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GREATER-THAN-CLASS C LOW-LEVEL WASTE CHARACTERIZATION TECHNICAL REVIEW PROCESS[a]

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ABSTRACT

Existing volume projections of greater-than-Class C low-level waste (GTCC LLW) vary significantly. The Department of Energy (DOE) National Low-Level Waste Management Program (NLLWMP) has undertaken activities to develop a best estimate of GTCC LLW volumes and activities for use as the planning basis. Initial information about the generation of GTCC LLW was obtained through a DOE Energy Information Administration survey. That information, combined with information from other related literature, formed the basis of a computer model, which projects potential GTCC LLW. This paper describes uncertainties in existing GTCC LLW characterization and volume projections data and describes the technical review process that is being used to assist in projections of GTCC LLW expected for storage and disposal.

INTRODUCTION

The Nuclear Regulatory Commission (NRC) has developed a classification system for commercial low-level waste (LLW) based on the near-surface disposal techniques required to safely isolate each class of waste. This classification system, contained in 10 CFR 61,[1] establishes three classes of LLW (A, B, and C), with Class C requiring the most rigorous disposal procedures. GTCC LLW exceeds the NRC concentration limits for Class C LLW and is generally not acceptable for near-surface disposal. The Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA), Public Law 99-240,[2] requires that GTCC LLW resulting from activities licensed by the NRC be disposed of in a facility or facilities licensed by the NRC. Additionally, the LLRWPAA makes the Department of Energy (DOE) responsible for disposal of GTCC LLW.

Existing volume projections of GTCC LLW vary significantly, ranging from 2,000 m^3 in DOE's February 1987 Report to Congress,[3] to 17,000 m^3 in the *Update of Part 61 Impacts Analysis Methodology*.[4] The DOE GTCC LLW Program has undertaken activities to develop a "best estimate" of GTCC LLW volumes and activities for use as the planning basis.

DEFINITION OF GTCC LLW

GTCC LLW is waste that contains radionuclide concentrations greater than the NRC limits stated in 10 CFR 61 for Class C LLW. GTCC LLW excludes high-level waste, as defined by the Nuclear Waste Policy Act of 1982. Tables 1 and 2 below provide the radionuclides and concentration limits for Class C LLW.

Table 1. NRC Class C Limits for Long-Lived Radionuclides

Long-Lived Radionuclides	Concentration Limits (Ci/m^3)
^{14}C	8
^{14}C in activated metal	80
^{59}Ni in activated metal	220
^{94}Nb in activated metal	0.2
^{99}Tc	3
^{129}I	0.08
Transuranics	(nCi/g)
> 5 year half-life (alpha emitting)	100
^{241}Pu	3,500
^{242}Cm	20,000

Table 2. NRC Class C Limits for Short-Lived Radionuclides

Short-Lived Radionuclides	Concentration Limits (Ci/m^3)
^{63}Ni	700
^{63}Ni in activated metal	7,000
^{90}Sr	7,000
^{137}Cs	4,600

UNCERTAINTIES IN EXISTING DATA

Initial information concerning GTCC LLW was obtained through the DOE's Energy Information Administration (EIA) survey in 1986. DOE, through the EIA and with the cooperation of NRC, surveyed the anticipated major commercial generators of GTCC LLW. In July and August, 1986, the survey was sent to 1275 possible generators of GTCC LLW; 1085 survey forms were returned to DOE. Through this survey, 115 current or potential generators of GTCC LLW were identified. Although this was a definitive survey of GTCC LLW, the information was incomplete. Uncertainties in the data can be attributed to several factors. For example, without actual experience in decontamination and decommissioning processes the generators could not predict GTCC LLW volumes and activities that would result from these processes. In addition, GTCC LLW in inventory at the time of the survey had not been fully characterized because of the expense required for such characterization.

The information from the EIA survey was supplemented by existing information obtained from the literature.[5,6] This information was used to develop a computerized projection model. Eight specific areas containing significant uncertainties, or issues have

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been identified as requiring resolution prior to finalizing a report on GTCC LLW characterization. These areas are briefly described below.

1. Concentration averaging. The practice of placing similar materials together in a container and averaging the concentrations results in both technical and regulatory uncertainties. For example, when GTCC activated metal wastes are combined with less-than-Class C activated metals, the resulting packaged waste may meet Class C standards. Because the NRC, Agreement States and DOE may have differing criteria relating to concentration averaging for determining whether LLW exceeds Class C limits, there is a possibility that an orphan category of waste could result, which exceeds Class C limits under the State or NRC criteria, but does not exceed Class C limits under criteria used by DOE. DOE is evaluating whether to adopt NRC criteria as its standard, whether to accept any LLW that is GTCC in accordance with the criteria of the regulating State, or whether to develop its own criteria for determining whether the waste exceeds Class C limits.

2. Estimating sealed sources. A second uncertainty in the data is in the sealed source projections. The current projections are low because the EIA survey did not reach every commercial sealed source user; only those with broad Type A NRC and similar Agreement State licenses were included. The NRC has performed a more detailed sealed source survey, the results of which have not yet been published. Preliminary indications are that the NRC survey will identify several orders of magnitude more sealed sources than the EIA survey.

3. Disposition of GTCC LLW currently held by DOE. In some circumstances, DOE has accepted radioactive waste generated by licensees of the NRC and State regulatory agencies in response to requests from those agencies. DOE has also accepted, on a limited basis, waste by-products from licensees, generally as part of contracts for radioactive materials processing services by these contractors. Currently, GTCC LLW held by DOE is being stored. P. L. 99-240 requires that GTCC LLW generated by licensees of the NRC be disposed of in a facility licensed by that agency, but also authorizes DOE to dispose of radioactive waste that it "owns" in DOE managed facilities. Applicability of the requirement for disposal of certain GTCC LLW in an NRC licensed facility is under review and could affect the volume of waste included in the projections.

