AUG 3 0 1991

Thomas H. Isaacs, Director
Office of Strategic Planning and
International Programs
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy
Washington, D.C. 20585

Dear Mr. Isaacs:

In response to your letter dated July 15, 1991, requesting an update from the U.S. Nuclear Regulatory Commission (NRC) on the U.S. Radioactive Waste Management (RWM) Status Report (September 1988), I am forwarding the enclosed information. As previously discussed by Mr. Robert Carlson of my staff and Ms. Renee Jackson, a hand markup of the RWM report is being forwarded to the U.S. Department of Energy since the NRC does not have access to the disk file of the report.

If you have any questions on this matter, please contact my staff point of contact, Mr. Carlson. He can be reached at (301) 492-0435.

Sincerely,

/S/

B. J. Youngblood, Director
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: As Stated

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RADIOACTIVE WASTE MANAGEMENT IN THE UNITED STATES

Mark up

prepared for

Radioactive Waste Management Committee

of the

OECD Nuclear Energy Agency

September 1988

TABLE OF CONTENTS

PREFACE

This overview provides a brief description of the civilian radioactive waste management systems in the United States. It includes a description of the policies, strategies, and requirements to ensure safe and environmentally acceptable disposal of nuclear waste.

Every effort has been made to present up-to-date information; however, the reader is advised to seek current information as the programs evolve.

GENERAL STRATEGY

OVERVIEW OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT IN THE UNITED STATES

The policies, strategies and programs for managing civilian radioactive waste in the United States are described in this overview. Included is a description of the management of wastes resulting from the production of electricity by nuclear power plants (commercial wastes). Wastes from uranium mining, milling, conversion and enrichment, as well as fuel fabrication are not included.

and nonreactor, non-fuel-cycle wastes (ie., academic, medical, industrial)

NATIONAL POLICY

The primary objective of radioactive waste management in the United States is to protect: 1) the health and safety of the public and 2) the quality of the environment. Management of radioactive wastes is considered the responsibility of the present generation and should not be left for future generations.

The U.S. Congress recognizing that a national problem exists due to the accumulation of commercial spent fuel and high level wastes, and that an environmentally acceptable method of permanent disposal is needed, enacted the Nuclear Waste Policy Act Of 1982 (NWPA) and in 1987 amended the act through the Nuclear Waste Policy Amendments Act (NWPAA), ~~(hereafter called the Amendments Act)~~. The two Acts provide the current bases for the safe, timely, and effective storage, transport and disposal of spent nuclear fuel and high-level waste (HLW) waste.

The general policy for the disposal of Radioactive commercial low-level waste (LLW) is provided in the Low-Level Waste Policy Act of 1980 (LLWPA) and the 1985 amendment to the Act (hereafter called the LLWPAA). The LLWPA and the LLWPAA assigned to the individual States the responsibility for providing disposal capability for all commercial LLW generated within their borders. The Act encourages States to form interstate agreements in order to share responsibility for disposal of LLW.

with certain exceptions, including class C low-level wast For this, disposa responsibility was assigned to the Federa Government.

For HLW at the West Valley (New York) facility, the West Valley Demonstration Project Act of 1980 sets the general policy on activities to be conducted. While this waste was of commercial origin, it is now considered to be a Department of Energy (DOE) waste. West Valley was a commercial nuclear fuel reprocessing facility which was transferred to Federal responsibility in 1980.

NATIONAL STRATEGIES

The major policies and strategies included in these laws are as follows:

Nuclear Waste Policy Act (as amended)

- Establishes a Federal program and responsibility for a geologic repository for permanent disposal of spent fuel and HLW.
- Provides for the permanent disposal of commercial spent fuel and HLW in a manner that ensures the protection of public health and safety, and the environment.
- Names the Yucca Mountain site in Nevada for detailed site characterization to determine its suitability as the first repository.
- Requires a report on the need for a second repository between 2007-2010.
- Provides for Nuclear Regulatory Commission (NRC) licensing of repositories for spent fuel and HLW.
- Provides for the appointment of a Nuclear Waste Negotiator to seek a volunteer host State(s) for a repository or a Monitored Retrievable Storage (MRS) facility.
- Provides for benefits compensation to the host State in which a repository or MRS facility is located.
- Authorizes DOE to seek, to enter into, and to negotiate written consultation and cooperation agreements with the State of Nevada.
- Authorizes an MRS facility but requires a number of conditions be met before construction can start.
- Establishes a system for safe transportation of waste to a repository or to other waste management facilities.
- Assigns responsibility for interim storage to the owner/generators of civilian spent fuel. Directs the Federal Government to expedite approval of new technologies to expand at-reactor storage. Provides for limited Federal interim storage capacity.
- Provides the State of Nevada and interested parties full and open evaluation of the civilian radioactive waste management program.

- Provides for costs to be borne by the waste generators through the establishment of the Nuclear Waste Fund.

West Valley Demonstration Project Act of 1980

- Authorizes DOE to carry out a nuclear waste management project at the West Valley facility in New York.
- Provides for a demonstration that liquid waste from reprocessing of spent fuel can be managed safely.
- Requires DOE to:
  - o solidify liquid HLW in a form suitable for transport and disposal.
  - o develop waste containers suitable for permanent disposal.
  - o transport the solidified HLW as soon as feasible to a Federal repository for permanent disposal.
  - o dispose of low-level and transuranic waste produced by the solidification of the HLW ~~at West Valley~~.
  - o decontaminate and decommission the facilities and equipment used in the solidification and temporary storage of HLW at West Valley, in accordance with NRC requirement.

Radioactive
Low-Level Waste Policy Act of 1980 (as amended)

- Requires each State, either alone or in cooperation with other States (in arrangements / compacts referred to as ~~agreement states~~), to provide for the disposal of commercial low-level radioactive (LLW) waste generated within its borders.
- Establishes a schedule that the State, or compact regions must meet in providing the required disposal capability. Critical dates are: (1) identification of the host state responsible for a siting plan by January 1, 1988; (2) submission of a license application by January 1, 1992; and (3) provision of disposal capability by January 1, 1993.
- Establishes penalties in the form of surcharges for those States not meeting the schedule. States not having disposal capability by 1996 must take title to the waste, if requested by a generator. and potential denials of access to existing disposal facilities.
- The 1985 Amendment of the Low-Level Waste Policy Act made Greater-than-Class C waste disposal a Federal responsibility.
- Requires NRC to develop procedures and criteria to act upon petitions to exempt disposal of specific waste streams from regulation by the NRC.

