MANAGING GREATER-THAN-CLASS-C LOW-LEVEL WASTE[a]

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ABSTRACT

Congress has assigned to the Federal Government responsibility to safely dispose of a category of nonDOE low-level radioactive waste classified as "greater-than-Class-C that results from activities licensed by the NRC." Concentrations of radionuclides in this waste exceed the Nuclear Regulatory Commission (NRC) limits for routine near-surface disposal. A recent Department of Energy (DOE) report to Congress identified the wastes that are in this category, defined issues that must be resolved to safely manage the waste, and proposed an approach to implement the federal responsibility. The volume of this waste is relatively small, but its management presents some unique needs. Those include a clear definition of the waste, improved data on volumes and characteristics of the waste, additional regulatory guidance from NRC and the Environmental Protection Agency, and an assessment of the viability of disposal at nonfederal sites.

When these needs have been met, disposal capacity can be developed that will ensure the safe disposal of all waste in this category. In the interim, DOE proposes to explore nonfederal disposal options and, if necessary, accept the waste upon request of the generators, take title to the waste, store it until disposal capacity is available, and ensure its safe disposal with all reasonable costs to be borne by the waste generator or owner.

INTRODUCTION

Several years ago, the U.S. Nuclear Regulatory Commission (NRC) issued regulations (10 CFR Part 61) for licensing of land disposal of radioactive waste. The regulations established a system for classifying low-level radioactive waste (low-level waste) into several categories, for which specific disposal requirements are set forth. Concentration limits for specific radionuclides are defined for three categories--Classes A, B, and C--of low-level waste suitable for routine near-surface disposal. Waste that contains radionuclides in concentrations that exceed the Class C limits (greater-than-Class-C, or GTCC, low-level waste) could be disposed in a licensed near-surface facility only on a case-by-case basis with the express permission of NRC or an Agreement State that has authority to regulate such materials.

The Low-Level Radioactive Waste Policy Act, passed in 1980, assigned to the States responsibility for providing disposal capacity for all low-level radioactive waste generated within their borders, except certain federal wastes. At that time, States retained responsibility for GTCC low-level waste disposal. However, case-by-case disposal of GTCC low-level waste has occurred on a limited basis in recent years. Most GTCC low-level waste, albeit a small volume, has remained in storage, without means of disposal. In Public Law 99-240, the Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act), Congress assigned responsibility for disposal of GTCC low-level waste, including transuranic waste, to the Federal Government. The Secretary of Energy was required to prepare a report for Congress that recommended options for the safe disposal of GTCC low-level waste.

The report, "Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste," submitted to Congress in February of 1987, includes the following information, as required in the Act:

1. An identification of the radioactive waste involved, including the source, volume, concentration, and other relevant characteristics;
2. A description of the actions proposed to ensure the safe disposal of this waste;
3. A description of the projected costs of undertaking such actions;
4. An identification of the options for ensuring that the beneficiaries of the activities resulting in the generation of such radioactive wastes bear all reasonable costs of disposal;
5. An identification of any statutory authority required for disposal of such waste.

One additional Congressional requirement--identification of the federal and nonfederal options for disposal of GTCC low-level waste--was not addressed at this time. Several key uncertainties make it difficult to adequately characterize GTCC low-level waste or to determine appropriate disposal options. These uncertainties include (a) inadequate information on the volumes, sources, and characteristics of GTCC low-level waste currently in storage and projected for the future, (b) potential changes in the regulatory definition of GTCC low-level waste, (c) the lack of specific NRC licensing guidance for GTCC low-level waste disposal facilities, (d) the lack of a general environmental standard from the EPA for disposal for nontransuranic GTCC low-level waste, and (e) uncertainties

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relating to an evolving regulatory framework applicable to mixed GTCC low-level waste.

This paper describes the steps necessary to resolve these uncertainties and the actions DOE proposes to take to be prepared to accept GTCC low-level waste and ultimately ensure its safe disposal.

CLEAR WASTE DEFINITION AND IDENTIFICATION NEEDED

To understand the scope of GTCC low-level waste management needs, the category of waste should be clearly defined and identified. Currently, GTCC low-level waste is defined by the Class C regulatory limits of 10 CFR Part 61 and the legislated definition of low-level waste.

