent fuel from utilities for extended storage.
- 3) AGNS Barnwell - The AGNS storage basin has capacity for 400 MTU of spent fuel. AGNS has applied for a license to operate its basin for interim storage prior to startup of the reprocessing facility. The licensing had proceeded to the hearing stage and was then suspended. Recently AGNS indicated that its facility would not be available for interim storage.

A recent survey of existing federal facilities identified three sites that might be suitable as AFR's - a 30 foot deep wet storage pool owned by the Federal Maritime Commission with 160 MTU of capacity at the Todd Shipyard in Galveston, Texas; a 100 MTU dry storage facility at Santa Susana, California owned by DOE and managed by Atomics International and a DOE-owned 1500 MTU dry storage facility north of Las Vegas, Nevada, that was formerly used for nuclear rocket engine research and development.

A3.2.2 International

Two types of foreign spent fuel management capabilities exist, namely: those countries who provide an international reprocessing service and those countries who have purely national programs. The international reprocessors include the United Kingdom and France. These countries have reprocessing facilities which handle spent fuel from their own national power reactors and which also offer spent fuel reprocessing services to other countries. These facilities include storage pools associated with the receiving function at the reprocessing plant. These storage pools could be considered as part of a potential international storage capability as discussed below.

a) International Reprocessor Facilities

The two major international reprocessors are BNFL at Windscale in the United Kingdom and Cogema at La Hague in France. BNFL has a current storage capacity of 1000 MTU and presently has 330 MTU stored. New storage pools are under construction with planned capacity at 6100 MTU. Cogema has a present pool capacity of 250 MTU and is considered to be about full. Eventual planned

capacity of Cogema is 5,250 MTU.

b) National Facilities

Several nations have indicated plans for national central storage installations. These planned installations are as follows:

COUNTRY	FACILITY	CAPACITY (FUEL ASSEMBLIES)	DATE OPERATIONAL
Belgium	Mol	350 to 1,000	1981
Federal Republic of Germany	Ahaus	3,260 (approximate)	1983
Federal Republic of Germany	Gorleben	6,520 (approximate)	1986
Finland	Olkiluoto	4,000 to 10,000	unknown
Sweden	Un-named	14,000 (approximate)	1984

The Belgian facility is part of the Eurochemic reprocessing plant and would become the plant's receiving pool if this plant is restarted. The storage pool at Gorleben would be part of a recycle center that is currently planned. The facilities at Ahaus, Finland, and in Sweden are planned as away-from-reactor storage facilities and are not connected with reprocessing facilities.

A3.3 Casks

Table A3-1 summarizes the availability of foreign spent fuel casks. Table A3-2 provides a similar summary for U.S. casks. Total available casks as shown in these tables are as follows:

TABLE A3-1

FOREIGN CASKS AVAILABLE

TYPE	NTL 2	NTL 3	NTL 4	NTL 5	NTL 8	NTL 9	NTL 10	NTL 11	NTL 12	NTL 14	EXL 13/3A	EXL 14	SGHWA
COMPETENT AUTHORITY APPROVAL NO.	F59	1806	1132	1124		F136A		1146		1164	1126/1141	1147	1120
OWNER	NTL	NTL	NTL	NTL	NTL	NTL	NTL	NTL	NTL	NTL	BNFL	BNFL	UKAEA
CAPACITY PWR (ASSEMBLIES) BWR (ASSEMBLIES)	4 9	7 ---	7 19	7 12	3 ---	---	12 ---	7 17	12 30	5 ---	5 14	5 14	2 10
THERMAL CAPACITY (kW)	15	30	35	35	35	25	100	42	100	50	30	40	20
TOTAL WEIGHT (MT)	32	52	65	69	36	34	104	75	95	82	72/72.5	100	45
PAYLOAD (MTU)	1.1	2.3	2.3	2.3	1.4	1.4	6.2	3.3	5.7	2.7	2.7	2.7	1.8
CAVITY LENGTH (mm)	3875	3330	4370	4675	4280	4520	5050	4630	4580	5160	4674/4776	4887	4420
CAVITY DIAMETER (mm)	440 (1)	854	864	864	3x230 (1)	474	1220	914	1220	914	864	914	610
PRIMARY COOLANT	AIR	WATER	WATER	WATER	AIR	AIR	AIR (WATER)	WATER	AIR (WATER)	WATER	WATER	WATER	WATER
PRIMARY MODE OF TRANSPORT	ROAD	RAIL	RAIL	RAIL	ROAD	ROAD	RAIL	RAIL	RAIL	RAIL	RAIL	RAIL	RAIL/ ROAD
APPROVAL STATUS	LICENSED	LICENSED	LICENSED	LICENSED	LICENSED	LICENSED	PENDING	LICENSED	LICENSED	LICENSED	LICENSED	PENDING	LICENSED
FLASKS OPERATING	2	3	1	1	2	2	---	---	1	---	3/4	---	1
FLASKS UNDER CONSTRUCTION/ ORDERED	---	1	---	---	---	---	1	2	11	2	---	PENDING	---

NTL - NUCLEAR TRANSPORT LIMITED
 BNFL - BRITISH NUCLEAR FUELS LIMITED
 UKAEA - UNITED KINGDOM ATOMIC ENERGY AGENCY

NTL 8 = TN8
 NTL 9 = TN9
 NTL 12 = TN12

TABLE A3-2

U.S. CASKS AVAILABLE

TYPE	GE-IF300	NLI-10/24	NFS-4	NAC-1	NLI-1/2	TN-8/9	TN-12	NAC-3
COMPETENT AUTHORITY APPROVAL NO.	9001	9023	6698	6698	9010	9015-16	---	---
OWNER	GE/CP	NL	NFS	NFS/DP	NL	TN/CmE	TN	NAC
CAPACITY PWR (ASSEMBLIES) BWR (ASSEMBLIES)	7 18	10 24	1 2	1 2	1 2	3 7	12 32	12 32
THERMAL CAPACITY (Kw)	76	97	11.5	11.5	10.6	35.5 24.3	TBD	TBD
TOTAL WEIGHT (MT)	64	88-91	22	22	22	36 34	95	105
PAYLOAD (MTU)	3.4	4.9	0.5	0.5	0.5	1.5 1.3	6.0	6.0
CAVITY LENGTH (FT)	14.1 3.1	15	15	15	15	14.3 2.3	15.3	TBD
CAVITY DIAMETER (FT)	15 3.1	3.8	1.2	1.2	1.1	15 1.6	4	TBD
PRIMARY COOLANT	WATER/AIR	HELIUM/AIR	WATER	WATER	HELIUM/AIR	AIR	AIR	TBD
PRIMARY MODE OF TRANSPORT	RAIL	RAIL	ROAD	ROAD	ROAD	ROAD	RAIL	RAIL
APPROVAL STATUS	LICENSED	LICENSED	LICENSED	LICENSED	LICENSED	LICENSED	PENDING	PENDING
FLASKS OPERATING	4	2	4	4	5	1	NONE	NONE
FLASKS UNDER CONSTRUCTION/ ORDERED	---	---	---	---	---	4-5	6	NONE

CmE = COMMONWEALTH EDISON
CP = CAROLINA POWER
DP = DUKE POWER

GE = GENERAL ELECTRIC
NAC = NUCLEAR ASSURANCE CORP
NFS = NUCLEAR FUEL SERVICES

NLI = NL INDUSTRIES
TN = TRANSNUCLEATRE, FRANCE

<u>Cask Size</u>	<u>U.S.</u>	<u>Foreign</u>
Legal Weight Truck	18	0
Overweight Truck	1	6
Rail	6	14

The yearly transport capacity of these casks varies dependent upon the conditions of transport. By way of example, an NLI 10/24 cask with 10 PWR assemblies of 0.486 MTU each carries 4.86 MTU per trip. Typical trip conditions might include a round trip sea distance of 8,000 nautical miles, average ship speed of 12 knots, and turnaround time for each land link of 14 days. This trip would take 42 days. If the cask requires 30 days maintenance per year, each cask can make 8 trips per year for a yearly capacity of 39 MTU per year. The two currently available NLI 10/24 casks could account for about 80 MTU per year. Legal weight and overweight truck casks carry fewer assemblies (e.g. 1 PWR and 3 PWR) and would contribute far less yearly transport capacity per cask. The yearly transport capacity of the total fleet of available casks would not exceed 900 MTU/year for the typical conditions noted above.