WASTE SOURCE AND TYPE

Radioactive wastes are broadly classified as follows:

Spent Nuclear Fuel. / Nuclear fuel withdrawn from a commercial nuclear power reactor ~~following irradiation~~ that has not been reprocessed.

Irradiated reactor fuel and liquid wastes from reprocessing irradiated reactor fuel (including solidified liquid)

High Level Waste (HLW). ~~The product primarily generated from reprocessing of spent fuel that contains the heat producing and other fission products.~~

the Low-Level Waste Policy Act

Low-Level Waste (LLW). Low-Level waste is defined by ~~DOE~~ as all wastes which are not classified as spent nuclear fuel, HLW, transuranic waste (TRU), or ~~by-products material~~, as well as those wastes that the NRC, consistent with existing law, classifies as low-level radioactive waste.

uranium or thorium mill tailings

LLW exceeding the Class C concentration limits is termed "Greater-than Class C waste."

both short and

In 10 CFR 61.55 (Code of Federal Regulations), the NRC has classified LLW into three categories (Class A, Class B, and Class C). These categories are based on ~~considerations of~~ the concentration of long-lived radionuclides and the length of time they could cause exposures, ~~and on the concentration of shorter-lived radionuclides for which~~ requirements on institutional controls, waste form, and disposal methods ~~are effective in isolating the waste.~~

considering the effectiveness of

GTCC low-level waste is not generally acceptable for near surface disposal.

WASTE INVENTORY

The current and projected inventories of commercial radioactive waste are shown in Table 1 below.

Table 1, Current and Projected Cumulative Inventories of Commercial Radioactive Wastes and Spent Fuel (a)

Waste Source and Type	1986	2000	2010	2020
HLW glass canisters (Need Units) (W. Valley)	0.0	0.2	0.2	0.2
LWR spent fuel, MTHM				
Upper reference case (b)	14,045	41,000	62,900	98,300
No new orders case	14,045	40,000	60,000	77,800
Greater-than-Class C, m				
LLW from operations, m	(Need Numbers)			
LLW from D&D, m				
Classes A, B, and C	--	0.0 -?	93.3	786.4

(a) DOE/RW-0006. Integrated Data Base for 1986: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, Tables 0.4 and C.11, Department of Energy, Washington, D.C., 9/87

(b) Includes all existing reactors (either completed or under construction) plus additional new reactors beyond the year 2005.

4 1990 or 1991

CONSIDERATIONS IN STRATEGIC PLANNING

The overall commercial radioactive waste management in the United States includes the following activities:

- Development and implementation of regulations to ensure long-term protection to public health and safety and to ensure compliance with environmental standards.
- Development of an integrated system(s) for the storage, transport, and disposal of spent fuel and HLW.
- Implementation of joint U.S. industry programs to develop and demonstrate new technologies and systems for interim storage of spent fuel.
- Establishment of a disposal system(s) for LLW from commercial and institutional sources through the collaboration of States, ~~and industry, and~~ the Federal Government, and funding by industry. assistance and regulatio by
- Demonstration and application of decontamination and decommissioning technologies for nuclear power reactors and other nuclear facilities.

IMPLEMENTING AGENCIES

Within DOE, the Office of Civilian Radioactive Waste Management (OCRWM) is responsible for implementation of the NWPA and its amendment. DOE's Office of Nuclear Energy is responsible for the development and demonstration of methods for "decontamination and decommissioning" of commercial facilities and for the West Valley facility.

The Nuclear Regulatory Commission (NRC) has the primary regulatory responsibility for OCRWM activities. The NRC is responsible for setting technical standards and criteria for the civilian repository and for implementing overall off-site release standards set by the Environmental Protection Agency (EPA). This includes requirements for licensing and operating storage and disposal facilities, as well as, the certification of transport cask for spent fuel and HLW. The NRC also regulates LLW waste disposal, ~~along with agreement States.~~ establishes requirements and together with Agreement States to which NRC has relinquished certain regulatory responsibilities

The EPA is responsible for developing generally applicable environmental standards for the management and disposal of LLW, HLW, and spent fuel. The EPA is also responsible for setting general standards for the protection of the environment from off-site release of radioactive material after disposal.

Both the Department of Transportation (DOT) and the NRC are ~~is~~ responsible for regulating transportation of radioactive materials.

OVERALL SCHEDULE

The key milestones of the U.S. waste management programs include:

Civilian ~~Radioactive~~ High-Level Waste Management Program

1987 - DOE is directed to perform detailed site characterization on the Yucca Mountain site, Nevada

2001 ~~1994~~ - DOE recommends repository site to the President, if approved, DOE will then submit an application to the NRC for construction of the repository.

1992 ~~1994~~ - Select a site for a Monitored Retrievable Storage (MRS) facility.

Two separate actions & dates → ~~1998~~ - Begin construction of geologic repository (2004) and an MRS facility for spent fuel and HLW. (1996)

→ ~~2003~~ - Begin operations at geologic repository. } 2010 / for MRS } 1998/1999

DOE should make the above dates consistent with its PDS

Civilian Low-Level Waste Management Program

1988 - Identification of host States for siting.

1992 - Submission of license applications.

1993 - States must have disposal capability available for low-level waste.

1996 - States not having disposal capability must take title to the waste.

TOTAL SYSTEM COSTS AND FUNDING

SPENT FUEL AND HLW

The NWPA prescribes that (1) the owners and generators of spent fuel and HLW will pay the full costs of its disposal; and (2) a Nuclear Waste Fund is established to cover the cost of the civilian radioactive waste management program. This fund receives revenue from an adjustable on-going fee charged for the net electricity generated by commercial nuclear power plants, beginning in April 1983, as well as a one-time fee charged for spent fuel generated prior to April 1983. The on-going fee for electricity generated is currently set at 1 mill ($0.001) per kilowatt-hour (net).

The total cost for disposing of commercial spent fuel and HLW has not been determined as yet based on the requirements of the 1987 Amendments of the NWPA.

On April 5, 1985, a Presidential decision following a study made pursuant to Section 8 of the NWPA authorized DOE to proceed with plans and arrangements to dispose of DOE HLW in the civilian repository. OCRWM's cost for the disposal of the waste will be paid by DOE's Defense Programs, which receives annual defense appropriations from Congress.

LOW-LEVEL WASTE

The costs for management and disposal of LLW vary due to differences in disposal concepts, management practices, and characteristics of the wastes. Estimates for various assumptions are presented in the storage, transportation, and disposal sections of this report. Each generator of commercial LLW provides the funds for storage from its operating budget.

