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Vol. 1

Draft Environmental Impact Statement on 10 CFR Part 61 "Licensing Requirements for Land Disposal of Radioactive Waste"

Summary

U.S. Nuclear Regulatory Commission

Office of Nuclear Material Safety and Safeguards

September 1981

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FOREWORD

The evaluations and analyses set out in Volume II of this EIS include a systematic analysis of a broad range of alternatives relating to the form and content of waste, the engineering design and method of operation of disposal facilities, institutional controls, financial assurances, and administrative and procedural requirements. Rather than presenting the results of the individual analysis of alternatives, this summary draws on the various analyses and presents the collective major conclusions, findings, and recommendations that have been derived and incorporated into the Part 61 rule. It is not possible to present the rationale or to summarize all the requirements in this summary. NRC has, therefore, concentrated on the major requirements of the rule--the performance objectives and technical requirements that establish the controls to be applied in disposal of waste. The discussion often cross-references specific sections or paragraphs of the proposed rule, which is included as Attachment A to this summary.

The results of the analyses carried out in this EIS indicate that, with modest increases in cost relating to improving the form and properties of waste shipped for disposal (most of which are essentially being implemented today) and modest improvements in the design and operation of a near-surface disposal facility (many of which are being used at some of the existing sites today), the potential health, safety, and environmental impacts from disposal of LLW and the degree of long-term social commitment can be reduced. The ability to predict the long-term performance and impacts of near-surface disposal facilities is also improved, and the uncertain and high costs required to care for disposal sites over the long term are reduced.

Stated simply, we can put some modest increased effort and cost into the disposal of LLW today--leading to reduction in potential impacts, reduction in long-term care costs, and increased confidence in the performance capability of near-surface disposal facilities. Or, we can continue as we have in the past, possibly leading to situations as has been evidenced at some existing sites where the potential impacts over the long term may be high, the costs for long-term care high, and confidence in the long-term performance low. The proper course of action is the former, and the performance objectives, technical, and other requirements selected and set out in the new Part 61 regulation and in amendments to other existing parts of NRC's regulations are directed at these key aspects.

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SUMMARY

1. DESCRIPTION OF THE PROPOSED ACTION--PURPOSE, SCOPE, NEED, AND STRUCTURE OF THE EIS

The proposed action being considered in this environmental impact statement (EIS) is the issuance of a new regulation, Part 61, to the U.S. Nuclear Regulatory Commission (NRC) rules in Title 10, Code of Federal Regulations (10 CFR). Part 61 will provide licensing procedures, performance objectives, and technical requirements for the issuance of licenses for the land disposal of "low-level" radioactive waste (LLW). Specifically, the proposed action includes consideration of requirements on the standards of performance that should be met in land disposal; technical requirements for the siting, design, operation, closure and postoperational activities for a near-surface disposal facility; technical requirements on waste form that waste generators would be required to meet for acceptance of waste at a disposal facility; classification of waste; administrative and procedural requirements for licensing a disposal facility; and provisions for adequate financial assurance.

1.1 Purpose

NRC has a two-fold purpose in preparing this EIS. First, it is to fulfill NRC's responsibility under the National Environmental Policy Act of 1969 (NEPA). NEPA requires that a federal agency prepare an EIS for "major actions significantly affecting the quality of the human environment." NRC has determined that the promulgation of Part 61 is such an action and this EIS has, therefore, been prepared.

Second, NRC has prepared this EIS to demonstrate the decision processes applied in the development of Part 61. It is the intent of NEPA to have federal agencies consider alternatives and to incorporate environmental values into the decision-making process at an early stage. NRC has analyzed alternative courses of action, and requirements were selected with consideration of costs, environmental impacts, and health and safety effects to current and future generations.

1.2 Scope

This EIS analyzes requirements for the land disposal of radioactive waste and specifically, near-surface disposal. Near-surface disposal involves disposal in the uppermost 15 to 20 meters of the earth's surface. Specific technical requirements for other alternative land disposal methods (e.g., deep-mined cavities) will be addressed in subsequent rulemaking actions. It also does not address other methods such as ocean and space disposal. Requirements for ocean disposal are a responsibility of the Environmental Protection Agency. Space disposal, although feasible, is not developed to the point of routine technical and economic application.

This EIS is not a generic EIS in that it does not analyze all of the issues involved in the disposal of LLW. Rather, this EIS provides the decision analysis for requirements in the Part 61 rule. Only issues that are germane to this decision process are analyzed and considered.

1.3 Need for the Proposed Action

Current NRC regulations for licensing radioactive materials do not contain sufficient technical standards or criteria for the disposal of the licensed materials as waste. As discussed below, the need for comprehensive national standards and technical criteria for the disposal of radioactive waste is well documented.

Performance objectives are needed to define the level of safety, environmental protection, and social commitment that should be achieved in the disposal of LLW. To ensure that the performance objectives are met, technical requirements are needed regarding the siting, design, operation, and closure of a LLW disposal facility. Requirements on postclosure activities are also needed, as are requirements on the form, packaging, and content of the disposed waste. Administrative and procedural requirements for licensing a LLW disposal facility should be reviewed and changes evaluated. Finally, requirements for financial assurance need to be evaluated to assure adequate financial resources for closure and postclosure activities.

Comprehensive standards, technical criteria, and licensing procedures are thus needed. They are needed to assure the public health and safety and long-term environmental protection in the licensing of new disposal sites. They are also needed with respect to operation of the existing sites and with respect to final closure and stabilization of all sites.

In evaluating the level of safety which should be achieved, NRC identified 3 principal components that needed to be considered:

1. Protection of occupationally exposed workers and the public during operation of the facility;

2. long-term environmental protection; and

3. Protection of an inadvertent intruder.

A level of safety has been established for occupationally exposed workers and protection of the public during operation of the facility and is set out in the existing standards in 10 CFR Part 20, which applies to the activities of all NRC licensees.

Neither the federal government nor any national and international organizations have, however, defined such a level of safety specific to the disposal of LLW involving long-term environmental protection and protection of an inadvertent intruder. NRC thus had to establish performance objectives to define the level of safety which should be achieved for each of these. Protection of an inadvertent intruder is a new concept, generally unique to disposal of waste. With respect to standards on long-term releases to the environment, the Environmental Protection Agency is developing such standards through its overall program to develop generally applicable environmental standards; however, no standard for LLW disposal presently exists.

In addition, there was a fourth component, generally unique to waste disposal that also needed to be addressed: long-term social commitment. Future generations should not be burdened with long-term expensive commitments to care for wastes generated today, and the development of requirements for the disposal of waste should take into account the long-term commitment of social and natural resources to care for waste over the long term.

1.4 Structure of the EIS

This EIS has been prepared in accordance with requirements of the National Environmental Policy Act. It has also been prepared following Council on Environmental Quality (CEQ) regulations for preparation of environmental impact statements and NRC implementing regulations as set out in 10 CFR Part 51, "Licensing and Regulatory Policy and Procedures for Environmental Protection."

This EIS is being published in four separate volumes. Volume I is this summary. Attachment A to this summary is the proposed Part 61 rule. Volume II contains the main text which consists of ten chapters described in greater detail below. Volumes III and IV contain appendices A-Q which set out details and other supporting technical information to that contained in the main text. The chapters and appendices are frequently referenced in this summary.

Chapter 1 of the main text is an introduction which presents background information about LLW disposal and the purpose, scope, and structure of this EIS. Chapter 2 presents the overall approach NRC has followed in developing regulations for LLW disposal. Chapter 3 describes the affected environment and the technical approach followed in this EIS in analyzing LLW disposal. Chapter 4 presents and analyzes alternatives regarding protection of an individual who might inadvertently intrude into a disposal facility at a future time. Chapter 5 presents and analyzes alternatives relating to long-term environmental protection and potential releases to the environment from a disposal facility. Chapter 6 presents and analyzes alternatives relating to safety during operation of the facility. Chapter 7 presents the classification of waste for near-surface disposal, defining those wastes which are acceptable for disposal by near-surface disposal methods and those wastes which are generally not acceptable and must be disposed of by other methods. Chapter 8 presents the regulatory program for licensing the land disposal of radioactive wastes. Chapter 9 presents and analyzes requirements for financial assurance. Chapter 10 presents typical unmitigated impacts of Part 61 through analysis of the disposal of waste on a regional basis following the preferred technical requirements identified in this EIS.

1.5 Scoping for the EIS

Scoping of an environmental impact statement is defined by the Council on Environmental Quality in 40 CFR Part 501.7 as "...an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action." Although the concept of EIS scoping is a relatively recent development, NRC has conducted scoping activities relative to the proposed Part 61 and this EIS since 1978. Included have been:

1. Public comments in response to an Advance Notice of Proposed Rulemaking on the LLW Disposal Regulation (10 CFR Part 61) published in the Federal Register on October 28, 1978;

2. Public comments on a preliminary draft of 10 CFR Part 61 dated November 5, 1979;

3. Four regional workshops on Part 61 sponsored by the Southern States Energy Board, the Western Interstate Energy Board, the Midwest Regional Office of the Council of State Governments and the New England Regional Commission;

4. Input from the State Planning Council, the National Governors Association, the National Council of State Legislators, and the National Conference of State Radiation Control Program Directors;

5. A Natural Resources Defense Council Petition for Rulemaking;

6. Discussions with industry, public interest groups, state and federal agencies, and others;

7. Licensing experience and current LLW management techniques at existing disposal sites;

8. Programs of the Environmental Protection Agency to develop standards for LLW disposal and regulations for disposal of nonradioactive solid and chemically hazardous wastes; and

9. The results of federal, state, and other organization's studies and technical data on LLW management and disposal.

Public participation in the development of Part 61 and analyses of the major scoping activities and public comments are discussed in Appendix C.

2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The environment affected or potentially affected by the generation, transport, and disposal of LLW encompasses the whole of the nuclear industry and much of society. It consists of all the industries, hospitals, private individuals, and governmental agencies and laboratories that generate LLW through the use of radioactive materials as a normal part of their day-to-day activities and functions. It consists of those involved in supplying waste processing and packaging services at waste generator facilities, and transporting waste from waste generators to disposal facilities. It consists of those involved in the ownership, operation, and long-term control of the disposal facilities. It involves the various regulatory agencies such as NRC, the Department of Transportation (DOT) and the state radiation control programs that license, regulate, and inspect all waste management phases to assure an adequate level of safety. In consists of society: the individuals, small population groups, and the general population that can be potentially affected by the various activities involved in the generation and disposal of waste. Finally, it consists of the

natural environment including the ground and surface water, the atmosphere, and various plant and animal species that would be affected by site-specific activities.

2.1 Waste Generation and Characteristics

The term "low-level waste" serves as a general term for a very wide range of radioactive wastes. All industries; hospitals; medical, educational, or research institutions; private or government laboratories; or facilities forming part of the nuclear fuel cycle (e.g., nuclear power plants, fuel fabrication plants) utilizing radioactive materials as a part of their normal operational activities generate so-called low-level radioactive waste just as they generate other types of hazardous and nonhazardous waste. LLW consists of the radioactive materials themselves and other materials which have been in contact with radioactive material and are contaminated or suspected of being contaminated.

Presently, there are more than 20,000 companies, institutions, laboratories, and government facilities licensed by NRC or Agreement States to use radioactive materials as a normal part of day-to-day activities. Because of the wide range in the types of activities and in specific purposes of application, LLW is generated in many waste types, forms, and amounts. It ranges from trash that is only suspected of being contaminated to highly radioactive material such as activated structural components from nuclear power reactors. The form of the generated waste can be solid, liquid, or gaseous. It can consist of a wide range of chemical forms and can be shipped in a number of different types of packages.

Currently, about 85,000 m^3 (3 million ft^3) of "commercial" LLW is generated annually. It ranges in activity from thousands of curies per cubic meter to less than a few microcuries per cubic meter. Most of the activity disposed of at the commercial sites is contained in a relatively small volume of waste which is generated by less than 100 licensees. Based on projections of LLW volume prepared by NRC for the basic waste streams considered in this EIS, about 3.62 million m^3 (128 million ft^3) will be generated during the period 1980-2000. Of this, about 65% of the waste is projected to be generated by fuel cycle sources and 35% by nonfuel cycle sources. Institutional generators will account for about 19% of the nonfuel cycle sources.

2.2 Waste Disposal

The operators of the disposal facilities offer the essential services of providing a licensed and controlled site for disposal of radioactive waste. The waste is disposed of by a method generally known as shallow land burial (SLB). This method of waste disposal consists of placing packaged waste into excavated trenches. The filled trenches are backfilled with soil, capped, and mounded to facilitate rainwater runoff.

Presently, there are 6 commercial sites: 3 operating and 3 closed. One of the operating sites, located at Barnwell, South Carolina, is operated by Chem-Nuclear Systems, Inc. The other two operating sites, located at Beatty, Nevada

and Richland, Washington are operated by U.S. Ecology, Inc. (formerly the Nuclear Engineering Company, Inc.). The commerical sites are summarized in Table S.1 below. The Department of Energy (DOE) also operates 14 sites throughout the country for the disposal of wastes generated from defense and DOE research and development activities. These 14 sites are not subject to NRC regulatory jurisdiction.

Table S.1 Commercial Waste Disposal Sites

Location	Operator	Originally Licensed By (year)	Currently Licensed By	Operational Status
Beatty, Nevada	U.S. Ecology, Inc.	AEC (1962)	State	Open
Maxey Flats, Kentucky	U.S. Ecology, Inc.*	Kentucky (1962)	State	Closed
West Valley, New York	Nuclear Fuel Services, Inc.	New York (1963)	State	Closed
Richland, Washington	U.S. Ecology, Inc.	AEC (1965)	State and NRC**	Open
Sheffield, Illinois	U.S. Ecology, Inc.	AEC (1967)	NRC	Closed
Barnwell, S. Carolina	Chem-Nuclear Systems, Inc.	South Carolina (1971)	State and NRC**	Open

*U.S. Ecology was the operator while the site was open. Currently, Hittman, Inc. maintains the site as a caretaker for the state of Kentucky.
**NRC licenses only special nuclear material.

2.3 Federal and State Responsibilities in Commercial LLW Disposal

There are five key federal agencies that administer programs regarding the management and disposal of LLW. These include the Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS) in the Department of Interior, the Department of Energy (DOE), and the Department of Transportation (DOT).

NRC has the responsibility in the United States of regulating and licensing the commercial and nondefense governmental use of source, byproduct, and special nuclear material. This responsibility extends to licensing commercial disposal

of LLW in licensed facilities. NRC carries out its responsibilities in compliance with overall federal radiation protection guidance and environmental standards established by the Environmental Protection Agency. EPA was charged with this responsibility in the Reorganization Plan Number Three of 1970. The U.S. Geological Survey is responsible for basic research in the geological sciences and development of basic data for application in the development of criteria and to provide technical advice in the assessment of specific disposal sites. The Department of Energy carries out federal responsibilities for the research, development, and transfer of LLW disposal technology to commercial industry. The U.S. Department of Transportation has the primary responsibility for regulating waste containers, transport vechicles, and other aspects of interstate transport of radioactive waste.

Existing NRC regulations for commercial LLW disposal in licensed disposal facilities are principally contained in a few paragraphs in 10 CFR Part 20 (§20.302). The requirements mainly describe in general terms the types of information to be included in an application for a disposal facility, and require that LLW disposal facilities must be sited on land owned by the state or federal government. In practice, this requirement has been met through lease conditions between the disposal facility operators and state landlords which provide that the states assume responsibility for long-term control and surveillance of the facility sites after closure.

Other NRC regulations--Part 30 ("Rules of General Applicability to Domestic Licensing of Byproduct Material"), Part 40 ("Domestic Licensing of Source Material"), and Part 70 ("Domestic Licensing of Special Nuclear Material")--apply to possession of licensed material by a disposal facility licensee. Part 2 ("Rules of Practice for Domestic Licensing Proceedings") contains general requirements for NRC licensing proceedings. Part 51 ("Licensing and Regulatory Policy and Procedures for Environmental Protection") contains requirements for compliance with the National Environmental Policy Act of 1969 (NEPA).

In discharging its responsibilities, NRC is empowered by the Atomic Energy Act to relinquish part of its regulatory authority over source, byproduct, and special nuclear material to the states. Under Section 274 of the Act, before the NRC enters into such an agreement, the state must have a radiation control program that is adequate to protect the public health and safety and compatible with NRC's program. Currently, there are 26 such Agreement States. Licensing of commercial LLW disposal facilities is part of the authority which may be relinquished by NRC to Agreement States. Of the six commercial disposal facilities which have operated in the United States, five of these facilities are located in Agreement States and are principally regulated by the Agreement States (See Table S.1).

To the extent that a new regulation such as Part 61 represents a change in NRC's radiation protection program for source, byproduct, and special nuclear material, it is necessary that the Agreement States cooperate in the formulation of compatible regulations and revise their existing regulations as necessary. Current NRC regulations regarding NRC's relationship with the Agreement States are contained in 10 CFR Part 150.

3. METHOD OF ANALYSIS

The overall method of analysis followed in this EIS may be summarized as follows:

1. First, the costs and impacts from the generation, transport, and disposal of waste at a reference near-surface disposal facility are calculated. This analysis is termed the "base case" analysis and represents the "no action alternative." The reference facility is sited and operated following existing practices and recommendations for siting and site operational safety. The base case facility, however, does not utilize some existing procedures commonly in effect at the real operating sites--e.g., the disposal of higher exposure rate packages on the bottom of disposal trenches. These assumptions were made to allow the calculation of a base level of costs and potential environmental impacts against which improvements (alternatives) could be evaluated with respect to their costs and effectiveness in mitigating impacts of the base case.

2. Second, a range of modifications and improvements (alternatives to the base case) are evaluated with respect to their incremental change in cost and effectiveness in mitigating potential impacts of the base case. The alternatives evaluated include those relating to various waste form, processing, and packaging options; near-surface disposal facility designs and operating procedures; site considerations; active institutional control time periods; and performance objectives. Alternatives were also considered and evaluated regarding financial assurance mechanisms for closure, postclosure care, and active institutional control, and the administrative procedures that should be followed in licensing near-surface disposal facilities.

3. Third, a comparative evaluation of the base case and alternatives is conducted which yields selection of the preferred performance objectives and technical requirements for the siting, design, operation, and long-term institutional control of a disposal facility. The performance objectives, technical, and other requirements developed through the analyses collectively form the basis for the new requirements to be codified through the Part 61 rulemaking action.

4. Finally, application of the preferred performance objectives and technical requirements selected and incorporated into Part 61 is evaluated to assess typical unmitigated impacts of LLW disposal following the preferred requirements. The disposal of waste according to the preferred requirements is analyzed on a regional basis at four regionally operated sites and the typical costs and impacts are determined. The analysis also helps assess the applicability of the Part 61 requirements to the wide range in site and waste characteristics expected in the regional disposal of LLW.

Information Base for Analysis

To perform these analyses, an information base had to be developed which involved three main components: alternative disposal facility environments, alternative waste characteristics, and alternative disposal facility designs and operating practices. Based upon this information base, an analysis methodology was developed to calculate impacts and compare alternatives.

First, the continental United States is assumed to be divided into four regions as shown in Figure S.1. The four regions considered correspond to the five U.S. Nuclear Regulatory Commission regions and are termed the northeast region (NRC Region I), the southeast region (NRC Region II), the midwest region (NRC Region III), and the western region (NRC Regions IV and V). In each region, a hypothetical regional disposal facility site is characterized. (The site in the western region is generally termed the southwest site.) These sites, while not representing any particular location within a region or any existing or possibly planned site, reflect typical environmental conditions within the regions. This allows consideration in the calculational methodology of a wide range of environmental conditions such as the amount of rainfall or the average distance from the waste generator to the disposal facility.

The next component of the information base involved considering and characterizing a wide range of waste types, waste forms, and processing options. In previous studies on LLW management and disposal, the disposed waste was usually assumed to be a mostly uncharacterized mass with little attempt to distinguish, in a quantitative manner, the different waste types and forms. In this EIS, however, LLW is separated into 36 waste streams and each waste stream is characterized in terms of its volumes and physical, chemical, and radiological properties as projected to be routinely generated during the period 1980 to 2000. The 36 waste streams so considered in this EIS are listed in Table S.2. Each waste stream represents a type of waste generated by a particular type of waste generator and having physical, chemical, radiological, and other characteristics unique to that individual stream. The most important radionuclides present in each waste stream are identified and the geometric mean of the range of activity concentrations for each radionuclide is determined from available data. The radionuclides considered are shown in Table S.3. The volumes of each waste stream are considered on a regional basis. That is, the volume of the waste stream is projected for each of the above four regions over the next 20 years, which allows consideration of regional impacts of management and disposal of LLW.

Furthermore, four generic alternative waste form and processing options are considered. These generic processing options, called "waste spectra," represent four relative levels of waste processing activities applied to the 36 waste streams characterized. The waste spectra have been developed to limit the number of waste form and packaging alternatives that would have to be analyzed, since an infinite number of possible combinations of various waste streams and processing options are available. The four spectra, which are described in detail in Appendix D, are as follows. Waste spectrum 1 characterizes existing and, in some cases, past waste management practices. Waste spectrum 2 characterizes improvements in the form of the waste through processing and reduction in waste

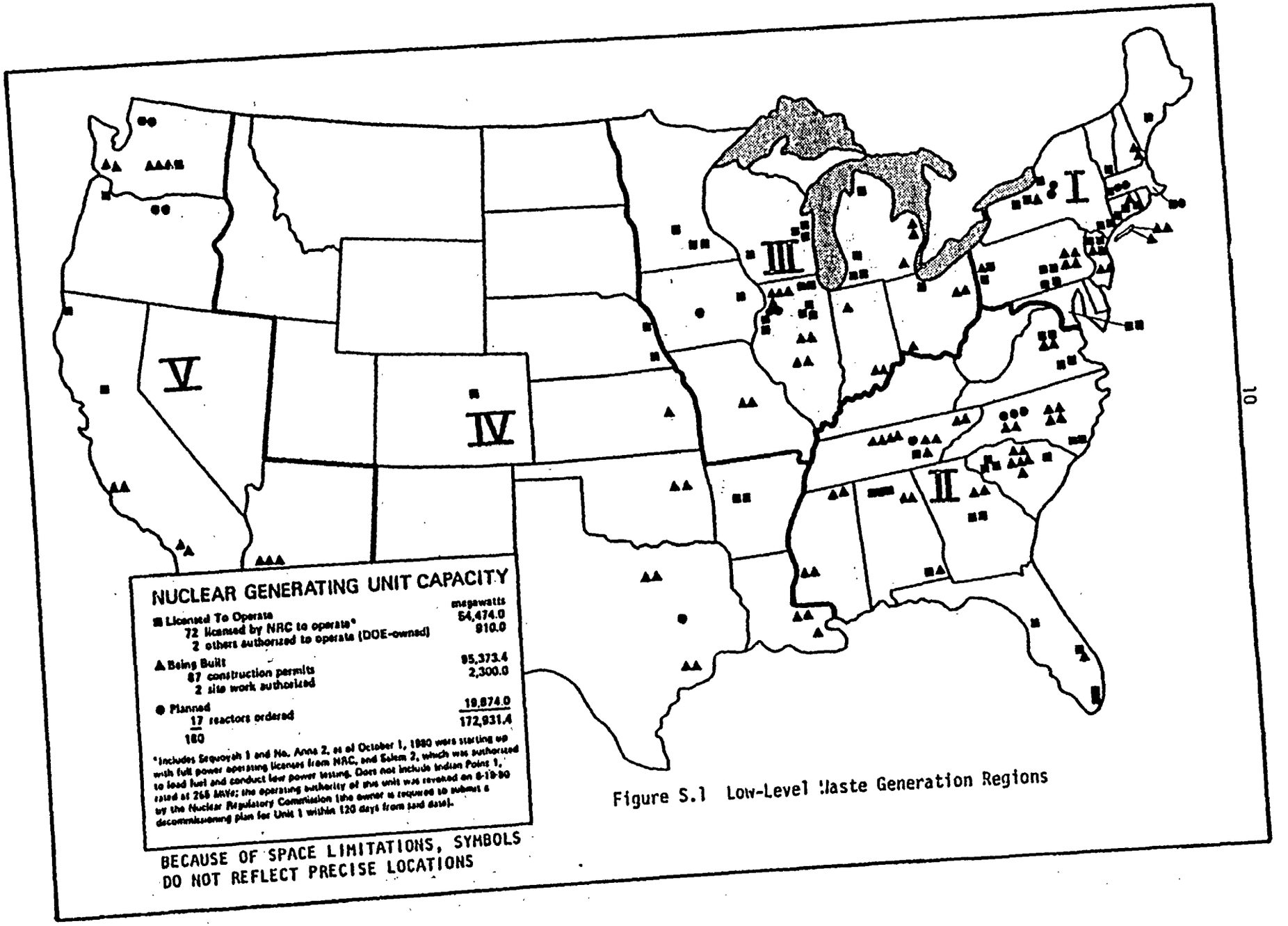

Figure S.1 Low-Level Waste Generation Regions

Table S.2 Waste Streams Considered in Analyses

Waste Stream	Symbol
Group I: LWR Process Wastes	
PWR Ion Exchange Resins	P-IXRESIN
PWR Concentrated Liquids	P-CONCLIQ
PWR Filter Sludges	P-FSLUDGE
PWR Filter Cartridges	P-FCARTRG
BWR Ion Exchange Resins	B-IXRESIN
BWR Concentrated Liquids	B-CONCLIQ
BWR Filter Sludges	B-FSLUDGE
Group II: Trash	
PWR Compactible Trash	P-COTRASH
PWR Noncompactible Trash	P-NCTRASH
BWR Compactible Trash	B-COTRASH
BWR Noncompactible Trash	B-NCTRASH
Fuel Fabrication Compactible Trash	F-COTRASH
Fuel Fabrication Noncompactible Trash	F-NCTRASH
Institutional Trash (large facilities)	I-COTRASH
Institutional Trash (small facilities)	I+COTRASH
Industrial SS* Trash (large facilities)	N-SSTRASH
Industrial SS Trash (small facilities)	N+SSTRASH
Industrial Low Trash (large facilities)	N-LOTRASH
Industrial Low Trash (small facilities)	N+LOTRASH
Group III: Low Specific Activity Wastes	
Fuel Fabrication Process Wastes	F-PROCESS
UF_6 Process Wastes	U-PROCESS
Institutional LSV** Waste (large facilities)	I-LIQSCVL
Institutional LSV Waste (small facilities)	I+LIQSCVL
Institutional Liquid Waste (large facilities)	I-ABSLIQD
Institutional Liquid Waste (small facilities)	I+ABSLIQD
Institutional Biowaste (large facilities)	I-BIOWAST
Institutional Biowaste (small facilities)	I+BIOWAST
Industrial SS Waste	N-SSWASTE
Industrial Low Activity Waste	N-LOWASTE
Group IV: Special Wastes	
LWR Nonfuel Reactor Components	L-NFRCOMP
LWR Decontamination Resins	L-DECONRS
Waste from Isotope Production Facilities	N-ISOPROD
Tritium Production Waste	N-TRITIUM
Accelerator Targets	N-TARGETS
Sealed Sources	N-SOURCES
Industrial High Activity Waste	N-NIGHACT

*SS: Source and Special Nuclear Material
**LSV: Liquid Scintillation Vial

Table S.3 Radionuclides Considered in Analyses

Isotope	Half Life (years)	Radiation Emitted	Principal Means Of Production
H-3	12.3	β	Fission; Li-6 (n, α)
C-14	5730	β	N-14 (n, p)
Fe-55	2.60	X	Fe-54 (n, γ)
Co-60	5.26	β, γ	Co-59 (n, γ)
Ni-59	80,000	X	Ni-58 (n, γ)
Ni-63	92	β	Ni-62 (n, γ)
Sr-90	28.1	β	Fission
Nb-94	20,000	β, γ	Nb-93 (n, γ)
Tc-99	2.12×10^5	β	Fission; Mo-98 (n, γ), Mo-99 (β^-)
I-129	1.17×10^7	β, γ	Fission
Cs-135	3.0×10^6	β	Fission; daughter Xe-135
Cs-137	30.0	β, γ	Fission
U-235	7.1×10^8	α, β, γ	Natural
U-238	4.51×10^9	α, γ	Natural
Np-237	2.14×10^6	α, β, γ	U-238 (n, 2n), U-237 (β^-)
Pu-238	86.4	α, γ	Np-237 (n, γ), Np-238 (β^-); daughter Cm-242
Pu-239	24,400	α, γ	U-238 (n, γ), U-239 (β^-), Np-239 (β^-)
Pu-240	6,580	α, γ	Multiple n-capture
Pu-241	13.2	α, β, γ	Multiple n-capture
Pu-242	2.79×10^5	α	Multiple n-capture; daughter Am-242
Am-241	458	α, γ	Daughter Pu-241
Am-243	7950	α, β, γ	Multiple n-capture
Cm-243	32	α, γ	Multiple n-capture
Cm-244	17.6	α, γ	Multiple n-capture

volume with relatively modest expenditures of time and money. These two spectra bound existing waste management practices, which are currently in a marked state of change due to state initiatives, a lack of disposal capacity, and economic considerations. In waste spectrum 1, for example, light water ion-exchange resins and filter sludges are shipped to disposal facilities in a dewatered form. Several other high activity waste streams are also shipped to disposal facilities in an unstable form, and no special effort is made to compact compressible waste streams. In waste spectrum 2, all light water reactor process wastes, including ion-exchange resins and filter sludges, are stabilized by solidification while other high activity waste streams are stabilized through improved packaging techniques. All compactible trash streams are compacted. Waste spectrum 3 characterizes further waste form improvements and volume reduction at further increased costs, including incineration of most combustible waste streams. Waste spectrum 4 characterizes the maximum volume reduction and improved waste forms that can currently be practically achieved.

The third component of the information base involved characterizing (costs, operational exposures, etc.) a number of alternative disposal facility designs and operating practices. These alternatives are developed in Appendix F to the main text, and include alternatives which will reduce potential impacts to inadvertent intruders, reduce ground-water migration and long-term social impacts, improve operational safety, or combinations thereof. The alternatives characterized include the following:

Deeper trenches	Improved monitoring
Thicker trench covers	Moisture barriers
Increased backfill thickness	Sand backfill
Layered waste disposal	Improved surface water drainage
Slit trenches	
Caisson disposal	Weather shielding
Concrete walled trenches	Stacked waste emplacement
Grouting	Waste segregation
Engineered intruder barriers	Decontainerized disposal
Improved compaction	Dynamic compaction

Other disposal alternatives were also briefly examined. These included potential land based methods (intermediate depth disposal, mined cavities) as well as other potential disposal methods (ocean disposal, space disposal).

Use of Reference Waste Volume and Disposal Facility

From the above, it can be seen that when considering the effect of alternative regional, waste form, and facilty design and operation characteristics on the magnitude of the impact measures calculated, an extremely large number (thousands) of possible permutations can be considered. To enable development of performance objectives and technical requirements for LLW disposal, the number of these

permutations needed to be controlled and analyzed on a systematic basis. NRC, therefore, adopted use of (1) a reference waste volume distribution and (2) a reference disposal facility site and design.

As discussed in Appendix D, the reference waste volume distribution is generated through averaging all the waste volumes assumed to be generated in each of the 36 streams for each of the four regions, and normalizing these volumes to one million m^3 of waste for waste spectrum one. This allows the effects of alternative waste spectra and alternative disposal facility designs and operating practices to be compared on a common basis.

To help provide conservative bounds to the potential costs and impacts of waste disposal, the reference LLW disposal facility is assumed to be sited in a humid eastern environment. NRC staff anticipates that over the next 20 years, over three-quarters of the waste generated in the United States will be generated in humid environments--i.e., in the eastern and humid midwestern sections of the country. Regional disposal of waste therefore implies that most of the waste generated in humid environments would also be disposed in humid environments. Potential ground-water impacts (and actions required to protect ground water) at a humid site are generally expected to be greater than those at an arid area. For this EIS, the reference disposal facility is assumed to have environmental characteristics corresponding to the southeast regional site, although either the northeast regional site or the midwest regional site could have been used for this purpose.

The reference facility is sized to accept a relatively large quantity of waste--i.e., 50,000 m^3 of waste per year over a 20-year operating life, or a total volume of one million m^3. This corresponds to approximately one-quarter of the total volume of LLW projected in the United States to the year 2000. Disposal of one million m^3 of waste in the reference facility will require about 150 acres of land, which corresponds to an approximate upper bound of the land area of current commercial disposal facilities.