A3.4 Transport Vehicles

There are at least four ships currently in use that are modified or constructed for use as spent nuclear fuel carriers. Three of these ships belong to Pacific Nuclear Transport Limited of the United Kingdom and the fourth belongs to Nuclear Transport Limited of Japan. These ships are described below.

A3.4.1 Hinoura Maru

The Hinoura Maru, Lloyd registry number 7429683, was built in 1974 by Kishigami Zosen-Akisu and has a gross registered tonnage of 1,290 tons. Main dimensions are length overall 77.55 meters, extreme breadth 12.22 meters and planning full load draft 4.20 meters. It can carry up to four casks. Two cask configurations have been used carrying 5 PWR/12 BWR or 7 PWR/19 BWR fuel assemblies in each cask. This ship carries a crew of 20. The basic ship was modified to the spent fuel carrier configuration by June 1977.

A3.4.2 Pool Fisher

Spent fuel from Italy, Spain and Sweden has been transported to BNFL using the Pool Fisher. This vessel, Lloyd registry 5282829 is owned by James Fisher and Sons, Ltd, and leased for the purpose of spent fuel transport. Modifications were made to the ship prior to leasing. The basic ship was built in 1959 by Foxol and has a gross registered tonnage of 1028 tons. The main dimensions are overall length 66.30 meters, extreme breadth 10.32 meters and maximum draft 4.41 meters.

A3.4.3 Pacific Fisher

A previous UK flag vessel, the Leven Fisher, has been replaced by the Pacific Fisher. The Pacific Fisher, Lloyd registry number 7030949 is the old Jopulp-75 built in 1970 by Schiffswerft "Neptun" as a general cargo vessel. It has been converted to conform to standards of the Japanese licensing authorities for spent fuel carriers and is now registered as a nuclear waste carrier. It has gross registered tonnage of 3082 tons. Hull dimensions are length overall 103 meters, extreme breadth 14.64 meters and maximum draft 5.80 meters. This ship can carry 26 spent fuel casks, 18 of them for metal oxide fuel and the rest for MAGNOX fuel. The size of casks carried are of the overweight truck size.

A3.4.4 Pacific Swan

A christening ceremony was held in January 1979 for a new ship, the Pacific Swan. This ship was built specifically to carry spent nuclear fuel casks. The ship was built by Swan has 3,000 tons deadweight capacity and has been built to Japanese standards. It can carry 20 casks holding spent oxide fuel and 4 casks carrying MAGNOX fuel. Total capacity of these casks is 60 MTU.

A4.0

PROPOSED GEOGRAPHIC SITES

Provide a discussion of the proposed geographic sites for such storage, including any alternatives thereto.

Section A3.2.1 identified facilities located within the U.S. that could potentially be used or modified for use as interim AFR storage facilities. In addition, there are many other potential locations within the U.S. that could be used as interim AFR storage sites (e.g., selected DOE reservations). Each of the above sites has been examined for geographic and environmental characteristics in relation to its past, present and, in some cases, planned use. Detailed geographic and environmental characteristics - including geologic, hydrologic, meteorologic, seismology, etc. - are provided in the following references:

<u>Plant/Site</u>	<u>Reference Documentation</u>
1) G.E. Morris Operation Morris, Illinois	G.E. Morris Operations Facility <u>Safety Evaluation Report</u> related to License Amendment for SNM-1265, Dec. 1975 (NRC Docket No. 70-1308)
2) AGNS Barnwell, South Carolina	<u>Safety Evaluation Report</u> Related to Operation of Barnwell Fuel Recovery Station, Jan. 1976 (NRC Docket No. 70-1729)
3) NFS West Valley, New York	<u>Safety Analysis Report</u> and other Licensing Actions (NRC Docket No. 50-201)
4) Todd Shipyard Galveston, Texas	<u>Port Operating Plans</u> (NRC Docket No. 50-238)
5) Nevada Test Site Las Vegas, Nevada	<u>Environmental Statement for Reactor Testing - 1972</u> WASH 1508
6) Savannah River Plant Aiken, South Carolina	<u>Draft Environmental Impact Statement Waste Management Operations</u> ERDA-1537 (Oct. 1976)
7) Hanford Operations Richland, Washington	<u>Final Environmental Impact Statement Waste Management Operations</u> ERDA-1538 (Dec. 1975)
8) Idaho Nuclear Engineering Laboratory Idaho Falls, Idaho	<u>Draft Environmental Impact Statement Long Term Management of Defense High Level Radioactive Wastes</u> ERDA-1536 (Sept. 1978)

A5.0

INTERNATIONAL ACCORDS, AGREEMENTS, ARRANGEMENTS AND UNDERSTANDINGS

Provide an identification and discussion of all proposed or potential international accords, agreements, arrangements, understandings, or any other direct or indirect form of conditional, discretionary, or mandatory arrangement with one or more foreign legal entities, government or nongovernment, or international or multinational organization for such repurchase, storage, or transportation, directly or indirectly.

A5.1

Introduction

All proposed international accords, agreements, arrangements, understandings, etc., between the U.S. and other nations and/or international organizations concerning the repurchase, storage and/or transportation of foreign spent fuel will be dealt with through a framework of Agreements for Cooperation in the Peaceful Use of Atomic Energy as authorized by the Atomic Energy Act of 1954 (Reference 1) and as renegotiated under the authority of the Nuclear Non-Proliferation Act of 1978 (Reference 2). A summary discussion follows.

A5.2

Agreements for Cooperation in the Peaceful Uses of Atomic Energy

Under the authority of Section 123 of the Atomic Energy Act of 1954, the U.S. has entered into a number of bilateral agreements with countries and international organizations on the peaceful uses of atomic energy. Table A5-1 delineates current agreements.

Under these agreements, which DOE inherited from the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA), the United States may export production and utilization facilities (e.g., research and power reactors) and source and special nuclear materials (e.g., enriched uranium and plutonium). The agreements contain guarantees against the use of transferred facilities and materials for nuclear weapons or any other military purpose, and provisions for safeguards to verify compliance with such guarantees. The bilateral agreements may involve exchange of information and materials related to nuclear-power production only, exchange of information and materials related to research reactors only, or both. Most of the 26 agreements now in effect cover both research and power reactors.