Funding for commercial LLW disposal is provided through current charges levied on the waste generator by a disposal site operator upon receipt of the wastes. Initial cost for developing LLW disposal facilities are borne by the States (or ~~agreement States~~ compacts) and the facility operator. These costs will be recovered through disposal fees and surcharges levied on waste generators.

INTERNATIONAL COOPERATION

The United States cooperates with foreign nations and international organizations to further the development of technology for the management and disposal of radioactive wastes. Presently DOE has bilateral agreements with the Commission of the European Communities and the following countries: Belgium, Canada, Federal Republic of Germany, France, Japan, ~~Spain,~~ and NRC Sweden, Switzerland and the United Kingdom. DOE ~~also~~ cooperates with the Nuclear Energy Agency of the Organization of Economic Cooperation and Development, and the International Atomic Energy Agency in projects, workshops, and meetings.

STORAGE SYSTEMS

NATIONAL POLICY

Spent Fuel and High-Level Wastes

As designated in the NWPA, commercial nuclear power plants are responsible for interim storage of spent fuel. Commercial power plants are encouraged to expedite the effective use of existing spent fuel storage facilities and to cooperate with DOE in the development and demonstration of technology to increase at-reactor storage (wet storage and/or dry storage).

The Amendments Act authorized an MRS facility but established a Commission which will determine the need for such a facility by June 1, 1989. Several alternative processes for siting the

facility are specified. The siting alternatives to be implemented by DOE will provide opportunities for public participation and grant funding for affected parties. In the siting alternative to be implemented by the Nuclear Waste Negotiator, participation and funding are also provided in a parallel but somewhat different manner.

A construction ~~license~~ authorization for an MRS from the NRC is required. Construction will take about four years to complete. The MRS facility will store up to 15,000 MTU of spent fuel and HLW.

The proposed MRS facility would receive spent fuel from power plants, consolidate the spent fuel rods into canisters, and provide dry storage of the consolidated fuel until shipment to the repository in large capacity casks transported in multi-car, dedicated trains.

Commercial Greater-than-Class C Low-Level Wastes

The small amounts of commercially generated Greater-than-Class C LLW are stored by the generators until a disposal facility has been specified. Limited amounts are also being stored by DOE. The need for on-site and centralized storage may increase if sufficient new Low-Level Wastes disposal capacity is not available after 1992.

Generators of commercial LLW generally store the wastes on-site, usually in covered storage areas, in the containers that will be used for transport. Storage is usually for short time periods (e.g., a few weeks to a few months) until enough waste is available for a sufficient shipment to a disposal site. In addition, because of the rapidly increasing costs for disposal, many commercial LLW generators now reduce the volumes of their LLW before shipment, by mechanical compaction and other means.

REQUIREMENTS

Spent Fuel and High-Level Wastes

In general, storage of the commercial spent fuel and HLW is the responsibility of the generator.

Storage of spent fuel in an MRS facility is to be regulated by the NRC under 10 CFR 72. Various safety features must be incorporated into the design of any storage facility for commercial spent fuel and HLW to protect the health and safety of the facility workers and the public. In addition to the standard industrial safety regulations, the facility must operate under the radiation protection standards established by the EPA and NRC. A Safety Analysis Report (SAR) must be submitted with the application for a NRC license to construct and operate a storage facility.

Commercial Greater-than-Class C Low-Level Waste

~~No regulatory requirements have been issued by U.S. regulatory authorities regarding the duration of~~ interim storage of these wastes prior to disposal. Storage of commercial wastes at the generator's site is regulated through a NRC license or Agreement State license for the facility.

Low-Level Wastes

Storage of LLW at commercial generator sites is regulated by the NRC and the Agreement State licenses for the operating facility. ~~No~~ Although regulatory requirements have been issued by the regulatory authorities in the United States regarding the time period for interim storage of LLW prior to disposal, NRC policy favors prompt disposal with storage limited to short periods of time (i.e., 5 years or less). If the commercial waste storage container is to be used for transport and disposal, then the container must meet the requirements for transportation as set forth in the DOT and NRC regulations.

DESCRIPTION AND EXPERIENCE/STATUS

Spent Fuel and High-Level Wastes

Since the late 1950's, most commercial spent fuel has been stored "on-site" at the nuclear power plant sites in metal racks submerged in water pools. Many power plants are installing high density metal racks that incorporate solid neutron absorbers to allow for closer spacing of fuel assemblies and thereby increase the total storage capacity. Some nuclear power plants are considering or demonstrating consolidation of the rods from spent fuel assemblies. Two types of on-site dry storage facilities for commercial spent fuel have been demonstrated and are licensed by the NRC. One is using metal storage casks. The casks are stored vertically on an outside concrete pad on-site. The other type uses a series of modular horizontal concrete chambers placed next to one another on concrete pads. Each module is cooled passively by convection.

A licensed dry metal cask storage facility has been in use at the Virginia Power Surry plant since 1986. At the Carolina Power and Light H.B. Robinson plant, modular concrete vaults for dry-storage will be demonstrated to increase at-reactor storage. Three modules will be loaded by 1989. At the Duke Power Oconee plant, there are plans to install 10 modules using 24 intact PWR assemblies per module.

A small scale demonstration was completed in the fall of 1987 at the Northeast Utilities Milestone 2 nuclear power plant, successfully consolidating six PWR assemblies. Several other

small scale demonstrations have been completed at Idaho National Experimental Laboratory (INEL), West Valley, and Battelle Columbus.

The liquid HLW, alkaline sludge and acid waste, have been safely stored at the West Valley facility in large underground tanks since 1966.

Commercial Greater-than-Class C Low-Level Wastes

Most of commercial Greater-than-Class C LLW in the United States ~~is located at~~ resulted from the West Valley facility and at the Three Mile Island nuclear power plant in Pennsylvania. These wastes consist of trash, spent resins, filters, and contaminated equipment. Other Greater-than-Class C LLW are very small quantities of miscellaneous solid materials stored at numerous research facilities. These wastes are typically stored in sealed metal containers, many in 55-gallon drums, in enclosed dry storage facilities. Most of the commercial Greater-than-Class C LLW have been stored at the generator's sites since the 1950's.

Low-Level Wastes

Commercial LLW is stored (for short periods of time, prior to shipment for disposal) in a variety of facilities and containers. ~~since the mid 1950's~~. Listed below are descriptions of the typical structures and containers used.