The reference facility site minimally meets all of the site suitability requirements set out in Chapter 5. The facility is also assumed to be operated in compliance with minimum radiation safety practices required by provisions of 10 CFR Part 20. Although the facility is assumed to comply with the NRC Branch Technical Position on Site Closure and Stabilization (Appendix I), no special effort is assumed regarding the waste form or design and operational practices to ensure long-term site stability. Several design and operational improvements directed at stability that have been instituted at some existing sites have not been assumed for the base case site (e.g., vibratory compaction of backfill material). This has been done to establish a base case level of long-term costs and radiological impacts against which measures to improve site performance, achieve greater site stability, minimize radiological impacts, and to ensure adequate funding can be assessed. The facility is described in detail in Appendix E. A brief description follows.

The disposal facility is assumed to be operated for profit by a small corporation which is engaged in other nuclear-related business activities in addition

to operating the disposal facility. The disposal area at the reference facility includes 58 disposal trenches with dimensions of 180 m (591 ft) long, 30 m (100 ft) wide, and 8 m (26 ft) deep. The rather large trench sizes assumed are representative of recent trends at existing disposal sites. Support facilities and structures at the site include (1) an administration building, (2) a health physics/security building, (3) a warehouse, (4) a garage, (5) a waste activities building, and (6) a storage shed. All structures at the site are one-story metallic structures on concrete pad foundations.

Shipments of radioactive waste arrive by truck and are processed onto the site on a first-come, first-served basis. Accompanying the shipments are manifest documents--termed radioactive shipment records (RSRs)--which describe the content of the shipment. Arriving shipments are inspected for compliance with applicable federal regulations and waste acceptance criteria established as conditions in the disposal facility license.

Waste is randomly emplaced in the trench, sometimes using cranes and forklifts, and backfilled with dirt removed during trench excavation. Random waste emplacement results in a trench volume use efficiency of about 50 percent. Waste is emplaced to within one meter of the top of the trench. Earthen fill is then backfilled into the trench until the trench cover approximately corresponds to the original grade of the site surface. A one-meter thick earthen cap is then placed upon the backfill and is mounded. The earthen cap is then covered with natural overburden material as necessary to provide good drainage characteristics and according to the final contours planned for the site surface. The overburden is then reseeded to promote growth of a short-rooted grass cover.

After a 20-year operating period, closure (decommissioning) of the facility is assumed to require approximately one to two years and involves dismantling and decontamination of site buildings, disposal of wastes produced during dismantlement and decontamination operations, and final site seeding and contouring. The licensee also makes a final survey of the disposal area to make sure direct radiation levels are at essentially background levels. Following closure, the disposal license is terminated and control of the site is transferred to the site owner. For this EIS, the site owner is assumed to be a state agency which carries out an active institutional control program of surveillance, monitoring, and maintenance for 100 years.

Impact Measures

The impact measures considered in this EIS include short-term radiological exposures, long-term radiological exposures, costs, energy use, and land use. These impact measures are listed in Table S.4.

Of these, the principal impact measures considered involved long-term radiological exposures and costs. Long-term radiological exposures could involve activities such as man potentially contacting the waste after disposal (i.e., inadvertent human intrusion into the disposal facility), potential leaching and transport of the waste through the ground water; intrusion and dispersion by plants and animals; long-term erosion of the site with eventual uncovering of the waste and surface

Table S.4 Impact Measures Used in Analyses

Waste Management Phase	Impact Measure
Waste processing	Costs Energy use Occupational exposures due to waste processing Population exposures due to waste incineration
Waste transportation	Costs Energy use Occupational exposures Population exposures
Waste disposal	Costs Energy use Land use Occupational exposures Exposures to individuals and populations due to: o operational accidents o ground-water migration o inadvertent human intrusion

water and air transport; and release of gaseous decomposition products from the waste containing radioactive species (e.g., tritiated methane gas). Further discussion is provided below:

Human Intrusion Exposure Pathways. Intrusion into disposed waste may be either deliberate or inadvertent. A deliberate intrusion event implies that the intruder knows of the potential hazard of the disposed waste but for some reason deliberately chooses to ignore the hazard. (For example, the intruder could be seeking something of possible value in the disposed waste.) NRC believes that deliberate intrusion into the disposal facility cannot reasonably be protected against, and it is not considered further. After the facility closes, however, and after active institutional control and surveillance over the facility have been removed, one or a few individuals could inadvertently disturb waste at the disposal facility through such activities as constructing a house or through gardening. In this case the intruder is unaware of the presence of the waste.

Intrusion into a closed waste disposal facility, assuming a breakdown in institutional controls, has been examined in detail in studies by a number of

industry, national laboratory, and federal agency contractor investigators (see Section 4.2.1 of Chapter 4). These studies analyzed a range of intrusion exposure pathways ranging from potentially trivial events to events which could cause relatively significant exposures.

Based on a review of the pathways considered by these investigators, NRC selected a limited number for analysis in the EIS. The events are conservatively assumed to occur based upon consideration of typical human activities. NRC recognizes the hypothetical nature of such events and that they may never occur. Given their hypothetical nature, NRC has assumed reasonably conservative (but not overly conservative) actions on the part of the intruder. In addition, some judgment was also made as to the likelihood and extent of the events occurring depending upon specific waste forms and disposal practices.

Two concentration-limited events and one activity-limited event are analyzed. One involves the assumed construction of a house directly on the disposal facility and is referred to as the intruder-construction scenario. A modification of this scenario, termed the intruder-discovery scenario, is assumed to occur when the inadvertent intruder contacts solid remains of waste, realizes that something is wrong and ceases intrusion activities. The second event involves an individual or several individuals living in the house thus constructed and is referred to as the intruder-agriculture scenario. The activity-limited event, which involves consumption of water by the intruder from a well drilled at the site, is termed the intruder-well scenario. (See following section on ground-water migration.) In addition, potential population exposures from radioactive material dispersed by the inadvertent intruder are also analyzed.

Ground-Water Migration. Potential impacts due to long-term releases to ground water are given major consideration in this EIS. Ground-water impacts are calculated for four human access locations: (1) a well located onsite which is assumed to be used by a potential inadvertent intruder following the end of the active institutional control period; (2) a well located at the site boundary which is assumed to be used by a few individuals; (3) a well assumed to be located approximately 500 meters downgradient from the disposal facility and used by a small population of about 100 persons; and (4) a small stream located about one kilometer downgradient of the disposal facility and assumed to be used by a small population of about 300 persons. All exposures listed are to individuals.

Possible increases in percolation into disposal cells due to intrusion by humans, burrowing animals, deep-rooted plants, or other factors are incorporated into the analyses.

Other Long-Term Release Pathways. There may be other potential pathways for long-term release of radionuclides to the environment from disposed waste. These pathways include:

- Gaseous releases from decomposing waste;
- Plant and animal intrusion; and
- Wind and surface water erosion and transport.

NRC staff believes, however, that the most significant pathway is ground-water migration. Gaseous releases do not have a large impact and can be reduced by assuring stable site conditions. Impacts from plant and animal intrusion are site-specific and can be reduced through engineering designs applied to reduce ground-water migration and potential intruder exposures. Erosion is a slow, long-term process which can be controlled through proper siting and good operational techniques.

Costs. Costs are calculated over 20 years operation of the disposal facility and are separated in this EIS into three components:

- processing costs
- transportation costs
- disposal facility costs.

Waste processing costs include costs associated with processing (e.g., compaction, solidification) and packaging wastes prior to disposal. Processing costs are separated into those associated with processing by waste generators and those which could result from transfer of the waste to a centralized regional processing center prior to disposal. Transportation costs are costs associated with transferring the waste to the disposal facility and for the reference facility, are calculated based upon an average transport distance of 400 miles.

Disposal facility costs are separated into (1) design and operating costs and (2) postoperational costs. Design and operating costs are those costs associated with siting, designing, constructing, and operating the facility over 20 years. These costs may be further separated into capital and operational costs (see Appendix Q), and are a function of the alternative disposal facility designs considered in the EIS. Postoperational costs are divided into closure costs and institutional control (long-term care) costs. Closure costs are calculated assuming that adequate funds for closure are provided for by the licensee through use of an investment fund (represented as a surcharge on received waste). The availability of funds for closure is assumed to be assured by a mechanism such as a surety bond. Institutional control costs are calculated based on the assumption that a state-operated sinking fund is established and that a surcharge is levied upon the waste received at the disposal facility on a cost-per-waste-volume arrangement. All postoperational costs are calculated as costs to a disposal facility customer.

4. COSTS AND IMPACTS OF BASE CASE (NO ACTION ALTERNATIVE)

Principal long-term radiological impacts for the base case (no action) alternative are listed in Table S.5 for several time periods following license termination.

Direct impacts to a potential inadvertent intruder (in mrem/yr to an individual) are summed over all 23 radionuclides considered in the analysis and volume-averaged over all 36 waste streams disposed into the disposal facility. The highest potential intruder exposures are those to the bone. Whole body exposures are also shown. Over the first 500 years, potential exposures to the bone from the intruder-construction scenario drop by a factor of 3 from

Table S.5 Principal Long-Term Radiological Impacts for the Base Case (No Action) Alternative

	Costs and Impacts
Direct intruder impacts:	
Body (mrem/yr)*	
o 100 C	1.502E+3**
A	1.769E+3
o 500 C	7.808E+1
A	4.336E+1
o 2000 C	4.491E+1
A	2.251E+1
Bone (mrem/yr)	
o 100 C	3.095E+3
A	2.482E+3
o 500 C	1.183E+3
A	4.851E+2
o 2000 C	8.264E+2
A	3.347E+2
Offsite releases from intrusion (at 100 years):	
Airborne impacts (man-millirem/yr)	
o Body	2.242E+3
o Bone	4.060E+4
Waterborne impacts (millirem/yr)	
o Body	8.475E-2
o Bone	5.097E-1
Ground-water impacts: (mrem/yr)	
Body	
o Intruder well	3.044E+1 (100)***
o Boundary well	1.571E+2 (70)
o Population well	4.434E-1 (6,000)
o Surface stream	1.781E-2 (8,000)
Bone	
o Intruder well	3.063E+0 (6,000)
o Boundary well	3.061E+0 (6,000)
o Population well	6.197E-1 (8,000)
o Surface Stream	2.685E-2 (10,000)
Thyroid	
o Intruder well	8.462E+2 (4,000)
o Boundary well	8.462E+2 (4,000)
o Population well	2.673E+2 (4,000)
o Surface stream	1.218E+1 (4,000)

*C = Intruder-Construction Scenario
A = Intruder-Agriculture Scenario
**The notation 1.502E+3 means 1.502×10^3.
***The numbers in parentheses indicate the approximate time in years following facility closure that maximum impacts occur.

about 3 rems/yr to about one rem/yr. Over the next 1500 years, however, potential exposures are reasonably constant, and are still at about 800 mrem/yr at 2000 years. A similar pattern is observed for potential exposure to the whole body. The potential exposures were conservatively calculated giving no credit (with the exception of activated metal) for the ability of waste form to reduce airborne dispersion of radionuclides or uptake by plant roots. That is, the waste is assumed to behave and disperse in a manner similar to ordinary dirt.

Ground-water exposures are also calculated in a conservative manner and are high for the base case. Due to the readily degradable nature of much of the waste and assumed inadequate site operational practices, severe slumping and subsidence problems occur. The disposal area is assumed to be characterized by potholes and subsidence depressions, leading to concentrated sources of rainwater infiltration. Maximum annual doses to all organs, with the exception of the thyroid and bone, are about 30 millirem at the intruder well, exceed 150 mrem at the boundary well, are on the order of 0.1 mrem at the population well, and are on the order of 10^{-2} to 10^{-3} mrem at the surface body water. Maximum annual thyroid doses are in the range of 850 mrem at the intruder and population wells, 270 mrem at the population well, and 12 mrem at the surface water body. It is not likely that doses to actual individuals could ever be this high, notwithstanding the conservatism of the analysis. For one thing, potholes and depressions would be filled in by the site owner, thus reducing the percolation. In addition, ground-water movement of radionuclides would almost certainly be detected through monitoring wells long before appreciable exposures could be received by the public. A more important point is that a considerable amount of effort and cost to the site owner may be required to <u>prevent</u> such exposures from occurring.

This is evidenced by the size of the postoperational funds that would have to be collected during the 20-year site operational period--i.e., $38.2 million, or about $38/m^3$ assuming 1 million m^3 of waste ($1.08/ft^3). These costs are shown in Table S.6 and are calculated assuming a high level of long-term maintenance in a site having moderately permeable soils. For sites having very impermeable soils where there is a possibility of a major leachate pumping and treatment problem (such as the current situation at the Maxey Flats, Kentucky disposal facility), then the amount of postoperational funds that would have to be collected is estimated to be $50 million ($1.42/ft^3).

NRC believes that this level of long-term maintenance and costs is unacceptably high. There is considerable uncertainty in the calculated long-term costs and the costs could easily be higher. Leaving a disposal facility in a condition so that extensive active maintenance activities are required to ensure public health and safety could result in a considerable financial burden to the site owner and to future generations. It is important to realize that these costs were calculated assuming that funds are collected as a surcharge on received waste and placed into a state-operated sinking fund (at an average interest rate of 10% and an average inflation rate of 9%). However, the facility may close prematurely and prior to collection of sufficient funds. The loss in accrued interest could be significant. For example, a major leachate pumping

Table S.6 Other Impacts and Costs of the Base Case (No Action) Alternative

	Costs and Impacts*
Short-term population exposures (man-mrem):	
Processing by waste generator**	-
Processing at regional processing center**	-
Waste transportation	7.12E+5
Short-term occupational exposures (man-mrem):	
Processing by waste generator**	-
Processing at regional processing center**	-
Waste transportation	6.89E+6
Waste disposal	3.05E+6
Waste generation and transport costs: ($)	
Processing by waste generator**	-
Processing at regional processing center**	-
Waste transportation	2.49E+8
Disposal costs: ($)	
Design and op.	1.85E+8
Postoperational	3.82E+7
Total	2.23E+8
Unit ($/m^3)	223
Incremental energy use: (gal)**	--
Land use: (m^2)	3.47E+5
Waste volume disposed: (m^3)	1.00E+6
Total volume not acceptable: (m^3)	0

*Costs and impacts are total costs and impacts over the 20-year operating life of the disposal facility.
**Not calculated for the base case (see text for explanation).

and treatment program is estimated to cost about $1 million per year in 1980 dollars. By the year 2000 and assuming a 9% interest rate over 20 years, this leachate pumping and treatment program would cost between five and six million dollars. The site owner could easily be saddled with expenditures of several million dollars per year for several years.

Another problem is that a high level of long-term maintenance implies that one is depending upon extensive human actions possibly carried out several years in the future in order to ensure public health and safety, and there is no assurance that such extensive activities would actually be carried out. For example, a seemingly minor to moderate water accumulation problem could be potentially ignored (perhaps for the sake of economics) until a major expensive problem develops. In addition, extensive site maintenance activities can lead to releases of quantities of radionuclides offsite and subsequent human exposures.

Other base case costs and impacts are also summarized in Table S.6. The costs and impacts are calculated over 20 years of waste generation, processing, transport, and disposal. Included are population exposures from waste processing and transportation; occupational exposures for waste processing, transportation, and disposal; costs for waste processing and transportation; incremental energy use for processing, transportation, and disposal; land used for disposal; and total waste volume disposed of. Impact measures for energy use as well as occupational exposures, costs, and population exposures for waste processing are not calculated for the base case and are not shown in Table S.6. Rather, incremental changes in these impact measures associated with alternative disposal facility design options and additional waste processing of specific waste streams are calculated. This is explained in greater detail in Section 4.3.2 of Chapter 4 and in Appendices D and G.

In summary, Tables S.5 and S.6 establish a baseline of cost and impact data, and furthermore demonstrate a need for regulatory action. The data shows that inadvertent intruder exposures are relatively high at 100 years, at which point they begin to decrease, leveling off at around 400-500 years. Although the exposures to the inadvertent intruder are not so high as to cause great (immediate life-threatening) concern for the one or few individuals who might be exposed, some additional controls could be exercised that could reduce such potential exposures to lower levels during the 100 to 500-year time frame. Furthermore, the major portion of the exposures may be contributed by a few waste streams that could be controlled to reduce potential exposures. The same would apply to exposures from consumption of ground water at various locations. Finally, the unstable site conditions for the base case results in a very high level of long-term maintenance and costs to the site owner, and a corresponding high level of long-term social commitment.

5. ANALYSIS OF ALTERNATIVES--DEVELOPMENT OF PERFORMANCE OBJECTIVES AND TECHNICAL CRITERIA

5.1 Performance Objectives

As a part of the analyses, NRC analyzed a range of alternative performance objectives to assure an adequate level of protection for the inadvertent

intruder and long-term social and environmental protection. As previously discussed there are four basic performance objectives that should be achieved in disposal:

1. Protect the inadvertent intruder;

2. Assure long-term stability to eliminate the need for long-term maintenance after operations cease;

3. Protect public health and safety (and the environment) over the long term; and

4. Assure safety during the short-term operational phase.

The results of the analyses to arrive at preferred performance objectives are presented below.

5.1.1 Protection of the Inadvertent Intruder

The impacts for potential inadvertent intrusion, while not immediately life-threatening, are significant since impacts on the order of several hundred mrem/yr could last for long time periods. Four methods were addressed by which potential human intrusion impacts may be mitigated:

1. Controlling the disposal of specific waste streams;

2. Waste form and packaging;

3. Use of engineered and/or natural barriers to intrusion; and

4. Institutional controls.

Controlling the Disposal of Specific Waste Streams

In the analysis, the potential hazard to an inadvertent intruder is initially principally due to gamma radiation from fission products such as Cs-137, and averages at about 1.5 to 3 rems/yr at 100 years following license termination. Due to radioactive decay, however, the potential hazard quickly drops to about 1000 mrem/yr to bone at about 500 years following facility closure and about 800 mrem/yr to bone at about 2,000 years following facility closure. Most of the longer-term hazard is caused by two small volume waste streams (1.94 E+4 m^3) containing large quantities of transuranic isotopes. If these waste streams are eliminated from the analysis (that is, if transuranics in large quantities are eliminated from near-surface disposal), potential long-term impacts averaged over the remaining 34 waste streams are only a few mrem/yr (e.g., 3 to 5) after 500 years.

Thus, it appears that by eliminating waste streams containing large quantities of transuranics from near-surface disposal, the long-term hazard to a potential inadvertent intruder may be greatly reduced. Over the short term, however, even with the removal of the transuranic streams, potential impacts can be

significant--e.g., about 1.5 rems/yr. It is useful to consider ways in which the near-term impacts may be reduced. As discussed below, this could result from more restrictive near-surface disposal requirements for a few higher-active waste streams.

Waste Form and Packaging

Another way in which potential intruder exposures can be reduced is through improvements in waste form and packaging, as well as minor improvements in site operational practices. These improvements can lead to reduced exposures in two principal ways:

1. The likelihood that the intruder will stay in contact with the waste (e.g., construct in it, grow crops in it) is reduced if the waste is placed into a stable form or package and disposed in a segregated manner from unstable wastes; and

2. The potential for the waste to be dispersed into a form which can be readily inhaled or taken up by plant roots is reduced if the waste is placed into a stable form or package.

Potential inadvertent intruder hazards were calculated for the base case based upon an assumption that all waste streams are randomly mixed together during disposal. Due to the slumping, subsidence, and higher infiltration that would be associated with this disposal practice, rapid waste degradation could occur. Even wastes that have been placed into a stable form or package could be subject to such rapid decomposition. However, if the stable wastes were also segregated and disposed of in separate disposal cells so that waste degradation would be minimized, then the likelihood that inadvertent intrusion would lead to prolonged contact with the stable wastes would be greatly reduced. It is not credible to suppose that such activities as housing construction or gardening could take place under these conditions since the inadvertent intruder would contact hunks of waste and realize something is wrong. Potential exposures would be limited to those received during discovery of the waste. If high activity waste streams are stabilized and segregated from compressible waste streams, exposures to an inadvertent intruder averaged over all waste streams would be reduced at 100 years following closure from 1 to 3 rems/yr to less than 100 mrem/yr.

In addition, if the waste is contacted through inadvertent intrusion, then potential inhalation exposures would be reduced if the waste is in a stable, less dispersible waste form. Similarly, exposure pathways which occur through consumption would be reduced if the waste is placed into a low leaching form. In order for radionuclides to be taken up by plants, the radionuclides must first be dissolved and leached out of the waste.

Another question addressed is how long waste form may be relied upon to reduce intruder impacts. As a minimum, the waste form should last through the operating life of the disposal facility, the closure period, any observation period prior to the termination of the facility license, and the active institutional control period. This results in a requirement of waste stability for at least 150 years. This requirement should be readily achievable, since if the disposal cell is

stabilized so that minimum infiltration is introduced to the disposal cell, then the waste form should be effective against intrusion for several hundred years. It is not reasonable, however, to expect this to be the case indefinitely. After several hundred years (i.e., on the order of 500 years), most of the shorter-lived radionuclides will have decayed away, leaving the longer-lived radionuclides. The reduction in hazard after 500 years takes place at a much slower rate. It would appear, then, that for most wastes, a limit of 500 years would appear to be the maximum reasonable upper bound. Attempting to reduce intruder impacts through waste form beyond 500 years would really not accomplish much in the way of additional protection.

Use of Engineered and/or Natural Barriers to Intrusion

Another method by which the hazard to a potential intruder may be reduced is to dispose of the waste in a manner that would make it more difficult for a potential intruder to contact the waste--that is, by placing one or more natural or engineered barriers between the waste and the intruder. The majority of the waste streams that could require disposal by methods that provide protection against inadvertent intrusion would probably also be characterized by high surface radiation levels.

NRC analyzed a number of such potential barriers to an intruder and these are described in detail in Appendix F and Chapter 4. The barriers considered and additional facility costs associated with use of these barriers are shown in Table S.7. These costs are for facility design and operation and do not include costs for closure and long-term care. In general, the barriers can be grouped into three major categories as follows:

1. Engineered barriers, including grouting or "engineered structures" such as caissons or concrete-walled trenches;

2. Depth of disposal, including thicker trench caps, layered waste disposal, and slit trenches; and

3. Other methods of disposal, including intermediate depth burial, mined cavities, ocean disposal, and space disposal.

Most waste streams contain relatively low levels of activity while some contain relatively high levels of activity. It would not appear to be justified to require that all waste streams would require disposal using a barrier to an intruder. For most waste streams, the potential hazard falls off rapidly with time--e.g., to levels on the order of a few millirems or less after a few hundred years. Thus, the use of such barriers would only be required for the higher activity waste streams. This can be provided in a relatively inexpensive manner through techniques such as layering. Layering refers to the technique of placing higher activity waste streams at the bottom of the disposal cell so that there is at least 5 meters of earth or lower activity waste between the top of the higher activity waste and the surface of the earth. Using this technique, waste volume-averaged intruder exposures can be reduced (at 100 years following site closure) to the range of 70-80 mrem/yr. If higher activity waste streams are stabilized and segregated from compressible wastes, volume-averaged exposures at this time period are reduced to exposures in the range of 30 mrem/yr.

Table S.7 Summary of Incremental Barrier Costs For Facility Design and Operation

Type of Barrier	Additional Disposal Costs $/m³	$/ft³	
No barrier	0	0	*
Thicker cap - 3m of soil	1.59	0.05	*
Thicker cap - 3m of compacted clay	10.89	0.31	*
Layered waste disposal	37.73	1.07	**
Slit trench (10% of waste)	91.49	2.59	**
Caisson disposal (10% of waste)	216.45	6.13	**
Walled trench (10% of waste)	256.09	7.25	**
Walled trench (100% of waste)	160.99	4.56	*
Grouting--cement†	60.46	1.71	*
Grouting--low-strength cement†	46.86	1.33	*
Engineered intruder barrier	59.17	1.68	*
Intermediate depth burial	53-159	1.50-4.50	*
Mined cavity	327-654	9.26-18.52	*
Ocean disposal	710-2200	20.11-62.31	*
Space disposal	2,000,000	56,600	*

*Unit costs based upon 1,000,000 m³ of waste disposed.

**Unit costs based upon volume of waste disposed by the disposal method indicated. For this table, the costs are based upon a volume of about 100,000 m³.

†Unit costs include additional costs for stacked waste emplacement.

A time limitation on the effectiveness of natural and engineered barriers was also considered. From the analyses performed for this EIS, it was determined that due to radioactive decay, exposures to a potential inadvertent intruder from almost all waste streams typically considered to be LLW fall to a few millirems after a few hundred years--e.g., 500 years. After 500 years, only a few waste streams are estimated to result in annual potential intruder exposures of a few hundred millirems. Very few (e.g., one or two) streams having small volumes are estimated to result in potential intruder exposures exceeding 500 mrem/yr after 500 years.

On the other hand, waste streams that are generally considered to be "high-level waste" (e.g., spent reactor fuel, solidified first solvent extraction stages from a nuclear fuel reprocessing plant) contain much higher initial levels of radioactivity. Typically, the potential hazard from high-level waste disposal is dominated by fission products over approximately the first 600 years. After that approximate time period, most of the fission-product activity has decayed, except for iodine-129 and technetium-99; radioactivity is dominated thereafter by the actinides--e.g., U, Np, Pu, Am, Cm and their daughters. Wastes which still contain appreciable activity after several hundred years (e.g., 500 years) would appear to more closely resemble high-level waste than what is usually considered to be low-level waste.

Finally, limitations on the effectiveness of barriers to a potential inadvertent intruder was discussed at the regional workshops on the Part 61 regulation. At these workshops, there appeared to be general agreement that a time period of 500 years seemed appropriate for most easy-to-implement intruder barriers.

Institutional Controls

Another mechanism for reducing potential impacts to a potential inadvertent intruder is use of institutional controls. Institutional controls are controls which require performance of some action by a government agency to preclude human contact with the waste, or require a continuing social order. Examples include controlled access to the site, controlled productive use of the site (e.g., as a golf course), and periodic inspection and surveillance. Ultimately, institutional controls must also rely upon relatively passive means involving some manner of social order. Probably the most significant concepts for long-term passive institutional control measures are those of control of the land by a governmental organization, land-use restrictions in the form of titles or deeds, and multiplicity of records.

Given this, however, it is still appropriate to consider how long institutional controls may be expected to preclude intrusion. Markers and monuments established at a disposal site may be stolen or defaced, and the nature of the hazard may be buried in forgotten governmental files. Land-use restrictions may be potentially ignored, or a future government bureaucracy may simply mistakenly release a site for inappropriate use.

The maximum time period for which active institutional controls can be relied upon to preclude inadvertent intrusion has been investigated by a number of people, including EPA as well as a number of researchers doing work on establishing a waste classification system. EPA has proposed that a limit of 100 years should be used as a limit for the length of institutional controls. This limit was proposed based upon consideration of public input received at a number

of public forums on radioactive waste disposal held by EPA. In various studies exploring ways in which to classify radioactive waste for disposal, different institutional control periods have been used. The institutional control periods assumed in these studies were all less than a few hundreds of years and ranged in these studies from 100 to 200 years.

The maximum time period that should be assumed for active institutional controls was discussed at a series of four regional workshops held on the preliminary draft of the Part 61 rule. The general consensus of these workshops was that a 100-year limit for active institutional controls was appropriate.

Development of Preferred Performance Objectives

Based upon the analyses and discussion of the previous subsections, the following conclusions were reached:

1. The potential for inadvertent human intrusion into a closed disposal facility at some point after closure of the disposal facility is likely. Extensive intrusion activities such as major housing or apartment construction are unlikely. The potential exposures from inadvertent intrusion are relatively high for the first few 100 years (i.e., 1.5-3 rems/year at 100 years) but, provided that a few waste streams are removed, then drop to a low level (a few mrem/year) after about 500 years.

2. Some waste streams present relatively little hazard to an inadvertent intruder. Some present an initial high potential hazard. If inadvertent intruders can be protected against contacting these latter waste streams for a few hundred years, then such waste streams present much reduced potential hazards. Such protection may be achieved through use of natural and engineered barriers to intrusion. However, there is a limit (e.g., 500 years) as to how long such barriers can be expected to last. Some waste streams may not be acceptable for near-surface disposal.

3. The extent and consequences of potential inadvertent intrusion are related to waste form and disposal facility design and operating practices. For example, improved waste form and packaging can reduce potential exposures through inhalation and food consumption pathways. Volume reduction may increase exposures from direct gamma radiation. If the waste is in a structually stable form and segregated from other wastes, then as long as the structural stability is retained, the possibility of extensive inadvertent intrusion activities is not considered credible.

4. Institutional controls can be effective in reducing the potential for inadvertent intrusion and in reducing potential intruder exposures.

Two aspects were then analyzed in further detail and specific limits developed to determine the disposal requirements of different LLW streams based on protection of an inadvertent intruder--that is, to determine which streams may be acceptable for near-surface disposal, which streams may require barriers to

an intruder, and which streams may be generally unacceptable for near-surface disposal. The aspects that were developed included:

1. An exposure guideline defining an acceptable level of safety regarding protection of an inadvertent intruder which can be used to stipulate when controls against potential intrusion should be implemented; and

2. A maximum time during which active institutional controls can be relied on to prevent inadvertent intrusion.

Three alternative dose rate limits were examined quantitatively in this EIS for protection of an inadvertent intruder:

- 25 mrem/yr to the whole body;
- 500 mrem/yr to the whole body; and
- 5000 mrem/yr (5 rem/yr) to the whole body.

Four alternative active institutional control periods were also analyzed:

- 50 years
- 100 years
- 150 years
- 300 years

These alternatives were examined in a case study set out in Chapter 4 of this EIS. The results of this case study are too lengthy to include here but resulted in the selection of a 500 mrem/yr (whole body) dose rate guideline for protection of an inadvertent intruder and a 100-year assumed maximum active institutional control period.

The preferred dose limitation criteria objective selected by NRC is similar to the maximum permissible levels of radiation in unrestricted areas as set out in 10 CFR Part 20. A dose rate limit in the range of 25 mrem/year was judged to result in considerably more costs, more change in existing practices, and greater reduction in disposal efficiency than the other two alternatives. This is especially important considering the hypothetical nature of the intrusion event. The 5 rem/yr alternative was seen to involve approximately the same costs and impacts as the 500 mrem/yr alternative. The higher dose rate limit, however, could potentially allow disposal of larger quantities of long-lived isotopes, which could result in moderately higher intruder hazards which could extend for long time periods. Therefore, 500 mrem/yr (whole body) was selected as a general dose rate limitation guideline. This limitation agrees with the consensus of the four regional workshops.

The second question was how long should credit be given to active institutional controls to prevent such intrusion. A time period that is too short could result in very high disposal costs for much of the LLW. A period that is very long, on the other hand, may place an undue burden on future generations. NRC analyzed alternative institutional control periods of 50, 100, 150, and 300 years to see if there was any technical preference for selecting one time period over another. From the analysis, there did not appear to be any overly compelling numerical reason to adopt a particular institutional control period. NRC believes, however, that institutional controls will last at least 50 years.

Three-hundred years appeared to be too long of a time period and did not offer any compelling numerical advantage over 150 years. The preferred alternative was, therefore, in the range of 100 to 150 years. NRC selected 100 years as the preferred institutional control period. This period of time agrees with previous estimates on the effective length of active institutional controls made by EPA and also is consistent with the consensus of the regional workshops. Based on the comments received on the preliminary draft of Part 61 and at the workshops, NRC identified no overriding social or political rationale for selection of one time period over another. The general consensus was that 100 years was about the right time period upon which reliance should be placed on active institutional controls.

5.1.2 Long-Term Environmental Protection

In developing performance objectives, NRC considered two key aspects related to long-term environmental protection: long-term potential exposure pathways, and long-term site stability.

The potential exposure pathways included: (1) ground-water migration, (2) gaseous releases from decomposing waste, (3) plant and animal intrusion, and (4) wind and surface water erosion and transport. Of the pathways, the consumption and use of water containing radionuclides from disposed waste is believed to be the most significant long-term environmental release pathway of potential human exposure. Thus, NRC concentrated on analysis of ground-water impacts in development of the performance objective.

In the analysis, it became apparent that long-term ground-water migration cannot be analyzed by only considering potential radiological impacts. Site stability and the need for long-term social commitment to care for sites over the long term and to maintain potential radiological impacts to low levels must also be considered as an integral part of the analysis.