The Class C limits in 10 CFR Part 61 are the maximum concentrations of radionuclides that can be routinely disposed by near-surface land disposal. Thus, these limits establish the lower bound for the concentrations of radionuclides in GTCC low-level waste. The radionuclides addressed in these limits are both long-lived (thousands of years, Table I) and relatively short-lived (30 to 100 years, Table II).

For waste containing more than one of the radionuclides in one of the tables, the limit is determined by a sum of the fractions obtained by dividing each radionuclide's concentration by its concentration limit.

The Act defines low-level waste (including GTCC) to exclude spent fuel or high-level radioactive waste.

TABLE I
Limits for Long-Lived Radionuclides in Class C Low-Level Radioactive Waste

Radionuclide	Half-Life[a] (years)	Maximum Allowable Concentration (curies/cubic meter)[b]
C-14	5,730	8
C-14 in activated metal	5,730	80
Ni-59 in activated metal	75,000	220
Nb-94 in activated metal	20,000	0.2
Tc-99	214,000	3
I-129	16,000,000	0.08
Alpha-emitting transuranics	>5	100 nCi/g[b]
Pu-241[c]	14	3,500 nCi/g[b]
Cm-242[c]	162.8[a]	20,000 nCi/g[b]

a. Half-life is in days for Cm-242.

b. Concentration is in nanocuries per gram of waste for transuranics.

c. Precursors of transuranics with half-life greater than five years.

TABLE II
Limits for Short-Lived Radionuclides in Class C Low-Level Radioactive Waste

Radionuclide	Years	Curies/Cubic Meter
Ni-63 in activated metal	100	*700*
Ni-63 in activated metal	100	7000
Sr-90	29	7000
Cs-137	30	4500

High-level radioactive waste is, in turn, defined by the Nuclear Waste Policy Act of 1982 (NWPA) as waste produced directly from reprocessing of spent nuclear fuel, as well as any other highly radioactive materials that NRC determines by rule require permanent isolation. NRC is, in fact, contemplating such a rulemaking. This rule could define the lower bound of the high-level waste category in terms of radionuclide concentrations, and thereby set an upper limit for such concentrations in GTCC low-level waste. Such a concentration-based definition of other high-level waste could therefore affect the volume and characteristics of waste included in the GTCC low-level waste category. Thus, until that rulemaking is complete, DOE cannot definitively identify current GTCC low-level waste, project future volumes, select a suitable disposal technology, or plan for disposal capacity.

DETAILED WASTE CHARACTERIZATION REQUIRED

When DOE began to consider the disposal of GTCC low-level waste, it became clear that little information exists on how much and what types of GTCC low-level waste there are. A key step in developing disposal capability will be a full determination of the sources, quantities, and characteristics of GTCC low-level waste requiring disposal. With this information and a clear definition of the waste category, federal and/or nonfederal disposal options may be considered and disposal facility design, general waste acceptance criteria, requirements for storage, treatment, packaging, transportation, and disposal, and costs can be better understood.

ADDITIONAL REGULATORY GUIDANCE NEEDED

Several kinds of regulatory guidance are needed to allow selection of disposal options for GTCC low-level waste. The most important of these is resolution of the potential NRC rulemaking on a definition for high-level waste as discussed above.

An EPA standard for disposal of low-level waste is currently under development. This standard will cover all nontransuranic low-level waste, including nontransuranic GTCC. Promulgation of this standard and conformance to it would enhance confidence in technical disposal planning and licensing decisions.

The Act requires that a disposal facility for GTCC low-level waste be licensed by NRC. While NRC has set forth performance objectives in 10 CFR Part 61 for land disposal of nontransuranic low-level waste, the technical criteria in Part 61 pertain primarily to the disposal of Class A, B, and C low-level waste within 30 meters of the surface. The criteria for disposal specific to GTCC low-level waste are unclear. DOE believes better guidance is required to select, design and develop facilities that would have to dispose of this kind of waste.