Large Engineered Structures: These are permanent buildings designed specifically for the extended storage of LLW. They may be reinforced concrete structures or steel frame buildings with metal siding and roofing. Overhead bridge cranes are used for handling of waste packages that require remote handling. These facilities are not presently used for extended storage since wastes are routinely shipped for disposal.

Shielded Storage Modules or Bunkers: These are concrete structures with removable covers. Waste containers are emplaced or retrieved with an overhead crane.

Shielded Storage Casks: These are all-weather concrete containers, usually cylindrical, that can be placed outdoors on pads and are designed to hold waste drums.

Minimum Unshielded Facilities: These are simple fenced-in outdoor pads, ~~or~~ storage sheds, or identified areas within a licensee's facility. These facilities are generally intended as holding areas for waste packages awaiting pick-up for transport to disposal or long-term storage, if needed.

Most LLW storage containers are 55-gallons steel drums. Other types of container include plastic drums, one-inch thick plywood boxes (some with and some without fiberglass or plastic reinforcement or lining), resin liners which are cylindrical steel containers, and "dumpsters" which are large steel boxes.

SEP. 1988

SCHEDULE

Spent Fuel and High-Level Wastes

The NRC has determined that, if necessary, spent fuel generated in any commercial reactor can be stored safely and without significant environmental impact for at least 30 years beyond the expiration of that reactor's operating licenses (which may include the term of a revised or renewed license), at its spent fuel storage basin or at either an onsite or offsite independent spent fuel storage installation. The schedule for an MRS facility includes at least 18-24 months for siting the facility and preparation of associated reports, 30 months for the NRC review and granting of a license, and approximately four years for construction.

Commercial Greater-than-Class C LLW

The small amounts of commercial Greater-than-Class C LLW have been stored at the generating sites since the start of their generation in the late 1950's. Storage is expected to continue there until a decision on disposal is made.

Low-Level Wastes

Storage facilities for commercial LLW are constructed by the individual waste generators as needs develop.

COSTS

Spent Fuel

The cost of spent fuel storage in a concrete cask is approximately $50,000-$80,000 per MTU and consolidation and storage in a metal cask is estimated to be $80,000-$100,000 per MTU. Consolidating spent fuel assemblies is not yet established but is estimated to be between $10,000-20,000 per MTU. The total cost to site, develop, construct, operate, and decommission the MRS facility as proposed is currently estimated to be between 2.8 and 3.2 billion (1986) dollars. The cost of an MRS facility includes many activities beyond storage.

Low-Level Waste

The cost of on-site storage of LLW for short periods is relatively low, but may vary considerably depending on the characteristics of the waste, and the location and characteristics of the generating facility.

DECOMMISSIONING CONSIDERATIONS

Spent Fuel and High-Level Wastes

Decommissioning storage facilities allows for the responsible management of radioactively contaminated facilities after their useful life. The objective of decommissioning is to release the site for unrestricted use. The regulation of decommissioning activities at commercial facilities is the responsibility of the NRC.

The criteria for licensing of an independent spent fuel storage installation (ISFSI) states that such a facility shall be designed for decommissioning.

Commercial Greater-than-Class C Low-Level Wastes

Commercial Greater-than-Class C LLW storage facilities will be decommissioned when the respective operating facility is decommissioned. This will be done under NRC decommissioning criteria for the operating facility.

Low-Level Wastes

Decommissioning of commercial LLW storage facilities will likely occur when the operating facility that generates the LLW is decommissioned. This will also be done under NRC decommissioning criteria.

QA CONSIDERATIONS

Spent Fuel and High-Level Wastes

The general quality assurance (QA) criteria in the regulations for commercial nuclear power plants and fuel reprocessing plants (NRC 10 CFR 72) apply to all commercial spent fuel storage facilities. The QA program takes into account the need for special controls, processes, test equipment, tools, and skills to attain the required quality, and the need for verification of quality by inspections and tests.

Commercial Greater-than-Class C Low-Level Wastes

Commercial facilities are regulated by the NRC. The QA program is developed and monitored by the generator.

Low-Level Wastes

QA for commercial LLW storage facilities is regulated by the NRC and/or the agreement State. The QA program is developed and monitored by the generator.

TRANSPORTATION SYSTEM

NATIONAL POLICY

The Hazardous Material Transportation Act of 1973 (later amended) established a National policy for the transportation of hazardous materials. Radioactive waste is consider, in the Act as hazardous material.

Overall regulation of transportation of radioactive materials in the civilian sector is the responsibility of the NRC and the DOT. Their requirements are generally consistent with the international transportation standards promulgated by the International Atomic Energy Agency (IAEA) as of 1979 and are being revised to adopt the 1985 IAEA rules. Economic regulation of rail and motor carriers is the responsibility of the Federal Interstate Commerce Commission (ICC).

Transportation of most commercially-generated radioactive wastes is the responsibility of the waste generator (except as discussed in subsequent subsections) using commercial carriers. Commercial radioactive wastes are transported by truck and conventional rail.

Spent Fuel and High-Level Wastes

Transportation of commercial spent fuel between nuclear power plants or to licensed commercial interim storage facilities is the responsibility of the waste generator. This transportation may be carried out under contract with commercial carriers or by the waste generator. Transportation is by truck or rail, using exclusive-use shipments in type B transport packages similar to those designated in the IAEA standards. Spent fuel and HLW that are transported by truck must follow preferred highway routes as specified by the DOT.

Transportation of commercial spent fuel and HLW to Federal storage and disposal facilities is the responsibility of DOE.

Commercial Greater-than-Class C Low-Level Wastes

Because there has been so little generated, the transportation of commercial Greater-than-Class C LLW has not occurred except for a few unusual situations. The few shipments of commercial Greater-than-Class C wastes that have taken place, and those in the future, are the responsibility of the waste generator. Transportation is typically carried out under contract with commercial carriers ~~under~~ NRC and DOT regulations. in accordance wit Waste is transported by truck or rail, using exclusive-use shipments. Greater-than-Class C wastes ~~can be~~ transported is typically in Type A or Type B transport packages, depending on the radioactive content and waste form.

The DOE will be responsible for transportation from commercial power plants and/or Federal storage to the Federal disposal site. These exclusive-use shipments ~~will~~ be transported in Type B transport packages by truck or rail. are anticipated to

Low-Level Wastes

Transportation of commercial LLW is the responsibility of the commercial waste generator. These wastes are usually transported

by truck in exclusive-use shipments under contract with commercial carriers using equipment that meet regulations of NRC and DOT.