The unpredictable nature of waste/disposal site instability can lead to increased radiological and economic impacts at both humid and arid sites. At humid sites, stable disposal cell covers are needed to minimize water infiltration into the waste and thus maintain potential ground-water releases to levels as low as reasonably achievable. Waste instability in poorly drained soils can especially lead to a potential "bathtub" problem, which can further lead to costly long-term trench pumping and site stabilization programs. In arid sites, trench instability can lead to subsidence and increased plant and animal intrusion plus increased potential for wind erosion and dispersion of trench contents.

Three interrelated factors contribute to waste form/disposal site instability, the contact of water with waste, and the resulting long-term radiological and economic consequences:

- site environment;
- site design and operations; and
- waste form.

To consider the maximum potential impacts from waste disposal, the base case site analyzed was a humid site, although as stated above, waste/site instability is also important at arid sites. Variations to site designs and operating

practices can lead to greater site stability and minimize long-term migration. Some of these variations considered in the EIS include: (1) segregation of compressible wastes and wastes containing large quantities of organic chemicals or chelating agents, (2) thicker, less permeable disposal cell covers, (3) improved compaction of disposal cell contents and covers, (4) stacked disposal of waste rather than random disposal, (5) grouting of disposed wastes, (6) decontainerized disposal of low-activity compressible wastes, and (7) use of engineered structures such as concrete-walled trenches.

The waste form (coupled with site design and operating practices) is probably the most significant factor contributing to site instability--a factor containing the paradox that much if not most of the problems with site instability and high maintenance costs is caused by the wastes containing the least activity. Most of the waste sent to LLW disposal facilities consists of very low activity material such as trash which is frequently easily degradable. In the past, some of this waste has been packaged in easily degradable packages such as cardboard boxes. Most of the waste, however, is currently packaged in longer-lasting, but still degradable, rigid containers such as wooden boxes and 55-gallon steel drums. Large void spaces can also exist within waste packages and the disposal cells after waste disposal. As the waste material degrades and compresses, a process which is accelerated by contact by water, additional voids are produced. This leads to settlement of the disposal cell contents, followed by subsidence or slumping of the disposal cell cover. This increases the percolation of water into disposal cells, accelerating the cycle. This slumping and subsidence is frequently quite sudden.

The use of the rigid containers would be expected to reduce the amount of short-term subsidence. Over the longer term, however, subsidence problems would still be observed, and factors contributing to this include: (1) the waste contained in the rigid containers is still frequently easily degradable and (2) even if the waste is not readily degradable (e.g., activated alloy metal), it is frequently packaged into containers so that large voids are left within the containers. The rigid containers initially provide some structural support to the disposal cell covers, and act to "bridge" voids within the disposal cell and waste packages. Eventually, however, this structural support is lost as the rigid containers rust or rot out, leading to disposal cell settling at rates which are difficult to predict. The basic problem is the production of voids. If a waste container were completely filled with relatively nondegradable, noncompressible materials--e.g., activiated metal with void spaces within the container filled with sand--and disposed so that voids between waste packages could be eliminated, then degradation of the waste package would not be expected to result in a subsidence problem.

In Chapter 5 of the main text, an extensive case study was performed including alternate site characteristics, waste forms and packages, disposal facility designs, and facility operational procedures. Twenty separate cases were considered in the case study. The alternatives were principally directed at improving long-term site stability (e.g., reducing void spaces within the waste and trench after disposal) and eliminating the contact of water with the waste both during and after operations. They included changes which could be implemented with little additional effort and increased cost, and those involving high effort and increased cost.

These alternatives included the following:

1. Alternatives Examined to Achieve Stability

   - Compaction of backfill (and waste) during operations
   - Use of improved waste forms and packaging
   - Stacking of waste packages
   - Walled trenches and other engineered techniques
   - Segregation of stable and unstable wastes
   - Decontainerized disposal

2. Alternatives Examined to Reduce Water Contact with Waste

   - Thicker, compacted caps
   - Moisture barriers
   - Improved waste forms and packaging
   - Walled trenches and other engineering techniques
   - Segregation of stable and unstable wastes
   - Use of a permeable backfill

The case study with its many nuances is too extensive to be reproduced here. From the analysis, however, NRC believes that the siting, design, operation, and closure of the disposal facility should be clearly directed toward achieving the maximum practical site stability. Disposal facility stability and the corresponding potential for ground-water migration directly affect the level of long-term care and maintenance by the site owner. Past experience with LLW disposal clearly indicates that one of the most important objectives of LLW disposal should be that the disposal facility is stabilized so that little or no maintenance is required by the site owner. NRC staff believes that the alternative of not considering this as a performance objective is clearly not acceptable.

Although the stability performance objective is needed, care is required in implementation to arrive at an equitable distribution of costs. Much of the waste sent to LLW disposal facilities consists of very low-activity material such as trash which is frequently easily degradable and compressible. This complicates the analysis, since most of the waste streams that contribute the most to site instability are the same waste streams that contain the least activity. Much of this low-activity waste is only suspected of being contaminated and/or is generated by small waste generators such as hospitals and research laboratories. These factors increase the difficulty of arriving at a cost-effective solution to the problem of disposal facility instability. That is, it is difficult to justify requiring large additional expenditures to dispose of otherwise low hazard material.

One alternative would be to incinerate and solidify all combustible waste streams. In general, although NRC staff believes that waste incineration may be a cost-effective solution for some waste generators, it would cause economic hardships if required generally, particularly to small waste generators such as hospitals and research laboratories. Costs would run on the order of \$927/m^3 (\$26.25/ft^3). In

addition, it is not a solution that could be generally instituted on a reasonable time basis. Other alternatives such as extensive engineered disposal techniques (e.g., grouted or concrete-walled trenches, decontainerized disposal) also appeared to have a number of drawbacks for general application. These drawbacks included significant additional disposal costs and significantly increased occupational exposures at the disposal facility. For example, additional disposal costs would run at about \$60.50/m^3 (\$1.70/ft^3) for grouted disposal, \$211/m^3 (\$6/ft^3) for disposal into a grouted concrete-walled trench, or \$49/m^3 (\$1.40/ft^3) for decontainerized disposal.

The most reasonable alternatives considered--those which could be implemented with reasonable costs and within a reasonable time frame--involved stabilization of higher activity waste streams coupled with segregated disposal of lower activity unstable waste streams. Segregation is estimated to cost an approximate additional \$6/m^3 (\$0.17/ft^3). Stabilization of the higher activity streams could be accomplished by either stabilizing the waste form (e.g., through solidification), stabilizing the waste package (e.g., through use of high-integrity containers), or by disposal facility design (e.g., by placing the waste into a structure which supports barriers to moisture). Once the disposal cells are stabilized, then improved barriers to moisture may be emplaced, further reducing exposures to levels as low as reasonably achievable.

This means that there still may be some long-term maintenance required for the segragated low-activity waste disposal cells. However, since the activity contained in these disposal cells would be relatively low, the impacts from increased percolation into these disposal cells would also be relatively low. In addition, long-term maintenance can be reduced through such improvements in facility design and operating practices as:

- improved backfill;
- improved disposal cell covers;
- increased attention paid to minimizing voids in disposal cells; and
- improved compaction of disposal cell covers.

Such improvements, which are estimated to cost an approximate additional \$22/m^3 (\$0.62/ft^3) in operational costs above the base case, are already being implemented to a certain extent at existing operating disposal facilities. Thus, implementation of such practices would involve few additional costs to waste generators.

Readily achievable improvements in waste form which would reduce long-term maintenance include the following:

- additional compaction of compressible wastes;
- increased attention paid to minimizing voids in waste containers; and
- use of longer-lasting waste containers.

The first two of the above options are already being carried out by a number of waste generators.

In regard to improved containers, polyethylene drums are available, for example, which have been certified by DOT for use in transporting nonradioactive hazardous wastes such as oxidizers or corrosive solids. These are apparently available at approximately the same (or possibly reduced) price as standard steel 55-gallon drums. Compared to steel 55-gallon drums, which is the most common type of waste container used in the nuclear industry, a polyethylene or other type of plastic drum would be expected to degrade very much slower after disposal, provided that the drum is designed to be compatible with the waste form and the disposal environment. The radionuclide containment capability would therefore be expected to be greater than a typical steel 55-gallon drum. More importantly, reduced container degradation would result in reduced compression of disposal cell contents, thus reducing subsidence and infiltration of water.

If the above options were generally carried out, then it is possible that the level of maintenance required for the low-activity disposal cells can be reduced to very low levels.

Given this overall objective--the need for disposal facility stability--numerical limits for migration were derived.

The EPA has a program underway leading to development of a standard for long-term releases of radioactivity to the environment from LLW disposal facilities. In the absence of that standard, NRC considered existing NRC and EPA standards and narrowed the range of alternatives to be analyzed in this EIS to a range of 1-25 mrem/year. One mrem/year was selected as a lower bound since it was less than the 4 mrem/yr limit in EPA's national primary drinking water standard (40 CFR Part 141), and it would provide a low limit against which the ability of current technology to meet such a limit could be analyzed. Twenty-five mrem/year was selected as an upper bound since it was already in use as an existing EPA standard (40 CFR Part 190) applied to routine operating releases from nuclear fuel cycle facilities.

Based on the analyses, NRC concluded that a limit in the range of existing EPA drinking water regulations (4 mrem/yr) can be achieved at the nearest public drinking water supply given some modest increased costs and changes. NRC also concluded that meeting the EPA drinking water standards at the nearest public drinking water supply results in annual potential exposures of less than 25 mrem whole body, 75 mrem thyroid, and 25 millirem to any other organ to an individual who might consume water from a well located at the site boundary.

An annual exposure limit of 25 mrem whole body, 75 millirem thyroid, and 25 mrem to any other organ to the maximally exposed individual at the site boundary coupled with an annual population limit of 4 mrem at the nearest public drinking water supply was, therefore, selected as the preferred performance objective. Because of the need to consider other potential environmental release pathways, albeit small, the performance objective includes potential releases from surface water, air, plants, and animals. Broad public acceptance of the application of the EPA drinking water standard and the existing fuel cycle standard at the site boundary was also expressed in the public comments and workshops on the preliminary draft Part 61 rule.

Moderate changes in waste form and packaging and disposal facility design and operating practices are needed to meet the selected performance objectives. These principally include methods by which the stability of the disposal facility can be enhanced:

1. Stabilization of higher activity waste streams;

2. Segregated disposal of low activity unstable waste streams from stable wastes;

3. Improving site stability through operation techniques such as improved backfilling and compaction; and

4. Reducing contact of waste with water.

Many of the the higher costs which would be associated with the stabilization of higher activity wastes represent activities that many waste generators are already carrying out to meet existing disposal facility license conditions.

5.1.3 Assuring Safety During Operations

The function of a near-surface radioactive waste disposal facility is to contain disposed radionuclides over the long term, and potential long-term impacts are of major concern in licensing an LLW disposal facility and in determining disposal requirements for specific types and forms of waste. However, protection of public health and safety during the operational phase of the disposal facility is also of concern when licensing the facility and regulating its operation. As part of the analysis performed in Chapter 6 of this EIS, NRC determined that existing standards in the NRC regulation 10 CFR 20 were an adequate performance objective for operational safety. The Part 20 regulation already provides standards for control of and limitation for release of radioactive materials to the environment from operations at NRC-licensed facilities, as well as limitations on the allowable radiation doses to radiation workers and the public.

5.2 Technical Requirements

Based upon the analyses for the performance objectives, a number of technical requirements were developed to help ensure that the performance objectives would be met. These technical requirements are set out in Subpart D of the Part 61 rule. (See Attachment A to this summary.) The technical requirements generally either fell directly from the analysis to determine the performance objectives or were developed based upon past experience and existing good practices. A given technical requirement frequently helps to ensure that more than one performance objective will be met.

Most of the technical requirements can be related to three key principles that are of most significance in assuring the performance objectives are met. These three principles are:

1. Long-term stability of the disposal facility and disposed waste. Trench cap collapse, subsidence, increased water infiltration,

and the need to actively care for the facility over the long term are all reduced if stability is ensured.

2. The presence of liquids in waste and the contact of water with waste both during operations and after the site is closed. Water is the primary vehicle for waste transport and its presence in and contact with waste can contribute to accelerated waste decomposition and increased potential for making the waste available for transport offsite.

3. Institutional and other engineering and natural controls that can be readily applied to reduce the likelihood and impacts of inadvertent intrusion.

The following chart summarizes the relative importance of each in helping to assure achievement of each of the performance objectives.

	Performance Objectives			
	Migration	Maintenance	Intruder	Operations
Long-term stability of waste and facility	Reduces water infiltration and thus the potential for migration.	Reduces uncertainty and need for long-term maintenance. Reduces long-term care costs.	Reduces likelihood for inadvertent intrusion. Reduces impacts to inadvertent intruder.	Reduces potential occupational hazards. Reduces off-site releases in the event of an accident.
Contact of water with waste	Reduces potential for migration and offsite transport of waste	Reduces need for active maintenance during and after operations.	Reduces waste degradation and thus impacts to intruder.	Reduces potential hazards. Reduces potential for offsite releases.
Institutional and other intruder controls	Custodial care during institutional control reduces potential for water infiltration.	Assures proper maintenance.	Reduces likelihood for inadvertent intrusion. Reduces impacts to inadvertent intruder.	Reduces potential occupational hazards.

As discussed below, safety during disposal facility operations is also an important consideration.

Stability

In translating these principles into technical requirements, NRC found that in general many were already being addressed in one way or another at one or more of the existing operating sites. For example, methods to improve site stability which are either already being carried out or may be readily implemented include improved, more stable waste forms and packaging for higher activity wastes, reducing void spaces between packaging placed in trenches, compaction of backfill material and trench covers, and use of institutional controls to continue to maintain and control site access after active operations cease.

The preferred alternatives selected will result in the least disruption of existing practices and will leave maximum flexibility in how stability can be achieved. The preferred alternative is to require that higher activity wastes must be placed into a stable form and segregated in disposal. Waste segregation is estimated to cost an approximate $6/m^3$ ($0.17/ft^3$) in additional disposal costs. Stability of the waste form can be achieved by several means:

1. The waste form itself (results in no increase in costs over those today);

2. Processing the waste to a stable form through techniques such as improved packaging, use of high integrity containers, or waste solidification (the costs for this can range from negligible additional packaging costs to an approximate additional $450/m^3$ for high integrity containers up to about an additional $2000/m^3$ in solidification costs. The costs are believed to be conservatively high. In any case, the industry is generally already moving toward this alternative and it is, therefore, not a significant change from existing practices);

3. Use of engineering design at the disposal facility. Many engineering design alternatives are possible including caissons filled with concrete and concrete-walled trenches. (The cost for a concrete-walled trench including use of concrete grout as a backfill material was estimated to cost an approximate additional $211/m^3$ ($6/ft^3$) in disposal costs.)

NRC also evaluated a number of facility design and operational improvements that are in many cases currently being applied at the existing operating sites to improve long-term site stability. These include waste placement, backfill, and compaction of backfill and trench covers. The use of specific design and operational techniques would be evaluated for a specific facility on a case-by-case basis as part of licensing that facility.

Contact with Water

A number of specific requirements relating to site characteristics, disposal facility designs and operating practices, waste forms and packages, and institutional controls are established which are directed at reducing the

contact of water with waste, both during operations and over the long term after closure (See Sections 61.50, 61.51, 61.52, 61.56, and 61.59). These included requirements that the site be free of areas of flooding or frequent ponding and providing sufficient depth to the water table that ground-water intrusion into the waste will not occur. They also included design features such as trench covers being designed to prevent water infiltration, to direct rainwater away from trenches and to prevent waste from sitting in rainwater in open trenches. Waste form requirements address the disposal of liquid waste. The minimum requirements provide that waste containing liquids must be packaged in sufficient absorbent material to absorb twice the volume of liquid. Higher activity wastes containing liquids must be converted into a stable form that contains not more than 1% free-standing liquid by volume.

Institutional Controls

Since the use of institutional controls to control site access and to monitor and care for the site over the long term is current practice, NRC included the costs for 100 years of active institutional control in the costs for the base case (reference) disposal facility. As such, this requirement reflects current practice and does not represent an increased cost over that today. The potential costs for maintenance of the site during this period can, however, vary depending upon the degree of site stability. As discussed above, the requirements in Part 61 directed at site stability should reduce the need and costs to actively maintain a site during this period.

Institutional controls (physical activities of man such as site surveillance or inspection) shall only be relied upon for 100 years following site closure to keep people from inadvertently intruding into the site and to carry out an environmental monitoring program and minor custodial care (see Section 61.59).

Safety During Operations

An applicant's or licensee's operational procedures and programs for compliance with the operational safety performance objective would be evaluated on a case-by-case basis. NRC staff believes that this approach would be preferable to setting out a number of prescriptive requirements for safe facility operation. Measures which could be used to minimize potential operational releases and exposures will be influenced by site-specific conditions at the particular disposal facility considered. Detailed prescriptive requirements would also inhibit incorporation of potential improvements in site safety. Some of the procedures and programs which would be analyzed as part of a specific application would include the following:

- The applicant's radiation safety program for control and monitoring radioactive effluents and occupational radiation exposure to demonstrate compliance with the Part 20 requirements and to control contamination of disposal facility personnel, vehicles, equipment, buildings, and grounds. Both routine operations and accidents would be addressed, and the program description would include procedures, instrumentation, facilities, and equipment.

2. Consideration of potential hazard to an individual or a population from potential consumption or use of contaminated ground-water.

A classification system based on these two considerations--intrusion and migration--presents some difficulties in calculating acceptable concentration limits for waste. The calculation of concentration limits for exposures to an inadvertent intruder are relatively straightforward since the potential exposures are directly related to the concentrations of the radionuclides available for uptake. In addition, potential intruder exposures are relatively less site-specific.

It is considerably less straightforward to set out categories of waste based upon consideration of ground-water migration. Potential ground-water migration impacts could occur from consuming water from a well located onsite, consuming water from a well located at the site boundary, or to populations consuming water down-gradient of the site. Potential migrational impacts are much more a function of site-specific environmental and geohydrological conditions than concentration-limited intruder impacts. Potential migrational impacts are furthermore a function of the total inventory of radionuclides at a disposal site.

Combining these two considerations, the approach that has been taken is to first determine waste classification requirements (based upon concentration limits) considering protection of a potential inadvertent intruder. Second, based on the analyses in Chapter 5, four radionuclides were identified that are of significance from the standpoint of migration. These are H-3, C-14, Tc-99, and I-129. These nuclides have been addressed on a site-specific inventory basis. That is, the total quantity of these four radionuclides acceptable for disposal at any particular site will be determined as part of the licensing process based on the specific hydrogeological conditions, facility designs, and operating procedures at the site. The waste classification procedure proposed by NRC is summarized as Table 1 in the attached Part 61 rule (see Section 61.55 of the rule).

6.1 Classes of Waste

Three classes of waste are determined by the Part 61 requirements:

1. Wastes for which there are no stability requirements but which must be disposed of in a segregated manner from other wastes. These wastes, termed Class A segregated wastes, are defined in terms of maximum allowable concentrations of certain isotopes and certain minimum requirements on waste form that are necessary for safe handling.

2. Wastes which need to be placed in a stable form and disposed in a segregated manner from unstable waste forms. These wastes, termed Class B stable wastes are also defined in terms of allowable concentrations of isotopes and requirements for a stable waste form as well as minimum handling requirements.

3. Wastes which need to be placed into a stable form, disposed in a segregated manner from nonstable waste forms, and disposed of so that a barrier is provided against potential inadvertent intrusion

- The applicant's quality assurance program for siting, design, construction, and operation of the disposal facility, and the receipt, handling, and emplacement of waste. Audits and managerial controls would be included as part of this program.

- The applicant's procedures and plans for construction and operation of the disposal facility. These would include methods of construction; waste emplacement; procedures for and areas of waste segregation; types of intruder barriers; onsite traffic and drainage systems; methods and areas of waste storage; and methods to control surface water and ground-water access to the wastes.

- The applicant's environmental monitoring program to provide data to evaluate potential health and environmental impacts, as well as plans for taking corrective measures if migration of radionuclides is indicated.

- The applicant's administration procedures to control activities.

- The applicant's physical security measures.

- If the application includes the proposed receipt, possession, and disposal of special nuclear material, the procedures and provisions for criticality control.

Despite this, however, NRC analyzed some potential impacts associated with facility operation and concluded that many of the same requirements that would reduce long-term environmental impacts and impacts to a potential intruder would also help reduce operational impacts. For example, segregated disposal of low activity compressible wastes from stabilized high activity waste--which reduces exposures to an inadvertent intruder, reduces ground-water migration and reduces long-term maintenance of the disposal facility--would also tend to reduce the impacts of a potential accidental fire in a disposal cell. Stabilizing high activity waste streams reduces the impacts of a waste container potentially dropped accidentally from a height and releasing part of the container's contents.

Finally, NRC identified some specific general waste form and packaging requirements that have been developed and applied in the past at disposal facilities. These requirements provide protection of the health and safety of site workers, facilitate handling of waste, and minimize the potential for releases to offsite areas. These requirements have been condensed from consideration of current practices at existing disposal facilities and are summarized in Section 61.56 of the proposed rule as minimum waste form and packaging criteria.

6. WASTE CLASSIFICATION

Based upon the analyses in Chapters 4 and 5, there are two fundamental mechanisms to classify wastes for long-term hazard:

1. Consideration of potential hazard to an inadvertent intruder due to direct contact with the disposed waste; and

after institutional controls have lapsed. These wastes are termed Class C intruder wastes and are also defined in terms of allowable concentrations of isotopes and requirements for disposal by deeper burial or some other barrier.

Upper concentration limits are also defined for Class C waste. Wastes containing concentrations higher than the upper limits would be generally unacceptable for near-surface disposal. The disposal of such wastes should be subject to case-by-case determinations depending upon the specific waste forms and disposal techniques. In addition, four isotopes--H-3, C-14, I-129 and Tc-99--require site-specific inventory considerations to assure the performance objective for long-term environmental protection is not exceeded.

6.2 Maximum Average and Allowable Concentration Limits

The radionuclides concentrations calculated by NRC represent maximum average concentrations in disposed waste. If they were applied as allowable concentration limits, the actual average radionuclide concentration in the disposed waste in any disposal facility would be less and, in most cases, significantly less than the calculated maximum average concentrations. This is due to the mixing or dilution of all the various waste stream packages containing varying concentrations of radionuclides during disposal.

To help in maintaining exposures to levels as low as reasonably achievable, the NRC staff believes that calculated maximum average concentrations should be used. This reduces the potential long-term hazard from long-lived radionuclides. NRC staff also believes, however, that there should be flexibility and that exceptions should be considered when there is good reason to do so.

A specific example in this letter is the isotope Cs-137. This isotope, which is a beta-gamma emitter having a half-life of about 30 years, is present in significant quantities in some wastes. For example, from 25 to 75 percent of the activity in spent LWR resins can be due to Cs-137. In the analyses performed in Chapters 4, 5, and 6, concentrations of Cs-137 were used which were based upon geometric means of a number of data points. However, there was a considerable range in the concentrations. It is therefore possible that the analysis in Chapter 4 could underestimate the volume (and costs) of LWR wastes which would have to be processed and disposed by more expensive means. If the Cs-137 concentrations were a factor of 10 higher, the overall intruder hazard at 100 years would be increased some, but the volume-weighted hazard would still be less than 500 millirem/yr. Use of the higher concentrations would not effect the long-term potential hazard.

The Cs-137 concentrations were, therefore, raised by a factor of 10 for Class B and Class C waste, and for the maximum concentration generally acceptable for near-surface disposal. A somewhat higher factor--i.e., 20--was applied to the interface concentration between Class A and B wastes to account for the preponderance of trash in Class A waste which contain very low concentrations of cesium or none at all. As noted, increasing the cesium concentration does increase the short-term potential hazard somewhat but not above the 500 mrem/yr performance objective. The long-term potential hazard does not change.

6.3 Transuranic Isotopes

Based upon work performed for this environmental impact statement as well as work performed by others, NRC decided not to raise the existing working limit of 10 nCi/gm for transuranic isotopes. This decision is based on several factors. For most of the alpha-emitting transuranic radionuclides, the maximum average concentrations calculated were in the range of 10 nanocuries per gram. As noted above, these concentrations are conservative in that they do not consider credit for dilution by other wastes.

In the spirit of the ALARA concept, the lower value of 10 nCi/gm has been demonstrated as an achievable concentration to control the disposal of transuranic nuclides by near-surface disposal. This value has been imposed by the Department of Energy for some eleven years and by most of the commercial disposal site operators for nearly that long. The last commercial site imposed the 10 nCi/gm restriction in 1979. In addition, it is believed that most of the potential for economic gain that would result from a higher limit (say in the range of 100 nCi/gm) could be negated by current limitations in routine measurement techniques. There is also a tendency toward a more conservative assessment of the hazard of certain transuranic nuclides (e.g., as in ICRP-30) and it does not seem prudent at this time to use higher values. In adopting the existing limit of 10 nCi/gm, NRC staff recognizes that the principal concern regarding potential future health hazards of TRU disposal is due to long-lived alpha activity. One exception to this rule would be Pu-241, which is a beta emitter which decays with a 13.2 year half-life to Am-241, which is an alpha emitter having a half-life of 458 years. The ratio of the specific activity of Pu-241 to Am-241 is about 35. Thus, to maintain an equivalent limit for alpha emitters of 10 nCi/gm, a limit of 350 nCi/gm will be allowed for Pu-241.

6.4 Isotopes Not Included in Table 1

NRC calculated and set out in Table 1 of the proposed Part 61 rule, limiting concentrations for 11 isotopes having half-lives over 5 years; natural, depleted, and enriched uranium; plus transuranic radionuclides. These are believed to generally cover many, if not most, of the longer-lived radionuclides currently delivered to a disposal facility. Of the hundreds of radioactive isotopes that have been identified, most have half-lives not exceeding 5 years. A limit for isotopes with a half-life of less than 5 years is also included in Table 1. For Classes A, B, and C waste, the concentration limit for Co-60 was used. As shown in the table, there is no upper bound allowable concentration for such isotopes since the calculated limits exceed the natural specific activity of the isotopes. Using the Co-60 concentration for Classes A, B, and C is believed to be conservative since Co-60 has a half-life greater than 5 years and emits two energetic gamma rays.

NRC also recognizes that there are several other isotopes (e.g., thorium and radium) for which concentration limits should be developed. Others may also be identified. NRC plans to analyze development of limits for such radionuclides subsequently. In the meantime, some working concentration limits should be considered for isotopes not presently analyzed. For these, NRC believes a reasonable, yet conservative, approach would be the following:

- Use of values for Sr-90 for beta-emitting isotopes with little or no gamma radiation;
- Use of values for Cs-137 for beta-emitting isotopes having significant gamma radiation; and
- Use of values for enriched uranium (U-235) for alpha-emitting isotopes other than radium.

For radium, no limits are established as of yet. In addition, NRC calculated limits for U-235 and U-238 and applied them as the limits for enriched uranium (U-235) and natural and depleted uranium (U-238). The use of U-238 for depleted uranium appears acceptable, but a calculated limit may be different for natural uranium which would include consideration of daughter isotopes. As noted above, NRC plans to further develop in the near future limits for nuclides not presently analyzed, including limits for natural uranium, U-233, and other isotopes.

6.5 Mixtures of Radioisotopes

Table 1 lists concentrations for single isotopes. However, LLW packages delivered to disposal facilities seldom contain just one radioisotope; generally, the waste packages contain a mixture of radioisotopes. To account for this mixture, NRC staff proposes to apply a sum-of-the-fractions rule similar to that described in Table II of the existing 10 CFR Part 20. That is, the sum of ratios of an isotope concentration in waste to the concentrations in the table shall not exceed unity for any waste class. That is,

$$\frac{C_a}{C'_a} + \frac{C_b}{C'_b} + \frac{C_c}{C'_c} \leq 1, \text{ where}$$

C_a, C_b, C_c = concentrations in waste of isotopes a, b, and c;

C'_a, C'_b, C'_c = limiting concentrations in a given waste class for isotopes a, b, and c.

In addition, concentrations may be averaged over the volume of any package. For example, for a 55-gallon drum, the concentration limits may be multiplied by a factor of 200,000 (the approximate volume of a 55-gallon drum in Cm^3) to determine the allowable total activity that could be placed in a 55-gallon drum.

6.6 Implementation of Waste Classification

To implement a waste classification requirement, it will be necessary for waste generators to identify and quantify specific radionuclides in the final waste form as shipped for disposal.

In some cases, the identity and concentrations of radionuclides in each waste package will be extremely difficult to determine--particularly for radionuclides which require complex, expensive, and time-consuming analytical procedures.

Thus, in some cases, it is not practical to determine the concentrations of all relevant radionuclides by direct measurement. One solution could be to routinely measure only those radionuclides that can be reasonably and accurately measured without terribly expensive and sophisticated techniques. Concentrations of other radionuclides would be scaled to the measured radionuclides based upon existing or generator-specific data.

For purposes of review and comment, NRC has prepared a specific example on the use of scaling factors and action levels for LWR waste streams which is set out in Chapter 7 of the main text. The example reflects the type of guidance which could be set out in a regulatory guide on classification of waste. Two radionuclides which are present in relatively high concentrations in LWR waste streams and can be readily measured by gamma spectroscopy are Co-60 and Cs-137. In the procedure, these two isotopes would be routinely measured and the concentrations of other radionuclides would be estimated based upon scaling factors developed from either data specific to the facility or from a set of reference scaling factors developed from existing data.

7. ADMINISTRATIVE, PROCEDURAL, AND FINANCIAL ASSURANCE REQUIREMENTS

This section summarizes the principal administrative, procedural, and financial requirements set out in the proposed Part 61 rule. The principal administrative and procedural requirements on disposal facility operators are presented first (in Section 7.1), and are discussed in the context of the expected life cycle of a typical LLW disposal facility. The financial requirements are then presented in Section 7.2. Finally, the proposed new waste manifest tracking system, which effects waste generators and waste transporters as well as disposal facility operators, is discussed in Section 7.3.

7.1 Procedural and Administrative Requirements on Disposal Facility Operators

The life cycle of a disposal facility can be divided into five phases: (1) preoperational phase, (2) operational phase, (3) closure phase, (4) observation and maintenance phase, and (5) institutional control phase. These five phases are summarized in Figure S.2 and discussed in more detail below.

Preoperational Phase

The preoperational phase consists of disposal site selection, characterization, and licensing. Disposal site selection and characterization is a period of data gathering and planning. The applicant selects a region of interest and searches for a number of possible disposal sites (a slate of candidate disposal sites) using reconnaissance-level information. The applicant then narrows the possible sites down to one. After a proposed disposal site has been selected, the applicant begins a detailed investigation (geology, depth to ground-water table, amount of rainfall, etc.) of the proposed disposal site. The applicant also initiates the preoperational monitoring program.

The applicant prepares an application for the land disposal facility following Subpart B of Part 61. The applicant also prepares an environmental report. Of particular importance to this application are the methods by which the applicant

Figure S.2 Life Cycle and Financial Assurances for a Disposal Facility Following the Proposed 10 CFR Part 61

Time in Years	Activity	Form of Financial Assurance
1-2 yrs	Site Selection and Characterization	Licensee responsible for costs incurred
1-2 yrs	Licensing Activities	Licensee responsible for costs incurred including licensee fee
		Site closure plan including cost estimates for closure is submitted as part of licensee application
		Lease arrangement with long-term care arrangements for financial responsibility between licensee and state submitted for review to NRC for adequacy
		Licensee obtains adequate short-term sureties to provide for closure
20-40 yrs	License Issued; Site is in Active Operation; Waste Received	Short-term sureties in place for closure: NRC periodically reviews and requires updating to account for changes in inflation, site conditions, etc.
		NRC periodically reviews revisions to lease arrangements to ensure that arrangements for financial responsibilities for long-term care are adequate
1-2 yrs	Site Closure and Stabilization	Costs covered from short-term sureties, if necessary; otherwise, licensee performs activities
		Lease arrangement between site owner and operator for long-term care is still in effect
5-15 yrs	Observation and Maintenance	Licensee still responsible for all further costs during this period, with short-term assurances still in place
100 yrs	License Transferred to Site Owner; "Active Institutional Control Period"	Terms and conditions of lease are met, and either state or licensee provides funds to pay for all required and necessary activities of this period

will comply with the Part 61 performance objectives and technical requirements, the preliminary site closure plan, arrangements concerning land ownership and associated responsibilities, and financial assurance.