TABLE A5-1

AGREEMENTS FOR COOPERATION IN THE CIVIL USES OF ATOMIC ENERGY

A. Bilaterals with Individual Countries

<u>Country</u>	<u>Scope</u>	<u>Effective Date</u>	<u>Termination Date</u>
Argentina	Research and Power	July 25, 1969	July 24, 1999
Australia	Research and Power	May 28, 1957	May 27, 1997
Austria	Research and Power	Jan. 24, 1970	Jan 23, 2014
Brazil	Research and Power	Sept. 20, 1972	Sept. 19, 2002
Canada	Research and Power	July 21, 1955	July 13, 1980
China, Republic of	Research and Power	June 22, 1972	June 21, 2014
Finland	Research and Power	July 7, 1970	July 6, 2000
India	Power (Tarapur)	Oct. 25, 1963	Oct. 24, 1993
Indonesia	Research	Sept. 21, 1960	Sept. 20, 1980
Iran	Research	April 27, 1959	April 26, 1979
Japan	Research and Power	July 10, 1968	July 9, 2003
Korea	Research and Power	March 19, 1973	March 18, 2014
Norway	Research and Power	June 8, 1967	June 7, 1997
Philippines	Research and Power	July 19, 1968	July 18, 1998
Portugal	Research and Power	June 26, 1974	June 25, 2014
South Africa	Research and Power	August 22, 1957	August 21, 2007
Spain	Research and Power	June 28, 1974	June 27, 2014
Sweden	Research and Power	Sept. 15, 1965	Sept. 14, 1996
Switzerland	Research and Power	August 8, 1966	August 7, 1966
Thailand	Research and Power	June 27, 1974	June 25, 2014
Turkey	Research	June 10, 1955	June 9, 1981
Venezuela	Research and Power	Feb. 9, 1960	Feb. 8, 1980
Vietnam, Republic of*	Research	July 1, 1959	June 30, 1979

*Status under review by U.S. Government (United States fuel withdrawn).

Notes:

1. U.S.-Greek 1955 research agreement (provisions for further supply) expired on August 3, 1974. U.S. material and equipment previously transferred under 1955 agreement is subject to IAEA (NPT) safeguards and Greek guarantees, affirmed by exchange of notes.
2. U.S.-Colombia 1963 research agreement and U.S.-Israel 1955 research agreement (provisions for continued supply) expired on March 28 and April 11, 1977, respectively. Through exchanges of notes and protocols, guarantees and IAEA safeguards continue with respect to material and equipment previously transferred under the agreements.

TABLE A5-1 (continued)

B. Bilaterals with International Organizations

<u>Organization</u>	<u>Scope</u>	<u>Effective Date</u>	<u>Termination Date</u>
European Atomic Energy Community (EURATOM)	Joint Nuclear Power Program	Feb. 18, 1959	Dec. 31, 1985
EURATOM	Additional Agreement (to Joint Nuclear Power Program)	July 25, 1960	Dec. 31, 1995
International Atomic Energy	Supply of Materials	August 7, 1959	August 6, 2014

The major provisions of the agreements generally fall into two categories: those that provide the enabling framework to permit an activity to occur; and those that specify term, conditions, or controls that apply when an activity is undertaken. Typically, the articles of these agreements include:

- Preamble
- Definitions
- Basic conditions (i.e., applicability of laws and regulations in effect)
- Provisions for unclassified information exchange
- Provisions for transfer of nonfuel material and equipment
- Disclaimer of responsibility for other party's use of material, equipment and information
- Provisions for participation by persons under jurisdiction of parties
- Fuel-supply framework
- Fuel-supply conditions
- Guarantees of peaceful and authorized uses
- U.S. safeguards rights
- Application of IAEA safeguards while United States rights are suspended
- Extension of provisions to superseded agreements

A5.3 Agreements of Cooperation as Affected by the Nuclear Non-Proliferation Act of 1978

In accordance with Section 401 of the Nuclear Non-Proliferation Act of 1978 (Reference 2), the President is authorized to initiate a program to renegotiate existing U.S. Agreements for Cooperation in order to be compatible with the dictates of the subject Act. To date, an aggressive Administration program has been launched to accomplish the dictates of Section 401.

A significant area for renegotiations includes the concept of "Subsequent Arrangements" for the storage or disposition of irradiated fuel elements. The Nuclear Non-Proliferation Act gives statutory recognition to the requirement that cooperating countries obtain U.S. approval before doing certain things with U.S. nuclear exports provided to those countries. The above requirement is called "Subsequent Arrangements" and is detailed in Section 303 of reference 2.

The Act gives special attention to "Subsequent Arrangements" for the return of spent fuel to the United States. The Secretary of Energy may not enter into such an agreement involving a direct or indirect commitment of the United States for storage or other disposition of any foreign spent power reactor fuel unless three conditions are met. Summarized, the three requirements are that: (1) such a U.S. commitment has been submitted to Congress for a period of 60 days of continuous session during which it can be disapproved by concurrent resolution; (2) the Secretary of Energy has obtained the concurrence of the Secretary of Defense; and (3) the Secretary of Energy has complied with, or the arrangement will comply with all other statutory requirements of the Atomic Energy Act.

A6.0

POTENTIAL COSTS

Provide a discussion of all potential costs, direct and indirect, for this fiscal year and the following 10 fiscal years on an annual basis, and 5-year increments beyond through the end of the century, including, but not limited to, all management and administrative costs, the value of any required U.S.-owned facilities or equipment, and all required payments to any legal entity for spent fuel, for facilities or equipment outside the United States, or for any supporting services..

A6.1

Introduction

As noted in section 2.3.2, "Fee Based Transfer of Foreign Spent Reactor Fuel to the United States for Storage", the Administration has offered to take title to and accept a limited amount of spent fuel from foreign sources, when such action would contribute to meeting U.S. non-proliferation goals. The potential costs which would be incurred by the U.S. Government in implementing this offer are discussed in the following paragraphs. It should be noted that all costs will be recovered by collecting appropriate user fees (see section A8).

A6.2

Basis for Cost Projections

The costs of conducting an interim spent fuel storage program are based on the following considerations:

- a) Projected Spent Fuel Scenario and Profile
- b) Fuel Cycle Services to be Provided
- c) Facility Requirements
- d) AFR Cost Assumptions
- e) Manpower Requirements
- f) Other Requirements

A discussion of each of these factors follows.

A6.2.1

Projected Spent Fuel Scenario and Profile

Spent fuel quantities expected from foreign countries were documented in reference 1.

That document postulated a range of effects spanning the minimum and maximum quantities of foreign spent fuel that might reasonably be expected to be sent to the United States. The range of options, as shown in Table A6-1, represents progressively larger increments of fuel that might be received, each increment from an additional category of countries. Those amounts from Option 3 countries are assumed to be conservative figures that would provide an upper bound on foreign spent fuel receipts by the United States. Under Option 3, the United States would accept spent fuel from countries in sensitive regions (Option 1 countries), from other small countries with clearly identifiable storage problems (Option 2 countries), and from some of the larger, industrialized, non-nuclear weapons states. In each instance, action would be taken on a case-by-case basis when U.S. non-proliferation interests are served and there is an apparent need for the action. Countries that play a key role in evolving useful international fuel cycle arrangements or that agree to renegotiate their agreements for cooperation with the United States to include the conditions established in the Nuclear Non-Proliferation Act of 1978 might be given preference. The United States might also give preference to countries which do not undertake reprocessing or that suspend new conventional reprocessing activities or that avoid entering into major new commercial reprocessing contracts with third countries. In general, countries located outside sensitive regions, as defined in Option 1, would be expected to make good faith efforts to establish or expand local spent fuel storage capacity.

Spent fuel discharges expected from U.S. domestic sources were documented in Reference 2 and are projected to range from 95,240 MTU to 119,802 MTU cumulative to the year 2000. Comparing the cumulative foreign spent fuel from Option 3, Table A6-2, with these domestic spent fuel forecasts indicates that foreign fuel stored would be from 11.3% to 14.3% of the domestic fuel stored.