Type A ~~or~~, Type B, or industrial type transport packages and packages are generally used for LLW depending on the content and form of the waste and on whether or not other materials are transported in the same shipment.

REQUIREMENTS

The general requirements of a transportation system are to transport the wastes from the source of generation to the disposal facility within the United States. In some cases, such as may occur with commercial spent fuel, an additional transport step to an interim storage facility may be required before shipment to the final disposal facility. The packaging and transportation of radioactive materials is regulated by the NRC (and other affected agencies such as DOT) under 10 CFR 71 and Parts 20, 21, 30, 40, 70, and 73.

Spent Fuel and High-Level Wastes

Spent fuel from commercial nuclear power plants will be transported from reactor sites to the geologic repositories. Transport distance will average about 3000 km if spent fuel and HLW are transported to the Yucca Mountain site in Nevada. In some cases, spent fuel may be first transported between the originating nuclear power plant and another power plant or to storage facility before transport to the repository.

The solidified HLW from West Valley will be transported to the geologic repository by the DOE.

Low-Level Wastes

LLW is currently being transported from the waste generating sites to one of three shallow-land burial sites for commercial wastes. ~~When all agreement States or individual States have their respective LLW disposal facilities,~~ transport will be in accordance with ~~the~~ NRC, ~~EPA and~~ DOT, the host State, and when applicable, EPA regulations.

DESCRIPTION AND EXPERIENCE

Spent Fuel and High-Level Wastes

More than 6,000 spent fuel assemblies have been shipped from nuclear power stations to other sites in the United States over the past 30 years.

Currently, DOE is developing procedures, institutional relationships, and transportation equipment for shipping spent fuel and HLW to a repository.

DOE has solicited, received, and evaluated proposals from private industry on design concepts for transportation casks. Contracts for further development have been awarded.

Future casks for transporting commercial spent fuel will be designed for fuel that is approximately 10 years old. The current reference capacities, which are the starting bases for the development of the future casks, are two PWR or five BWR spent fuel assemblies for legal-weight truck (LWT) casks (double that for over-weight truck (OWT) casks), and 14 PWR or 36 BWR assemblies for a rail cask. Cask capacities are expected to be higher than these values, and concepts are being considered that could increase the capacities by as much as a factor of two. About 30 percent of the spent fuel shipped from nuclear power plants is expected to be transported by truck, and up to 70 percent is anticipated by rail.

Low-Level Wastes

Commercial LLW have been transported to commercial shallow-land disposal facilities since 1962. In calendar year ~~1986, 1,000,000~~ 1989 1,600,000 cubic feet of LLW were shipped to the three existing commercial LLW near surface disposal facilities. Total volume of commercial LLW transported to LLW disposal facilities through 1987 is about 42,000,000 cubic feet.

Non-exclusive-use shipments of commercial LLW which are of low-activity must be transported either in strong-tight packages or in Type A or Type B transport packages, depending on the form and content of the waste.

SCHEDULE DOE should make this Consistent with its POS

Spent Fuel and High-Level Wastes

1988 - Contract awarded for LWT and Rail/Barge casks

1994 ~~1995~~ - Certification of LWT and Rail/Barge transport cask

2010 ~~2002~~ - First shipments of spent fuel to geologic repository

Low-Level Wastes

LLW have routinely been shipped for disposal to the commercial LLW disposal facilities since the early 1960's when the first commercial LLW disposal sites went into operation.

1993 - ~~First~~ shipments of commercial LLW to ~~agreement State~~ new Compacts or individual State disposal facilities for commercial LLW will likely begin in 1993.

COSTS

Spent Fuel and High-Level Wastes

The estimated costs for transporting spent fuel from nuclear power plants directly to the Yucca Mountain site are listed. Costs are in millions of 1986 U.S. dollars, and are total life cycle costs for transporting 106,300 MTU equivalent of spent fuel and 8000 MTU equivalent of DOE HLW and 600 MTU of HLW from West Valley.

	Millions
Total development costs for transportation system	$ 920
Total transportation costs for commercial spent fuel	2,130
Decommissioning costs (decom. costs equal salvage value)	0
Total transportation & development costs, spent fuel and HLW	3,330 ?

Numbers don't add up.

Low-Level Wastes

Transportation costs for commercial LLW depend on negotiated contracts with the carriers and are highly variable. In addition, costs are dependent on the part of the country, whether or not shielded casks are needed (which incur costs for a return trip) and numerous other factors.

DECOMMISSIONING CONSIDERATIONS

Decommissioning of transportation equipment is typically carried out by decontamination to allow unrestricted use. The decontaminated materials are then salvaged for re-use. Fixed transportation maintenance and operating facilities are typically decommissioned in a similar manner.

QA CONSIDERATIONS

Quality assurance (QA) requirements for transportation of commercial waste are established by the NRC and DOT. QA requirements are applicable to all aspects of the transportation system. Each organization that participates in transportation of wastes is required to have a regulatory-approved QA program and to execute it to the satisfaction of all applicable regulatory criteria. The QA programs and activities of all participating entities must be audited periodically, and records must be kept for the duration period of the regulatory requirements.

in a type B package

SAFETY and Physical Protection CONSIDERATIONS

Regulations for commercial transport is generally consistent with IAEA Transportation Safety Standards. To obtain certification of transport packages by the regulatory authorities, safety may be demonstrated by approved destructive testing or by approved methods of analysis, or by a combination of testing and analysis. Each reusable transportation ~~packaging~~ package design must be recertified by the regulatory authority every five years. Other specific safety requirements are identified below.

Spent Fuel and High-Level Wastes

Currently, truck shipments require communication with the dispatcher every two hours. Rail shipments are followed through the standard train tracking system.

Low-Level Wastes

Under DOT regulations, some truck shipments of commercial LLW may contain sufficient radioactive materials to require control of the highway routing.

Pre-notification of expected arrival time at a State border ~~is~~ may also be required. No major additional safety requirements are needed beyond those in the IAEA transportation regulations.

DISPOSAL SYSTEMS

NATIONAL POLICY

Spent fuel and High-Level Wastes

DOE siting guidelines (10 CFR 960) establish requirements for a geologic repository system, define technical and environmental qualifications that a candidate site must meet, and specify the site selection process.

After site characterization, if Yucca Mountain is a suitable site for a repository, DOE will then submit to the President a Site Recommendation Report accompanied by an Environmental Impact Statement. After Presidential approval of the site, DOE must then file an application to NRC for authorization to construct the repository. Once the repository facility is constructed, DOE must obtain license from the NRC to operate the repository.