Licensing activities begin when the applicant files the application. Prior to docketing, the application is reviewed for completeness and acceptability in accordance with the new ¶2.101(b)(2). A notice of receipt of the tendered application is published in the Federal Register. The Commission notifies state, local, and tribal officials and begins to coordinate with these officials. Once docketed, the application is again noticed in the Federal Register and the application and accompanying environmental report widely distributed. An opportunity for interested parties to request a hearing is provided pursuant to 10 CFR 2.105. Application fees are paid in accordance with 10 CFR Part 170.

The regulatory review period follows. The applicant continues any disposal site studies and the preoperational observation and monitoring. The applicant also responds to informational requests from NRC. Section 61.3 requires that construction not begin until a decision is made to issue the license. The application and environmental report are updated if necessary.

Based upon the application, environmental report, and any additional information, the Commission prepares a draft environmental impact statement (DEIS) and publishes it for public comment. Based upon public comments and any additional information, the staff prepares and publishes a final environmental impact statement (FEIS). If hearings are requested, an Atomic Safety and Licensing Board (ASLB) is appointed. Hearings, if any, would be held in accordance with existing rules in 10 CFR Part 2. An Atomic Safety and Licensing Appeal Board and/or the Commission may review the findings of the ASLB, or the ASLB findings may be appealed to these next levels and to the courts. Upon resolution of the hearings, reviews, and appeals, the Director* takes final action to issue or deny the application in accordance with the criteria in Section 61.23, plus any conditions rendered by the Licensing or Appeals Boards or the Commission. A notice is published in the Federal Register in accordance with Section 2.106. If the ownership of the land has not been transferred to the state or federal government, transfer would now take place. If the license is issued, it is subject to the general license condition in Section 61.24 and to specific conditions as required.

States and Indian tribes may participate in the Commission's license review process. Subpart F of the proposed Part 61 rule addresses such participation, which is in addition to participation as already provided in Parts 2 and 51. Examples of the forms that state and tribal participation may take include:

1. Development of technical data, including but not limited to, socio-economic, hydrological, geological, environmental, or land use data for incorporation into the Commission's environmental impact statement on the application or other analyses.

*The "Director" means the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

2. Development of public participation mechanisms to be included in the licensing process.

3. Provisions of a technical data base to provide verification to the Commission for materials presented in the license application.

4. Exchange of state and Commission staff for cooperative review.

Operational Phase

After issuance of a license by the Commission, the land disposal facility is constructed and waste receipt and disposal operations start. At intervals specified in the license (the normal term for materials licenses is currently 5 years), the licensee would be required to submit a license renewal application (Section 61.27). At this time, the disposal site closure plan and funding requirements would be updated and financial arrangements for assurance of adequate funding reviewed. A public hearing would be offered. The licensee may also apply for amendments to the license at any time during the operational phase (Section 61.26).

Disposal Site Closure Phase

As the disposal site becomes filled, the time for disposal site closure approaches. Prior to closure, the licensee would submit a final closure plan for review and approval (Section 61.28). A public hearing would be offered. Upon approval, the licensee implements the plan. This would consist of decontamination and dismantlement, as appropriate, of buildings or other site facilities. Final disposal site contouring and preparation is performed. The licensee should work toward closure during the entire operational phase so that disposal site closure would not involve a major task.

Postclosure Observation and Maintenance

Implementation of the closure plan would be followed by a period of postclosure observation and maintenance on the part of the licensee, in which the licensee's monitoring and maintenance programs would continue.

This period is expected to last about 5 years and will help assure that the disposal site is in a stable condition so that only minor care, surveillance, and monitoring by the custodial agency are required. When the disposal site has reached a stable condition, the licensee may prepare and submit an application for transfer of the license. A public hearing would be offered. Among other things, the licensee must provide reasonable assurance that the site meets all performance objectives under Subpart C, and the Commission must find that the state or federal agency responsible for postclosure care of the site is prepared to assume these responsibilities. As a condition for assuming these responsibilities, a state may require the licensee to comply with requirements of its own, as long as the state's requirements are not inconsistent with the requirements of the Commission. Upon a satisfactory finding, the license will be transferred to the federal or state custodial agency to cover their activities during the active institutional control period (Section 61.30).

Institutional Control Period

During the institutional control period, which for purposes of Part 61 the Commission assumes to be not more than 100 years, the custodial agency carries out a program of monitoring and physical surveillance to assure continued satisfactory site performance, as well as other minor custodial activities. As a part of the license termination requirements, the licensee is required to place records of the disposal facility with local, state, and federal agencies. These records along with restrictions on the property deed and trench markers should help minimize disturbance of the disposal site. These latter mechanisms are those that would continue after the active institutional control period. At the end of the necessary institutional control period, the custodial agency license may be terminated (Section 61.31).

7.2 Financial Assurance Requirements

Financial assurance requirements for low-level waste disposal facilities are needed to help ensure the long-term protection of public health and safety and the environment. A review by the staff of the operating experiences at both hazardous waste and LLW disposal sites reveals that operators of both types of sites did not adequately plan for closure and long-term care activities. With respect to LLW sites, the state and federal governments recognized the need to care for the sites over the long term. The sites had to be located on land owned by the federal or state government and funds were collected for long-term care activities. In most cases, however, the funds collected for long-term care activities (e.g., the Maxey Flats, Kentucky site) were not adequate and there was essentially no financial planning for contingencies that might occur (e.g., the need to pump trenches and treat trench leachate). In addition, until recently little planning or financial assurance was provided for funding final closure and stabilization of the existing sites. This has led to a situation where financial responsibility for the continued assurance of protection of the public health and safety at several of the existing closed sites already has or could become a responsibility of the state or federal government. Closure, postclosure, and active institutional control costs are generally incurred after the site operator is no longer receiving revenues from waste generators. Thus, proper planning during the operating phase when revenues can be accrued is essential.

Based on these considerations, there is a strong need for regulatory requirements to ensure that: (1) the licensee has sufficient financial resources to construct and operate the facility and to provide for final closure and postclosure care of the site and (2) the licensee provides financial assurance for the active institutional control period after the site is closed and stabilized. The staff believes these closure and active institutional care costs should be identified early and should be provided for as part of the necessary costs of operating a site. Financial assurance mechanisms to provide for these costs should be established during the active operating period of the site, when revenues are still being received by the licensee and he has access to financial resources. The need for stringent financial requirements to ensure that the licensee is financially responsible has been voiced by a number of sources, including the U.S. General Accounting Office and the National Conference of Radiation Control Program Directors. Financial assurance requirements are set out in Subpart E of the proposed Part 61 rule.

7.2.1 Requirements for Short-Term Financial Assurances for Operations, Closure, and Postclosure Observation and Maintenance

Given the past history at some of the existing disposal sites, one of the requirements in the Part 61 rule is assurance of adequate financial qualification on the part of the applicant to construct and operate the disposal facility and to provide adequate financial provisions for disposal site closure and postoperational activities.

Short-term financial assurance mechanisms refer to arrangements intended to ensure that the licensee is financially responsible for undertaking required closure, stabilization, and postclosure activities at a low-level waste site, and would be particularly based on a specific site closure and stabilization plan. The amount of financial assurance required would be based on cost estimates submitted by the licensee in an approved plan for disposal site closure and stabilization. In the proposed rule, the applicant must submit a cost estimate for disposal site closure that includes consideration of inflation, increases in the amount of disturbed land, and the closure and stabilization activities that have already occurred at the disposal site. As used in the Part 61 rule, the concept of financial assurances does not include any requirements for third party liability coverage for damages to people or property resulting from operation of the facilities.

The proposed rule requires applicants to provide proof of financial qualifications prior to the commencement of construction of the disposal facility. Proof of the financial qualifications of applicants is not currently required by Parts 30 and 40. Requiring such financial qualification in the Part 61 rule will help assure that resources are not expended on projects without adequate backing and should minimize the potential for early default or the abandonment of the site by the operator.

The NRC has received strong public interest concerning the issue of financial responsibility for closure of a disposal site. Numerous written comments were made on this portion of the preliminary draft regulation, and the issue was also raised at all four workshops held to review this regulation. Many commenters felt that the licensee should be held responsible for the full costs of closure of a disposal site, and that the license should not be terminated and the land returned to custodial government authority until the licensee has completed satisfactory closure.

There are a variety of short-term financial assurance mechanisms that could be used by a low-level waste disposal facility operator to assure that sufficient funds are available for closure and postclosure care. Short-term financial assurance mechanisms considered by the staff included the following:

1. Surety bonds, obtained from a surety company;

2. Escrow arrangements between a bank, the government, and the licensee;

3. Trust funds, arranged between the government, a financial institution, and the licensee;

4. Certificates of deposit to a state or federal agency;

5. Cash deposits to a state or federal agency;

6. Deposits of securities to a state or federal agency;

7. Secured interests in the disposal operator's assets;

8. Letters of Credit from a financial institution;

9. Self-insurance by the low-level waste disposal facility operator;

10. Financial tests of the operator or his holding company;

11. Development of a sinking fund based on receipts from surcharges on received wastes; and

12. Development of a closure assurance pool.

These types of financial assurances are standard commercial law arrangements currently being used by state and federal government agencies for the chemical waste disposal, uranium milling, low-level waste disposal, and surface coal mining industries. The staff considers these to be reasonable alternatives for consideration in this EIS.

The primary criterion considered by the staff in evaluating these alternative financial mechanisms was the degree of assurance provided by each method to ensure that funds are available to close the disposal site and to provide for all necessary activities to protect the public's health and safety. Other criteria considered by the staff included the following:

- The degree of security (or level of difficulty) in obtaining funds in case of default.

- The administrative time and expense required by the regulatory agency to implement and monitor the financial assurance mechanisms.

- The cost to the licensee of utilizing the financial assurance mechanism.

Conclusions

Based on the review of the alternative financial assurance mechanisms, the staff concluded that a number of financial assurance mechanisms exist that will provide adequate public protection to ensure that funds for closure and postclosure exist in the event that the site operator defaults or unforeseen site conditions require early closure of the site. The alternatives that the staff finds generically acceptable for a disposal facility licensee are:

- surety bonds
- trust funds
- escrow arrangements
- cash deposits

- certificates of deposit
- deposits of government securities
- irrevocable letters of credit
- combinations of the above

These alternatives were all found to be acceptable because they did not impose a significant economic burden on the license, they did not impose an administrative burden on the staff, and yet they each could be structured to ensure a high degree of confidence that funds would be available to ensure proper closure. The staff has also concluded that approving a range of satisfactory financial assurance alternatives allows the operator flexibility in selecting the mechanism that best suits his needs. These requirements are set out in Section 61.62. While the other financial assurance mechanisms discussed earlier may be acceptable in certain isolated cases, they are not acceptable to the staff on a generic basis. Plans for alternative financial assurance mechanisms not discussed here would be evaluated and approved by the staff on a case-by-case basis. The costs for short-term financial assurances have been included as part of the costs for the reference facility.

7.2.2 Requirements for Long-Term Financial Assurances for Institutional Care.

Based on a review of the operating history at existing LLW disposal sites, the staff finds that financial responsibility for long-term care (active institutional control) should be established prior to issuance of the disposal facility license. A review of the history of commercial low-level waste sites in this country indicates that there has been continuing concern by the public and by regulatory authorities over long-term financial responsibility for low-level waste disposal sites. In addition to questions over the equity issues of who pays for active institutional control over the site, the government and the public are concerned that funds be readily available for postoperational activities to ensure that the public's health and safety are continually protected.

Financial assurances for active institutional control involve the financing of any required activities at a low-level waste site after termination of the disposal facility license. These funding assurancies would cover surveillance, monitoring, and any necessary maintenance to assure that the stability and integrity of the site is maintained and that there are no disruptive human activities at the site for up to 100 years. The proposed requirements do not cover unanticipated contingencies that may occur at the site. Based on these considerations, the Commission staff concluded that requirements for financial guarantees for active institutional control should be included in the proposed Part 61 regulation.

A review of the various financial assurance mechanisms commonly used in the commercial law area (see Section 9.3.3 of the main text) revealed that few, if any, of these mechanisms are suitable for the long-term nature of a long-term financial assurance mechanism. The extended time period (100 years) means that few financial institutions are willing or able to handle that type of long-term financial assurance. There are, however, several other alternative long-term financial assurance mechanisms that can be used for active institutional control at a disposal site. Several criteria were applied in reviewing the adequacy

of alternative financial assurance mechanisms for long-term care. The staff considered that the most important consideration for long-term financial assurances was the extent to which they were able to provide a guarantee that the necessary funds would be produced by the responsible parties. Another necessary consideration was the extent to which enabling authority existed to allow the Commission staff to require a specific financial assurance mechanism. Several of the financial assurance mechanisms proposed by various parties would require enabling legislation that is currently lacking at the federal level. Financial assurance mechanisms reviewed by the staff included a sinking fund funded by a surcharge recovered from disposal facility customers, an LLW disposal "superfund," and a lease or a legally binding arrangement.

Conclusions

The staff has determined that all low-level waste disposal site operators must establish evidence of financial responsibility to provide for long-term care of the site during the active institutional control period. Financial responsibility for long-term care must be demonstrated prior to the issuance of the facility license, including costs for all required and necessary activities at the site, including surveillance, monitoring, and required maintenance. States regulating existing commercial low-level waste disposal sites have traditionally required licensees to establish sinking funds based on surcharges collected from the disposal facility customers, along with leases between themselves and the operator specifying financial responsibility for long term care of the site. The staff is aware of the benefits of requiring disposal operators to require a surcharge on waste generators which is consequently deposited into a sinking fund and then invested. Such a cost recovery mechanism directly charges the benefiting parties (i.e., the waste generators) with the costs of long-term care. However, this approach cannot be required by the Commission, since the Commission lacks the legal authority to: (a) require that a long-term care fund be established and (b) require that the operator impose a surcharge on waste generators.

Since the Commission lacks the authority to explicitly require that a surcharge be imposed and a sinking fund be established, the staff considers that the next best regulatory alternative is to require that the operator be party to a binding arrangement such as a lease between himself and the site's landowner which establishes evidence of financial responsibility. (Current Commission regulations require the state or federal government to be the site landowner.) The staff is aware of the shortcomings of such an approach, but considers this the most viable regulatory alternative based on the current statutory authority of the Commission. Such regulatory requirements will help to ensure that the licensee or the site owner is responsible for performing all required long-term care activities that are necessary to protect the public health and safety and the environment. These requirements are set out in Section 61.63.

The staff has included the costs for 100 years of active institutional control into the cost of the reference facility as well as the alternatives considered in the EIS. The actual costs of long-term care, however, will vary depending upon the level of active maintenance required under varying disposal facility conditions. Long-term site stability will significantly reduce and possibly eliminate the need for any major maintenance and cost over the long term.

7.3 Manifest Tracking System

Section 20.311 of Part 20 establishes the requirements for a manifest tracking system for wastes. The system will address the need for more complete information on the classification and characteristics of the waste, for improved accountability of wastes, and for a better data base. The General Accounting Office (GAO) noted the need for improvements in these areas in its report entitled "The Problem of Disposing of Nuclear Low-Level Waste: Where Do We Go from Here?" published March 31, 1980. The GAO recommended that the Commission "determine who the generators of low-level waste are in both the Agreement and non-Agreement States and how much waste each licensee is generating" and "establish a method to track waste from the point of generation to the point of disposal." Improving the data base on waste characteristics will improve the credibility of decision-makers, enable better planning for inspections and emergencies, enhance projections of future waste generation, and help in site-specific analyses and planning. The information on waste classification and characteristics is necessary for proper handling and disposal at the land disposal facility (e.g., which waste requires intruder barriers).

Licensees who ship under existing regulations are required to prepare and forward shipping manifests that comply with DOT regulations. The proposed manifest content requirements in Section 20.311 are somewhat more comprehensive but compatible with DOT requirements. The waste generator must be specifically identified. The information requirements concerning the waste itself are somewhat more extensive and geared to information needed for disposal, not just transportation and handling. More explicit information on chemical content, waste composition, and solidification agents is required. Licensees are required to comply with and certify compliance with waste form requirements of Part 61. This latter requirement stems solely from the technical requirements for disposal and is therefore new. The land disposal facility licensee must record data on the condition of the waste itself and document and certify receipt, handling, repackaging, storage, and disposal.

The use of the manifests as provided for in Section 20.311 provides a tracking system that is inspectable. The LLW manifest tracking system is somewhat similar to the manifest tracking system recently instituted by EPA for nonradioactive hazardous wastes. Section 20.311 requires that the shipper precede and accompany shipments with copies of the manifest and investigate if notification of receipt or disposal is not received. The responsibility for tracking shipments is with the shipper who may also be the waste generator, a service company who collects, stores and delivers the waste, or an intermediate processor. A crosscheck is provided to ensure that delayed or missing shipments are investigated by requiring land disposal facility operators to periodically match advance copies of manifests to those for shipments actually received.

8. UNMITIGATED IMPACTS

As part of the EIS, NRC analyzed the potential unmitigated impacts of the proposed Part 61 regulation. In some cases, these unmitigated impacts are presented as total estimated exposures, costs, or other impacts from LLW management and disposal. In other cases, particularly when it was more convenient to

do so due to lack of data, impacts are presented as incremental impacts to those which could occur without the Part 61 regulation. The unmitigated impacts are quantified to the extent practicable. Some impacts, however, can only be addressed in general terms.

Both direct and indirect impacts will occur as a result of the proposed Part 61 rule. Direct impacts are discussed first and, because this EIS is being prepared for a rulemaking action, the direct effects of the action do not fall upon the physical and natural environments, but rather upon those segments of the human environment whose conduct of affairs will be affected by the change in regulatory requirements. Among the directly affected groups are:

- Waste generators and processors;
- Waste transporters;
- Waste disposal facility operators;
- Federal agencies and the states; and
- The public.

Potential indirect impacts are addressed secondly. To estimate these impacts the performance objectives and minimal technical criteria established in this EIS are applied to four reference disposal facilities assumed to be constructed and operated on the four hypothetical regional sites.

8.1 Environmental Consequences Occurring Directly as a Result of the Proposed Part 61 Rule

Impacts on Federal Agencies

There are a number of federal agencies which have responsibilities relative to low-level waste management. These agencies are: NRC, the Environmental Protection Agency, the Department of Energy, the Department of Transportation, and the U.S. Geological Survey.

In general terms, the chief impact of the adoption of 10 CFR Part 61 on NRC would be to more clearly define to the staff the established policies, licensing procedures, and performance objectives governing LLW disposal. It would also help ensure that LLW disposal facilities are treated uniformly in terms of complying with the above regulations and procedures.

The Environmental Protection Agency (EPA) is charged with the responsibility of protection and enhancement of environmental quality and it carries out its mission through research, monitoring, regulatory, and enforcement functions. An important EPA role with regard to low-level radioactive waste management is in the establishment of generally applicable environmental standards for waste disposal. The agency does not license radioactive waste disposal facilities. The technical criteria established in the rule will not impact the ongoing EPA program for establishing overall environmental standards for waste disposal. Rather, the NRC rulemaking effort may advance EPA's efforts in this regard.

The Department of Energy (DOE) is responsible for managing disposal of low-level radioactive waste generated by government operations and for conducting research into various aspects of radioactive waste disposal. Disposal of LLW by DOE is

exempted from NRC licensing authority and would remain so under the proposed Part 61 rule. One impact of the Part 61 rule on DOE would occur if DOE resumed using commercial disposal facilities for disposal of DOE LLW. Under this situation DOE would have to ensure that its waste conformed to applicable parts of the new rule.

Transportation of radioactive materials in the United States is jointly regulated by the Department of Transportation (DOT) and NRC. DOT regulates all radioactive materials in interstate commerce while NRC regulates the transportation of byproduct, source, and special nuclear material. NRC's existing regulations for transport reflect the requirements of DOT and the situation will remain the same under the proposed Part 61 rule. As a byproduct of the proposed rule, the stability requirements for higher activity wastes will help improve transportation safety, as will the minimum waste form requirements intended to improve operational safety at the disposal facility.

Impacts on the States

Promulgation by NRC of the proposed Part 61 regulation will have impacts on the states in addition to these realized by industry and federal agencies. These impacts will primarily affect those states which have entered into Agreements with NRC for regulation of certain radioactive materials--i.e., the Agreement States. The promulgation of 10 CFR Part 61 would mean that the Agreement States would have to modify their regulations to include provisions compatible with the new NRC regulation. This process of modification would involve, at a minimum, the following steps:

- Preparation of draft regulations to reflect the requirements of Part 61;
- Review and approval of proposed regulations by NRC; and
- Public review and formal incorporation into state code.

Impacts on the Public

Promulgation of the proposed Part 61 rule by NRC will impact the public most significantly. The purpose of the rule is to provide improved safeguards for protection of public health and safety and the environment, but despite these improvements, the technology of waste disposal is not risk-free. Whatever risks remain in the presence of the operative rule will be borne by the public, as will the ultimate costs of implementing the rule.

The requirements of the Part 61 regulation are expected to result in beneficial impacts to the public in three major areas. First, the implementation and enforcement of performance objectives and uniform minimum technical requirements will improve the performance of LLW disposal facilities and thereby reduce the hazards of LLW disposal to public health and safety and environmental quality. Second, the requirements of the Part 61 rule should assure that near-surface disposal remains a safe viable option for the disposal of LLW. Finally, the Part 61 rule provides public benefits in the form of more explicit provisions for participation in the licensing process for future LLW disposal facilities.

There will also be adverse impacts. The first of these impacts will be residual environmental and human health hazards resulting from LLW disposal. Despite the provisions of the Part 61 rule, the variables and processes involved in LLW disposal are sufficiently complex that unmitigated impacts cannot be avoided. Secondly, implementing the requirements of Part 61 will involve costs to the disposal facility operators, waste transporters, and waste generators. Finally, implementation and enforcement of the provisions of the Part 61 rule will require the allocation of federal and state resources during the operational and post-operational periods of an LLW disposal facility.

8.2 Environmental Consequences Occurring Indirectly as a Result of the Proposed Part 61 Rule

This section discusses the indirect impacts of the proposed Part 61 regulation. To estimate these impacts the performance objectives and minimal technical criteria established in the EIS are applied to four reference disposal facilities assumed to be constructed on the four hypothetical regional sites discussed in Chapter 3 of this summary. The site descriptions include three disposal facilities located in humid environments (northeast, southeast, and midwest sites) and one (southwest site) located in a semiarid climate. A wide range of environmental properties are represented.

8.2.1 Assumed Regional Disposal Facility Designs and Waste Source Term

This section provides a description of the disposal facilities assumed to be situated at the regional sites discussed in the preceding section, as well as the wastes which are assumed to be disposed in the facilities. The examples are intended to illustrate an upper bound range of impacts from implementation of the rule, with the expectation that actual impacts at existing or future disposal facilities would be less.

Assumed Facility Designs

All cases assume disposal into "regular" shallow land burial trenches as well as segregated disposal of waste streams containing organic chemicals as well as low activity unstable waste streams containing compressible material. Layering is used as an intruder barrier. For the three humid sites (northeast, southeast, and midwest), a moisture barrier in the form of a thick clay cap is installed and compacted using standard construction techniques. In the southwest site, however, the standard "thin" cap is assumed to be installed. Similar to the humid sites, however, the disposed waste, backfill, and cap are assumed to be compacted using improved methods (e.g., a vibratory compactor).

Due to the relatively impervious nature of the soils at the northeast site, there is a greater chance for a water accumulation problem than at the other two humid sites. For this case, therefore, and to provide one case for analysis of a more extreme engineering design, all waste packages are assumed to be stacked into disposal cells and grouted in place. At the other disposal facilities, an imported sand backfill is assumed to be used to reduce the contact time of percolating water.

All regional facilities are assumed to be operated for 20 years, followed by a two-year closure period and a five-year observation period prior to license termination and transfer of site control to the site owner.

Assumed Waste Forms

In the analysis, the higher activity waste streams are assumed to be stabilized. To provide a range of costs and impacts for the calculations, two waste spectra are considered: waste spectrum 2 and waste spectrum 1 modified by use of high-integrity containers. In waste spectrum 2, all of the LWR process waste streams are assumed to be solidified. Half are solidified in cement and half in a synthetic polymer binder. Waste streams for which most of the activity is principally contained in activated metal are stabilized using improved packages (e.g., filling void spaces within the package with a noncompressible material, use of high integrity containers, etc.). All compressible waste streams are compacted. In modified waste spectrum 1, LWR process waste streams except for solidified concentrated liquids are packaged in high-integrity containers. Concentrated liquids are assumed to be solidified. High-integrity containers are also used for packaging two waste streams containing large quantities of tritium. The other higher activity waste streams are again assumed to be stabilized through improved packaging techniques or high-integrity containers. Compressible waste streams are not compacted.

In the analysis, the volumes of waste projected to be generated in each region over a 20-year period are processed according to the waste spectra considered and delivered to the disposal facility. This results in a range in projected waste volume (in m^3) for each region as follows:

Waste Spectrum	Northeast	Southeast	Midwest	Southwest
Modified spectrum 1	9.92E+5	1.07E+6	7.56E+5	7.26E+5
Spectrum 2	6.85E+5	7.51E+5	5.29E+5	4.91E+5

As shown, the largest volumes are projected for the southeast region.

8.2.2 Results of the Regional Analysis

This section presents a discussion of the indirect unmitigated impacts of implementation of the Part 61 rule based on analysis of the above regional cases. The section is divided into three subsections as follows: long-term radiological impacts, costs and short-term radiological impacts, and other impacts.

Long-Term Radiological Impacts

A range of long-term radiological impacts for the regional case study are summarized on Table S.8.

Table S.8 Summary of Long-Term Environmental Impacts from Regional Case Study

Impact Measures	Modified Waste Spectrum 1				Waste Spectrum 2			
	Northeast	Southeast	Midwest	Southwest	Northeast	Southeast	Midwest	Southwest
Maximum individual intruder impacts: (mrem/yr to bone)								
100 years	3.80E+0	2.32E+1	2.73E+1	2.09E+1	5.23E+0	2.97E+1	3.50E+1	2.86E+1
500 years	4.83E-1	5.00E+0	6.19E+0	3.15E+1	6.54E-1	6.84E+0	8.50E+0	4.63E+1
Maximum population intruder impacts:								
Airborne (man-mrem/yr to bone)	1.70E+5	1.93E+4	3.22E+4	1.87E+2	1.02E+5	1.66E+4	2.80E+4	1.67E+2
Waterborne (mrem/yr to bone)	8.29E-3	3.17E-3	4.82E-3	4.36E-3	1.09E-2	4.04E-3	6.05E-3	5.78E-3
Maximum erosion impacts:								
Airborne (man-mrem/yr to bone)	3.12E+2	1.49E+2	1.42E+2	6.11E+0	3.11E+2	1.49E+2	1.42E+2	6.11E+0
Waterborne (mrem/yr to thyroid)	9.77E-1	1.18E+0	9.47E-1	5.90E-1	9.77E-1	1.18E+0	9.47E-1	5.90E-1
Maximum ground-water impacts: (mrem/yr to thyroid)								
Intruder well	6.43E+0	5.62E+0	6.84E+0	2.53E-2	7.25E-1	6.36E-1	6.73E-1	1.45E-2
Boundary well	6.02E+0	5.62E+0	6.84E+0	2.45E-2	6.52E-1	6.36E-1	6.73E-1	2.91E-3
Population well	$<10^{-9}$	1.78E+0	3.26E-1	9.40E-4	$<10^{-9}$	2.01E-1	3.20E-2	1.11E-4
Surface stream	$<10^{-9}$	8.09E-2	$<10^{-9}$	*	$<10^{-9}$	9.14E-3	$<10^{-9}$	*

*Impacts at the surface stream are not calculated for the southwest site due to the intermittent nature of the nearest stream to the site and the extreme depth to ground water.

Maximum individual intruder impacts are summarized on Table S.8 at time periods equal to 100 and 500 years following disposal facility license termination. Maximum population intruder impacts are also summarized as estimated at 100 years following license termination. Airborne impacts are presented as total exposures (in man-mrem/yr) to persons living within 50 miles of the disposal facility. Waterborne impacts are presented for an individual who is assumed to use water from a surface stream contaminated from overland flow of material released from the facility by the intruder. Maximum potential erosional impacts (to the bone) are also shown as impacts to populations for airborne releases and as impacts to an individual for waterborne releases.

In the analysis, the assumed use of grouting to stabilize the northeast site results in reduced intruder exposures relative to the southeast and midwest sites. For these latter two sites, inadvertent intruder exposures averaged over the total waste volume disposed at the sites range from about 15 to 35 mrem/yr at 100 years but drop to a few (4 to 9) mrem/yr at 500 years. The increased volume reduction associated with waste spectrum 2 results in higher overall radionuclide concentrations then for modified spectrum 1, with resulting slightly higher estimated impacts. In the analysis, no credit has been taken for improved waste forms to reduce dispersion and plant root uptake. This improved waste form would tend to reduce intruder exposures for waste spectrum 2, particularly at the southwest site.

The highest individual intruder exposures are estimated to occur at the southwest site. These exposures run at about 46 mrem/yr to bone but are still a factor of 10 less than the 500 mrem/yr limit. The increased exposure is due to the increased silt content of the site soils as well as the increased wind speeds relative to the other three sites. These impacts are believed to be very conservative, since the great depth to the water table allows disposal at much greater depths than at the other three sites--further reducing the potential for inadvertent intrusion into the more highly active waste streams.

Both types of scenarios--inadvertent intrusion and erosion--should be interpreted as hypothetical events. In particular, the erosional impacts are included as an upper bound of such impacts if significant large scale erosion did occur. Disposal facilities licensed under the Part 61 regulation would be sited to avoid such potential problems with erosion.

As shown in Table S.8 the highest exposures due to ground-water migration are to the thyroid, although in all cases the performance objectives for inadvertent intrusion and ground-water migration are met. The estimated impacts reflect the differing volumes of waste streams and corresponding radionuclide inventories within each regional facility, as well as the differing environmental characteristics of each regional site. Of the three humid regional sites, the southeast is assumed to experience the largest percolation component (PERC) as well as the quickest ground-water travel times to human access locations. In addition, the midwest and southeast site soils are assumed to have moderate retardation capabilities while the retardation capability of the northeast site soil is higher.

The southwest site is located in a semiarid area and a water balance calculation for the site indicated that essentially no precipitation falling upon the site

reaches the underlying aquifer. For completeness in the analysis, however, a percolation coefficient of 1 mm was conservatively assumed for the site. The resulting estimated exposures are a few orders of magnitude less than those for the other three sites at the intruder, boundary, and population wells. The surface water body exposures are not presented for the southwest site, however. The closest water body down-gradient of the site is an intermittent stream, and in any case, the water table is located on the order of 80 meters below ground surface.

Costs and Short-Term Radiological Impacts

Costs and short-term radiological impacts are summarized in Table S.9. Included in this table are (1) potential impacts to populations (in man-mrem) from transporting waste to the regional facilities, (2) potential occupational impacts (in man-mrem) associated with processing, transporting, and disposing of waste within the region, and (3) costs. Impacts and costs are shown as total impacts and costs over the 20-year operating life of the disposal facility.

As shown, transportation impacts over 20 years range from about 420 to 1,100 man-rems, or about 21 to 55 man-rems per year. The higher estimated impacts for the southwest site are due to the greater transportation distance for the western region as compared to the other three regions (1,000 miles vs 300 to 600 miles).

Occupational impacts are listed as total impacts over 20 years for waste processing, transportation to the disposal facility, and waste disposal. Waste processing occupational exposures are presented as additional exposures to those associated with waste spectrum 1. These exposures are believed to be conservatively high, due to the conservative nature of the analysis as well as the fact that many waste generators are already compacting waste or stabilizing high activity streams to comply with existing license conditions at LLW waste disposal facilities.

Also included are the occupational exposures that are estimated to be associated with operation of a regional processing center. For waste spectrum 2, waste processing is assumed to consist of compaction of compressible waste streams by large compactor/shredders. This is not likely a cost effective operation but has been included for completeness.

As expected, the largest occupational exposures for waste disposal are those estimated for the northeast site. This is due to the assumed additional operational practices carried out at the northeast site.