A6.2.2 Fuel Cycle Services to be Provided

In the scenario provided herein, the only fuel cycle service to be performed by the United States Government is interim storage of foreign spent fuel. All

TABLE A6-1

FOREIGN SPENT FUEL DELIVERED TO UNITED STATES

FY	Countries in Sensitive Regions (Option 1)						Nonproliferation Benefits - Low Option (Option 2)						Nonproliferation Benefit - High Option (Option 3)					
	LWR		HWR		Total		LWR		HWR		Total		LWR		HWR		Total	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1983	30	35	75	75	110	110	50	50	165	165	220	220	180	180	360	360	541	540
1984	20	55	30	105	50	160	55	105	70	235	125	340	85	270	330	690	417	960
1985	20	70	45	150	65	225	25	130	70	305	95	435	105	370	340	1030	443	1400
1986	35	110	35	186	70	295	70	200	70	375	140	575	120	490	500	1530	620	2020
1987	30	140	50	235	80	375	40	240	75	450	115	690	140	630	400	1930	540	2560
1988	50	190	40	275	90	465	105	345	90	540	195	885	180	810	260	2190	440	3000
1989	45	235	50	325	95	560	100	445	110	650	210	1095	210	1020	270	2460	480	3480
1990	55	290	55	380	110	670	110	555	115	765	220	1320	250	1270	280	2740	530	4010
1991	55	345	60	440	115	785	115	670	120	880	230	1550	300	1570	300	3040	600	4610
1992	60	405	60	500	120	905	120	790	120	1005	240	1795	350	1920	310	3350	660	5270
1993	65	470	65	565	130	1035	125	915	125	1130	250	2045	420	2340	330	3680	750	6020
1994	70	540	65	635	135	1170	135	1050	130	1260	265	2310	480	2820	350	4030	830	6850
1995	75	615	70	700	145	1315	150	1195	135	1395	285	2595	540	3360	360	4390	900	7750
1996	80	690	70	775	150	1465	165	1365	140	1535	305	2900	590	3950	380	4770	970	8720
1997	90	780	70	845	160	1625	185	1550	145	1680	330	3230	670	4620	410	5180	1080	9800
1998	95	875	75	920	170	1795	200	1755	150	1830	350	3580	740	5360	430	5610	1170	10,970
1999	100	980	75	995	180	1970	220	1975	150	1980	375	3955	800	6150	460	6070	1260	12,230
2000	110	1085	80	1075	190	2160	245	2220	155	2135	400	4355	870	7030	480	6550	1350	13,580

transportation costs would be borne by the foreign users involved. No foreign fuel would be reprocessed or placed in a geologic repository. Ultimate disposition would be the return of spent fuel after storage to the originating country.

A6.2.3 Facility Requirements

The costs presented herein assume a scenario in which six regional AFR storage facilities are provided within the United States. These facilities will be sized based on U.S. domestic spent fuel quantities, with foreign fuel storage requirements considered as an add-on. Six 6000 MTHM storage facilities will be required by the year 2000.

A6.2.4 AFR Cost Assumptions

Although consideration is being given to acquisition of existing AFR spent fuel storage facilities, it is not possible to assign acquisition costs for these facilities at this time. Therefore, cost estimates are based on acquisition of new facilities. Capital and operating costs for AFR facilities were based upon the costs given in Reference 3. That document included cost estimates for a 5000 MTHM facility. The cost estimates were scaled up for a 6000 MTHM facility according to the 0.7 power of the capacity. Figure A6-1 shows the agreement between this approach and estimates for various sized facilities. Capital costs were assumed to be distributed over four years in the following manner: First year, 15% of cost; second year, 40%; third year, 30%, and the last year, 15%. This distribution of expenditures is based upon spending rates of other comparable projects.

A6.2.5 Manpower Requirements

Manpower requirements for handling and storing the foreign spent fuel in the postulated scenario are estimated to be 39,000,000 manhours total. The above manpower requirements were developed from information contained Reference 1. The manpower requirements are presented for the operations involved with interim storage of the foreign spent fuel. The manpower requirements resulting from terminal disposition alternatives and the associated transportation are not shown since transportation costs will be borne by user countries and no

FACILITY COSTS IN MILLIONS OF FY-1978 DOLLARS

FIGURE A6-1, FUEL STORAGE FACILITY COST

terminal disposition is being considered other than return of the spent fuel to the originating countries.

A6.2.6 Other Requirements

Consumption of other resources (i.e., fossil fuel, natural resources, and chemicals, etc.) are not addressed in the estimate. These were assessed in Reference 2 where they were noted to be well within accepted limits. The relatively small amounts of foreign fuel would not add significantly to the consumption of these resources.

Costs of facilities or equipment outside the United States have not been addressed because their costs will not be incurred by the U.S. Government.

A6.3 Cost Projections

The total cost to the U.S. Government can be separated into the following cost categories:

- a. Capital Investment in the Facilities
- b. Operation and Maintenance Charges
- c. Research and Development

As previously noted, these costs will be recovered as described in Section A8. Research and development costs are treated in Section A7. The capital and operating costs for six 6000 MTHM interim AFR storage facilities are shown in Table A6-2. The costs, computed on the basis described in paragraph A6.2.4, are given by year through 1990 and then in two 5-year periods to give the expected total expenditure through the year 2000. The costs are on a 1978-cost basis. In addition to the cash flow, the table also shows present value (1980), discounted at a rate of 10%/year.

Capital expenditures could be required for port modifications and support facilities construction. These funds would be required if special equipment (such as redundant cranes) were required for handling spent fuel casks or if transfers were to take place at Government port facilities. The estimated cost of modifying existing port facilities would be on the order of \$1 million for each port included in the program. The total program could be serviced by two U.S. seaports, one on the East Coast and one on the West Coast.

TABLE A6-2
U.S. Regional AFR Storage of Foreign Spent Fuel - Six Facilities
(Millions of 1978 Dollars)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991-1995</u>	<u>1996-2000</u>	<u>TOTAL</u>	<u>Present Value of Discounted Costs</u>
Operating	--	--	--	2	2	2	2	2	2	2	2	10	10	36	14
Capital	10	28	21	11	--	--	--	--	--	--	--	--	--	70	61

REFERENCES FOR SECTION A6

1. Draft Environmental Impact Statement - Storage of Foreign Spent Power Reactor Fuel. U.S. DOE Report DOE/EIS-0040-D, U.S. Department of Energy, Washington D.C. (December 1978).
2. Draft Environmental Impact Statement - Storage of U.S. Spent Power Reactor Fuel. U.S. DOE Report DOE/EIS-0015-D, U.S. Department of Energy, Washington, D.C. (August 1978).
3. Preliminary Estimate of the Charge for Spent Fuel Storage and Disposal Service. U.S. DOE Report DOE-ET/0055, Department of Energy, Washington, D.C. (July 1978).

A7.0

RESEARCH, DEVELOPMENT AND DEMONSTRATION REQUIRED

Provide a discussion of any and all research, development or demonstration funds, personnel or facilities which directly or indirectly will be required to support the technical implementation of the plan over the life of the proposed program.