Concurrently, under the NWPAA, DOE may enter into a benefits agreement with the State of Nevada concerning a repository. However, if the State of Nevada signs an agreement with DOE, the State relinquishes its right to submit to Congress, a "notice of disapproval" of the site selection.

Waste acceptance specifications and requirements for vitrified HLW will define the minimum acceptable waste form and canister requirements and the documentation required for disposal in the repository.

Low-Level Wastes

The LLW Policy Act of 1980 (as amended) requires that each State ~~develop a disposal system,~~ either through ~~an agreement~~ with more than one State or individually, according to a defined timetable or incur penalties. States lacking a disposal system by 1996 must take title to a generator's waste and assume liability for not having a disposal facility. Power plants are required under the Act to meet certain waste volume specifications during a seven-year transition period which is provided for the opening of new disposal sites under arrangements by States or ~~agreement~~ compacts. ~~States.~~

provides for safe management and disposal of specified LLW generated within a compact its borders.

REQUIREMENTS

The EPA is responsible for setting general standards for the protection of the environment, which includes regulations for radioactive and other hazardous materials. NRC is responsible for specific regulations relating to radiation protection and radioactive materials. The NRC radiation protection regulations, found in ~~which are being~~ amended ~~to be~~ consistent with those of the International Commission on Radiation Protection (ICRP), ~~are given in~~ 10 CFR 20, "Standards for Protection Against Radiation." These regulations establish the general requirements for radiation protection, including general amounts and concentrations of radionuclides that may be released to the environment. ~~or disposed of in the ground.~~

and are

have been

another

Spent Fuel and High-Level Wastes

The EPA issued environmental standards for the management and disposal of spent nuclear fuel, HLW and TRU waste (40 CFR 191) in 1985. These standards limit the radiation doses to members of the public from the management and storage of radioactive wastes at repositories during the preclosure period to the same level as those for other nuclear fuel cycle operations. These limits are 75 mrem/year to the thyroid and 25 mrem/year to the whole body and any other critical organ. EPA standards also set a maximum limit the projected cumulative releases of radionuclides to the accessible environment for 10,000 years after disposal to specific numerical values. These values are based on limiting the resulting premature cancer deaths to no more than an average of 0.1/year from disposal of each 100,000 MTU equivalent of spent fuel and HLW.

For the operational phase of the repository, NRC regulations (10 CFR 60) require the preservation of the option of waste retrieval (50 years) throughout the preclosure period. For the postclosure period, the primary specific

that insert from next page

It also requires

technical requirements are: (1) substantially complete containment within the waste package for 300 to 1,000 years, (2) a maximum radionuclide release rate from the engineered barrier system of one part in 100,000/year of the 1,000-year inventory of that radionuclide, and (3) a pre-emplacement ground-water travel time from the "disturbed zone" around the underground facility to the accessible environment of at least 1,000 years. ~~10 CFR 60 also~~ contains siting, facility design, and waste package criteria; and criteria pertaining to land ownership and control as well as requirements for the establishment of programs for performance confirmation, quality assurance, and personnel training and certification.

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The DOE siting guidelines (10 CFR 960) identify the factors to be considered in evaluating and comparing sites on the basis of the regulatory preclosure and postclosure requirements.

Low-Level Wastes

The regulations governing the disposal of commercial LLW are found in the following:

1. NRC 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste." This regulation applies to all disposal techniques ~~in the subsurface of the land~~. Specific technical requirements are given for near-surface (up to approximately 30 meters deep) disposal.

2. ~~EPA Draft of Proposed 40 CFR 193, "Environmental Radiation Protection Standards for Management and Land Disposal of Low-Level Radioactive Waste," September 1987. This proposed regulation would provide overall environmental standards for disposal of commercial LLW in near-surface disposal facilities.~~ Delete

10 CFR 61 establishes, among other things, (1) performance objectives for disposal facilities during operations and after closure (including inadvertent intrusion), (2) requirements for institutional controls after closure, (3) technical requirements for near-surface disposal sites and facilities, and (4) definitions of the upper radionuclide limits for the three classes of LLW. Class A wastes ~~require~~ present a low hazard potential to an inadvertent intruder after 100-years ~~isolation~~ and Classes ~~B and C~~ wastes ~~require~~ 300 years ~~of isolation~~; Class C wastes require additional intruder protection for 500 years. All three classes of waste rely on a combination of site, design, operations, and closure to provide long-term isolation and environmental protection.

Delete ~~The proposed EPA standard 40 CFR 193 would (1) define limits on radiation exposure of the public resulting from management and storage of LLW before disposal, (2) define criteria for classifying those LLW that have so little radioactivity as to be "Below-Regulatory-Concern," (3) define limits on potential exposures from LLW disposal systems and establish requirements to ensure that these limits will not be exceeded, (4) provide four~~

Delete { ~~principles for ensuring compliance with the long-term containment requirements, and (5) define ground-water contamination limits from LLW management and disposal.~~

SITE SELECTION/CHARACTERIZATION

Site characterization consists of surface-based investigations conducted by means of shallow and deep boreholes, laboratory tests, and tests conducted in the host rock at the proposed depth of the repository to determine its suitability as a potential repository site.

Spent Fuel and High-Level Wastes

NRC reviewed the SCP and provided comments in July 1989 in its site characterization Analysis.

The NWPA requires DOE to issue a Site Characterization Plan (SCP) for the Yucca Mountain site. In ~~January 1988, a consultative~~ Document DOE issued ~~draft~~ SCP for the Yucca Mountain site, ~~was issued. After~~ Throughout Site Characterization consultations with the State of Nevada, ~~and the~~ NRC, ~~DOE will issue the SCP, hold a formal comment period and hold public hearings on the SCP~~. When site characterization has been completed and assuming the characterization shows the site is suitable, the site will be selected for development into a repository. DOE will then issue the Site Recommendation Report, ~~with~~ and others. an Environmental Impact Statement on the site, and a License Application

Low-Level Wastes

and compacts together with the proposed commercial operator.

Selection of a commercial LLW disposal site is the responsibility of ~~each~~ States, ~~which may conduct the selection as part of a compact with other States~~. Selection of a site is done through a screening process which requires characterization of available land and comparison of the potential sites with the site ~~selection~~ suitability criteria of NRC in 10 CFR 61.