Costs, including waste processing, transport, and disposal costs are also listed in Table S.9. Costs due to processing the waste by the waste generator are presented as additional costs to those associated with waste spectrum 1. For the modified spectrum 1 case, these additional costs involve stabilizing high activity waste streams at an estimated cost of $450 per m^3 of waste so stabilized, which is the approximate cost of placing the waste streams into high-integrity containers. It is expected that some of the waste streams may be stabilized by the less expensive means; however, using the high-integrity container costs

Table S.9 Summary of Costs and Short-Term Radiological Impacts for the Regional Case Study

Impact Measures*	Modified Waste Spectrum 1				Waste Spectrum 2			
	Northeast	Southeast	Midwest	Southwest	Northeast	Southeast	Midwest	Southwest
Transportation Population Impacts: (man-mrem)	4.16E+5	6.02E+5	6.54E+5	1.10E+6	4.02E+5	5.97E+5	6.52E+5	1.08E+6
Occupational Impacts: (man-mrem)								
Waste Process								
By Generators	-	-	-	-	+1.70E+6	+1.98E+6	+1.50E+6	+9.00E+5
Regional Center	0	0	0	0	1.81E+5	7.15E+4	1.08E+5	9.02E+4
Transportation	5.54E+6	6.92E+6	5.04E+6	4.89E+6	5.21E+6	6.43E+6	4.79E+6	4.54E+6
Waste Disposal	5.10E+6	2.96E+6	2.03E+6	2.80E+6	4.78E+6	2.81E+6	1.96E+6	1.68E+6
Waste Processing Costs: ($)								
Waste Generator	+7.28E+7	+9.89E+7	+6.63E+7	+5.22E+7	+3.47E+8	+3.95E+8	+2.92E+8	+1.91E+8
Regional Center	0	0	0	0	+5.29E+7	+2.07E+7	+3.14E+7	+2.63E+7
Waste Transportation Costs: ($)	1.45E+8	2.43E+8	2.40E+8	3.41E+8	1.32E+8	2.18E+8	2.22E+8	3.08E+8
Waste Disposal Costs: ($)								
Design & Op.	2.75E+8	2.10E+8	2.01E+8	1.89E+8	2.53E+8	2.01E+8	1.94E+8	1.86E+8
Post operational	1.26E+7	1.91E+7	1.91E+7	1.26E+7	1.26E+7	1.26E+7	1.26E+7	1.26E+7
Total	2.88E+8	2.29E+8	2.20E+8	2.02E+8	2.66E+8	2.14E+8	2.07E+8	1.99E+8
Unit ($/m^3)	290	214	291	278	388	285	391	405

*Costs and impacts (except for unit disposal costs) are shown as total costs and impacts over the 20-year operating life of the disposal facility.

provides an upper bound. For waste spectrum 2, stability of many of the waste streams--particularly LWR process waste streams--is provided through solidification. Costs for stabilization of other waste streams is again represented by the estimated costs for high-integrity containers. Finally, in waste spectrum 2, additional costs are incurred through compaction of compressible waste streams, both by waste generators and at a regional center.

Of these costs, the only additional waste processing costs that would be incurred through implementation of the Part 61 regulation would be through stabilization of the higher activity streams. For waste spectrum 2, these are conservatively estimated as follows:

Waste Spectrum 2	Northeast	Southeast	Midwest	Southwest
$\$(\times 10^8)$	2.82	3.58	2.70	1.64
$\$/m^3$	1363	1310	1390	1158

Thus, the requirement that higher activity wastes be stabilized would appear to involve additional processing costs in the following range.

	Northeast	Southeast	Midwest	Southwest
Low ($\$\times 10^7$)	7.3	9.9	6.6	5.2
High ($\$\times 10^7$)	28.2	35.8	27.0	16.4

This range is believed to be conservatively high, however. In addition, much of the above costs would be expended in any case to comply with license conditions already implemented by the states at existing disposal facilities.

Waste transportation costs range from about $130 to $240 million, depending upon the waste spectra and the region considered. The largest costs are for the southwest region, for which the reduced volume of waste relative to the other three regions is counterbalanced by the longer transportation distances.

Waste disposal costs are set out into design and operational costs and post-operational costs, where postoperational costs include costs to waste customers (over 20 years of operation) for providing for: (1) facility closure, (2) a 5-year observation and maintenance period, and (3) 100 years of institutional control. Also shown are total disposal costs as well as unit ($\$/m^3$) costs.

As shown, the most significant design and operational costs are for the northeast site, due to the assumed use of grouting to assure stabilization of wastes. The design and operational costs for the other three sites are clustered within a relatively small range.

Unit costs are seen to vary widely depending upon the assumed design and operating practices carried out at the particular disposal facility as well as the volumes of waste delivered to the facility. For example, the design and operation of the southeast site is essentially the same as the midwest facility. However, the volume of waste delivered to the midwest facility is much less than the southeast facility, while the design and operational costs are only slightly less. This is because capital costs to construct the disposal facility are much less dependent upon the volumes of waste delivered to the facility than the operating costs. Many of the same expenses to design, build, and operate the facility would be incurred whether a high or a low volume of waste was received.

Other Impacts

This section discusses indirect impacts associated with the proposed Part 61 regulation other than radiological impacts or costs. The impacts are broken down into the following subsections: Air quality (nonradiological), biota (ecology), land use, energy use, and social impacts.

Air Quality. Nonradiological impacts to air quality due to LLW management and disposal would principally arise from two sources: combustion of fossil fuels during processing, transporting, and disposing of waste and (2) particulate matter (dust) released into the air due to earth moving activities at the disposal facility. Typical combustion products would include suspended particulates, sulphur dioxide, CO_2, CO, various hydrocarbons, and various nitrogen oxides.

It is believed that implementation of the Part 61 regulation would have a relatively slight effect upon overall air quality. For example, increased waste processing such as compaction and solidification would probably result in increased combustion of fossil fuels, with correspondingly increased release of combustion products into the air. However, many waste generators are already performing such waste processing activities to reduce transportation costs or to comply with existing license conditions at disposal facilities. Moreover, waste processing activities that reduce waste volumes would tend to reduce releases of fossil fuel combustion products during transportation.

At the disposal facility, local impacts to air quality result from combustion of fossil fuels by vehicles delivering waste to the facility, by vehicles owned by facility personnel, and by heavy equipment operated at the facility. Dust could be raised by excavating, backfilling, and grading activities. However, similar types of impacts can and would be raised by many other types of small industrial concerns.

Since the Part 61 regulation emphasizes increased disposal facility stability, somewhat additional air quality impacts could result during the operating life of the disposal facility. However, such additional impacts would be felt only during the time the facility was operating. In addition, if the facility was left in an unstable condition after operation, increased longer-term air quality impacts could result due to operating machinery to repair holes in disposal cell covers, potential operation of a leachate evaporator, and so forth. Placing

the facility in a more stable condition during site operations reduces the maintenance that would be required after facility closure, thus lowering longer term nonradiological air quality impacts.

Biota. The operation of a disposal facility would involve acquiring and fencing in up to a few hundred acres of land. Existing vegetation would be mostly cleared, and after waste disposal, the disposal cells would be regraded, recontoured, and probably reseeded with short-rooted local vegetation. During this process, impacts to biota could result from destruction of habitat. Similar types of impacts would result from other uses of the land which involve heavy construction. Implementation of the Part 61 rule is expected to have little effect on the potential for impacts to biota. There are already existing federal and state laws and regulations governing protection of endangered or unique flora and fauna.

Land Use. In most cases, the operation of a licensed nuclear facility by a licensee does not result in the land being permanently committed to that activity. At an LLW disposal facility, however, possible future use of the facility after it has closed is greatly influenced by the presence of the disposed waste. This does not mean that land used for LLW disposal is permanently excluded from productive use. Rather, as long as care was taken to restrict activities to those which would not involve excavating into the disposed waste or bringing contamination to the surface, there may be a number of useful purposes the facility surface may be put to. These could possibly include use of the facility for golf courses, recreational areas, or light industry.

It is difficult to assess the influence of the Part 61 regulation on land use. Depending upon the design and operation of the disposal facility and the manner in which higher activity wastes are stabilized, land use could be lower or potentially higher than without the regulation. A range in land use may be estimated, however, using the regional analysis as a guide. In the analysis land use ranges from about 160,000 m^2 (39 acres) to 370,000 m^2 (92 acres) at the regional sites, depending upon the volume of waste disposed and the disposal technology implemented. For modified spectrum 1, the total amount of land committed to LLW disposal over 20 years is estimated to be 1.1 million m^2, or about 276 acres. For waste spectrum 2, for which increased use is made of volume reduction, this land use is reduced to 775,000 m^2 or 192 acres. This includes an assumed 3-meter spacing between disposal cells but does not include other land such as administrative areas, buffer zones, onsite roads, and so forth.

Energy Use. One way in which the effects of a proposed action can be quantified is to estimate the total energy requirements associated with that action. In the analysis, incremental energy use ranged from -270,000 gal to +8,970,000 gal per region. It should be realized that there are large uncertainties in these calculations. Much of the projected increase in energy use is due to activities such as increased disposal stability or increased waste processing which by and large are already being carried out. In general, the overall tendency of the Part 61 regulation would be to increase short-term energy use but reduce long-term energy use.

Social Impacts. In general, social impacts due to promulgation of the Part 61 regulation are difficult to address. These impacts are very site-specific and would include such aspects as the effect of bringing a labor force into an area on local utilities, schools, and other services. These types of impacts are typically of most concern during the siting, construction, and operation of large facilities such as a large nuclear power plant. A low-level waste disposal facility is by comparison a very small operation, and the proposed Part 61 regulation is not expected to result in any significant incremental changes in social impacts associated with operation of LLW disposal facilities.

ATTACHMENT A. Proposed Rule 10 CFR Part 61: Licensing Requirements for land Disposal of Radioactive Waste

NUCLEAR REGULATORY COMMISSION

10 CFR Parts 2, 19, 20, 21, 30, 40, 51, 61, 70, 73 and 170

Licensing Requirements for Land Disposal of Radioactive Waste

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed Rule.

SUMMARY: This notice invites public comment on proposed amendments to the Commission's rules to provide specific requirements for licensing the land disposal of radioactive wastes. The proposed amendments set forth performance objectives for disposal, general requirements for land disposal of radioactive waste, technical requirements for disposal of radioactive waste into near-surface disposal facilities, requirements for submitting applications for licenses authorizing such activities and procedures which the Commission will follow in the issuance of such licenses. The rule does not deal with disposal by individual licensees by burial of their own wastes. The proposed amendments also set forth provisions for consultation and participation in license reviews by State governments and Indian tribes. Further amendments are proposed governing the transfer of licensed material for disposal. The proposed requirements respond to the needs and requests of the public, Congress, industry, the states, the Commission, and other Federal agencies for codification of regulations for the disposal of low-level radioactive waste.

DATE: Comment period expires October 22, 1981. Comments received after October 22, 1981 will be considered if it is practical to do so, but assurance of consideration cannot be given except as to comments received on or before this date.

ADDRESS: All interested persons who desire to submit written comments in connection with the proposed amendments should send them to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch. Copies of comments received on the proposed amendments may be examined in the Commission's Public Document Room at 1717 H Street NW., Washington, D.C.

FOR FURTHER INFORMATION CONTACT: R. Dale Smith, Chief, Low-Level Waste Licensing Branch, Division of Waste Management, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, telephone (301) 427-4433.

SUPPLEMENTARY INFORMATION:

I. Description of the Proposed Action

The U.S. Nuclear Regulatory Commission proposes to add to its rules in 10 CFR a new Part 61 to provide licensing procedures, performance objectives, and technical criteria for licensing facilities for the land disposal of radioactive waste. Specifically, the regulations would establish performance objectives for land disposal of waste; technical requirements for the siting, design, operations, and closure activities for a near surface disposal facility; technical requirements concerning the waste form that waste generators must meet for the land disposal of waste; classification of waste; institutional requirements; and administrative and procedural requirements for licensing a disposal facility. Amendments to other parts of 10 CFR are proposed to govern the certification and use of shipping manifests to track waste shipments and clarify, but not substantially modify, the requirements of existing regulations. Specific requirements for licensing facilities for the disposal of radioactive wastes by alternative land disposal methods will be proposed for Part 61 in subsequent rulemakings. Disposal of radioactive wastes by an individual licensee will continue to be governed by 10 CFR Part 20.

Part 61 defines which wastes are acceptable for disposal by near-surface disposal methods (and which wastes are not acceptable and must be disposed of by other methods). It also sets out the administrative and procedural requirements for licensing a facility for the land disposal of waste.

II. Need for the Proposed Action

Current general regulations for licensing materials do not contain any technical standards or criteria for the disposal of licensed materials. However, the need for comprehensive, national standards and technical criteria for the disposal of radioactive waste is well documented. The Commission has undertaken a program to establish such standards and criteria through this proposed rulemaking action.

III. Background

The Commission has had a program underway for several years to develop regulations and other guidance for the management and disposal of low-level waste (LLW). On October 25, 1978, the Commission published an Advance Notice of Proposed Rulemaking (43 FR 49611) regarding the development of specific regulations for the disposal of LLW. The development of these regulations was in response to needs and requests expressed by the public, the Congress, industry, the States, the Commission, and other Federal agencies for codification of regulations for the disposal of LLW. To provide guidance and support for developing the new regulation, 10 CFR Part 61, the Commission has prepared a draft environmental impact statement (EIS) NUREG-0782.[1] The statement is not a generic EIS on the disposal of LLW. Rather, it is a decision document that has been prepared to provide a basis for decisions on the performance objectives and technical and financial criteria set out in Part 61. As part of the process to scope the form and content of the EIS and the proposed regulation, the advance notice asked for advice, recommendations, and comments on the scope and content of the EIS and the regulation. As a part of this advance notice, the Commission announced its intention to:

- Develop technical criteria and standards for the disposal of LLW by shallow land burial and alternative disposal methods.
- Prepare a supporting EIS for the regulation.
- Coordinate development of technical criteria and standards for shallow land burial and alternative disposal methods with requirements for the classification of waste (Define the concentrations and quantities of waste acceptable for disposal by various disposal methods).

[1] Single copies of this report will be available free upon publication to the extent of supply and may be obtained by written request to the Director, Division of Technical Information and Document Control, Washington, D.C. 20555. Copies will also be made available for inspection or copying for a fee at the NRC Public Document Room, 1717 H Street NW., Washington, D.C.

The Commission received a total of 36 responses from the public on the advance notice. These comments have been docketed (Docket No. PR-61) and may be examined in the Commission's Public Document Room located at 1717 H Street NW., Washington, D.C. A detailed analysis by the Commission of the public responses received may also be examined in the Public Document Room. The respondents to the advance notice strongly supported the Commission's development of specific criteria and standards for the disposal of low-level waste. There was also support among the commenters that an overall EIS should be prepared to provide an essential part of the informational and decisional base for the development of the criteria and standards for the rulemaking action. However, the commenters were divided on the form and structure of the criteria and standards. Some commenters stated that the criteria and standards should be minimal and basic and should emphasize the performance objectives to be met by low-level waste disposal facilities. Others suggested the criteria and standards should be specific and detailed. Many commenters also stated that as part of the development of LLW disposal standards and criteria a system was needed for classifying or segregating the waste based on hazard.

A number of comments were received on the Commission's questions regarding alternative disposal methods to shallow land burial. Although the comments in this area were mixed, the most often expressed opinion was that primary consideration should be given to developing requirements for shallow land burial and emplacement of waste into mined cavities. Disposal of wastes in ocean waters was given the lowest priority. Four commenters felt there was no need to establish a priority list of the alternative disposal methods to shallow land burial. The most often expressed disadvantage of any alternative method was the potential for increased cost. Approximately 60 percent of the respondents suggested other potentially viable methods for low-level waste treatment and/or disposal. The methods most frequently mentioned were volume reduction and other advanced processing techniques.

The comments received by the Commission on the advance notice were used by the Commission in scoping the form and content of the EIS and the regulation. For this scoping process, the Commission also considered a numbr of other sources, including:

- The results of program studies and other technical data on LLW management and disposal;
- Licensing experience with current LLW disposal sites and current LLW management techniques;
- Programs by the Environmental Protection Agency (EPA) to develop criteria and standards for LLW management and regulations for disposal of nonradio-active solid and chemically hazardous wastes;
- Recommendations of the Interagency Review Group on Nuclear Waste Management;
- Natural Resources Defense Council (NRDC) Petition for Rulemaking (PRM 20-7);
- Discussions with industry and public interest groups, State and Federal agencies, and others;
- Recommendations from the State Planning Council; and
- Public Law 96-573, "Low-Level Radioactive Waste Policy Act."

On February 28, 1980, the Commission also published a Notice of Availability of a preliminary draft regulation, dated November 5, 1979, announcing availability of the draft for public review and comment to help ensure wide distribution and early public review and comment (45 FR 13104). Copies of this draft regulation were distributed to all of the States. The comments received in response have been docketed (Docket No. PR-61) and may be examined in the Commission's Public Document Room located at 1717 H Street NW., Washington, D.C.

During the summer and fall of 1980, the Commission also sponsored 4 regional workshops to provide an opportunity for open dialogue among representatives of the States, public interest groups, the industry, and others on the issues to be addressed through the Part 61 rulemaking. One workshop was conducted by the Southern States Energy Board for the southeast region, a second by the Western States Energy Board for the west, a third by the Midwestern Regional Office of the Council of State Governments for the central region and midwest, and a fourth by the New England Regional Commission for the northeast. These workshops were particularly useful in formulating our positions on the more judgmental aspects of the rule and underlying assumptions (such as the length of time we should assume that active governmental controls could reasonably be relied on). A copy of the full transcript for each meeting and a summary report documenting the collective views of the participants has been placed in the docket for this rulemaking (Docket No PR-61) and may be examined at the Commission's Public Document Room located at 1717 H Street NW., Washington, D.C.

IV. Purpose and Scope of Part 61

It is the purpose of Part 61 to establish technical criteria and procedures for licensing facilities for the land disposal of radioactive wastes. Part 61 will not apply to alternative disposal methods such as deep space or ocean disposal. It is not practicable to develop one regulation dealing with such a wide variety in disposal technologies. Requirements for ocean disposal are a responsibility of the EPA. Space disposal, although technically feasible, is not developed to the point of routine, economic application.

The recently enacted Low-Level Radioactive Waste Policy Act (Pub. L. 96-573) sets forth a traditional definition of "low-level radioactive waste," i.e., radioactive waste not classified either as high-level radioactive waste, transuranic waste, spent nuclear fuel, or uranium mill tailings (byproduct material as defined in section 11 e.(2) of the Atomic Energy Act of 1954). While Part 61 is intended to deal with the disposal of most wastes included in this definition, the waste classification scheme that forms the basis for Part 61 has identified some "low level radioactive wastes" that are not suitable for disposal by the means that Part 61 provides, and alternative methods will have to be used. Therefore, the term "low-level radioactive waste" is not used in Part 61. Reference is made to "waste" and "radioactive wastes" which, within the context of Part 61, refers to those wastes that are acceptable for disposal under the provisions of Part 61.

This proposed regulation includes overall performance objectives expected in any type of land disposal and technical requirements for the disposal of waste near the surface. The technical requirements for disposal are set forth for disposal site characteristics, disposal site design and near-surface disposal facility operations, classification and characteristics of wastes, and institutional control and surveillance.

V. Summary of Rule

The following sections provide a discussion of the major provisions of Part 61.

A. Performance Objectives Versus Prescriptive Requirements

In developing Part 61, the Commission has considered two basic approaches: a performance objective approach and a

prescriptive approach. A regulation oriented toward performance objectives would establish the overall objectives to be achieved in waste disposal and would leave flexibility as to how the objectives would be achieved.

In the latter approach, specific detailed requirements for design and operation of a land disposal facility would be set out in the regulations. Prescriptive standards would specify the particular practices, designs, or methods to be employed—for example, the thichness of the cover material (the cap) over a land disposal trench, or the maximum slope of the trench walls.

Setting of prescriptive standards requires a considerable amount of detailed knowledge about potential designs, techniques, and procedures for disposing of wastes in order to prescribe which designs, techniques, and procedures are among the best and would assume that the state of art in waste disposal is developed to the point where there are clear choices to be made among all the potential approaches.

A combination of approaches has been chosen for Part 61. Overall performance objectives are stated and the applicant has flexibility in choosing design features and operating practices to achieve these objectives. There are some prescriptive requirements that have been judged necessary in light of past operating experience with disposal facilities. To the extent practicable, these requirements are stated as minimum criteria to afford some flexibility in meeting them.

B. Development of Performance Objectives

With respect to the performance objectives, the Commission's overall goal is to assure protection of the public health and safety. In considering radioactive waste disposal, attainment of this goal would appear to fall into two time frames: the short-term operational phase and the long term after operations cease.

In the short term, the concern is for protection of workers and the general population during operation of a disposal facility.

Protection of the public health and safety over the long term is most important and long-term performance of the land disposal facility after operations cease should be given greater emphasis than short-term considerations and conveniences. It is therefore at the time of the land disposal facility closure that greatest reliance will be placed on the disposal site characteristics and design as well as the waste characteristics to assure protection of the public health and safety without the need for continued active care and maintenance.

Assuring safety over the long term involves three considerations: (1) protection of individuals from inadvertent intrusion into the site and coming in contact with the waste at some point in the future; (2) protection of the general public from potential releases to the environment; and (3) stability of the disposed waste and the site to eliminate the need for ongoing maintenance of the site following closure.

Safety During Operations. The short-term performance objective included in Subpart C of Part 61 will be to assure that the disposal facility will be operated in conformance with the same Commission standards for radiation protection set out in 10 CFR Part 20 that are applied to all Commission licensees for protection of workers (See § 61.43.)

Protection of the Inadvertent Intruder. The Commission believes that intentional intrusion into the land disposal facility (e.g., an archaeologist reclaiming artifacts) cannot reasonably be protected against. However, after the land disposal facility closes, and after active institutional control and surveillance over the disposal site have been removed, one or a few individuals could inadvertently disturb waste in the disposal site through activities such as construction of a house or by farming.

Actual intrusion into the waste may never occur; but, for purposes of Part 61, it has been assumed that intrusion could occur, in which case the one or few such individuals should not receive an unacceptable radiation exposure. The Commission is applying a 500 mrem/yr maximum individual exposure limit for this unusual case. This limit is based on ICRP recommendations for dose limits to individuals and is a level that is recognized as providing adequate protection. Since only one, or at most a few, persons would be involved, it is not necessary to consider a population dose. This limit is then used to determine the allowable concentrations of nuclides in each class of waste. (See § 61.42.)

Protection of the Environment. The primary long-term pathway of release of radioactivity from near-surface disposal involves radionuclide contamination of and transport through the ground water. Presently there exists no specific numerical standard for protection of the ground water. The Environmental Protection Agency (EPA), under its generally applicable environmental standards-setting authority, has responsibility to prepare a standard that will set limits for releases of radioactivity to the general environment from disposal facilities. After examining other existing standards, the Commission does not anticipate that the standard will be much higher than the standards already established for releases to the environment from fuel cycle facilities set out in 40 CFR Part 190 (25 mrem/yr whole-body exposure). Also, the standard will probably not be any lower than the limits established in 40 CFR Part 141 for concentrations of radioactivity in drinking water (4 mrem/yr whole body exposure). As a part of the EIS for Part 61, the Commission analyzed a range of limits from 1 mrem/yr to 25 mrem/yr applied at various locations at and in the vicinity of a disposal facility. Based on the numerical limits already set for existing standards and this analysis, the Commission has selected an objective that requires that any movement of radioactivity not result in calculated doses exceeding 25 mrem/yr to an individual at the site boundary or cause the EPA Drinking Water Standards (40 CFR Part 141) to be exceeded at the nearest public drinking water supply (See § 61.41). When EPA standards are effective, licensees will have to comply with them. Because these standards are specific to land disposal of radioactive waste, they are included in Part 61 rather than 10 CFR Part 20.

C. Minimum Technical Requirements

To help assure that the performance objective will be met, minimum requirements will be placed on the various parts of an overall disposal "system".

The principal parts of an overall disposal system that are readily identifiable and will be addressed in the minimum technical requirements are:

- The characteristics of the disposal site into which the waste is placed:
- The method by which the disposal site is designed, the land disposal facility constructed, the waste emplaced, and the disposal site closed;
- The characteristics of the waste; and
- The degree and length of institutional control, surveillance, and monitoring of the disposal site after closure.

Disposal Site Suitability Requirements. A wide range of locations are potentially available for use as a near-surface disposal facility ranging from the humid east to the arid west. The approach the Commission has followed in establishing the disposal site suitability requirements has been to establish a common-sense base of disposal site evaluation factors that can be consistently applied throughout the country. The requirements would essentially eliminate certain limited

areas from consideration because of undesirable characteristics but would leave large areas in each region where acceptable sites could be found (see § 61.50). The requirements are intended to eliminate, to the extent practicable, those areas with certain characteristics that are known to lead to or have high potential to lead to problems over the long term (e.g., flooding or rapid erosion of the site). These disposal site characteristics include:

(1) Complexity—The disposal site must be capable of being investigated and analyzed. If the disposal site cannot be characterized, prediction of potential long-term impacts is not possible.

(2) Potential Land and Resource Use—The disposal site should not have any extensive natural resources beneath it or have such high potential for other subsequent uses of the land that immediate intrusion into the disposal site after active institutional controls are removed is likely.

(3) Surface Water—Areas with large surface water sources or high potential for flooding should be avoided to reduce the greater potential for migration that large quantities of water present.

(4) Ground water—Ground water intrusion into the disposal units should be avoided to reduce the potential for leaching of waste and subsequent migration.

(5) Stability—Stability of the disposal site over the long term is important in helping assure continued site integrity and in reducing the potential for migration and transport of waste to offsite areas.

Disposal Site Design, Land Disposal Facility Operation, and Disposal Site Closure Requirements. The specific requirements for design, operation, and closure of a near-surface disposal facility are directed at achieving long-term stability of the disposed waste and the disposal site so that, after closure, the need for ongoing active maintenance is eliminated and only minor custodial care, surveillance, and monitoring are required. (See § 61.51.) Other requirements are directed at enhancing natural disposal site characteristics by directing surface water away from disposal units, reducing infiltration of precipitation into disposal units, and reducing the potential for erosion, leading to an acceptable condition for disposal site closure.

Specific design requirements are set out relating to assuring protection of an inadvertent intruder from exposure to higher concentration wastes. Such wastes, defined by § 61.55, must be disposed of at greater depths (i.e., a minimum 5 meters below grade) or with equivalent natural or engineering barriers to reduce radiation exposure and further minimize the potential that an individual might inadvertently come in contact with the waste. In addition, a specific provision requires segregation of the lower activity compressible waste from the higher activity wastes and separate disposal. Higher activity wastes are subject to the structural stability requirements of § 61.55(b). Requirements are also established on environmental monitoring (§ 61.53).

Waste Characteristics and Classification. A cornerstone of the system to control the migration of radionuclides offsite is stability—stability of the waste and of the disposal site so that once emplaced and covered, the access of water to the waste can be eliminated or minimized. Thus, a basic requirement on waste is that it should be stable, that is, it should maintain its configuration and consistency under the conditions if would be exposed to after disposal. This stability should last long enough for the radioisotopes to decay to levels where they are no longer of concern from the migration standpoint.

While stability is a necessary characteristic for waste that has a potential for migration, studies have shown that much of the waste being disposed of does not contain sufficient amounts of radionuclides to be of concern from the migration standpoint. However, these same wastes, such as ordinary trash-type wastes tend to be unstable. It is obvious that if these wastes were disposed of with higher activity waste, their deterioration could lead to failure of the system and permit water to penetrate the disposal site and cause problems with the higher activity wastes. The choice, then, is either to require these less hazardous wastes to meet stability requirements or to segregate them from the more hazardous waste. Since stability requirements for low activity wastes would probably require expensive processing, segregation appears to have a cost/benefit advantage in spite of possible increased costs of disposal site stabilization.

A simple waste classification scheme has been devised and incorporated into Part 61. The scheme is based on the role that the waste plays in the assurance that the performance objectives of protecting persons from radiation from waste will be met.

The first categorization of waste is to identify those wastes that do not have to meet the stability requirements and that will be segregated at the disposal site. These wastes, called Class A segregated wastes, are defined in § 61.55 in terms of the maximum allowable concentration of certain isotopes and certain minimum requirements on waste form that are necessary for safe handling. The second category is for waste that requires stability, Class B stable waste, and is defined in terms of allowable concentrations of isotopes and requirements for a stable waste form as well as the minimum handling requirements.

There are concentrations of certain isotopes that will require protection against inadvertent intrusion after institutional controls have lapsed. These concentrations have been determined by analysis of the exposure to humans from the postulated intrusion of an individual after the 100 year period of institutional control. Any waste with concentrations of these isotopes that would cause an exposure greater than 500 millirem must be protected from intrusion by deeper burial or some other barrier. Wastes requiring such protection are identified as Class C intruder wastes.

The waste classification section also places upper limits on concentrations of isotopes in any class of waste. Wastes containing higher concentrations are generally excluded from near-surface disposal. Part 61 provides for special consideration by the Commission of proposed disposal methods on a case-by-case basis for wastes that exceed these values.

For most of the alpha emitting transuranic nuclides, the maximum allowable concentrations were calculated to be in the range of 10 nanocuries per gram currently imposed by disposal facilities. These calculations were conservatively based, in that they did not allow credit for dilution by other wastes. If this factor were changed, the values would increase somewhat. A decision was made not to recalculate in order to come up with higher values. This decision is based on two factors. First, in the spirit of the ALARA (as Low as Reasonably Achievable) concept, the lower value of 10 nCi/g has been demonstrated as an achievable concentration to control the disposal of transuranic nuclides. This value has been imposed by the Department of Energy for some eleven years and by most of the commercial disposal site operators for nearly that long. The last commercial site imposed the 10 nCi/g restriction in 1981. Thus, there is no need to increase the limit from the standpoint of achievability. Second, there is a tendency toward a more conservative assessment of the hazard of certain transuranic nuclides (Ref. ICRP 30) and it does not seem prudent at this time to use the higher calculated values. A value of 350 nCi/g was established for plutonium-241, since

this concentration of short lived beta-emitting isotope decays to a 10 nCi/g concentration of americium=241, a longer lived alpha-emitter. At present, wastes containing transuranic nuclides in concentrations greater than 10 nCi/g are not being generaged in significant volumes.

Based on the values in Table I, and the isotopic content of various waste streams analyzed in the Environmental Impact Statement, the following waste streams would generally fall into the waste classes indicated.

Class A—Segregated Waste

PWR Ion Exchange Resin (low activity)
PWR Concentrated Liquids (low activity)
PWR Filter Sludges (low activity)
PWR Filter Cartridges (low activity)
PWR Compactible Contaminated Trash
BWR Compactible Contaminated Trash
Fuel Fabrication Compactible Trash
Fuel Fabrication Noncompactible Trash
Institutional Trash
Industrial Sealed Source Manufacturing Contaminated Trash
Industrial Low Activity Trash
Fuel Fabrication Process Waste
UF_6 Process Waste
Nuclear Medicine Waste
Biomedical Research Radiotracer Waste, Biowastes, and Contaminated Trash
Academic Institution Radioactive Radiotracer Wastes, Biowastes, and Contaminated Trash

Class B—Stable Waste

PWR Ion Exchange Resins
PWR Concentrated Liquid
PWR Filter Sludges
PWR Filter Cartridges
BWR Ion Exchange Resins
BWR Concentrated Liquids
BWR Filter Sludges
PWR Noncompactible Trash
BWR Noncompactible Trash
LWR [2] Nonfuel Reactor Components
LWR [2] Decontamination Resins
Tritium Production and Processing Waste Accelerator Targets
High Specific Activity Industrial Waste

Class C—Intruder Waste

Waste [2] from Isotope Production Facilities
Sealed [2] Sources

Note.—More recent data indicate that power reactor operation and waste processing characteristics are tending to move LWR wastes into higher classes.

The Commission has not developed a classification of waste based on total hazard. The classification is based on radiation protection considerations.

The Commission, however, has addressed other potential hazards presented by other associated components of waste (e.g., chemical and biological hazards) through te exclusion or treatment of certain chemical, physical and biological forms of waste.

The Commission recognizes the need for a "de minimis" classification of wastes, wastes that would be exempt from Part 61 and would be considered of no regulatory concern. The Commission believes, however, as the Federal Radiation Policy Council has recommended, that such exemptions should be determined on a specific waste basis. In this regard, a recent rulemaking (46 FR 16230) established such an exemption in a new § 20.306 for certain levels of tritium and carbon-14 contained in liquid scintillation and animal carcass waste. Other wastes may also readily lend themselves to treatment in this manner. The Commission will be working over the next 2 years to define these wastes and provide for additional exemptions as appropriate. Thus, Part 61 will not establish a generic "de minimis" category for waste.