A7.1

Introduction

Technical research and development activities will be required for the interim spent fuel storage program. These R&D activities apply to storage facilities regardless of their use and therefore apply to both foreign and domestic spent fuel storage programs. Each of these R&D categories is discussed briefly below:

A7.2

Research and Development Activities

Research and development activities for the spent fuel storage program have been classified into the following categories:

- a) Safety and environmental technology
- b) Development and qualification of advanced storage technology
- c) Contingency storage investigations
- d) Support studies
- e) Reracking

A7.2.1

Safety and Environmental Technology

This element includes monitoring of long term effects of water storage of spent fuel. It includes corrosion evaluation, fuel integrity determination, comparability studies of commercial and government storage and safety studies of low probability events.

A7.2.2

Advanced Storage Technology

This element includes alternate storage concepts such as methods to increase storage density in water basins. Alternate concepts to wet storage such as dry storage are also included.

A7.2.3 Contingency Storage Investigation

This element includes studies on siting of AFR facilities. Studies include, for example, survey of existing government facilities and plans for use of private facilities, etc.

A7.2.4 Support Technology

This element includes studies in support of AFR facility development and includes environmental studies, shielding requirements, safeguards and waste generation requirements and options.

A7.2.5 Reracking Technology

This element provides assistance to both domestic and foreign utilities on better utilization of existing storage space and includes informational exchange programs.

A7.3 Research and Development Costs

The technical R&D activities described above are those planned for the first five years of the program. The technical development required beyond 1985 will be built upon the accomplishments and findings of the current developments. The effort on the technical development will probably decrease after 1985. The R&D costs attributable to foreign spent fuel storage are essentially a pro-rata share of total R&D expenditures. This R&D cost sharing will be factored into the fees charged to foreign users (see Section A8). Reference 1 included an estimate of R&D costs chargeable to foreign users. The planned R&D costs are assumed to occur in the same years as capital expenditures. The cost distribution is similar except that the early years are more heavily loaded than those for capital spending. The distribution of foreign user R&D costs is shown in Table A7-1. In addition to annual cash flow, the table shows present value (1980) of R&D expenditures, discounted at 10%/year.

TABLE A7-1

INTERIM STORAGE FACILITY RESEARCH AND DEVELOPMENT COSTS
(MILLIONS OF 1978 DOLLARS)

<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>Present Value of Total Discounted Costs @10%/year</u>
4	6	3	1	13

REFERENCE FOR SECTION A7

1. Preliminary Estimate of the Charge for Spent Fuel Storage and Disposal Service. USDOE Report DOE-ET/0055, Department of Energy, Washington, D.C. (July 1978).

Provide a complete justification of the basis for the price proposed to be paid for the foreign spent fuels, in terms of the remaining unburned fissionable fuel or other reusable fuel assembly components or any amount considered to be an incentive payment for inducing sale to the United States, any imputed value as a result of a particular policy objective or other factors.

A8.1 Introduction

In October 1977, the Department of Energy (DOE) announced a new spent nuclear fuel policy, approved by the President, to take title to and store spent fuel, and initiated efforts to determine a one-time charge for the storage and disposal services. A preliminary estimate of the spent fuel storage and disposal charge was released by DOE in the summer of 1978.¹ The report was favorably received with general approval of the methodology and acceptance of the results.

The general philosophy to be applied to recovery of Government costs for fuel storage and disposal is full cost recovery from those utility customers who benefit from the use of nuclear power. Because many of the costs will be incurred several years in the future, a discounted value for costs needs to be used.

Several key points of the October 18, 1977 Spent Fuel Policy are considered fundamental to the development of the storage and disposal charge:

- a) The charge should not be open-ended. All liability of a utility with respect to transferred fuel will cease at the time of transfer and payment.
- b) Except for emergencies, which will be considered on a case-by-case basis, the fuel shipped to the Government must be cooled a minimum of five years. Prior notification of intent to transfer is required.
- c) Transfer of fuel to the Government is voluntary.

- d) Fuel transferred must be delivered to a Government-approved storage site.
- e) The Government will accept some spent fuel from foreign countries on a case-by-case basis in support of U.S. nuclear non-proliferation goals.
- f) DOE will provide interim away-from-reactor (AFR) storage facilities beginning around 1983.

A8.2 Basis for Pricing Approach

The basis for pricing is dependent upon the conditions of the transfer and basic policy decisions governing the terms of the transaction. These conditions and terms are discussed below.

A8.2.1 Basis for Value of Spent Fuel

No allowance will be made for any value of the spent fuel received. Spent fuel does contain some uranium and plutonium which, if it were removed from the spent fuel, could be used again in new fuel assemblies. The value of these useful products is equal to the value of similar useful products that could be obtained by other means, less the cost of removal from the spent fuel. Exact estimation of this residual energy value of spent fuel is difficult to determine as eventual reprocessing costs are unknown. Most estimates of reprocessing cost indicate levels that leave little or no residual value for the spent fuel. It is for this reason that no payment will be made by the Government for foreign fuel transferred to U.S. facilities. Rather, the Government will accept title to the fuel and a fee in return for the service of fuel storage. By a future date, to be specified by the storage contracts, reprocessing may be available at costs that provide value to the stored spent fuel. If so, at that time a credit may be given to the utilities or the fuel may be returned to the utilities for their use. In any event, no payments or credits will be made unless all Government costs are recovered.

A8.2.2 Basis for Transportation Costs

All transportation costs to or from the U.S. will be borne by the users. It

is anticipated that shipment of spent fuel to the United States and later to multinational or international facilities will require increased numbers of casks, transporters, ships, and handling cranes at ports. However, sufficient capability is considered to be available in foreign countries to provide the necessary items. Should the United States have to take the lead in organizing a transportation activity, this cost would be included in the Research and Development costs used to determine the storage fee. If, at some later date, a decision is made to reprocess foreign spent fuel in the United States, the cost of transportation of spent fuel to the reprocessor and of waste to the repository would be borne by the Government. These costs would be included in the costs of reprocessing and would thereby be recovered by a reduction in any credit provided for value of the residual energy value of the fuel.

A8.2.3 Basis for Program Costs

There are three basic categories of direct Government costs in providing interim storage for foreign spent fuel. As the foreign fuel will be stored in common with domestic fuel, these costs must be an allocated portion of the total costs of the integrated program. The cost categories are Research and Development, Capital Expenditures and Operations. Sections A6 and A7 have discussed these cost items.

A8.2.4 Basis for Timing of Payments

Following passage of the necessary spent fuel legislation by Congress, utilities could contract for services at any time. All fuel that has been cooled for a minimum of five years would be eligible for transfer to either a Federal AFR basin or a repository. The Government requires at least a five year notification period for such transfer. The contracted price would be that in effect on the contract date. The Government would not require payment at this time for interim storage.

At delivery, full payment would be due using the cost for storage and disposal services in effect at the time of acceptance. This might require an adjustment to the amount owed by the utility if the cost estimate in effect at delivery differs from that in effect when the contract was signed. Any prepayments

utilities had made to the Government would be credited to these accounts. All unpaid balances would be due at the time of delivery. Any further cost changes for storage of fuel following delivery would be assigned to new batches of fuel either at time of contracting for services or at time of delivery.

The provision for a refund of the appropriate portion of the charge, if and when reprocessing is allowed, reflects the basic approach of fairness and efficiency which has been assumed in considering alternative program options. If a cash refund is made, the Government would set the level based on the cost of services it has provided and a nonspecific net value of the fissile uranium and plutonium, at the time of resumption of reprocessing. If the fuel is actually returned to the customer, the unearned portion of the charge would be refunded. Assurance of available funds for repayment would derive from the capital accounts for this program which would include partitioned funds for the possibility of a refund.