UNDERGROUND TESTING

Spent Fuel and High-Level Wastes

The Yucca Mountain site was recognized in the late 70's as a possible site for an underground repository. As a result, the Nevada Nuclear Waste Storage Investigations (NNWSI) program was initiated in 1977. Underground testing was performed in both tuff and granite. Experiments were conducted to obtain data on radionuclide migration and rock mechanics in tuff. In the early 1980's, 11 canisters of spent fuel were placed in a granite test facility 1400 feet below the surface within the Climax granite stock (Spent Fuel Test - Climax) to evaluate granite as a method for deep geologic disposal of spent fuel and HLW.

During detailed site study characterization at the Yucca Mountain site, an exploratory ~~shaft~~ facility (ESF) for in-situ testing will be constructed. The ESF will consist of two exploratory shafts, a drift that connects the shafts, other drifts and underground rooms for testing, and associated surface facilities.

Site characterization will be conducted in two phases. The first phase, construction testing, is defined as the tests beginning during shaft construction and continuing until underground connection of the shafts is completed. The second phase, in-situ testing, will begin after excavation of the subsurface facility and continue until sufficient data have been collected. These tests will concentrate on characterizing the rock mass (e.g. in-situ stress and permeability), thermomechanical parameters, geochemical properties, thermal properties, and heat dissipation.

This information is required to support the Site Recommendation Report, the license application to NRC, and the Environmental Impact Statement.

Low-Level Wastes

Extensive R&D has been done to develop an understanding of the characteristics of existing disposal sites for commercial LLW and of potential improvements at these sites. No plans currently exist for construction and use of a research facility to characterize a potential new site. Each State that hosts a LLW disposal site is responsible for developing its own plans for site characterization, and to carry out site characterization activities in preparing an application for the selected site.

DISPOSAL CONCEPTS DESCRIPTION AND EXPERIENCE

Spent Fuel and High-Level Wastes

The repository for spent fuel and HLW will resemble a mine with both surface and underground facilities. The surface facilities will receive and handle the wastes and transfer the wastes down to the underground disposal galleries.

The underground facilities will consist of the underground structures and components, including engineered barriers not associated with the waste package such as shaft seals and backfill, and the host rock that supports them.

In addition to testing experience, the United States has shared experience through cooperative programs in underground research laboratories in Canada, Sweden, Switzerland, the Federal Republic of Germany, and in cooperative studies with the Nuclear Energy Agency, International Atomic Energy Agency, and the Commission of European Communities.

The reference material for the waste container is stainless steel for a repository in tuff. Copper and selected copper-based alloys are also being studied for waste containers in tuff.

The HLW waste form is monolithic borosilicate glass that is filled into the canister to a height of 91 inches. Conceptually the canister is 0.375-inch thick stainless steel, 24 inches in diameter and 118 inches in overall length. The canister is a 98-inch-long cylinder with a reverse-dish head on the bottom and an elliptical head on the top that includes a five-inch diameter filling nozzle. The filling nozzle is sealed with an oversized plug by pressing with high pressure and fusing electrically.

Low-Level Wastes

Commercial LLW packages disposed of in near-surface disposal facilities cannot be made of cardboard or fiberboard (NRC, 10 CFR 61.56). The most common LLW package is the 55-gallon steel drum (wall thickness ca. 0.12 cm) that is painted, galvanized, or plastic-coated. ~~In 1981,~~ 55-gallon drums comprised ~~64~~ about 75 percent of all the LLW packages, but accounted for ~~only 26~~ less than 20 percent of the waste volumes that were disposed. Recently
Other sizes of steel drums are also used, ranging from five gallons to 80 gallons. In addition, cylindrical containers made of plastic, fiberglass-plastic, and reinforced concrete are used, particularly for Classes B and C wastes ranging in size from 30 gallons to about 500 gallons.

DISPOSAL CONCEPTS - BUFFER AND BACKFILL

Spent Fuel and High-Level Wastes

No buffer material will be used around the waste packages (with either spent fuel or HLW) at the Yucca Mountain site because the waste package is designed to be surrounded by an air gap. Open areas of the repository will be backfilled with crushed tuff during closure of the repository.

Low-Level Wastes

No buffer materials are used around packages for commercial LLW. Backfill is typically the soil material that was excavated to make the disposal trenches. In some cases for Class C wastes, cement backfill is used around the waste package to enhance intruder protection.

DISPOSAL CONCEPTS - TEMPERATURE AND PRESSURE

Spent Fuel and High-Level Wastes

Near-field temperature limits in a tuff repository are under consideration. A preliminary goal for near-field is to limit

the maximum temperature to about 235 C and to limit the waste heat loading to 57 KW/acre (i.e., room scale). For the far-field (i.e., regional scale), the temperature increases will be limited to temperatures of about 5 C in the aquifer and 0.5 C in the earth surface. Further evaluation is underway to determine if these tentative limits are appropriate.

Low-Level Wastes

LLW commercial disposal facilities have no temperature requirements. Class A LLW have no specific structural requirements except they must withstand the forces of normal operations and should show no deformation before emplacement. Commercial Class B and C LLW are required to maintain gross physical properties and identity for 300 years, and are required to maintain structural integrity ~~from external pressures of 50 pounds/sq. inch and from 30 heating-cooling cycles~~. High-integrity containers for Classes B and C LLW ~~that do not~~ must meet the waste form stability requirements and must maintain integrity under the structural forces from cover material and equipment at the disposal facility.

under expected disposal conditions such as weight of over burden.

DISPOSAL CONCEPTS - DECOMMISSIONING

Spent Fuel and High-Level Wastes

After the repository has been filled and the caretaker and performance-confirmation program (about 25 years) has been completed, the DOE plans to submit to the NRC an application for a license amendment to close the repository. After NRC approval, the DOE will seal the repository and decommission the surface facilities. Repository shafts will be sealed; surface facilities will be decontaminated and dismantled; the mined rock that is not used in backfilling will be stabilized or moved off the site; the surface area will be returned to its original natural condition to the extent feasible; and permanent markers will be erected.