D. Land Ownership of Near-Surface Disposal Facilities

Federal or State government ownership of land for disposal of waste at a land disposal facility has been a requirement in the Commission's regulations (10 CFR 20.302) since the inception of commercial disposal operations. This requirement is being continued to assure adequate control of the disposal site after closure and to reduce the potential for inadvertent intrusion. (See § 61.59.)

Although ownership by a State or the Federal Government is required before the Commission will issue a license, the Commission will consider an application when the site is privately owned if the applicant provides evidence that arrangements have been made with a State or the Federal government to assume ownership before the license is issued. The details of the arrangement may include whatever provisions the State or Federal agency considers appropriate as long as they are not inconsistent with requirements of the Commission.

E. Institutional Control

Control of access to the disposal site and use of the land following closure of the site is required to keep people from having contact with the waste and affecting the integrity of the disposal site. Active institutional controls involving periodic surveillance by the custodial agency and controlled access (e.g., maintaining a fence) cannot be relied upon indefinitely (§ 61.60 will not allow reliance on active institutional controls for more than 100 years since this is judged to be maximum time that governmental institutions should be relied on to carry out active controls.)

A monitoring program to check on continued disposal site integrity would also be carried out. Control and surveillance of the disposal site by the State or Federal land owner/custodial agency is needed to prevent an intruder from excavating, drilling wells, or performing other activities that would expose that individual or lead to possible increased migration offsite. Active controls would eventually be removed and replaced by more passive controls (e.g., government land ownership and records) which will be an inexpensive means of ensuring that knowledge of the disposal facility will be retained.

F. Financial Assurances

Given the past history at some of the existing disposal sites, one of the key concerns is assurance of adequate financial qualification on the part of the applicant to construct and operate the disposal facility and to provide adequate financial provisions for disposal site closure and postoperational activities.

Subpart E requires that the applicant be financially qualified to conduct all licensed activities during the construction and operational phases of the land disposal facility. Proof of the financial qualifications of applicants is not currently required by Parts 30 and 40. This new requirement will help assure that resources are not expended on projects without adequate backing. This requirement should minimize the potential for early default or the abandonment of the site by the operator.

Section 61.62 of the Part 61 requires the applicant to provide an acceptable form of financial surety to ensure that funds are available to perform closure and stabilization and observation until the license is transferred to the custodial agency for institutional control or terminated. The Commission has received evidence of a great deal of public interest concerning the issue of financial responsibility for closure of a disposal site. Numerous written comments were made on this portion of the draft regulation, and the issue was also raised at all four workshops held to review this regulation. Many commenters felt that the licensee should be held responsible for the full costs of closure of a disposal site and that the license should not be terminated and the land returned to the custodial government authority until the licensee has completed satisfactory closure.

The amount of surety liability required is based on cost estimates

[2] These waste streams may contain concentrations of certain isotopes that will require special assessment and Commission approval for near-surface disposal

submitted by the licensee in an approved plan for disposal site closure and stabilization. The applicant must submit a cost estimate for disposal site closure that includes consideration of inflation, increases in the amount of disturbed land, and the closure and stabilization activities that have already occurred at the disposal site. The Commission expects that the closure costs will be minimal when compared to the other life cycle costs of the disposal site because the regulation requires the licensee to perform the majority of closure and stabilization activities as an integral part of normal disposal site procedures during the operating period.

The types of surety arrangements being considered in Part 61 are similar to the Commission's recently enacted uranium mill tailings requirements (45 FR 65521). In their evaluation of various surety mechanisms, the Commission used the following criteria: (1) degree of security in obtaining funds in case the licensee defaults; (2) amount of administrative time and expense required to implement and monitor the surety; (3) problems of asset valuation posed by the mechanism; and (4) the cost of the surety mechanism. Based on this review, the Commission found the following types of surety mechanisms to be acceptable: surety bonds, cash deposits, trust funds, deposits of government securities, escrows, letters or lines of credit, and a combination of these mechanisms or such other types of arrangements as may be approved by the Commission. The Commission found that self-insurance for a private sector applicant was not an acceptable surety mechanism.

Section 61.63 requires the applicant to provide evidence to the Commission that a legally binding arrangement, such as a lease, exists between the applicant and the party holding title to the disposal site. Such a binding arrangement would delineate financial responsibility for the active institutional control period, which is not expected to exceed 100 years. The Commission feels that this regulatory approach is required so that all necessary activities following licensing transfer, such as surveillance, monitoring, and custodial activities, will be performed promptly and in a manner that will protect the public health and safety.

Currently the Commission lacks authority to require land disposal facility licensees to provide financial responsibility for activities occurring after the original licensee's responsibilities have ceased and the license has been transferred to another party. The Commission is considering legislation proposals that would give the Commission the authority to require financial assurances of land disposal facility licensees for the active institutional control period. In the meantime, the Commission feels that the most appropriate regulatory approach is to require an applicant to submit evidence of a binding arrangement.

Manifest Tracking System. Section 20.311 of Part 20 establishes the requirements for a manifest tracking system for wastes. The system will address the need for more complete information on the classification and characteristics of the waste, for improved accountability of wastes, and for a better data base. The EPA has recently instituted a manifest tracking system for hazardous wastes. The General Accounting Office (GAO) noted the need for improvements in these two areas in its report entitled "The Problem of Disposing of Nuclear Low-Level Waste: Where Do We Go from Here?", published March 31, 1980. The GAO recommended that the Commission "Determine who the generators of low-level are in both the Agreement and non-Agreement States and how much waste each licensee is generating" and "Establish a method to track waste from the point of generation to the point of disposal." Improving the data base on waste will improve the credibility of decisionmakers, enable better planning for inspections and emergencies, enhance projection of future waste generation, and help in site specific analyses and planning. The information on waste classification and characteristics is necessary for proper handling and disposal at the land disposal facility (e.g., which waste requires intruder barriers).

Licensees who ship under existing regulations are required to prepare and forward shipping manifests that comply with DOT regulations. The proposed manifest content requirements in § 20.311 are somewhat more comprehensive but compatible with DOT requirements. The waste generator must be specifically identified. The information requirements concerning the waste itself are somewhat more extensive and geared to information needed for disposal, not just transportation and handling. More explicit information on chemical content and composition and solidification agents is required. Licensees are required to comply with and certify compliance with waste form requirements of Part 61. This latter requirement stems solely from the technical requirements for disposal and is therefore new. The land disposal facility licensee must record data on the condition of the waste itself and document and certify receipt, handling, repackaging, storage, and disposal.

The use of the manifests as provided in § 20.311 provides a tracking system that is inspectable. Section 20.311 requires the shipper to provide copies of the manifest to precede and accompany shipments and investigation if notification of receipt or disposal is not received. The responsibility for tracking shipments is with the shipper who may be the generator, a service company who collects, stores, and delivers the waste, or an intermediate processor. A crosscheck is provided to ensure that delayed or missing shipments are investigated by requiring land disposal facility operators to periodically match advance copies of manifests to those for shipments actually received.

G. Life Cycle of a Typical Land Disposal Facility

The life of a typical facility can be broken into 5 phases: preoperational, operational, closure, postclosure observation, and institutional control. The following discussion considers each phase separately. The applicant's activities and procedural requirements as established by this proposed rulemaking are included.

Preoperational Phase. The preoperational phase consists of two parts: disposal site selection and characterization and licensing. The disposal site selection and characterization fall into the data gathering and planning phase. This is the phase in which the applicant selects a region of interest and searches for a number of possible disposal sites (a slate of candidate disposal sites), using reconnaissance-level information. The applicant then narrows the possible disposal sites down to one. After a proposed disposal site has been selected, based upon reconnaissance-level information, the applicant begins a detailed investigation (geology, depth to ground-water table, amount of rainfall, etc.) of the proposed disposal site. The applicant also initiates the preoperational monitoring program.

The applicant prepares an application for the land disposal facility following Subpart B. The applicant also prepares an environmental report. Of particular importance to this application are the performance objectives and technical requirements discussed earlier and the preliminary site closure plan, arrangements concerning land ownership and associated responsibilities, and financial assurance.

Licensing activities begin when the applicant files the application. The application is reviewed for completeness and acceptability in accordance with new Paragraph 2.101(b)(2), prior to docketing. Notice of receipt of the tendered application is to be published in the Federal Register. The Commission notifies state, local and tribal officials and begins to coordinate with these officials. Once docketed, the application is again noticed in the Federal Register and the application and environmental report widely distributed. An opportunity for interested parties to request a hearing is provided pursuant to 10 CFR 2.105. Application fees are paid in accordance with 10 CFR Part 170.

The regulatory review period follows. The applicant continues any disposal site studies and the preoperational observation and monitoring. The applicant also responds to informtional requests. Section 61.3 requires that construction not begin until a decision is made to issue the license. The application and environmental report are updated if necessary.

The Commission reviews the application and the accompanying environmental report. The Commission requests additional information if necessary. The Commission prepares a draft environmental impact statement (DEIS). If hearings are requested, an Atomic Safety and Licensing Board (ASLB) is appointed. After the Commission's review is completed and documented and the EIS and any hearings completed, and the Commissioners have approved, the Director issues the license or denies the application in accordance with the criteria in § 61.23 and any decision rendered by the Licensing or Appeals Board. Hearings, if any, would be held in accordance with existing rules in 10 CFR Part 2. An Atomic Safety and Licensing Appeal Board and/or the Commission may review the findings of the ASLB or the ASLB findings may be appealed to these next levels and to the courts. Upon resolution of the hearings, reviews, and appeals, and the Commissioners have approved, the Director takes final action to issue or deny and publishes a notice in the Federal Register. If the ownership of the land has not been transferred to the State or Federal government, transfer would now take place. If the license is issued, it is subject to the general license condition in § 61.24 and to specific conditions as required.

If no hearings have been requested, and the Commissioners approve, the Commission publishes a notice of the issuance in the Federal Register in accordance with § 2.106, and the Director takes final action to issue or deny the license.

State and Indian tribes may participate in the Commission's license review process to aid the Commission in its review. Subpart F of the proposed Part 61 addresses such participation, which is in addition to participation as already provided in Parts 2 and 51.

Examples of the forms that State and Tribal participation may take include:

(1) Development of technical data, including, but not limited to, socioeconomic, hydrological, geological, environmental, or land use data for incorporation into the Commission's environmental impact statement on the application or other analyses.

(2) Development of public participation mechanisms to be included in the licensing process.

(3) Provision of a technical data base to provide verification to the Commission for materials presented in the license application.

(4) Exchange of State and Commission staff for cooperative review.

Operational Phase. After issuance of a license by the Commission the land disposal facility is constructed and waste receipt and disposal operations start. At intervals specified in the license, (the normal term for materials licenses is currently 5 years) the licensee would be required to submit a license renewal application (§ 61.27). At this time, the disposal site closure plan and funding requirements would be updated and financial arrangements for assurance of adequate funding reviewed. A public hearing would be offered. The licensee may also apply for amendments to the license (§ 61.26).

Disposal Site Closure Phase. As the disposal site becomes filled, time for disposal site closure approaches. Prior to closure, the licensee would submit a final closure plan for review and approval (§ 61.28). A public hearing would be offered. Upon approval, the licensee implements the plan. This would consist of decontamination and dismantlement, as appropriate, of buildings. Final disposal site contouring and preparation is performed. The licensee should work toward closure during the entire operational phase so that disposal site closure would not involve a major task.

Postclosure Observation and Maintenance. Implementation of the closure plan would be followed by a period of postclosure observation and maintenance on the part of the licensee, in which the licensee's monitoring and maintenance programs would continue (§ 61.29). This period is expected to last about 5 years to help assure that the disposal site is in a stable condition so that only minor custodial care, surveillance, and monitoring by the custodial agency are required. When the disposal site has reached a stable condition, the licensee may prepare and submit an application for transfer of the license. A public hearing would be offered. Among other things, the licensee must provide reasonable assurance that the site meets all performance objectives under Subpart C, and the Commission must find that the State or Federal agency responsible for postclosure care of the site is prepared to assume these responsibilities. As a condition for assuming these responsibilities, a State may require the licensee to comply with requirements of its own, as long as State's requirements are not inconsistent with the requirements of the Commission. Upon a satisfactory finding, the license will be transferred to the Federal or State custodial agency to cover their activities during the active institutional control period (§ 61.30).

Institutional Control Board. During the institutional control period, which for purposes of Part 61, the Commission assumes to be not more than 100 years, the custodial agency carries out a program of monitoring to assure continued satisfactory site performance and physical surveillance to keep people off the site and carries out minor custodial activities at the site. As a part of the license termination, the licensee is required to place records of the disposal facility with local, State, and Federal agencies. These records along with restrictions on the property deed and trench markers should help minimize disturbance of the disposal site. These latter mechanisms are those that would continue after the institutional control period. At the end of the necessary institutional control period, the license may be terminated (§ 61.31).

H. Other Considerations

Application to Existing Sites. Many of the operational provisions and waste characteristics requirements proposed in this rulemaking are in effect at the existing disposal facilities. Although nearly all disposal at existing facilities is carried out under State licenses, it would be the Commission's intent that in the future all disposal would be expected to comply with the provisions of Part 61. Existing disposal facilities should have no difficulty in complying with the waste classification and characteristics, manifest requirements, and the minimum requirements dealing with design and operations.

environmental monitoring, closure, post-closure observation, and institutional control. Where existing operating sites have difficulty meeting any of the criteria, the Commission will consider the matter on a case by case basis.

Naturally Occurring and Accelerator-Produced Radionuclides in Waste. Although the Commission has no direct statutory authority over naturally occurring and accelerator-produced radionuclides the evaluation of any specific disposal site will include consideration of the total impacts from all waste disposed of at the disposal site, including byproduct, source, special nuclear material, and naturally occurring and accelerator-produced material. Specific concentration limits for the disposal of important naturally occurring and accelerator-produced nuclides will be included in the planned regulatory guide on the classification of waste.

Paperwork Reduction Act. As required by Pub. L. 96-511, this proposed rule will be submitted to the Office of Management and Budget for clearance of the reporting/recordkeeping/application requirements.

Regulatory Flexibility Act. Based upon the information available at this stage of this rulemaking proceeding and in accordance with the Regulatory Flexibility Act of 1980, 5 U.S.C. 605(b), the Commission hereby certifies that this rulemaking will not, if promulgated, have a significant economic impact upon a substantial number of small entities.

The Regulatory Flexibility Act (Public Law 96-345) was signed into law in September 1980. The Act's principal objective is to make certain that Federal agencies try, where possible, to fit regulatory requirements to the scale of the affected activity. Significant economic impacts on a substantial number of small entities is a major concern. The proposed Part 61 and accompanying rule changes will potentially impact a significant number of persons licensed by the Commission and the Agreement States. The following discussion addresses the analyses required by the Act and briefly describes the impacts and how the interests of the small entities were considered in developing this proposed rule. The draft EIS for Part 61 provides additional background information and analysis of the impacts of this rulemaking action.

The need for standards to govern the disposal of radioactive wastes and new regulations to implement these standards is discussed in detail in the draft EIS.

Some provisions of the proposed rulemaking will apply to all Commission licensees who transfer radioactive waste for disposal on land. The Commission has approximately 9,000 licensees. All but a few hundred are small entities. Types of small entities that may be impacted include physicians, hospitals, medical and clinical laboratories, colleges and universities, waste collection companies, small industrial operations, and waste disposal site operators. Exact numbers of impacted entities are not available. Based on a 1979 survey of Commission licensees, less than one quarter of the licensees should be affected on a regular basis.

The reporting, recordkeeping, and other requirements with which licensees must comply in the proposed rule impose only a minor incremental burden and will result in better accountability of wastes and improvements in disposal of wastes. The reporting requirements are directed primarily at disposal site operators. Currently only two firms hold this type of license. In the foreseeable future it is not anticipated that the number of this type of licensee will reach ten. The requirements are comparable to existing requirements or requirements that would be imposed in specific licenses for site operation. All licensees transferring waste would be required to investigate and file reports if shipments are lost. (See proposed § 20.311 of 10 CFR Part 20.) Existing regulations have similar but more specific reporting requirements for lost radioactive materials. All licensees transferring waste are also required to prepare complete shipping manifests. The user and radiation safety personnel currently preparing wastes for shipment will have to spend some additional time preparing manifests and tracking shipments. Licensees are already required to keep records of transfers and certain disposals.

Compliance with the waste classification and characteristics requirements is required of all licensees who transfer waste for land disposal. The need for and impacts of compliance with waste criteria are addressed in the draft EIS. The types of impacts that the rule changes may have include additional waste treatment and processing, use of containers to meet waste form requirements, new labels for packages, and higher disposal costs in some cases to cover, for example, the addition of intruder barriers when required. Based on the analysis in the Draft EIS, it appears that very few small entities generate radioactive waste that would be subject to these requirements.

Federal rules that overlap the proposed rule are primarily those of the Department of Transportation (DOT). The Commission is not aware of any rules that duplicate or conflict with the proposed rule except that reports to the Environment Protection Agency on effluent releases and broker activities required by "Superfund" registration may be duplicative. The Commission would particularly welcome comments on how to minimize duplication with "Superfund" requirements. The Commission and DOT have an established working relationship implemented through a formal Memorandum of Understanding. The rule itself acknowledges the need to comply with DOT rules, and the Commission currently inspects licensees for compliance with DOT requirements. The manifest required by this rulemaking is consistent with DOT requirements, and the same document will be used to meet requirements of both agencies. The waste form and packaging requirements are in addition to and compatible with DOT rules.

The Regulatory Flexibility Act also requires discussion of alternatives to the proposed rule. The recordkeeping and reporting requirements impose such a minor incremental burden that no relief or exemption was considered. They are, in fact, minor modifications of existing rules and practices. Further, since the small entities account for a significant percentage of the volume of waste generated, it is important that all licensees participate in the manifest tracking system. The waste classification and characteristics portion of the rule does provide some relief from compliance for waste produced by the small entities. Where radiological hazard permits, segregated disposal has been provided as an option to complying with more restrictive waste acceptance requirements. The rule is a combination of performance and prescriptive requirements, as discussed earlier. Exemption from coverage is feasible when the radiological hazard of the wastes permits. The exemption of less hazardous wastes on a specific waste basis by separate rulemaking efforts was discussed previously. (See de minimis discussion in Section V.C.)

The economic costs of the rule to small entities have not been quantified. The incremental burdens are judged small and have been addressed qualitatively in this summary and in the EIS. The rulemaking should not affect economic factors such as employment, business viability, or ability for affected entities to compete.

The requirements in waste disposal practices are judged to significantly outweigh the small economic impact on

small entities. However, the Commission is seeking comments and suggested modifications because of the widely differing conditions under which small entities operate.

Any small entity subject to this regulation who determines that because of its size, it is likely to bear disproportionate adverse economic impact should apprise the Commission in a comment that indicates:

(1) The size of their business and how the proposed regulations would result in a significant economic burden upon them as compareed to larger organizations in the same business community;

(2) How the proposed regulations could be modified to take into account their differing needs or capabilities;

(3) The benefits that would accrue, or the detriments that would be avoided, if the proposed regulations were modified as suggested by the commenter; and

(4) How the proposed regulations, as modified, would still adequately protect the public health and safety.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and section 553 of title 5 of the United States Code, notice is hereby given that adoption of a new 10 CFR Part 61 and the following amendments to 10 CFR Parts 2, 19, 20, 21, 30, 40, 51, 70, 73 and 170 is contemplated.

A new Part 61 is added to 10 CFR to read as follows:

PART 61—LICENSING REQUIREMENTS FOR LAND DISPOSAL OF RADIOACTIVE WASTE

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Authority. Secs. 53, 57d, 62, 63, 65, 81, 161b., i., o., 182, 183, Pub. L.83-703, as amended, 68 Stat., 930, 932, 933, 935, 948, 950, 953, 954, as amended (42 U.S.C., 2073, 2077, 2092, 2093, 2095, 2111, 2201, 2232, 2233); Secs. 202, 206, Pub. L. 93-438, 88 Stat. 1244, 1246 (42 U.S.C. 5842, 5846); Sec. 14, Pub. L. 95-601 (42 U.S.C. 2021a). For the purposes of Sec. 223, 68 Stat. 958, as amended, 42 U.S.C. 2273, Table 5, §§ 61.55, 61.56 issued under Sec. 161b, 68 Stat 948; §§ 61.3, 61.10 through 61.17, 61.24, 61.61 through 61.63, and 61.80 issued under Sec. 161o., 68 Stat. 950, as amended (42 U.S.C. 2201)

Subpart A—General Provisions

§ 61.1 Purpose and scope.

(a) The regulations in this part establish, for land disposal of radioactive waste, the procedures and criteria for the issuance, and terms and conditions upon which the Commission issues licenses, for the disposal for others of radioactive wastes containing byproduct, source and special nuclear material. Disposal of waste by an individual licensee is set forth in Part 20 of this chapter.

(b) Except as provided in § 61.6 "Exemptions" and in Part 150 of this chapter, the regulations in this part apply to all persons in the United States. The regulations in this part do not apply to the disposal of high-level waste as provided for in Part 60 of this chapter or byproduct material (as defined in § 40.4(a-1)) as provided for in Part 40 of this chapter and licensed material as provided for in Part 20.

§ 61.2 Definitions.

As used in this part:

"Active maintenance" means any significant remedial activity needed during the period of institutional control to maintain a reasonable assurance that the performance objectives in §§ 61.41 and 61.42 are met. Such active maintenance includes ongoing activities such as the pumping and treatment of water from a disposal unit or one-time measures such as replacement of a disposal unit cover. Active maintenance does not include custodial activities such as repair of fencing, repair or replacement of monitoring equipment, revegatation, minor additions to soil cover, minor repair of disposal unit covers, and general disposal site upkeep such as mowing grass.

"Buffer zone" is a portion of the disposal site that is controlled by the licensee and that lies between the disposal units and the boundary of the site.

"Chelating agent" means a chemical compound which can be attached to a metal ion by at least two bonds in such a way as to form a ring structure. It is used to sequester metal ions that might be undesirable in a particular environment.

"Commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a land disposal facility. The term does not mean disposal site exploration, necessary roads for disposal site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the disposal site or the protection of environmental values.

"Commission" means the Nuclear Regulatory Commission or its duly authorized representatives.

"Director" means the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

"Disposal" means the isolation of radioactive wastes from the biosphere by emplacement in a land disposal facility.

"Engineered barrier" means a man-made structure or device that is intended to protect an intruder from inadvertent exposure to radiation from certain wastes.

"Disposal site" means that portion of a land disposal facility which is used for disposal of waste. It consists of disposal units and a buffer zone.

"Disposal unit" means a discrete portion of the disposal site into which waste is placed for disposal. For near-surface disposal the unit is usually a trench.

"Government agency" means any executive department, commission, independent establishment, corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the government.

"*Inadvertent intruder*" means a person who might occupy the disposal site unknowingly after closure and engage in normal activities, such as agriculture, dwelling construction, and other pursuits in which the person might be exposed unknowingly to radiation from the waste.

"*Indian Tribe*" means an Indian tribe as defined in the Indian Self-Determination and Education Assistance Act (25 USC 450).

"Intruder barrier" means a sufficient depth of cover over the waste that inhibits contact with waste and helps to assure that radiation exposures to an inadvertent intruder will meet the performance objectives set forth in this part, or engineered structures that provide equivalent protection to the inadvertent intruder.

"Hydrogeologic unit" means any soil or rock unit or zone which by virtue of its porosity or permeability, or lack thereof, has a distinct influence on the storage or movement of groundwater.

"Land disposal facility" means the land, buildings, and equipment which is intended to be used for the disposal of radioactive wastes into the subsurface of the land. For purposes of this chapter, a geologic repository as defined in Part 60 is not considered a land disposal facility.

"License" means a license issued under the regulations in Parts 30 through 35, 40, 50, 61, or 70 of this chapter, including licenses to operate a production or utilization facility pursuant to Part 50 of this chapter.

"Licensee" means the holder of such a license.

"Monitoring" means observing and making measurements to provide data to evaluate the performance and characteristics of the disposal site.

"Near-surface disposal facility" means land disposal facility in which radioactive waste is disposed of in or within the upper 15-20 meters of the earth's surface.

"Person" means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than the Commission or the Department of Energy, (except that the Department of Energy is considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to section 202 of the Energy Reorganization Act of 1974 (88 Stat. 1244)), any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

"Site closure and stabilization" means those actions that are taken upon completion of operations that prepare the disposal site for custodial care and that assure that the disposal site remain stable and will not need ongoing active maintenance.

"State" means any State, Territory, or possession of the United States, the Canal Zone, Puerto Rico, and the District of Columbia.

"Surveillance" means observation of the disposal site for purposes of visual detection of need for maintenance, custodial care, evidence of intrusion, and compliance with other license and regulatory requirements.

"Tribal Governing Body" means a Tribal organization as defined in the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450).

"Waste", for purposes of this part, means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level waste has the same meaning as in the Low-Level Waste Policy Act, that is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act.

§ 61.3 License required.

(a) No person may receive, possess, and dispose of radioactive waste containing source, special nuclear, or byproduct material at a land disposal facility unless authorized by a license issued by the Commission pursuant to this part.

(b) Each person shall file an application with the Commission and obtain a license as provided in this part before commencing construction of a land disposal facility. Failure to comply with this requirement may be grounds for denial of a license.

§ 61.4 Communications.

Except where otherwise specified, all communications and reports concerning the regulations in this part and applications filed under them should be addressed to the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Communications reports, and applications may be delivered in person at the Commission's offices at 1717 H Street NW., Washington, D.C. or 7915 Eastern Avenue, Silver Spring, Maryland.

§ 61.5 Interpretations.

Except as specifically authorized by the Commission, in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be considered binding upon the Commission.

§ 61.6 Exemptions.

The Commission may, upon application by an interested person, or upon its own initiative, grant any exemption from the requirements of the regulations in this part as it determines is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest.

§ 61.7 Concepts.

(a) *The Disposal facility.* (1) Part 61 is intended to apply to *land disposal* of radioactive waste and not to other methods such as sea or extraterrestrial disposal. In its present form, Part 61 contains procedural requirements and performance objectives applicable to any method of land disposal. It contains specific technical requirements for *near-*

surface disposal of radioactive waste which involves disposal in the ppermost 15 to 20 meters of the earth. ·echnical requirements for alternative methods will be added in the future.

(2) Near-surface disposal of radioactive waste takes place at a *near-surface disposal facility*, which includes all of the land and buildings necessary to carry out the disposal. The *disposal site* is that portion of the facility which is used for disposal of waste and consists of *disposal units* and a *buffer zone*. A *disposal unit* is a discrete portion of the disposal site into which waste is placed for disposal. For near-surface disposal, the disposal unit is usually a trench. A *buffer zone* is a portion of the disposal site that is controlled by the licensee and that lies between the boundary of the disposal site and any disposal unit. It provides controlled space to establish *monitoring* locations which are intended to provide an early warning of radionuclide movement, and to take mitigative measures if needed.

(b) *Waste Classification and Near-Surface Disposal.* (1) Disposal of radioactive waste in near-surface disposal facilities has two primary safety objectives: *prevention of migration* of radionuclides, primarily rough *groundwater*; and prevention of posure to *inadvertent intruders*.

(2) A cornerstone of the system to control the migration of radionuclides offsite is *stability*—stability of the waste and the disposal site so that once emplaced and covered, the access of water to the waste can be eliminated or minimized. While stability is a necessary characteristic for waste that has a potential for migration, much radioactive waste does not contain sufficient amounts of radionuclides to be of concern from this standpoint: this waste, however, tends to be unstable, such as ordinary trash type wastes. If mixed with the higher activity waste, their deterioration could lead to failure of the system and permit water to penetrate the disposal unit and cause problems with the higher activity waste. Therefore, in order to avoid placing requirements for a stable waste form on relatively innocuous waste, these wastes have been classed as *Class A segregated* waste. Even though the Class A segregated waste is unstable, it decays to acceptable levels during the period when the site is occupied and active maintenance can control water infiltration. Those higher activity wastes it should be stable for proper disposal e classed as *Class B stable* waste. The Class A segregated waste will be disposed of in separate disposal units at the disposal site. For certain isotopes, a maximum disposal site inventory will be established based on the characteristics of the disposal site.

(3) It is possible but unlikely that persons might occupy the site in the future and engage in normal pursuits without knowing that they were receiving radiation exposure. These persons are referred to as *inadvertent intruders*. Protection of such intruders can involve two principal controls: *institutional control* over the site after operations by the site owner to assure that no such occupation or improper use of the site occurs; or, designating which waste would present an unacceptable risk to an intruder, and disposing of this waste in a manner that provides some form of *intruder barrier* that is intended to prevent contact with the waste. This regulation incorporates both types of protective controls.

(4) Institutional control is relied on for periods up to *100 years* to control access to the closed site. This permits the disposal of Class A segregated and Class B stable waste without special provisions for intrusion protection, since these classes of waste contain types and quantities of radioisotopes that will decay during the 100-year period to levels that do not pose a danger to public health and safety.

(5) Waste that will not decay to such levels within 100 years is designated as *Class C intruder* waste. This waste is disposed of at a greater depth than the other classes of waste so that subsequent surface activities by an intruder will not disturb the waste. Where site conditions prevent deeper disposal, *engineered barriers* such as concrete covers may be used. The assumed effective life of these intruder barriers is 500 years. A *maximum concentration* of radionuclides is specified for all wastes so that at the end of the 500 year period, remaining radioactivity is at a level that does not pose a danger to public health and safety. Waste with concentrations above these limits is generally unacceptable for near-surface disposal. Some provisions are made for exceptions on a case-by-case basis. Class C intruder waste must also be stable, since stability contributes to intruder protection by providing a recognizable and nondispersible waste form.

(c) *The Licensing Process.* (1) During the *preoperational phase*, the potential applicant goes through a process of *disposal site selection* by selecting a region of interest and examining a number of possible disposal sites and narrowing the choice to the *proposed* site. Through a detailed investigation of the *disposal site characteristics* the potential applicant obtains data on which to base an analysis of the disposal site's suitability. Along with these data and analyses, the applicant submits other more general information to the Commission in the form of an *application* for a license for land disposal. The Commission's review of the application is in accordance with established administrative procedures and may involve *participation* by affected *State governments* or *Indian tribes*. While the proposed disposal site must be owned by a State or the Federal government before the Commission will issue a license, it may be privately owned during the preoperational phase if suitable arrangements have been made with a State or the Federal government to take ownership in fee of the land before the license is issued.

(2) During the *operational phase*, the licensee carries out disposal activities in accordance with the requirements of this regulation and any conditions on the license. Periodically, the authority to conduct the above surface operations and receive waste will be subject to a *license renewal*, at which time the operating history will be reviewed and a decision made to permit or deny continued operation. When disposal operations are to cease, the licensee applies for an amendment to his license to permit *site closure*. After final review of the licensee's *site closure and stabilization plan*, the Commission may approve the final activities necessary to prepare the disposal site for the period of institutional control, without the need for ongoing *active maintenance* of the site.

(3) During the period when the site closure and stabilization activities are being carried out, the licensee is in a *disposal site closure* phase. Following that, for a period of at least 5 years, the licensee must remain at the disposal site for a period of *postclosure observation and maintenance* to assure that the disposal site is stable and ready for institutional control. At the end of this period, the licensee applies for a *license transfer* to the disposal site owner.

(4) After a finding of satisfactory disposal site closure, the Commission will transfer the license to the State or Federal agency that owns the disposal site. If the Department of Energy is the Federal agency the license will be terminated. Under the conditions of the transferred license, the owner will carry out a program of *monitoring* to assure continued satisfactory disposal site performance, physical *surveillance* to restrict access to the site and carry out minor *custodial activities*. At the end of

performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses must clearly demonstrate that there is reasonable assurance that the exposures to humans from the migration of radioactivity will not exceed the limits set forth in § 61.41.

(b) Analyses of the protection of individuals from inadvertent intrusion must include demonstration that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided.

(c) Analyses of the protection of individuals during operations must include assessments of expected exposures due to routine operations and likely accidents during handling, storage, and disposal of waste. The analyses must provide reasonable assurance that exposure will be controlled to meet the requirements of Part 20 of this chapter.