A8.2.5 Basis for Determining Price

Costs will be recovered through the revenue received from the users of the storage service provided by the Government. It is planned that these users will pay the Government a fee for storage at the time fuel is received at the storage location. The revenue received will be the fixed unit fee times the number of units received as follows:

$$\text{Revenue} = \text{Unit Fee} \times \text{number of units}$$

Where unit fee is in dollars per Kilogram of heavy metal
and number of units is in Kilograms of heavy metal received.

To determine the appropriate unit fee, the general financial equation associated with rate-of-return on investment is the basis for financial planning. Application of this equation allows recovery of direct Government costs with the desired rate of return. This equation states:

$$\text{Total discounted costs} = \text{Total discounted revenues}$$

In this equation, the costs and revenues are those noted above and discounted values are determined for each year of the program and summed to arrive at the total discounted values. Yearly discounted values are determined by applying the following discount factor to each cost or revenue

$$\text{Discounted value} = \text{Actual value} \div (1 + r)^n$$

where: r = the discount rate

n = the time between when the actual value applies
and the present time which is used as a base

The discount rate is set to reflect the cost of capital to the operator of the services. For a commercial venture, the rate would be set high enough to recover interest expenses and to attract investment capital. For the Government storage program, the discount rate set for fee determination will reflect the cost of borrowing. The current average interest rate for marketable treasury bills, notes, and bonds is the discount rate used for pricing uranium enrichment services and will be used in spent fuel fee determinations.

Reorganization of the basic rate-of-return equation to solve for the unit storage fee results in the following

$$\text{Unit fee} = \text{Total discounted costs} \div \text{total discounted transfers}$$

Discounted transfers are defined as the sum of the amounts of spent fuel received adjusted by the discount factor.

A8.3 Proposed Target Price

The unit fee, or price, resulting from the above equation depends not only upon costs but also upon the quantities of both foreign and domestic spent fuel accepted for storage. It is not possible to predict the exact quantities of foreign spent fuel which may be sent to the U.S. under the Spent Fuel Policy announced in October 1977 since this would depend on a number of variables including the policy and economic decisions of foreign governments and utilities regarding the optimum means of handling their spent fuel. Such decisions will be based on the cost and availability of alternatives including the U.S. storage

offer, individual national fuel cycle plans (which could include expanded national storage or reprocessing) and non-proliferation considerations. A reference case was developed in the "Charge" Environmental Impact Statement (reference 2). This case was based upon domestic and foreign spent fuel transfer scenarios and cost estimates developed in References 2 and 3 and discussed in section A6. For this case the relevant elements of the proposed fee for foreign users were as follows:

<u>Service</u>	<u>Fee (1978 Dollars)</u>
a) Interim Storage	89 dollars per Kilogram of uranium stored
b) Research and Development and Government Overhead	14* dollars per Kilogram of uranium stored

* That portion of cost estimated to be applicable to interim storage

From the above, it would appear that a reasonable target unit price for temporary storage of foreign spent fuel is about 103 dollars per Kilogram of uranium stored.

REFERENCES FOR SECTION A-8

1. DOE/ET-0055, Preliminary Estimates of the Charge for Spent Fuel Storage and Disposal Services, U.S. Department of Energy, July 1978.
2. DOE/EIS-0041D, Draft Environmental Impact Statement, Charge for Spent Fuel Storage, U.S. Department of Energy, December 1978.
3. DOE/EIS-0040-D, Draft Environmental Impact Statement, Storage of Foreign Spent Power Reactor Fuel, U.S. Department of Energy, December 1978.

A9.0

COST BENEFIT ANALYSIS OF INTERIM STORAGE OF SPENT FUEL

Provide a cost/benefit analysis of planned repurchase, transportation or storage taking into account the factors discussed in other sections, and including a specific cost comparison analysis of the planned disposition with other alternatives including, but not limited to, reprocessing and recycling the spent fuel.

A9.1

Introduction

The planned transfer of foreign spent power reactor fuel to the United States for interim storage is part of an overall spent fuel management plan to provide improved assurances that spent power reactor nuclear fuel will not be used for nuclear weapon proliferation purposes. The basic features of this plan include the following:

- 1) Encouragement of interim storage of spent fuel.
- 2) Encouragement of multinational or international control over interim storage and subsequent disposition of spent fuel.
- 3) Provision of limited storage of foreign fuel in the United States.

Implementation of the offer by the United States to provide storage of spent fuel involves a tradeoff between potential gains for non-proliferation policy and cost of this storage in terms of expenditures; additional risks to the environment posed by transportation and storage; and use of other resources. The discussions presented in the remainder of this section summarize the cost/benefit tradeoff as applicable to the planned spent fuel management program.

A9.2

Cost/Benefit Analysis

The benefit to be received from foreign fuel transfer activities is a decrease in the probability of nuclear proliferation. This benefit is of value to the United States but its monetary equivalent is indeterminate. At the same time, the financial cost of the activities is considered as an investment. That is, the United States Government will invest funds during startup and receive an appropriate return on its capital. Therefore, it can be said

that the non-proliferation benefit is received at no net cost to the U.S. Government. A specific cost benefit ratio is, therefore, an inappropriate measure of the program's effectiveness. However, a brief discussion of relevant elements that make up a cost/benefit analysis is provided below.

A9.2.1 Summary of Non-Proliferation Benefits

The basic benefits of the United States policies and plans with respect to international spent fuel activities (see Sections 2 and 3) are that it a) will tend to encourage the reduction of the number and dispersal of sensitive fuel cycle facilities and plutonium stockpiles and b) will encourage the use of spent fuel management practices through multinational or international spent fuel regimes. The role of limited transfer of foreign spent fuel for storage in the United States is to allow time for the necessary arrangements to be negotiated. This activity should reduce world tensions, increase safety of the world's population, and remove certain road blocks in the way of the peaceful use of nuclear power to solve world energy problems.

A9.2.2 Summary of Financial Costs

Costs for implementation of the policy to offer storage of limited amounts of spent fuel in the United States have been presented in Sections A6 and A7. Section A8 discussed the pricing methods and has indicated that all U.S. Government costs will be recovered through collection of a fee for the service provided.

A9.2.3 Summary of Environmental Effects

The environmental effects, other than those associated with non-proliferation, believed to be significant are the radiation exposure of the public, occupational radiation exposure, radiological health effects, and deaths resulting from accidents. This material is presented in Section A12 and shows that additional environmental effects due to the transfer of foreign spent fuel for storage in the United States are so small as to have negligible impact on the population of the United States.

A9.2.4 Summary of Resource Depletion Effects

Resources that could be committed in an irreversible and irretrievable manner by acceptance of foreign fuel consist of:

- a) Land areas permanently affected.
- b) Manpower for construction, operation, and decommissioning of storage facilities
- c) Materials such as fuels and chemicals consumed and construction materials that are not recyclable.

Using dismantlement as the basic method of decommissioning of interim spent fuel storage facilities results in no permanent commitment of land for these items. Some construction materials used in storage facilities are expected to be recycled after decontamination. These include copper, zinc, aluminum, lead, depleted uranium, chromium and nickel. For example, almost all the stainless steel in a temporary storage facility (up to 6,700 tonnes for pool liners and storage baskets) may be recycled. U.S. resource and energy consumption for interim storage in the U.S. are approximated as shown in Table A9-1.