Some GTCC low-level waste may also contain hazardous chemical waste. Such "mixed waste" is currently

regulated under the jurisdiction of several licensing agencies, including NRC, EPA, the States, or combinations of the three. Potential conflicts among the regulations of these agencies need to be resolved to develop and implement effective plans for the disposal of mixed GTCC low-level wastes.

DEVELOPMENT OF DISPOSAL CAPACITY

After sufficient regulatory guidance on disposal and data on waste characteristics and volumes are available, a number of technical steps will be required to develop the capability to dispose of GTCC low-level waste. Available storage, treatment, packaging, transportation, and disposal technologies and options must be evaluated in light of the specific quantities and characteristics of GTCC low-level waste; health, safety, and environmental risks, and costs. General waste acceptance and facility design criteria can then be developed.

Both federal and nonfederal facilities will be evaluated to determine whether these might be suitable for management of GTCC low-level waste for which there is currently no disposal available. If a new federal facility proves necessary, DOE would need to develop technical siting criteria and determine a siting process. That process would have to be implemented and a site would have to be selected and characterized. For either a new or existing facility, disposal facility designs, operation procedures, environmental monitoring and safety protection systems, closure plans, and other technical aspects of developing and operating the facility must be prepared or modified.

Environmental analysis and documents to comply with the National Environmental Policy Act or equivalent state requirements would need to be prepared for such a facility. For federal and possibly some nonfederal options, applications for NRC licensing, EPA hazardous waste permits, and other appropriate permits and support for their regulatory review will be required. Finally, construction or modification of the disposal facility, additional equipment, and hiring and training of staff may be necessary.

In parallel with the technical activities, a program could be required to involve state and other affected parties in site selection and to provide for continuing consultation with affected government and public entities and waste generators.

FUNDING

One of DOE's goals, pursuant to the Act, is to ensure that the beneficiaries of the activities resulting in the generation of GTCC low-level waste bear all reasonable costs of waste disposal. This requires estimating total costs for the disposal program, including any required ancillary storage, treatment, packaging, and transportation, as well as disposal. Based on these estimates of cost and waste quantities, unit charges for disposal can be defined and mechanisms for funding the disposal system selected.

INTERIM MEASURES PROPOSED

We estimate that filling the gaps in regulatory guidance and waste characterization data could take several years. As much as eight to ten additional years could be required to implement a new fully licensed disposal facility.

The volume of GTCC low-level waste currently in storage and projected to be generated during this period is quite small (less than 0.1 percent of the Class A, B, and C low-level waste projected to be shipped in the same period for commercial disposal). However, DOE recognizes that continued onsite storage of this waste may, in some cases, be difficult for some generators. DOE's proposal, therefore, is to develop a program to accept GTCC low-level waste as needed, upon request of the generators, and to store it until disposal capacity is available. DOE would assume title to waste that is accepted at delivery and DOE will be responsible for its subsequent storage, treatment, packaging, transportation, and disposal. Nonfederal disposal possibilities will also be explored to provide an alternative to DOE acceptance of GTCC low-level waste.

DOE acceptance of waste will be predicated on several conditions. The waste must meet DOE acceptance criteria for waste content, form, and packaging. Advance arrangements must be made by the generator to facilitate DOE planning. Adequate storage facilities must be available and contractual and financial arrangements must be in place. Finally, all reasonable costs of storage, subsequent disposal, and associated waste management services such as treatment and transportation must be borne by the beneficiaries of the activities resulting in the generation of this waste. Such costs will be conservatively estimated for the specific wastes that may be accepted under this program, to ensure all reasonable costs are covered.

CONCLUSIONS

The amount of GTCC low-level waste expected to be generated through the year 2020 is uncertain but is roughly estimated to be quite small (i.e., an average of 59 cubic meters per year, or 2100 cubic feet per year). However, the disposal of this waste presents some unique requirements. Development of disposal capacity for GTCC low-level waste is expected to take at least several years. In the interim, DOE is planning to explore nonfederal options for GTCC low-level waste disposal and, if necessary, accept GTCC low-level waste meeting waste acceptance criteria upon request of the generators. DOE will take title to the waste, provide for its storage and ensure that the waste is safely disposed when disposal capacity is available. DOE believes that this is the most responsible way for the Federal Government to ensure the ultimate safe disposal of GTCC low-level waste.