(d) Analyses of the long-term stability of the disposal site and the need for ongoing active maintenance after closure must be based upon analyses of active natural processes such as erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils and surface drainage of the disposal site. The analyses must provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

§ 61.14 Institutional information.

The institutional information must include:

(a) A certification by the Federal or State government agency which owns the disposal site that the agency is prepared to accept transfer of the license when the provisions of § 61.30 are met, and will assume responsibility for custodial care after site closure and post closure observation and maintenance.

(b) Where the proposed disposal site is on land not owned by the Federal or a State government, the applicant must submit evidence that arrangements have been made for assumption of ownership in fees by the Federal or a State government before the Commission issues a license.

§ 61.15 Financial information.

The financial information must be sufficient to demonstrate that the financial qualifications of the applicant are adequate to carry out the activities for which the license is sought and meet other financial assurance requirements as specified in Subpart E of this part.

§ 61.16 Other information.

Depending upon the nature of the wastes to be disposed of, and the design and proposed operation of the land disposal facility, additional information may be requested by the Commission including the following:

(a) Physical security measures, if appropriate. Any application to receive and possess special nuclear material in quantities subject to the requirements of Part 73 of this chapter shall demonstrate how the physical security requirements of Part 73 will be met. In determining whether receipt and possession will be subject to the requirements of Part 73, the applicant does not need to consider materials after disposal.

(b) Information concerning criticality, if appropriate.

(1) Any applicant to receive and possess special nuclear material in quantities that would be subject to the requirements of § 70.24, "Criticality accident requirements" of Part 70 of this chapter shall demonstrate how the requirements of this section will be met. In determining whether receipt and possession would be subject to the requirements of § 70.24, the applicant does not need to consider the quantity of special nuclear material that has been disposed.

(2) Any application to receive and possess special nuclear material shall describe procedures and provisions for criticality control which address both storage of special nuclear material prior to disposal and waste emplacement for disposal.

§ 61.20 Filing and distribution of application.

(a) An application for a license under this part, and any amendments thereto, shall be filed with the Director, must be signed by the applicant or the applicant's authorized representative, under oath and must consist of 1 signed original and 2 copies.

(b) Another 85 copies of the application and environmental report must be retained by the applicant for distribution in accordance with written instructions from the Director or designee.

(c) *Fees.* Application, amendment, and inspection fees applicable to a license covering the receipt and disposal of radioactive wastes in a land disposal facility are required by Part 170 of this chapter.

§ 61.21 Elimination of repetition.

In its application or environmental report, the applicant may incorporate by reference information contained in previous applications, statements, or reports filed with the Commission if these references are clear and specific.

§ 61.22 Updating of application and environmental report.

(a) The application and environmental report must be as complete as possible in the light of information that is available at the time of submittal.

(b) The applicant shall supplement its application or environmental report in a timely manner, as necessary, to permit the Commission to review, prior to issuance of a license, any changes in the activities proposed to be carried out or new information regarding the proposed activities.

§ 61.23 Standards for issuance of a license.

A license for the receipt, possession, and disposal of waste containing or contaminated with source, special nuclear, or byproduct material will be issued by the Commission upon finding that the issuance of the license will not be inimical to the common defense and security and will not constitute an unreasonable risk to the health and safety of the public, and:

(a) The applicant is qualified by reason of training and experience to carry out the disposal operations requested in a manner that protects health and minimizes danger to life or property.

(b) The applicant's proposed disposal site, disposal design, land disposal facility operations (including equipment, facilities, and procedures), disposal site closure, and postclosure institutional care are adequate to protect the public health and safety in that they provide reasonable assurance that the general population will be protected from releases of radioactivity as specified in the performance objective in § 61.41.

(c) The applicant's proposed disposal site, disposal site design, land disposal facility operations (including equipment, facilities, and procedures), disposal site closure, and postclosure institutional care are adequate to protect the public health and safety in that they provide reasonable assurance that doses to individual inadvertent intruders should not exceed the dose limits established in the performance objective in § 61.42.

(d) The applicant's proposed land disposal facility operations, including equipment, facilities, and procedures, are adequate to protect the public health and safety in that they provide reasonable assurance that the standards for radiation protection set out in Part 20 of this chapter will be met.

(e) The applicant's proposed disposal site, disposal site design, land disposal

the prescribed period of institutional control, the license will be terminated by the Commission.

Subpart B—Licenses

§ 61.10 Content of application.

(a) An application to receive from others, possess, use and dispose of wastes containing or contaminated with source, byproduct or special nuclear material by land burial must consist of general information, specific technical information, institutional information, and financial information as set forth in §§ 61.11 through 61.16. An environmental report prepared in accordance with Part 51 of this chapter must accompany the application.

§ 61.11 General information.

The general information must include each of the following:

(a) Identity of the applicant including:

(1) The full name, address, telephone number and description of the business or occupation of the applicant;

(2) If the applicant is a partnership, the name, and address of each partner and the principal location where the partnership does business;

(3) If the applicant is a corporation or an unincorporated association, (i) the state where it is incorporated or organized and the principal location where it does business, and (ii) the names and addresses of its directors and principal officers; and

(4) If the applicant is acting as an agent or representative of another person in filing the application, all information required under this paragraph must be supplied with respect to the other person.

(b) Qualifications of the applicant:

(1) The organizational structure of the applicant, both offsite and onsite, including a description of lines of authority and assignments of responsibilities, whether in the form of administrative directives, contract provisions, or otherwise;

(2) The technical qualifications, including training and experience, of the applicant and members of the applicant's staff to engage in the proposed activities and minimum training and experience requirements for personnel filling key positions described in § 61.11(b)(1).

(3) A description of the applicant's personnel training program; and

(4) The plan to maintain an adequate complement of trained personnel to carry out waste receipt, handling, and disposal operations, in a safe manner.

(c) A description of:

(1) The location of the proposed disposal site;

(2) The general character of the proposed activities;

(3) The types and quantities of radioactive waste to be received, possessed, and disposed of;

(4) Plans for use of the land disposal facility for purposes other than disposal of radioactive wastes; and

(5) The proposed facilities and equipment.

(d) Proposed schedules for construction, receipt of waste, and first emplacement of waste at the proposed land disposal facility.

§ 61.12 Specific technical information.

The specific technical information must include the following information needed for demonstration that the performance objectives of Subpart C of this part and the applicable technical requirements of Subpart D of this part will be met:

(a) A description of the natural disposal site characteristics as determined by disposal site selection and characterization activities. The description must include geologic, technical hydrologic, meteorologic, climatologic, and biotic features of the disposal site and vicinity.

(b) A description of the design features of the land disposal facility and the disposal units. For near-surface disposal, the description must include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; and disposal site monitoring.

(c) A description of the principal design criteria and their relationship to the performance objectives.

(d) A description of the design basis natural events or phenomena and their relationship to the principal design criteria.

(e) A description of codes and standards which the applicant has applied to the design and which will apply to construction of the land disposal facilities.

(f) A description of the construction and operation of the land disposal facility. The description must include the methods of construction; waste emplacement; the procedures for and areas of waste segregation; types of intruder barriers; onsite traffic and drainage systems; survey control program; methods and areas of waste storage; and methods to control surface water and groundwater access to the wastes.

(g) A description of the disposal site closure plan, including those design features which are intended to facilitate disposal site closure and to eliminate the need for ongoing active maintenance.

(h) An identification of the natural resources at the disposal site, the exploitation of which could result in inadvertent intrusion into the low-level wastes after removal of active institutional control.

(i) A description of the kind, amount, classification and specifications of the radioactive material proposed to be received, possessed, and disposed of at the land disposal facility.

(j) A description of the quality assurance program for the determination of natural disposal site characteristics and for quality assurance during the design, construction, and operation of the land disposal facility and the receipt, handling, and emplacement of waste. Audits and managerial controls must be included.

(k) A description of the radiation safety program for control and monitoring radioactive effluents and occupational radiation exposure to demonstrate compliance with the requirements of Part 20 of this chapter and to control contamination of personnel, vehicles, equipment, buildings, and the disposal site. Both routine operations and accidents must be addressed. The program description must include procedures, instrumentation, facilities, and equipment.

(l) A description of the environmental monitoring program to provide data to evaluate potential health and environmental impacts and the plan for taking corrective measures if migration of radionuclides is indicated.

(m) A description of the administrative procedures that the applicant will apply to control activities at the land disposal facility.

§ 61.13 Technical analyses.

The specific technical information must also include the following analyses needed to demonstrate that the performance objectives of Subpart C of this part will be met:

(a) Pathways analyzed in demonstrating protection of the general population from releases of radioactivity including air, soil, groundwater, surface water, plant uptake, and exhumation by burrowing animals. For near-surface disposal, the groundwater pathway will generally be the most significant in terms of releases of radioactivity. The migration analyses must clearly identify and differentiate between the roles

facility operations, disposal site closure, and postclosure institutional care are adequate to protect the public health and safety in that they provide reasonable assurance of long-term stability of the disposed waste and the disposal site and should eliminate the need for ongoing active maintenance of the disposal site following closure.

(f) There is adequate demonstration that the applicable technical requirements of Subpart D of this part will be met.

(g) Institutional care is assured for the length of time found necessary to assure the findings in paragraphs (b)-(e) of this section and that the institutional care meets the requirements of §§ 61.59 and 61.60.

(h) The information on financial assurances meets the requirements of subpart E of this part.

(i) The applicant has demonstrated compliance with the requirements of Part 73 of this chapter, insofar as they are applicable to special nuclear material to be possessed under the license.

(j) The applicant has demonstrated compliance with the requirements of § 70.24 of Part 70 of this chapter, insofar as they are applicable to special nuclear material to be possessed under the license.

(k) Any additional information submitted as requested by the Commission pursuant to § 61.16 is adequate.

(l) The requirements of Part 51 of this chapter have been met.

§ 61.24 Conditions of licenses.

(a) A license issued under this part, or any right thereunder, may be transferred, assigned, or in any manner disposed of, either voluntarily, directly or indirectly, through transfer of control of the license to any person, only if the Commission finds, after securing full information, that the transfer is in accordance with the provisions of the Atomic Energy Act and gives its consent in writing in the form of a license amendment.

(b) The licensee shall submit written statements under oath upon request of the Commission, at any time before termination of the license, to enable the Commission to determine whether or not the license should be modified, suspended, or revoked.

(c) The license will be terminated only on the full implementation of the final closure plan as approved by the Commission, including postclosure observation and maintenance.

(d) The licensee shall be subject to the provisions of the Atomic Energy Act now or hereafter in effect, and to all rules, regulations, and orders of the Commission. The terms and conditions of the license are subject to amendment, revision, or modification, by reason of amendments to, or by reason of rules, regulations, and orders issued in accordance with the terms of the Atomic Energy Act.

(e) Any license may be revoked, suspended or modified in whole or in part for any material false statement in the application or any statement of fact required under Section 182 of the Act, or because of conditions revealed by any application or statement of fact or any report, record, or inspection or other means which would warrant the Commission to refuse to grant a license to the original application, or for failure to operate the facility in accordance with the terms of the license, or for any violation of, or failure to observe any of the terms and conditions of the Act, or any regulation, license or order of the Commission.

(f) Each person licensed by the Commission pursuant to the regulations in this part shall confine possession and use of materials to the locations and purposes authorized in the license.

(g) No radioactive waste may be disposed of until the Commission has inspected the land disposal facility and has found it to be in conformance with the description, design, and construction described in the application for a license.

(h) The Commission may incorporate in any license at the time of issuance, or thereafter, by appropriate rule, regulation or order, additional requirements and conditions with respect to the licensee's receipt, possession, and disposal of source, special nuclear or byproduct material as it deems appropriate or necessary in order to:

(1) Promote the common defense and security;

(2) Protect health or to minimize danger to life or property;

(3) Require such reports and the keeping of records, and to provide for such inspections of activities under the license that may be necessary or appropriate to effectuate the purposes of the Act and regulations thereunder.

(i) Any licensee who receives and possesses special nuclear material under this part in quantities that would be subject to the requirements of § 70.24 of Part 70 of this chapter shall comply with the requirements of that section. The licensee does not need to consider the quantity of materials which it has disposed.

§ 61.25 Changes.

(a) Except as provided for in specific license conditions, the licensee shall not make changes in the land disposal facility or procedures described in the license application. The license will include conditions restricting subsequent changes to the facility and the procedures authorized. These restrictions will fall into three categories of descending importance to public health and safety as follows: (1) those features and procedures which may not be changed without (i) 60 days prior notice to the Commission, (ii) 30 days notice of opportunity for a prior hearing, and (iii) prior Commission approval; (2) those features and procedures which may not be changed without (i) 60 days prior notice to the Commission, and (ii) prior Commission approval; and (3) those features and procedures which may not be changed without 60 days prior notice to the Commission. Features and procedures falling in paragraph (a)(3) of this section may not be changed without prior Commission approval if the Commission, after having received the required notice, so orders.

(b) Amendments authorizing license renewal, site closure, license transfer, or license termination shall be included in paragraph (a)(1) of this section.

§ 61.26 Amendment of license.

(a) An application for amendment of a license must be filed in accordance with § 61.20 and shall fully describe the changes desired.

(b) In determining whether an amendment to a license will be approved, the Commission will apply the criteria set forth in § 61.23.

§ 61.27 Application for renewal or closure.

(a) Any expiration date on a license applies only to the above ground activities and to the authority to dispose of waste. Failure to renew the license in no way relieves the licensee of responsibility for carrying out site closure, postclosure observation and transfer of the license to the site owner. An application for renewal or an application for closure under § 61.28 must be filed at least 30 days prior to license expiration.

(b) Applications for renewal of a license must be filed in accordance with §§ 61.10 through 61.16 and 61.20. Applications for closure must be filed in accordance with §§ 61.20 and 61.28. Information contained in previous applications, statements or reports filed with the Commission under the license may be incorporated by reference if the references are clear and specific.

(c) In any case in which a licensee has timely filed an application for renewal a license, the license for continued ceipt and disposal of licensed materials does not expire until the Commission has taken final action on the application for renewal.

(d) In determining whether a license will be renewed, the Commission will apply the criteria set forth in § 61.23.

§ 61.28 Content of application for closure.

(a) Prior to final closure of the disposal site, or as otherwise directed by the Commission, the applicant shall submit an application to amend the license for closure. This closure application must include a final revision and specific details of the disposal site closure plan included as part of the license application submitted under § 61.12(g) that includes each of the following:

(1) Any additional geologic, hydrologic, or other disposal site data pertinent to the long-term containment of emplaced radioactive wastes obtained during the operational period.

(2) The results of tests, experiments, or any other analyses relating to backfill of excavated areas, closure and sealing, waste migration and interaction with emplacement media, or any other tests, periments, or analysis pertinent to the g-term containment of emplaced aste within the disposal site.

(3) Any proposed revision of plans for:

(i) Decontamination and/or dismantlement of surface facilities;

(ii) Backfilling of excavated areas; or

(iii) Stabilization of the disposal site for post-closure care.

(4) Any significant new information regarding the environmental impact of closure activities and long-term performance of the disposal site.

(b) Upon review and consideration of an application to amend the license for closure submitted in accordance with paragraph (a) of this section, the Commission shall issue an amendment authorizing closure if there is reasonable assurance that the long-term performance objectives of Subpart C of this part will be met.

§ 61.29 Post-closure observation and maintenance.

Following completion of closure authorized in § 61.28, the licensee shall observe, monitor, and carry out necessary maintenance and repairs at the disposal site until the site closure is complete and the license is transferred the Commission in accordance with .30. Responsibility for the disposal e must be maintained by the licensee for a minimum of 5 years.

§ 61.30 Transfer of license.

(a) Following closure and the period of post-closure observation and maintenance, the licensee may apply for an amendment to transfer the license to the disposal site owner. The license shall be transferred when the Commission finds:

(1) That the closure of the disposal site has been made in conformance with the licensee's disposal site closure plan, as amended and approved as part of the license;

(2) That reasonable assurance has been provided by the licensee that the performance objectives of Subpart C of this part are met;

(3) That any funds and necessary records for care will be transferred to the disposal site owner;

(4) That the post-closure monitoring program is operational for implementation by the disposal site owner; and

(5) That the Federal or State government agency which will assume responsibility for custodial care of the disposal site is prepared to assume responsibility and assure that the institutional requirements found necessary under § 61.23(g) will be met.

§ 61.31 Termination of license.

(a) Following any period of custodial care needed to meet the requirements found necessary under § 61.23, the licensee may apply for an amendment to terminate the license.

(b) This application must be filed, and will be reviewed, in accordance with the provision of § 61.20 and of this section.

(c) A license is terminated only when the Commission finds:

(1) That the institutional care requirements found necessary under § 61.23(g) have been met; and

(2) That any additional requirements resulting from new information developed during the custodial period have been met.

Subpart C—Performance Objectives

§ 61.40 General requirement.

Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits extablished in the performance objectives in §§ 61.41 through 61.44.

§ 61.41 Protection of the general population from releases of radioactivity.

Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. In addition, concentrations of radioactive material in groundwater must not exceed the maximum contaminant levels established in the National Primary Drinking Water Standards (40 CFR Part 141) at the nearest public drinking water supply (a limit of 10 pCi/1 above background must be used for uranium and thorium).

§ 61.42 Protection of individuals from inadvertent intrusion.

Design operation and closure of the land disposal facility must not result in conditions where any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste after active institutional controls over the disposal site are removed, could receive a dose to the whole body in excess of 500 millirem per year.

§ 61.43 Protection of individuals during operations.

Operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set out in Part 20 of this chapter.

§ 61.44 Stability of the disposal site after closure.

The disposal facility must be designed, used, operated, and closed to achieve long-term stability of the disposed waste and the disposal site and to eliminate the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

Subpart D—Technical Requirements for Land Disposal Facilities

§ 61.50 Disposal site suitability requirements for land disposal.

(a) Disposal site suitability for near-surface disposal.

(1) The purpose of this section is to specify the minimum characteristics a disposal site must have to be acceptable for use as a near-surface disposal site. The primary emphasis in disposal site suitability is given to isolation of wastes, a matter having long-term impacts, and to disposal site features that assure that the long-term performance objectives of Subpart C of this part are met, as opposed to short-term convenience or benefits.

(2) The disposal site shall be capable of being characterized, modeled, analyzed and monitored.

(3) Within the region or state where the facility is to be located, a disposal site should be selected so that projected population growth and future developments are not likely to affect the ability of the disposal facility to meet the performance objectives of Subpart C of this part.

(4) Areas must be avoided having economically significant natural resources which, if exploited, would result in failure to meet the performance objectives of Subpart C of this part.

(5) The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain, coastal high-hazard area or wetland.

(6) Upstream drainage areas must be minimized to decrease the amount of runoff which could erode or innundate waste disposal units.

(7) The disposal site must provide sufficient depth to the water table that ground water intrusion, perennial or otherwise, into the waste will not occur. The Commission will consider exceptions to this requirement if it can be conclusively shown that disposal site characteristics will result in diffusion being the predominant means of radionuclide movement and the rate of movement will result in the performance objectives of Subpart C of this part being met.

(8) Any groundwater discharge to the surface within the disposal site must not originate within the hydrogeologic unit used for disposal.

(9) Areas must be avoided where tectonic processes such as faulting, folding, seismic activity, or vulcanism may occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of Subpart C, of this part or may preclude defensible modeling and prediction of long-term impacts.

(10) Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of Subpart C, of this part or may preclude defensible modeling and prediction of long-term impacts.

(11) The disposal site must not be located where nearby facilities or activities could adversely impact the ability of the site to meet the performance objectives of Subpart C of this part or significantly mask the environmental monitoring program.

(b) Disposal site suitability requirements for land disposal other than near-surface (reserved).

§ 61.51 Disposal site design for land disposal.

(a) Disposal site design for near-surface disposal.

(1) Site design features must be directed toward long-term isolation and avoidance of the need for continuing active maintenance.

(2) The disposal site design and operation must be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that provides reasonable assurance that the performance objectives of Subpart C of this part will be met.

(3) The disposal site must be designed to complement and improve the ability of the disposal site's natural characteristics to assure that the performance objectives of Subpart C of this part will be met.

(4) Covers must be designed to prevent water infiltration, to direct precolating or surface water away from the buried waste, and to resist degradation by surface geologic processes and biotic activity.

(5) Surface features must direct surface water drainage away from disposal units at velocities and gradients which will not result in erosion that will require ongoing active maintenance in the future.

(6) The disposal site must be designed to eliminate the contact of water with waste during storage, the contact of standing water with waste during disposal, and the contact of percolating or standing water with wastes after disposal.

(7) The disposal site shall be used exclusively for the disposal of radioactive wastes.

(b) Disposal site design for other than near-surface disposal (reserved).

§ 61.52 Land disposal facility operation and disposal site closure.

(a) Near-surface disposal facility operation and disposal site closure.

(1) Wastes designated as Class A segregated, pursuant to § 61.55, must be segregated from other wastes by placing in disposal units which are sufficiently separated from other units so that there is no interaction between them.

(2) Wastes designated as Class B stable, pursuant to § 61.55, shall be disposed of in accordance with the requirements of paragraphs (a)(4) through (10) of this section.

(3) Wastes designated as Class C intruder, pursuant to § 61.55, must be disposed of so that the top of the waste is a minimum of 5 meters below the surface of the cover or must be disposed of with natural or engineered barriers that are designed to protect against an inadvertent intrusion for at least 500 years.

(4) Wastes must be emplaced in an orderly manner that maintains the package integrity during emplacement and disposal.

(5) Void spaces between waste packages must be filled with earth or other material to reduce future subsidence within the fill.

(6) Waste must be placed and covered in a manner that limits the gamma radiation at the surface of the cover to levels that are within a few percent above the natural background levels of the site.

(7) The boundaries and locations of each disposal unit (e.g., trenches) must be accurately located and mapped by means of a land survey. Near-surface disposal units must be marked in such a way that the boundaries of each unit can be easily defined. Three permanent survey marker control points, referenced to United States Geological Survey (USGS) or National Geodetic Survey (NGS) survey control stations, must be established on the site to facilitate surveys. The USGS or NGS control stations must provide horizontal and vertical controls as checked against USGS or NGS record files.

(8) A buffer zone of land must be maintained between any buried waste and the disposal site boundary. The buffer zone shall extend at least 100 feet outward from the outermost waste disposal units.

(9) Adequate closure and stabilization measures must be carried out as each disposal unit (e.g., each trench) is filled and covered.

(10) Active waste disposal operations must not have an adverse effect on completed closure and stabilization measures.

(b) Facility operations and disposal site closure for land disposal facilities other than near-surface (reserved).

§ 61.53 Environmental monitoring.

(a) At the time a license application is submitted, the applicant shall have conducted a preoperational monitoring program to provide basic environmental data on the disposal site characteristics. The applicant shall obtain information about the ecology, meteorology, climate, hydrology, geology, and seismology of the disposal site. For those characteristics that are subject to seasonal variation, data must cover at least a twelve month period.

(b) During the land disposal facility site construction and operation, the licensee shall maintain a monitoring program. Measurements and observations must be made and recorded to provide data to evaluate the potential health and environmental impacts during both the construction and the operation of the facility and enable the evaluation of long-term effects and the need for mitigative measures.

(c) After the disposal site is closed, the licensee responsible for post-operational surveillance of the disposal site shall maintain a monitoring system based on the operating history and the closure and stabilization of the disposal site. The monitoring system must be capable of providing early warning of migration of radionuclides from the disposal site.

(d) The licensee must have plans for taking corrective measures if migration of radionuclides would incidate that the performance objectives of Subpart C would not be met.

§ 61.54 Alternative requirements for design and operations.

The Commission may, upon request or on its own initiative, authorize provisions other than those set forth in §§ 61.51 through 61.53 for the segregation and disposal of waste and for the design and operation of a land disposal facility on a specific basis, if it finds reasonable assurance of compliance with the performance objectives of Subpart C of this part.

§ 61.55 Waste classification.

Radioactive wastes are defined to fall within one of the following categories:

(a) *Class A segregated waste* is waste that is segregated at the disposal site and disposed of with only minimum requirements on waste form and characteristics and has the following properties:

(1) the radioisotope concentration does not exceed the values shown in Column 1, Table I, of this section; and

(2) the physical form and characteristics must meet the minimum requirements set forth in § 61.56(a).

(b) *Class B stable waste* is waste that must meet more rigorous requirements on waste form to assure stability after disposal, and has the following properties:

(1) the radioisotope concentration exceeds the concentrations shown in Column 1; and,

Table 1

Isotope	Column 1[1]	Column 2[2]	Column 3[3]
Any with half-life less than 5 years	700	70 000	Theoretical maximum specific activity
H-3	40	10[4]	Theoretical maximum specific activity[4]
C-14	0 8	0 8	0 8[4]
Na-59	2 2	2 2	2.2
Co-60	700	70,000	Theoretical maximum specific activity
Ni-63	3 5	70	70
Nb-94	0 002	0 002	0 002
Sr-90	0 04	150	700
Tc-99	0 3	0 3	0 3[4]
I-129	0 008	0 008	0 008[4]
Cs-135	84	84	84
Cs-137	1 0	44	4600
Enriched Uranium	0 04	0 04	0 04
Natural or Depleted uranium	0 05	0 05	0 05
Alpha-emitting transuranic isotopes			10 nCi/g
Pu-241			350 n Ci/g

[1] Maximum concentration for Class A segregated waste Above this, it is Class B stable waste μCi/cm³
[2] Concentrations above which some wastes become Class C intruder waste μCi/cm³
[3] Maximum concentration for any waste class μCi/cm³
[4] Near-surface disposal facilities will be limited to a specified quantity for the disposal site The quantity will be determined at the time the license is issued and will be governed largely by the characteristics of the site Therefore, the total activity of these isotopes in each package of waste must be shown on the shipping manifest (see § 20 311 of this chapter)
For isotopes contained in metals, metal alloys, or permanently fixed on metal as contamination, the values above may be increased by a factor of ten, except natural or depleted uranium which can be the natural specific activity
For isotopes not listed above, use the values for Sr-90 for beta emitting isotopes with little or no gamma radiation; the values for Cs-137 for beta emitting isotopes with significant gamma radiation; and the values for U-235 for alpha emitting isotopes other than radium.
Wastes containing chelating agents in concentrations greater than 0 1% are not permitted except as specifically approved by the Commission
For mixtures of the above isotopes, the sum of ratios of an isotope concentration in waste to the concentration in the above table shall not exceed one for any waste class
Concentrations may be averaged over volume of the package For a 55 gallon drum multiply the concentration limits by 200,000 to determine allowable total activity
Until establishment and adoption of other values or criteria, the values in this table (or greater concentrations as may be approved by the Commission in particular cases) shall be used in categorizing waste for near-surface disposal

(2) The physical form and characteristics of the waste must meet the *minimum* and *stability* requirements set forth in § 61.56.

(c) *Class C intruder waste* is waste that not only must meet more rigorous requirements on waste form to assure stability but also requires special measures at the disposal facility to protect against inadvertent intrusion. This class has the following properties:

(1) The radioisotope concentrations exceed those shown in Column 2; and

(2) The physical form and characteristics meet the *minimum* and *stability* requirements set forth in § 61.56 of this part.

(d) Waste that has a radioisotope concentration that exceeds the values shown in Column 3, Table I of this section, is not generally acceptable for near-surface disposal and shall not be disposed of without specific Commission approval pursuant to § 61.58 of this part.

§ 61.56 Waste characteristics.

(a) The following requirements are *minimum* requirements for all classes of waste and are intended to facilitate handling at the disposal site and provide protection of health and safety.

(1) The waste must be packaged and the waste form and packaging must meet all applicable transportation requirements of the Commission set forth in 10 CFR Part 71 and of the Department of Transportation set forth in 49 CFR Parts 171–179, as applicable.

(2) Wastes must not be packaged for disposal in cardboard or fiberboard boxes.

(3) Waste containing liquids must be packaged in sufficient absorbent material to absorb twice the volume of the liquid.

(4) Waste must not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.

(5) Waste must not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.

(6) Wastes must not be pyrophoric. Pyrophoric materials contained in wastes shall be treated, prepared, and packaged to be nonflammable.

(7) Wastes in a gaseous form must be packaged at a pressure that does not exceed one atmosphere at 20° C. Total activity must not exceed 100 curies per container.

(8) Wastes containing biological, pathogenic, or infectious material must be treated to reduce to the maximum extent practicable the potential hazard.

(b) The requirements in this section are intended to provide *stability* of the waste for at least 150 years. Stability is intended to assure that the waste does not degrade and promote slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent

intruder, since it provides a recognizable and nondispersible waste.

(1) Waste must have structural stability. A structurally stable waste form will maintain its physical dimensions within 5% and its form, under the expected disposal conditions of compressive load of 50 psi, and factors such as the presence of moisture, and microbial activity, and internal factors such as as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.

(2) Notwithstanding the provisions in § 61.56(a)(3), liquid wastes, or wastes containing liquid, must be converted into a form that contains as little free standing noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste.

(3) Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.

§ 61.57 Labeling.

Each package of waste must be clearly labeled to identify whether it is *Class A segregated, Class B stable,* or *Class C intruder,* in accordance with § 61.55.

§ 61.58 Alternative requirements for waste classification and characteristics.

The Commission may, upon request or on its own initiative, authorize other provisions for the classification and characteristics of waste on a specific basis, if, after evaluation, of the specific characteristics of the waste, disposal site, and method of disposal, it finds reasonable assurance of compliance with the performance objectives in Subpart C of this part.

§ 61.59 Institutional requirements.

(a) *Land ownership.* Disposal of radioactive waste received from other persons may be permitted only on land owned in fee by the Federal or a State government.

(b) *Institutional control.* The land owner or custodial agency shall carry out an active institutional control program to physically control access to the disposal site following transfer of control of the disposal site from the disposal site operator. The active control program must also include, but not be limited to, carrying out an environmental monitoring program at the disposal site, periodic suveillance, minor custodial care, and other requirements as determined by the Commission and administration of funds to cover the costs for these activities. The period of active controls will be determined by the Commission, but active controls may not be relied upon for more than 100 years following transfer of control of the disposal site to the owner.

Subpart E—Financial Assurances

§ 61.61 Applicant qualification and assurances.

Each applicant shall show that it either possesses the necessary funds or has reasonable assurance of obtaining the necessary funds, or by a combination of the two, to cover the estimated costs of conducting all licensed activities over the planned operating life of the project, including costs of construction and disposal.

§ 61.62 Funding for disposal site closure and stabilization.

(a) The applicant shall provide assurances prior to the commencement of operations that sufficient funds will be available to carry out disposal site closure and stabilization, including: (1) decontamination or dismantlement of land disposal facility structures; and (2) closure and stabilization of the disposal site so that following transfer of the disposal site to the owner, the need for ongoing active maintenance is eliminated and only minor custodial care, surveillance, and monitoring are required. These assurances shall be based on Commission approved cost estimates reflecting the Commission approved plan for disposal site closure and stabilization. The applicant's cost estimates must take into account total capital costs that would be incurred if an independent contractor were hired to perform the closure and stabilization work.

(b) In order to avoid unnecessary duplication and expense, the Commission will accept financial sureties that have been consolidated with earmarked financial or surety arrangements established to meet requirements of other Federal or State agencies and/or local governing bodies for such decontamination, closure and stabilization. The Commission will accept this arrangement only if they are considered adequate to satisfy these requirements and that the portion of the surety which covers the closure of the disposal site is clearly identified and committed for use in accomplishing these activities.

(c) The licensee's surety mechanism will be reviewed by the Commission annually to assure sufficient funds for completion of the closure plan if the work has to be performed by an independent contractor.

(d) The amount of surety liability should change in accordance with the predicted cost of future closure and stabilization. Factors affecting closure and stabilization cost estimates include: inflation; increases in the amount of disturbed land; changes in engineering plans; closure and stabilization that has already been accomplished and any other conditions affecting costs. This will yield a surety that is at least sufficient at all times to cover the costs of closure of the disposal units that are expected to be used before the next license renewal.

(e) The term of the surety mechanism must be open ended unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance could be provided with a surety mechanism which is written for a specified period of time (e.g., five years) yet which must be automatically renewed unless the party who issues the surety notifies the beneficiary (the Commission) and the principal (the licensee) not less than 90 days prior to the renewal date of its intention not to renew. In such a situation the licensee must submit a replacement surety within 30 days after notification of cancellation. If the licensee fails to provide a replacement surety acceptable to the Commission, the Commission will collect on the original surety.