A9.2.5 Cost/Benefit Comparison of Other Alternatives

The alternatives to the Administration's policy for acceptance of a limited amount of foreign spent power reactor fuel for storage in the United States are much more limited than might be expected when one considers the non-proliferation goals and the time required to make suitable arrangements. Alternatives requiring consideration include the following:

- 1) Take no positive action in regard to foreign spent power reactor fuel.
- 2) Encourage multinational or international temporary storage without the offer of limited storage in the United States.
- 3) Offer to provide U.S. storage for large amounts of foreign spent reactor fuel pending development of suitable methods of permanent disposition.
- 4) Encourage immediate multinational or international facilities for permanent storage of spent fuel assemblies or for recycling and disposal of waste.

TABLE A9-1

RESOURCE COMMITMENTS DUE TO FOREIGN FUEL STORAGE IN U.S.

Water, m ³	3.1 x 10 ⁶
Materials	
Concrete, m ³	8.7 x 10 ⁴
Steel, tonnes	1.2 x 10 ⁵
Copper, tonnes	1.5 x 10 ²
Zinc, tonnes	5.4 x 10 ¹
Aluminum, tonnes	2.6 x 10 ¹
Lumber, m ³	2.5 x 10 ³
Lead, tonnes	0
Depleted uranium, tonnes	0
Chromium (in stainless steel), tonnes	3.1 x 10 ²
Nickel (in stainless steel), tonnes	1.4 x 10 ²
Uranium, tonnes	0
Plutonium, tonnes	0
Zirconium, tonnes	0
Energy	
Propane, m ³	2.9 x 10 ³
Diesel fuel, m ³	2.0 x 10 ⁵
Gasoline, m ³	9.4 x 10 ³
Electricity, KWH	6.7 x 10 ⁹
Coal, tonnes	1.3 x 10 ⁶
Manpower, man hours	3.9 x 10 ⁷

Source: Reference 1 for fuel shipped to U.S. - later returned and reprocessed.

The cost and benefits of these alternatives are briefly discussed below.

- a) No Action: A "no action" alternative by the United States to defer certain foreign national plans for early reprocessing and recycle implies no financial or environmental cost for the United States. Correspondingly, desirable nuclear non-proliferation benefit would not accrue and certain countries would tend to follow current reprocessing plans and subject the world to a greater potential for nuclear weapons proliferation.
- b) Encourage multinational or international temporary storage without limited U.S. storage: This option would have little or no cost associated with it. But such a policy does not address the immediate need of some countries who are facing possible shutdown of their power reactors for lack of a means of spent fuel disposal. These countries could be forced to take quick national action which might include near term reprocessing action or contractual commitments and thus preclude their joining in a longer term multinational or international spent fuel regime. Their loss in the multinational or international regime could be detrimental to the overall non-proliferation objectives of the United States.
- c) Offer U.S. storage for large amounts of foreign fuel pending development of permanent disposition programs: This offer would expand the role of U.S. interim storage for foreign spent fuel over that currently planned. The cost effects noted above would be increased commensurate with the increase in foreign spent fuel shipments to the United States. However, the non-proliferation benefits would not increase proportionately to the amount of foreign spent fuel received for U.S. storage since certain national nuclear programs have greater potential for nuclear proliferation than others. Therefore, the current U.S. spent fuel policy of accepting limited and selected amounts of foreign spent fuel for storage in the United States is designed to optimize the nuclear proliferation benefits received in relation to attendant financial and environmental costs.

- d) Encourage immediate multinational or international facilities for permanent storage of spent fuel or of recycling of spent fuel and disposal of wastes: The basic decision as to whether reprocessing or permanent disposal of spent fuel should be done has not been made on a worldwide basis. Implementation of one of these approaches in a manner that satisfies the non-proliferation objectives is not considered possible within a time scale that supports the immediate needs of the international nuclear power community.

REFERENCE FOR SECTION A9

1. Draft Environmental Impact Statement, Storage of Foreign Spent Power Reactor Fuel. DOE/EIS-004-D, U.S. Department of Energy, December 1978.

A10.0

LEGAL AND REGULATORY CONSIDERATIONS

Provide a discussion of all legal and regulatory considerations and requirements for the planned actions under any applicable local, state, or federal law or regulation or under any international law, accord, agreement or any other form of conditional, discretionary or mandatory arrangement with one or more foreign entities, government or nongovernment, or international or multinational organization.

A10.1

Introduction

Operations dealing with transportation, storage, and disposition of spent power reactor fuel have a number of institutional considerations involving legal issues, regulatory and licensing requirements and international agreements, arrangements and understandings. Major issues in this category include formation of spent fuel regimes, licensing of U.S. facilities, change of foreign laws to enable transfers, and establishment liability. These items are discussed below.

A10.2

Agreements of Formation

Establishment of multinational or international facilities and/or arrangement for the transfer of limited amounts of foreign power reactor fuel to the United States for storage, requires that a considerable body of agreements be negotiated and established as indicated in sections 3 and A5. These storage agreements would involve numerous complex legal issues and conditions, some of which are discussed below:

- 1) Establishing the participants, including intergovernmental agencies, such as IAEA.
- 2) Establishing provisions for the addition and withdrawal of participants.
- 3) Establishing basic rights of participants including:
 - Participation in management of any cooperative facilities
 - Use of facilities
 - Ownership of spent fuel stored in the facility and retrieval of spent fuel

- Access to new technology
- Contracting to supply related goods and services

4) Establishing basic duties of participants including:

- Participation for a minimum time period
- Storage of spent fuel in facilities
- Project financing
- Termination agreements
- Protection of proprietary rights
- Performance of obligations

A10.3 Regulatory Licensing and Requirements

Nations that may participate in international storage of spent fuel regulate most of their own nuclear activities, typically in the areas of public health and safety, environmental impacts, physical security, safeguards, accountability, transportation, import and export, and liability to nonparticipating parties. Siting is usually regulated as well. Uniform international guidelines have been adopted by such nations for some of these areas including liability to non-participating parties, safeguards, and transportation. To conduct these activities, licenses are usually issued by the competent government authority according to its established requirements.

In most countries, transportation is regulated by a designated governmental authority or "competent authority," and their laws are based upon guidelines issued by the IAEA entitled "Regulations for the Safe Transport of Radioactive Materials," Safety Series No. 6 (1973). Shipments at sea are governed by guidelines in the International Maritime Dangerous Goods Code issued by the Inter-Governmental Maritime Consultative Organization.

In regard to specific licensing in the United States, the following will be licensed by the U.S. Nuclear Regulatory Commission:

- 1) Interim storage facilities.
- 2) Transportation casks.
- 3) Ships dedicated to the transport of foreign spent fuel.

A11.0 Proposed Procedures for Obtaining Public/Local/State
Approval

Provide proposed procedures for seeking and obtaining the comments and approval of the public and any local or state jurisdiction, as may be required by Federal law in which or through which the foreign spent fuel will be transported and stored.

A11.1 Introduction

The planned transfer of foreign spent power reactor fuel to the United States represents potential hazards to the environment and to the general safety of the public. Therefore, this transfer will be subject to the review process that has been established by the Congress and the applicable regulatory bodies. Key legislation and regulations that will apply are as follows.

- 1) Transportation. The Department of Transportation Act of 1966 (Public Law 89-670), The Transportation of Explosives Act, the Dangerous Cargo Act, the Federal Aviation Act of 1958, and the Hazardous Material Transportation Act of 1974, vest in the Secretary of Transportation the regulatory responsibility for safety in transporting radioactive materials by all modes of transport. These laws are embodied in Title 49, Code of Federal Regulations, parts 171 through 179.
- 2) Nuclear Licensing. The Nuclear Regulatory Commission (NRC) was established by the Energy Reorganization Act of 1974. The NRC regulates the packaging, transportation, and storage of radioactive by-products, source, and special nuclear materials by licensees within the United States. The applicable regulations are included in Title 10, Code of Federal Regulations, parts 10 to 73.
- 3) Environmental Impact. The National Environmental Protection Act (NEPA) requires preparation of Environmental Impact Statements, and soliciting public review in the Federal Register, and the conduct of public meetings to review the effect of projects which have potential impact on the environment.