4. Projecting operations waste. The EIA information provided by certain waste generators did not predict generation of any GTCC LLW from operations from 1985 to 2020. However, these waste generators had GTCC LLW in inventory from past operations. It may be unrealistic to expect ongoing operations that have generated GTCC LLW in the past to discontinue generation of GTCC LLW; therefore, the projected volumes of GTCC LLW from operations may be low.

5. Timing of receipt of decommissioning waste. The NRC generally grants operating reactor licenses for a period of 40 years. Therefore, current GTCC LLW projections assume decommissioning at the end of a 40-year life, with the GTCC LLW coming to DOE in the first year following reactor shutdown. Currently operating reactors, or those scheduled to go on line soon (129 reactors), would effectively be decommissioned by 2035. Life extensions, if granted, would affect the time at which DOE received the GTCC LLW resulting from decommissioning activities.

6. Non-fuel-bearing components. The term "non-fuel-bearing components" (or non-fuel components) is used to describe both the non–fuel–bearing hardware (spent fuel disassembly) hardware that comprises the structure of a fuel assembly and the non-fuel-assembly hardware that is structurally separate from the assembly but may be inserted into, or otherwise used in close proximity to the assembly. Whether this waste will be disposed of under the standard contract for disposal of spent fuel, or whether it will be disposed of as GTCC LLW under a separate funding arrangement, will affect the volume of waste included in the GTCC LLW volume projections. Application of the standard contract to this waste is under review.

   Additionally, these non-fuel-bearing components may be classified as LLW or GTCC LLW depending upon the concentrations of nickel and niobium in activated metals contained in these components. Luksic[7] concluded that in-core components such as control rods, fuel channels, etc. may be GTCC LLW, as determined using ORIGEN code calculations for trace elements and nickel in the alloys. The alloys include stainless steel-304, Inconel-718, and Zircaloy-4. Current volume projections do not include non-fuel-bearing components generated during decommissioning.

7. Ion-exchange resins. GTCC LLW may be generated by nuclear utilities in the form of ion-exchange resins and filters during routine operations, periodic decontamination, and final decommissioning. These ion-exchange resins and filters are the result of decontaminating the recirculation piping or the steam generator channel head. The volume of GTCC LLW from ion-exchange resins is being evaluated and is discussed in the draft report, *Estimated GTCC Waste Volumes of Ion Exchange Resins and Filters Generated by the Commercial Nuclear Power Industry*,[3] by Vance & Associates.

8. Waste packaging. Two subcategories relate directly to waste packaging and the current GTCC LLW characterization information. These include:

   Packaged volumes of decommissioning waste: References 5 and 6 (NUREG/CR-0130 and NUREG/CR-0672) project volume estimates of reactor vessel internals that will be GTCC LLW. Disposal volumes in these documents, however, are determined by the packaging appropriate for disposal in near-surface LLW facilities. Because packaging assumptions for other disposal methods may differ significantly from the reference case used in the two studies, there is potential for significant variation in the packaged volume projections.

   Waste Packaging Factors: The current GTCC LLW characterization information uses several packaging factors to compute the total packaged volume of GTCC LLW. The packaging factors used in the projections report are engineering estimates and may need to be refined.

TECHNICAL REVIEW PROCESS

Many of the problem areas or issues described above either involve complex legal determinations or cannot be definitively resolved with currently available information. Therefore, in order to finalize GTCC LLW characterization information, assumptions regarding the method of dealing with these issues are being developed. The DOE NLLWMP has initiated a multi-phased technical review process to aid in developing these assumptions.

A technical review team, composed of DOE personnel and representatives from external organizations representing the NRC and industry will assist in developing the assumptions. This review process is approximately 60% complete.

The review process uses a multi-phased approach. In Phase I, DOE team members met to discuss the DOE specific issues or problems. These problems included concentration averaging, the disposition of GTCC LLW currently held at DOE locations, timing of DOE receipt of decommissioning waste, non-fuel-bearing components, and ion-exchange resins. The DOE members of the technical review team met to develop assumptions for the GTCC LLW characterization report for these problems. Where necessary, the issues are being carried over into future phases of the technical review process.

In Phase II, NRC representatives have joined the DOE team members to resolve regulatory issues. These issues included concen-

tration averaging, packaged volume of decommissioning waste, non-fuel-bearing components, and sealed source estimates.

In Phase III, DOE, NRC, and industry representatives will meet to resolve the remaining areas of uncertainty. Through this multi-phased approach, preliminary assumptions regarding each of the problem areas will be recommended.

PRELIMINARY ASSUMPTIONS

At the time of publication, the technical review process had not been completed. Therefore, the assumptions developed through this process cannot be included.

FUTURE ACTIVITIES

The assumptions from the technical review process will be used to finalize the report, *Projected Volumes, Activities, and Other Waste Characteristics of Commercial Greater-Than-Class C Low-Level Radioactive Waste*, which is scheduled to be published near the end of the 1990 calendar year.

Although, due to the need for GTCC LLW projections in the near term, assumptions regarding these areas of uncertainty or problem areas will be made in order to finalize the GTCC LLW characterization report, these areas of uncertainty will be investigated in more depth. As additional information becomes available, the GTCC LLW projections will be updated.

REFERENCES

1. *U.S. Code of Federal Regulations*, Section 10, Part 61 (10 CFR 61).

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