Low-Level Wastes

The operator or holder of the license for a commercial LLW disposal facility must dismantle/decontaminate surface facilities to the extent defined in the site closure plan provided in the original license application. The disposal facility operator must show by measurements and modeling that the closed facility will met regulatory requirements without active controls. Permanent markers must show locations of all burial trenches. A passive site security system must be installed that requires minimum maintenance. The disposal facility is turned over to the State for custodial care for ~~the time period requiring~~ institutional control, period.

a minimum 100 year

or Federal landowner

DISPOSAL CONCEPTS - POST-CLOSURE

Spent Fuel and High-Level Waste

The total preclosure time is estimated to be about 90 years for the repository. Six years of this 90-year period will be used for construction and 28 years for repository operation. The repository design will provide the capability for retrieval at any time for 50 years after the start of waste package emplacement. The remaining 34 years is the length of time assumed to be necessary for waste retrieval if waste retrieval is determined to be necessary at the end of the 50-year retrievability period.

10 CFR 60 requires that a description of the program for monitoring of the repository during the post-closure period be included in the license amendment for permanent closure.

However, because the performance confirmation program during the retrieval period is expected to provide final assessment of facility performance, additional monitoring subsequent to post-closure is not expected to be necessary.

Low-Level Wastes

For commercial LLW disposal facilities, post-closure activities by the State custodian for the duration of institutional control will involve periodic visits, inspections, maintenance (if any), and environmental monitoring of the performance of the site. The period of institutional control will be determined by the NRC, or the Agreement State but may not be relied upon for more than 100 years in evaluating the license application.

SCHEDULE DOE should make this table consistent with its PDS

Spent Fuel and High-Level Wastes

1988 - Consultative draft of Site Characterization Plan for Yucca Mountain site for repository issued

1992 ~~1989~~ - Exploratory shafts and construction-phase testing of site characterization initiated at the Yucca Mountain repository site

1996 ~~1991~~ - Start in-situ testing at Yucca Mountain site for repository

2001 ~~1995~~ - Submit license application to NRC to construct repository

2004 ~~1998~~ - Receive construction authorization from NRC for repository and start construction

2010 ~~2003~~ - Start Phase 1 operations (400 MTU/year receipt) at repository

Low-Level Wastes

Three sites are currently operating for commercial LLW and the plans for additional sites vary from state to state. The Low Level Radioactive Waste Policy Amendments Act of 1985 establishes a schedule that each State must meet for commercial LLW or face penalties. (see page 6)

COST

Spent Fuel and High-Level Wastes

The estimated total life-cycle cost to site, develop, construct, operate, and decommission the repository are presented on the following page. The costs are reference case estimates for a repository in an "improved performance" waste management system (i.e., which includes a Monitored Retrievable Storage facility in the system) containing 70,000 MTU-equivalent of commercial spent nuclear fuel and HLW. The costs are also based on the schedule presented above.

Estimated Repository Costs in
Millions of 1986 Dollars

	Selected Repository in Tuff
Development and Evaluation	$ 5,600
Socioeconomic Impact Mitigation	300
Construction	800
Operation	4,200
Decommissioning	400
Total	$11,300

Low-Level Wastes

Costs for commercial LLW disposal vary due to differences in disposal facility concepts and management practices, and the characteristics of the radioactive wastes received.

A recent study comparing alternative disposal systems for 8,800,000 cubic feet of commercial LLW over a 30-year period developed the following cost estimates which includes pre-

operating, operating, closure, and post-operating costs for each type of disposal (in millions of 1986 dollars).

Near-surface burial	$ 406
Intermediate-depth disposal	421
Below-ground vault	617
Above-ground vault	790
Modular concrete canisters	630
Earth-mounded concrete bunker	893

? Total →

RADIATION PROTECTION

During the operational period, releases of radioactive materials to the general environment from a repository for spent fuel and HLW and from commercial LLW disposal facilities must not result in an annual dose to any member of the public in excess of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other critical organ. Occupational doses at repositories are limited to ~~3 rems/calendar quarter and an occupational lifetime average of 5 rem/yr.~~ — values indicated in NRC Part 2[illegible] regulations (40 CFR Part 2[illegible] However, the principle of ALARA must also be applied, and occupational doses significantly below this value ~~is~~ are anticipated.

QA CONSIDERATIONS

Spent Fuel and High-Level Wastes

The NRC's 10 CFR 60 mandates that the general Quality Assurance (QA) criteria of NRC's regulation 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Facilities," shall be applied to disposal of commercial spent fuel and HLW. An extensive program has been developed by DOE to assure quality in the total commercial waste management system.

A major goal in the commercial waste management activities is to sustain a high level of quality, both technically and administratively, in all activities. This concept is referred to as "Managing For Quality," and QA is an important aspect of this broad concept. QA includes elements of management planning and control, verification, and overview. QA elements are systematically and selectively applied in a formal and auditable QA program that is designed to: (1) assure compliance with regulatory and other programmatic requirements and standards; and (2) demonstrate technical appropriateness, adequacy, and completeness.

Low-Level Wastes

~~All regulations by NRC, EPA, and the States require that a~~ must stringent QA plans approved by the regulatory agencies, be in effect for all disposal facility siting, verification, evaluation, design and construction, operations, and decommissioning.

SAFETY CONSIDERATIONS

Spent Fuel and High-Level Wastes

Analytical techniques developed for and successfully used in the radiological assessment and licensing of other nuclear facilities are being used for estimating public and occupational radiation doses from waste disposal facilities. For long term safety, performance assessment includes estimation of the potential release of radionuclides to ensure that release levels are below the NRC criteria and EPA standards. All commercial spent fuel and HLW storage and disposal facilities and activities are monitored by the NRC.

Commercial Greater-than-Class C Low-Level Wastes

Stringent industrial and radiological safety requirements are dictated by the Federal, DOE, or State agencies responsible for regulating the various aspects of commercial Greater-than-Class C wastes.

Low-Level Wastes

All commercial LLW disposal activities are monitored by regulatory personnel from the NRC or the ~~host~~ Agreement State, and by other regulatory and enforcement organizations to ensure that facility activities conform to applicable industrial and radiological safety regulations.

REFERENCES

1. 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," December 1982.

2. 10 CFR Part 72, "Independent Spent Fuel Storage Facility Licenses," November 1980.

3. 10 CFR 50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Facilities," July 1985.

4. 10 CFR Part 20, "Standards for Protection Against Radiation," amended through 1985.

5. 10 CFR 71, "Packaging and Transportation of Radioactive Material," amended through 1983

6. 40 CFR Part 191, "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," August 1985.

7. 10 CFR Part 60, "Disposal of High-Level Wastes in Geologic Repositories," June 1983.

8. 10 CFR Part 960, "Nuclear Waste Policy Act General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories," December 1984.

9. ~~40 CFR Part 193, Environmental Radiation Protection Standards Management and Land Disposal of Low-Level Waste," September 1987.~~ delete