A11.2 Planned Responses to Federal Legislation Requiring Public
Review and Approval

The responses to the above federal regulations that will provide for public review and comment are as follows:

- 1) Spent Fuel Transfer. Environmental impact statements will be prepared to cover the transfer of foreign fuel to the United States for storage. The statements to be prepared include:
 - a) Storage of Foreign Spent Power Reactor Fuel (draft published December 1978).
 - b) Storage of U.S. Spent Power Reactor Fuel (draft published August 1978).
- 2) Spent Fuel Storage. Environmental Impact Statements and Safety Analysis Reports will be prepared for the facilities used for interim storage of foreign spent fuel as follows:
 - a) Environmental Impact Statement, Storage of Foreign and Domestic Spent Power Reactor Fuel at * . (*The specific site to be used for the storage facility will be covered in the statement).
 - b) Safety Analysis Report, Independent Spent Fuel Storage Installation for Foreign and Domestic Spent Fuel at * . (*The specific site and facility design to be used will be covered by the report).
- 3) Spent Fuel Transportation
 - a) Environmental Impact Statements, Transportation of Foreign Spent Power Reactor Fuel from * to * . (*The specific port, storage sites, and transportation routing will be covered).
 - b) Safety Analysis Report, * Cask for Transportation of Power Reactor Fuel in the United States. (*Any new U.S. cask designs or any foreign designed casks that will be used in the United States must be licensed in the U.S. competent authority and an appropriate safety analysis report submitted).

- c) Safety Analysis Report, * ship for use as a Spent Fuel and Nuclear Waste Carrier in Ports of the United States. (*If dedicated ships are used for sea transport, and if it is decided that new regulations governing licensing of ships are required, then reports will be prepared for each ship design in support of its licensing).

A11.3 Planned Response to State Laws

Some state laws now limit storage of spent fuel in operating reactor basins and laws of some states prohibit receipt of spent fuel from other states. Other local and state laws concerning transportation of radioactive materials have the effect of extending, or adding to, the Federal regulations. These laws have involved one or more of the following:

- Advance notification of spent nuclear fuel and radioactive waste shipments.
- Routing restrictions or requirements as deemed important to avoid dangerous or densely populated areas.
- Inspection of shipments at the nuclear facility or on the vehicle at state borders or weigh stations.
- Escorts in separate vehicles.
- Prohibitions against certain radioactive material shipments moving through the state or a portion of the state.
- Establishment of speed limits and load limits.

The outcome of future DOT rulemaking on routine U.S. restrictions will affect the importance of state and local restrictions. In any event, the Department of Energy will assure that U.S. routing is selected to minimize local impact. When routes are defined, the local protective and regulative authorities will be contacted and the various safety provisions of the transport system will be explained. Operating restrictions and emergency procedures will be agreed upon with these agencies to the extent necessary to allow the fuel transfer.

A12.0 ENVIRONMENTAL IMPACT

Provide an Environmental Impact Statement for any Federal actions in the United States.

A12.1 Introduction

This section summarizes the environmental impact effects resulting from the transfer of a limited amount of foreign spent fuel to the United States for interim storage. All environmental impact effects presented herein are associated with the Option 3, Scenario/Spent Fuel profile, defined in Section A6, Table A6-1 (through CY 2000) and are based on information presented in Reference 1.

The major radiological environmental effects summarized in this section include the following:

- a) Population dose commitments
- b) Occupational whole body exposure
- c) Radiological health effects
- d) Death resulting from accidents

Nonradiological environmental effects from the transportation, storage, and disposition of foreign spent fuel will have only a small incremental effect to those effects produced by the transport of hazardous and other commodities in U.S. and international commerce. The environmental impacts of nonradiological releases (e.g., thermal effluents, releases from combustion of fossil fuel, liquid and chemical effluents, etc.) were assessed in the Domestic EIS (reference 2). The relatively small amounts of foreign fuel would not add significantly to these effects.

A12.2 Population Dose Commitments

The population whole body dose commitments resulting from interim storage of foreign spent fuel are as follows:

	<u>Man-rem</u>
U.S. and Global Commons	960
World	960

The above doses are a very small fraction of the estimated 200 billion man-rem whole body exposure to the world population from natural radiation sources.

A12.3 Occupational Whole Body Exposure

The occupational whole body exposure resulting from interim storage of foreign spent fuel is estimated to be as follows:

	<u>Man-rem</u>
U.S. and Global Commons	260
World	260

A12.4 Radiological Health Effects

The health effects calculated for the population and occupational doses due to interim storage of foreign spent fuel are as follows:

	<u>Man-rem</u>
U.S. and Global Commons	.77
World	.77

A12.5 Death Resulting from Accidents

The number of accidental deaths due to operations associated with interim storage of foreign spent fuel are as follows:

	<u>No. of Accidental Deaths</u>
U.S. and Global Commons	< .32
World	< .32

REFERENCES FOR SECTION A12

1. Draft Environmental Impact Statement - Storage of Foreign Spent Power Reactor Fuel. USDOE Report DOE/EIS-0040-D, U.S. Department of Energy, Washington, D.C. (December 1978).
2. Draft Environmental Impact Statement - Storage of U.S. Spent Power Reactor Fuel. USDOE Report DOE/EIS-0015-D, U.S. Department of Energy, Washington, D. C. (August 1978).

LIST OF ABBREVIATIONS

ACDA	-	Arms Control and Disarmament Agency
AEC	-	Atomic Energy Commission
AFR	-	Away-from-Reactor Storage Facility
AGNS	-	Allied General Nuclear Services
BEC	-	Boeing Engineering and Construction Company
BNFL	-	British Nuclear Fuels Limited
BWR	-	Boiling Water Reactor
CmE	-	Commonwealth Edison
CP	-	Carolina Power
DOE	-	Department of Energy
DOS	-	Department of State
DOT	-	Department of Transportation
DP	-	Duke Power
ERDA	-	Energy Research and Development Administration
FT	-	Feet
GE	-	General Electric

LIST OF ABBREVIATIONS (continued)

IAEA	-	International Atomic Energy Agency
INFCE	-	International Nuclear Fuel Cycle Evaluation
ISFS	-	Independent Spent Fuel Storage
IRG	-	Interagency Review Group
KW	-	Kilowatts
KWH	-	Kilowatt-Hours
LWR	-	Light Water Reactor
M	-	Meters
MM	-	Millimeters
MTHM	-	Metric Tons of Heavy Metal
MTU	-	Metric Tons of Uranium
NAC	-	Nuclear Assurance Corporation
NEPA	-	National Environmental Protection Agency
NFS	-	Nuclear Fuel Services
NLI	-	NL Industries
NPT	-	Nuclear Non-Proliferation Treaty
NRC	-	Nuclear Regulatory Commission
NTL	-	Nuclear Transport Limited

LIST OF ABBREVIATIONS (continued)

P.L.	-	Public Law
PWR	-	Pressurized Water Reactor
R&D	-	Research and Development
RR	-	Railroad
TN	-	Transnucleaire, France
UKAEA	-	United Kingdom Atomic Energy Agency