(f) Proof of forfeiture must not be necessary to collect the surety so that in the event that the licensee could not provide an acceptable replacement surety within the required time, the surety shall be automatically collected prior to its expiration. The conditions described above would have to be clearly stated on any surety instrument which is not open-ended, and must be agreed to by all parties. Liability under the surety mechanism must remain in effect until the closure and stabilization program has been completed and approved by the Commission and the license has been transferred to the site owner.

(g) Financial surety arrangements generally acceptable to the Commission include: surety bonds, cash deposits, certificates of deposit, deposits of government securities, escrow accounts, irrevocable letters or lines of credit, trust funds, and combinations of the above or such types of arrangements as may be approved by the Commission. However, self-insurance, or any arrangement which essentially constitutes pledging the assets of the licensee, will not satisfy the surety

requirement for private sector applicants since this provides no additional assurance other than that which already exists through license requirements.

§ 61.63 Financial assurances for institutional control.

(a) Prior to the issuance of the license, the applicant shall provide for Commission review and approval a copy of a binding arrangement, such as a lease, between the applicant and the disposal site owner that ensures that sufficient funds will be available to cover the costs of monitoring, and any required maintenance during the institutional control period. The binding arrangement will be reviewed periodically by the Commission to ensure that changes in inflation, technology and disposal facility operations are reflected in the arrangements.

(b) Subsequent changes to the binding arrangement specified in paragraph (a) of this section relevant to institutional control shall be submitted to the Commission for approval.

Subpart F—Participation by State Governments and Indian Tribes

§ 61.70 Scope.

This subpart describes mechanisms through which the Commission will implement a formal request from a State or Tribal government to participate in the review of a license application for a land disposal facility. Nothing in this subpart may be construed to bar the State or tribal-governing body from participating in subsequent Commission proceedings concerning the license application as provided under Federal law and regulations.

§ 61.71 State and tribal government consultation.

Upon request of a State or tribal government body, the Director may make available Commission staff to discuss with representatives of the State or tribal governing body information submitted by the applicant, applicable Commission regulations, licensing procedures, potential schedules, and the type and scope of State activities in the license review permitted by law. In addition, staff will be made available to consult and cooperate with the State or tribal governing body in developing proposals for participation in the license review.

§ 61.72 Filing of proposals for State and tribal participation.

(a) Following publication in the Federal Register of the notice of docketing, but no later than 120 days following docketing of an application submitted under § 61.20, a State or tribal-governing body potentially affected a near-surface disposal facility at the proposed site may submit to the Director a proposal for participation in the review of the license application. A State or tribal governing body may also submit to the Director a proposal for participation in the review of any subsequent application for license renewal or amendment.

(b) Proposals for participation in the licensing process must be made in writing and must be signed by the Governor of the State or the official otherwise provided for by State or Tribal law.

(c) At a minimum, proposals must contain each of the following items of information:

(1) A general description of how the State or tribe wishes to participate in the licensing process specifically identifying those issues it wishes to review.

(2) A description of material and information which the State or tribe plans to submit to the Commission for consideration in the licensing process. A tentative schedule referencing steps in the review and calendar dates for planned submittals should be included.

(3) A description of any work that the State or tribe proposes to perform for the Commission in support of the licensing process.

(4) A description of state or tribal plans to facilitate local government and citizen participation.

(5) A preliminary estimate of the types and extent of impact which the State expects, should be a disposal facility be located as proposed.

(6) If desired, any requests for educational or information services (seminars, public meetings) or other actions from the Commission such as establishment of additional Public Document Rooms or exchange of State personnel under the Intergovernmental Personnel Act.

§ 61.73 Commission approval of proposals.

(a) Upon receipt of a proposal submitted in accordance with § 61.72, the Director will arrange for a meeting between the representatives of the State or tribal governing body and the Commission staff to discuss the proposal and to ensure full and effective participation by the State or tribe in the Commission's license review.

(b) If requested by a State or tribal governing body, the Director may approve all or any part of a proposal if the Director determines that:

(1) The proposed activities are within the scope of Commission statutory responsibility and the type and magnitude of impacts which the State or tribe may bear are sufficient to justify their participation; and

(2) The proposed activities will contribute productively to the licensing review.

(c) The decision of the Director will be transmitted in writing to the Governor or the designated official of the tribal governing body.

(d) Upon the written request of the Governor or the tribal official, any determination of the Director under this section may be reviewed by the Commission.

Subpart G—Records, Reports, Tests, and Inspections

§ 61.80 Maintenance of records, reports, and transfers.

(a) Each licensee shall maintain any records and make any reports in connection with the licensed activities as may be required by the conditions of the license or by the rules, regulations, and orders of the Commission.

(b) Records which are required by the regulations in this Part or by license conditions must be maintained for a period specified by the appropriate regulations in this chapter or by license condition. If a retention period is not otherwise specified, these records must be maintained and transferred as a condition of license termination unless the Commission otherwise authorizes their disposition.

(c) Records which must be maintained pursuant to this Part may be the original or a reproduced copy of microfilm if this reproduced copy or microfilm is capable of producing a clear and legible copy.

(d) If there is a conflict between the Commission's regulations in this part, license condition, or other written Commission approval or authorization pertaining to the retention period for the same type of record, the longest retention period specified takes precedence.

(e) Notwithstanding paragraphs (a) through (d) of this section, copies of records of the location and the quantity of radioactive wastes contained in the disposal site must be transferred upon license termination to the chief executive of the nearest municipality, the chief executive of the county in which the facility is located, the county zoning board or land development and planning agency, the state governor and other State, local and Federal governmental agencies as designated by

the Commission at the time of license termination.

(f) Each licensee shall comply with the reporting requirements of § 30.55 of this chapter, § 40.64 of this chapter, and § 70.53 and § 70.54 of Part 70 of this chapter if the quantities or activities of materials received or transferred exceed the limits of these sections. Inventory reports are not required for materials after disposal.

(g) Each licensee authorized to dispose of radioactive waste received from other persons, shall, upon each issuance of its annual financial report, if any, including any certified financial statements, file a copy thereof with the Commission in order to update the information base for determining financial qualifications.

(h)(1) Each licensee authorized to dispose of waste materials received from other persons, pursuant to this part, shall submit annual reports to the appropriate Commission regional office shown in Appendix D of Part 20 of this chapter, with copies to the Director of the Office of Inspection and Enforcement and the Director of the Division of Waste Management, USNRC, Washington, D.C. 20555. Reports shall be submitted by the end of the first calendar quarter of each year for the preceding year; (2) the reports shall include (i) specification of the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in airborne effluents during the preceding year, (ii) the results of the environmental monitoring program, (iii) a summary of licensee disposal site maintenance activities, (iv) summary of activities and quantities of radionuclides disposed of, (v) any instances in which observed site characteristics were different from those described in the application for a license, and (vi) any other information the Commission may require. If the quantities of radioactive materials released during the reporting period, monitoring results, or maintenance performed are significantly different from those expected in the materials previously reviewed as part of the licensing action, the report must cover this specifically.

(i) Each licensee shall report in accordance with the requirements of § 70.52 of this chapter.

(j) Any transfer of byproduct, source, and special nuclear materials by the licensee is subject to the requirements in § 30.41 of Part 30 of this chapter, § 40.51 of Part 40 of this chapter, and § 70.42 of Part 70 of this chapter. Byproduct, source and special nuclear material means materials as defined in these Parts, respectively.

§ 61.81 Tests at land disposal facilities.

(a) Each licensee shall perform, or permit the Commission to perform, any tests as the Commission deems appropriate or necessary for the administration of the regulations in this Part, including tests of:

(1) Radioactive wastes and facilities used for the receipt, storage, treatment, handling and disposal of radioactive wastes;

(2) Radiation detection and monitoring instruments; and

(3) Other equipment and devices used in connection with the receipt, possession, handling, treatment, storage, or disposal of radioactive waste.

§ 61.82 Commission inspections of land disposal facilities.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect radioactive waste and the premises, equipment, operations, and facilities in which radioactive wastes are received, possessed, handled, treated, stored, or disposed.

(b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by it pursuant to the regulations in this chapter. Authorized repesentatives of the Commission may copy, for the Commission's use, any record required to be kept pursuant to this part.

§ 61.83 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the Atomic Energy Act of 1954, as amended, or any regulation or order issued thereunder. A court order may be obtained for the payment of a civil penalty imposed pursuant to section 234 of the Act for violation of section 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Act, or section 206 of the Energy Reorganization Act of 1974, or any rule.

The following amendments are also made to existing parts of the regulations in this chapter.

PART 2—RULES OF PRACTICE

2. In § 2.101, paragraph (a)(2), (b), and (d) are revised to read as follows:

§ 2.101 Filing of application.

(a) * * *

(2) Each application for a license for a facility will be assigned a docket number. However, to allow a determination as to whether an application for a construction permit or operating license for a production or utilization facility is complete and acceptable for docketing, it will be initially treated as a tendered application after it is received and a copy of the tendered application will be available for public inspection in the Commission's Public Document Room, 1717 H Street, NW., Washington, D.C. Generally, that determination will be made within a period of thirty (30) days.

* * * * *

(b) Each application for a license to receive radioactive waste from other persons for disposal under Part 61 of this chapter and the accompanying environmental report shall be processed in accordance with the provisions of this paragraph.

(1) To allow a determination as to whether the application or environmental report is complete and acceptable for docketing, it will be initially treated as a tendered document, and a copy will be available for public inspection in the Commission's Public Document Room, 1717 H Street, NW., Washington, D.C. One original and two copies shall be filed to enable this determination to be made.

(i) Upon receipt of a tendered application, the Commission will publish in the Federal Register notice of the filed application and will notify the governors, legislatures and other appropriate State, county, and muncipal officials and tribal governing bodies of the States and areas containing or potentially affected by the activities at the proposed site and the alternative sites. The Commission will inform these officials that the Commission staff will be available for consultation pursuant to § 61.71 of this chapter. The Federal Register notice will note the opportunity for interested persons to submit views and comments on the tendered application for consideration by the Commission and applicant.

(ii) The Commission will also post a public notice in a newspaper or newspapers of general circulation in the affected States and areas summarizing information contained in the applicant's tendered application and noting the opportunity to submit views and comments.

(iii) When the Director of Nuclear Material Safety and Safeguards determines that the tendered document is complete and acceptable for docketing, a docket number will be assigned and the applicant will be notified of the determination. If it is determined that all or any part of the tendered document is incomplete and therefore not acceptable for processing, the applicant will be informed of this determination and the aspects in which the document is deficient.

(2) With respect to any tendered document that is acceptable for

docketing, the applicant will be requested to (i) submit to the Director of Nuclear Material Safety and Safeguards such additional copies as the regulations in Parts 61 and 51 of this chapter require, (ii) serve a copy on the chief executive of the municipality in which the waste is to be disposed of or, if the waste is not to be disposed of within a municipality, serve a copy on the chief executive of the county in which the waste is to be disposed of (iii) make direct distribution of additional copies to Federal, State, Indian Tribe, and local officials in accordance with the requirements of this chapter and written instructions from the Director of Nuclear Material Safety and Safeguards and (iv) serve a notice of availability of the application and environmental report on the chief executives or governing bodies of the municipalities or counties which have been identified in the application and environmental report as the location of all or part of the alternative sites if copies are not distributed under paragraph (b)(2)(iii) of this section to the executives or bodies. All distributed copies shall be completely assembled documents identified by docket number. Subsequently distributed amendments, however, may include revised pages to previous submittals and, in such cases, the recipients will be responsible for inserting the revised pages. In complying with the requirements of paragraph (b) of this section the applicant shall not make public distribution of those parts of the application subject to § 2.790(d).

(3) The tendered document will be formally docketed upon receipt by the Director of Nuclear Material Safety and Safeguards of the required additional copies. Distribution of the additional copies shall be deemed to be complete as of the time the copies are deposited in the mail or with a carrier prepaid for delivery to the designated addressees. The date of docketing shall be the date when the required copies are received by the Director of Nuclear Material Safety and Safeguards. Within ten (10) days after docketing, the applicant shall submit to the Director of Nuclear Material Safety and Safeguards a written statement that distribution of the additional copies to Federal, State, Indian Tribe, and local officials has been completed in accordance with requirements of this section and written instructions furnished to the applicant by the Director of Nuclear Material Safety and Safeguards.

(4) Amendments to the application and environmental report shall be filed and distributed and a written statement shall be furnished to the Director of Nuclear Material Safety and Safeguards in the same manner as for the initial application and environmental report.

(5) The Director of Nuclear Material Safety and Safeguards will cause to be published in the Federal Register a notice of docketing which identifies the State and location of the proposed waste disposal facility and will give notice of docketing to the governor of that State and other officials listed in paragraph (b)(3) of this section and, in a reasonable period thereafter, publish in the Federal Register a notice pursuant to § 2.105 offering opportunity for a hearing to the applicant and other affected persons.

* * * * *

(d) The Director of Nuclear Reactor Regulation or Director of Nuclear Material Safety and Safeguards, as appropriate, will give notice of the docketing of the public health and safety, common defense and security, and environmental parts of an application for a license for a facility to the Governor or other appropriate official of the State in which the facility is to be located or the activity is to be conducted and will cause to be published in the Federal Register a notice of docketing of the application which states the purpose of the application and specifies the location at which the proposed activity would be conducted.

* * * * *

3. Section 2.103(a) is revised to read as follows:

§ 2.103 Action on applications for byproduct, source, special nuclear material, and operator licenses.

(a) If the Director of Nuclear Reactor Regulation or the Director of Nuclear Material Safety and Safeguards, as appropriate, finds that an application for a byproduct, source, special nuclear material, or operator license complies with the requirements of the Act, the Energy Reorganization Act, and this chapter, he will issue a license. If the license is for a facility or if it is to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter, the Director of Nuclear Reactor Regulation or the Director of Nuclear Material Safety and Safeguards, as appropriate, will inform the State, Indian Tribe, and local officials specified in § 2.104(e) of the issuance of the license.

* * * * *

4. Section 2.104(e) is revised to read as follows:

§ 2.104 Notice of hearing.

* * * * *

(e) The Secretary will give timely notice of the hearing to all parties and to other persons, if any, entitled by law to notice. The Secretary will transmit a notice of hearing on an application for a facility license or for a license for receipt of waste radioactive material from other persons for the purpose of disposal under Part 61 of this chapter or for a license to receive and possess high-level radioactive waste at a geologic repository operations area pursuant to Part 60 of this chapter to the governor or other appropriate official of the State and to the chief executive of the municipality in which the facility is to be located or the activity is to be conducted or, if the facility is not to be located or the activity conducted within a municipality, to the chief executive of the county (or to the Tribal organization, if it is to be so located or conducted within an Indian reservation).

5. Section 2.105(a)(2) is revised to read as follows:

§ 2.105 Notice of proposed action.

(a) * * *

(2) A license for receipt of waste radioactive material from other persons for disposal by the waste disposal licensee under Part 61 of this chapter.

* * * * *

6. Section 2.106 is amended by adding a new paragraph (d) to read as follows:

§ 2.106 Notice of issuance.

* * * * *

(d) The Director of Nuclear Material Safety and Safeguards will also cause to be published in the Federal Register notice of, and will inform the State and local officials or tribal governing body specified in § 2.104(e) of any licensing action with respect to a license to receive radioactive waste from other persons for disposal under Part 61 of this chapter or the amendment of such a license for which a notice of proposed action has been previously published.

7. Section 2.764 is amended by adding a new paragraph (e), and by revising paragraphs (a) and (b) to read:

§ 2.764 Immediate effectiveness of initial decision directing issuance or amendment of construction permit or operating license.[1]

(a) Except as provided in paragraphs (c), (d), and (e) of this section, an initial decision directing the issuance or amendment of a construction permit, a construction authorization, or an operating license shall be effective immediately upon issuance unless the presiding officer finds that good cause has been shown by a party why the initial decision should not become

immediately effective, subject to the review thereof and further decision by the Commission upon exceptions filed by any party pursuant to § 2.762 or upon its own motion.

(b) Except as provided in paragraphs (c), (d), and (e) of this section, the Director of Nuclear Reactor Regulation or Director of Nuclear Material Safety and Safeguards, as appropriate, notwithstanding the filing of exceptions, shall issue a construction permit, a construction authorization, or an operating license, or amendments thereto, authorized by an initial decision, within ten (10) days from the date of issuance of the decision.

* * * * *

(e) An initial decision directing the issuance of a license under Part 61 of this chapter (relating to land disposal of radioactive waste) or any amendment to such a license authorizing actions which may significantly affect the health and safety of the public, shall become effective only upon order of the Commission. The Director of Nuclear Material Safety and Safeguards shall not issue a license under Part 61 of this chapter, or any amendment to such a license which may significantly affect the health and safety of the public, until expressly authorized to do so by the Commission.

PART 19—NOTICES, INSTRUCTIONS, AND REPORTS TO WORKERS; INSPECTIONS

§ 19.2 [Amended]

8. Section 19.2 is amended by adding "61," following "40, 60."

§ 19.3 [Amended]

9. In § 19.3, paragraph (d) is amended by adding "61," following "40, 60."

PART 20—STANDARDS FOR PROTECTION AGAINST RADIATION

§ 20.2 [Amended]

10. Section 20.2 is amended by adding "61," following "40, 60."

§ 20.3 [Amended]

11. In § 20.3, paragraph (a)(9) is amended by adding "61," following "40, 60."

12. In § 20.301, paragraph (a) is amended by adding "61," following "40, 60," and paragraph (b) is revised to read as follows:

§ 20.301 General requirement.

* * * * *

(b) As authorized under § 20.302 or Part 61 of this chapter; or

* * * * *

§ 20.302 [Amended]

13. In § 20.302, paragraph (b) is removed.

14. A new § 20.311 is added to read as follows:

§ 20.311 Transfer for disposal and manifests.

(a) *Purpose.* The requirements of this section are designed to control transfers and establish a manifest tracking system and supplement existing requirements concerning transfers and recordkeeping.

(b) Each shipment of radioactive waste to a licensed land disposal facility must be accompanied by a shipment manifest that contains the name, address, and telephone number of the person generating the waste as well as the name, address, and telephone number of the person transporting the waste to the land disposal facility. The manifest must also indicate as completely as practicable: the type of waste; the waste volume and mass; radionuclide identity and concentration; total radioactivity; and chemical form. The solidification agent must be specified. Wastes classified as Class A segregated, Class B stable, or Class C intruder in § 61.55 of this part chapter must be clearly identified as such in the manifest. The total quantity of noted isotopes identified in Table 1, Part 61 of this chapter must be shown.

(c) Each manifest must include a certification by the waste generator that the transported materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and the Commission. An authorized representative of the waste generator shall sign and date the manifest.

(d) Any generating licensee who transfers radioactive waste to a land disposal facility or a licensed waste collector or processor shall:

(1) Prepare all wastes so that the waste is classified according to § 61.55 and meets the waste characteristics requirements in § 61.56 of this chapter;

(2) Label each package of waste to identify whatever it is, Class A segregated, Class B stable, or Class C intruder waste, in accordance with § 61.55 of this chapter;

(3) Conduct a quality assurance program to assure compliance with §§ 61.55 and 61.56 of this chapter; the program must include management audits;

(4) Prepare shipping manifests to meet the requirements of §§ 20.311 (b) and (c) of this part;

(5) Forward a copy of the manifest to the intended recipient, at the time of shipment;

(6) Include one copy of the manifest with the shipment;

(7) Retain a copy of the manifest until receipt of waste is acknowledged; and,

(8) Investigate late or missing shipments or any part of a shipment in accordance with paragraph (h) of this section.

(e) Any waste collector licensee who handles only prepackaged waste shall:

(1) Acknowledge receipt of the waste from the generator within one week of receipt;

(2) Prepare a new manifest to reflect consolidated shipments; the new manifest shall serve as a listing or index for the detailed generator manifests. Copies of the generator manifests shall be a part of the new manifest. The collector licensee shall certify that nothing has been done to the waste which would invalidate the generator's certification;

(3) Forward a copy of the new manifest to the land disposal facility operator at the time of shipment;

(4) Include the new manifest with the shipment to the disposal site;

(5) Retain a copy of the manifest until receipt of waste is acknowledged; and

(6) Investigate late or missing shipments or any part of a shipment in accordance with paragraph (h) of this section.

(f) Any licensed waste processor who treats or repackages wastes shall:

(1) Acknowledge receipt of the waste from the generator within one week of receipt;

(2) Prepare a new manifest that meets the requirements of paragraphs (b) and (c) of this section. Preparation of the new manifest reflects that the processor is responsible for the waste;

(3) Prepare all wastes so that the waste is classified according to § 61.55 and meets the waste characteristics requirements in § 61.56 of this chapter;

(4) Label each package of waste to identify whatever it is, Class A segregated, Class B stable, or Class C intruder waste, in accordance with § 61.55 of this chapter;

(5) A quality assurance program shall be conducted to assure compliance with §§ 61.55 and 61.56 of this chapter. The program shall include management audits;

(6) Forward a copy of the new manifest to the disposal site operator or waste collector at the time of shipment;

(7) Include the new manifest with the shipment;

(8) Retain copies of original manifests and new manifests until receipt of the wastes is acknowledged; and

(9) Investigate late or missing shipments in accordance with paragraph (h) of this section.

(g) The land disposal facility operator shall:

(1) Acknowledge to the shipper receipt of the waste within one week of receipt. The shipper to be notified is the licensee who last possessed the waste and transferred the waste to the operator;

(2) Following receipt and acceptance of a shipment of radioactive waste accompanied by a manifest, record on the shipment manifest the date of receipt of the waste, the date of disposal of the waste, the location in the disposal site, the condition of the waste packages as received, and any evidence of leaking or damaged packages or radiation or contamination levels in excess of limits specified in DOT and Commission regulations. The licensee shall also briefly describe any repackaging operations of any of the waste packages included in the shipment, plus any other information required by the Commission as a license condition;

(3) Sign, date, and certify that the transported materials have been received, classified, handled, stored, and disposed of in compliance with Commission regulations and all license conditions;

(4) Maintain copies of all completed manifests until the Commission authorizes their disposition at transfer; and

(5) Notify the shipper (i.e., the generator, the collector, or processor) and the Director of the nearest Commission Inspection and Enforcement Regional Office listed in Appendix D of this part when a shipment has not arrived within 60 days after the advance manifest was received.

(h) Late or missing shipments must:

(1) Be investigated by the shipper if the shipper has not received notification of receipt within 20 days after transfer; and

(2) Be traced and reported. The investigation shall include tracing the shipment and filing a report with the nearest Commission Inspection and Enforcement Regional Office listed in Appendix D of this part. Each licensee who conducts a trace investigation shall file a written report with the nearest Commission's Regional office within 2 weeks of completion of the investigation.

15. In § 20.401, paragraphs (b) and (c)(3) are revised to read as follows:

§ 20.401 Records of surveys, radiation monitoring, and disposal.

* * * * *

(b) Each licensee shall maintain records in the same units used is this part, showing the results of surveys required by § 20.301(b), monitoring required by §§ 20.205(b) and 20.205(c) and disposals made under §§ 20.302, 20.303, deleted § 20.304,[1] and Part 61 of this chapter.

(c) * * *

(3) Records of disposal of licensed materials made pursuant to §§ 20.302, 20.303, deleted § 20.304[1]; and Part 61 of this chapter are to be maintained until the Commission authorizes their disposition.

* * * * *

16. Section 20.408 is amended by adding a new paragraph (a)(5) to read as follows:

§ 20.408 Reports of personnel monitoring on termination of employment or work.

(a) * * *

(5) Receive radioactive waste from other persons for disposal under part 61 of this chapter.

* * * * *

PART 21—REPORTING OF DEFECTS AND NONCOMPLIANCE

§ 21.2 [Amended]

17. Section 21.2 is amended by inserting "61", after "40, 60," in the third line, and after "50, 60" in the final line.

§ 21.3 [Amended]

18. In § 21.3, paragraphs (a)(3), (a) (a-1)(1), (a) (a-1)(2), and (k) are amended by adding "61," after "50, 60."

§ 21.21 [Amended]

19. Section 21.21 is amended by adding "61,"' after "50, 60," in paragraphs (b)(1)(i) and (b)(1)(ii).

PARTS 30—RULES OF GENERAL APPLICABILITY TO LICENSING OF BYPRODUCT MATERIAL

20. Section 30.11(c) is revised to read as follows:

§ 30.11 Specific exemptions.

* * * * *

(c) Except as specifically provided in Part 61 of this Chapter, any licensee is exempt from the requirements of this part to the exent that its activities are subject to the requirements of Parts 60 and 61 of this chapter.

21. In § 30.32, paragraph (f) is amended to read as follows:

§ 30.32 Application for specific licenses.

* * * * *

(f) An application for a license for the conduct of any activity which the Commission determines will significantly affect the quality of the environment shall be filed at least 9 months to commencement of construction of the plant or facility in which the activity will be conducted and shall be accompanied by any Environmental Report required pursuant to Part 51 of this chapter.

22. In § 30.33, paragraph (a)(5) is revised to read as follows:

§ 30.33 General requirements for issuance of specific licenses.

(a) * * *

(5) In the case of an application for a license for the conduct of any activity which the Commission determines will significantly affect the quality of the environment, the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to Part 51 of this chapter, has concluded, after weighing the environmental, economic technical, and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such conclusion shall be grounds for denial of a license to receive and possess byproduct material in such plant or facility. As used in this paragraph the term "commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a site. The term does not mean site exploration, necessary roads for site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the site or the protection of environmental values.

* * * * *

PART 40—LICENSING OF SOURCE MATERIAL

23. In § 40.14, paragraph (c) is revised to read as follows:

§ 40.14 Specific exemptions.

* * * * *

(c) Except as specifically provided in Part 61 of this chapter any licensee is exempt from the requirements of this part to the extent that its activities are subject to the requirements of Parts 60 and 61 of this chapter.

24. In § 40.31, paragraph (f) is revised to read as follows:

§ 40.31 Applications for specific licenses.

* * * * *

(f) An application for a license to possess and use source material for uranium milling, production of uranium hexafluoride, or for the conduct of any other activity which the Commission determines will significantly affect the quality of the environment shall be filed at least 9 months prior to commencement of construction of the plant or facility in which the activity will be conducted and shall be accompanied by any Environmental Report required pursuant to Part 51 of this chapter.

* * * * *

25. In § 40.32, paragraph (e) is revised to read as follows:

§ 40.32 General requirements for issuance of specific licenses.

* * * * *

(e) In the case of an application for a license to possess and use source and byproduct material for uranium milling, production of uranium hexafluoride, or for the conduct of any other activity which the Commission determines will significantly affect the quality of the environment, the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to Part 51 of this chapter, has concluded, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such a conclusion shall be grounds for denial of a license to possess and use source and byproduct material in such plant or facility. As used in this paragraph the term "commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a site. The term does not mean site exploration, necessary roads for site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the site or the protection of environmental values.

* * * *

PART 51—LICENSING AND REGULATORY POLICY AND PROCEDURES FOR ENVIRONMENTAL PROTECTION

26. In § 51.5, paragraphs (a)(6) and (b)(4)(iii) are revised, paragraph (b)(6) is amended by inserting "61" following "50, 60,", and (d)(3) is amended by inserting "61" following "50, 60." The revised paragraphs read as follows:

§ 51.5 Actions requiring preparation of environmental impact statements, negative declarations, environmental impact appraisals; actions excluded.

(a) * * *

(6) Issuance of a license authorizing receipt and disposal of radioactive waste from other persons under Part 61 of this chapter;

* * * * *

(b) * * *

(4) * * *

(iii) Authorizing receipt and disposal of radioactive waste from other persons under Part 61 of this chapter.

* * * * *

§ 51.40 [Amended]

27. In § 51.40, paragraph (c) is amended by inserting "61" after "30, 40."

PART 70—DOMESTIC LICENSING OF SPECIAL NUCLEAR MATERIAL

28. In § 70.14, paragraph (c) is amended to read as follows:

§ 70.14 Specific exemptions.

* * * * *

(c) Except as specifically provided in Part 61 of this chapter, any licensee is exempt from the requirements of the regulations in this part to the extent that its activities are subject to the requirements of Parts 60 and 61 of this chapter.

29. In § 70.21 paragraph (f) is revised to read as follows:

§ 70.21 Filing.

* * * * *

(f) An application for a license to possess and use special nuclear material for processing and fuel fabrication, scrap recovery or conversion of uranium hexafluoride, or for the conduct of any other activity which the Commission determines will significantly affect the quality of the environment shall be filed at least 9 months prior to commencement of constrution of the plant or facility in which the activity will be conducted, and shall be accompanied by an Environmental Report required under Part 51 * * * of this chapter.

* * * * *

30. In § 70.23 paragraph (a)(7) is revised to read as follows:

§ 70.23 Requirements for the approval of applications.

(a) * * *

(7) Where the proposed activity is processing and fuel fabrication, scrap recovery, conversion of uranium hexafluoride, or any other activity which the Commission determines will significantly affect the quality of the environment, the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to Part 51 of this chapter, has concluded, after weighing the environmental, economic, technical, and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such conclusions shall be grounds for denial to possess and use special nuclear material in such plant or facility. As used in this paragraph the term "commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a site. The term does not mean site exploration, necessary roads for site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the site or the protection of environmental values.

* * * * *

PART 73—PHYSICAL PROTECTION OF PLANTS AND MATERIALS

31. In § 73.1, paragraph (b)(1)(iii) is revised to read as follows:

§ 73.1 Purpose and scope.

* * * * *

(b) * * *

(1) * * *

(iii) the physical protection of special nuclear material by any person who, pursuant to the regulations in parts 61 and 70 of this chapter, possesses or uses at any site or contiguous sites subject to the control by the licensee, formula quantities of strategic special nuclear material or special nuclear material of moderate strategic significance or special nuclear material of low strategic significance.

* * * * *

PART 170—FEES FOR FACILITIES AND MATERIALS LICENSES AND OTHER REGULATORY SERVICES UNDER THE ATOMIC ENERGY ACT OF 1954, AS AMENDED*

32. Section 170.2 is revised to read as follows:

§ 170.2 Scope.

Except for persons who apply for or hold the permits, licenses, or approvals exempted in § 170.11, the regulations in this part apply to a person who is an applicant for, or holder of, a specific byproduct material license issued pursuant to Parts 30 and 32–35 of this chapter, a specific source material license issued pursuant to Part 40 of this chapter, a specific materials license issued under Part 61 of this chapter, a specific special nuclear material license issued pursuant to Part 70 of this chapter, a specific approval of spent fuel casks and shipping containers issued pursuant to Part 71 of this chapter, a specific request for approval of sealed sources and devices containing byproduct material, source material, or special nuclear material, or a production or utilization facility construction permit and operating license issued pursuant to Part 50 of this chapter, to routine safety and safeguards inspections of a licensed person, to a person who applies for approval of a reference standardized design of a nuclear steam supply system or balance of plant, for review of a facility site prior to the submission of an application for a construction permit, for review of a standardized spent fuel facility design, and for a special project review, which the Commission completes or makes whether or not in conjunction with a license application on file or which may be filed.

Note.—Amendments to all parts are issued pursuant to citations of authority presently codified or, in the case of 10 CFR Part 61, as set out after the list of sections in the new Part 61.

Dated at Washington, D.C., this 21st day of July 1981.

For the U.S. Nuclear Regulatory Commission.

Samuel J. Chilk,
Secretary of the Commission.

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16. ABSTRACT (200 words or less)

The four volume draft environmental impact statement (DEIS) is prepared to guide and support publication of a proposed new regulation, 10 CFR Part 61, for the land disposal of low-level radioactive waste. The analysis in the DEIS include a systematic analysis of a broad range of alternatives relating to the form and content of waste, the engineering design of disposal facilities, the method of operation of the facilities, institutional controls, financial assurances, and administrative and procedural requirements. From the analysis, four main performance objectives are established in the proposed regulation relating to (1) minimizing long-term social commitment and costs, (2) minimizing long-term environmental releases, (3) minimizing long-term impacts to humans potentially inadvertently intruding into disposed waste, and (4) assuring short-term operational safety. Based upon the analysis and overall performance objectives, a number of technical, financial, procedural, and administrative requirements are also developed.

17 KEY WORDS AND DOCUMENT ANALYSIS

low-level waste
land disposal
social commitment
groundwater migration
inadvertent intrusion
10 CFR Part 61
waste form

17a DESCRIPTORS

financial assurances
institutional controls
radioactive waste
disposal technologies
cost-benefit analysis

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