

**Comparison of LLW Disposal Performance Objectives 10 CFR 61
and DOE 435.1**

by

E. L. Wilhite

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

DOE Contract No. **DE-AC09-96SR18500**

This paper was prepared in connection with work done under the above contract number with the U. S. Department of Energy. By acceptance of this paper, the publisher and/or recipient acknowledges the U. S. Government's right to retain a nonexclusive, royalty-free license in and to any copyright covering this paper, along with the right to reproduce and to authorize others to reproduce all or part of the copyrighted paper.

DISCLAIMER

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

This report has been reproduced directly from the best available copy.

Available for sale to the public, in paper, from: U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161,
phone: (800) 553-6847,
fax: (703) 605-6900
email: orders@ntis.fedworld.gov
online ordering: <http://www.ntis.gov/ordering.htm>

Available electronically at <http://www.doe.gov/bridge>
Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from:
U.S. Department of Energy, Office of Scientific and Technical Information, P.O. Box 62,
Oak Ridge, TN 37831-0062,
phone: (865)576-8401,
fax: (865)576-5728
email: reports@adonis.osti.gov



WSRC-RP-2001-00341-TL

March 8, 2001

TO: P. H. Stevens, 703-H (3 copies)

A handwritten signature in cursive script, appearing to read 'B. T. Butcher', is written over the printed name.

FROM: B. T. Butcher, 773-43A (x5-5810)

**TRANSMITTAL OF COMPARISON OF LLW DISPOSAL PERFORMANCE
OBJECTIVES 10 CFR 61 AND DOE 435.1**

Attached is the "Comparison of LLW Disposal Performance Objectives 10 CFR 61 and DOE 435.1", WSRC-RP-2001-00341, 3/1/2001. The purpose of this document is to support waste incidental to reprocessing decisions by the evaluation process, as required by DOE M 435.1, II.B(2)(a)2. Specifically, this document shows the essential comparability of the performance objectives for disposal of low-level waste contained in 10 CFR 61 (i.e., the Nuclear Regulatory Commission requirements for licensing a low-level waste disposal facility) and DOE 435.1 (i.e., the Department of Energy requirements for a DOE low-level waste disposal facility). This document will serve as a helpful reference for all waste incidental to reprocessing evaluations where the waste is to be disposed as low-level waste at the E-Area low-level waste disposal facility.

Att.

CC:

J. N. Dewes, 703-H
K. J. Collins, 703-H
M. D. Johnson, 703-H
V. G. Dickert, 703-H
T. J. Lex, 703-H
B. E. Long, 241-197-H
D. E. Lott, 241-197-H
WPT File, 773-43A
STI, 703-43A (4 copies)

W. T. Goldston, 705-3C
P. I. Hudson, 705-3C
J. E. Black, 773-A
W. E. Stevens, 773-A
J. R. Cook, 773-43A
L. B. Collard, 773-43A

WSRC-RP-2001-00341

KEY WORDS: Incidental Waste
Evaluation
High-Level Waste
Low-Level Waste Disposal

**Comparison of LLW Disposal Performance Objectives
10 CFR 61 and DOE 435.1**

Author

Elmer L. Wilhite

Westinghouse Savannah River Company
Savannah River Technology Center
Aiken, SC 29808

March 1, 2001

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808



SAVANNAH RIVER SITE

REVIEWS AND APPROVALS

Author

E.L. Wilhite 3/5/2001
Elmer L. Wilhite, Author Date
Waste Disposal and Environmental Development

SRTC Review/Approvals

J.R. Cook 3/5/2001
James R. Cook, Reviewer Date
Waste Disposal and Environmental Development

B.T. Butcher 3/5/2001
B. T. Butcher, Level 4 Date
Waste Disposal and Environmental Development

W.E. Stevens 3/5/2001
W. E. Stevens, Level 3 Date
Waste Processing Technology

High-Level Waste Division Approval

P.H. Stevens 3/6/2001
P.H. Stevens Date
High-Level Waste Division Operations

J.N. Dewes 3/7/01
J.N. Dewes Date
High-Level Waste Division Engineering

Solid Waste Division Approval

W.T. Goldston 3/8/01
W. T. Goldston Date
Solid Waste Division

1. Summary

This report documents that waste disposed according to DOE M 435.1 requirements for LLW disposal (i.e., performance objectives, performance assessment (PA), waste characterization, and other requirements) meets safety requirements comparable to the 10 CFR 61 performance objectives. This documentation supports waste incidental to reprocessing (WIR) decisions by the evaluation process for waste that is to be managed as low level waste (LLW) at the Savannah River Site (SRS) E-Area LLW disposal facility, specifically requirement DOE M 435.1, II.B (2)(a) 2.

2. Introduction

Requirements and guidance for managing Department of Energy (DOE) radioactive wastes are contained in DOE Order, Manual and Guide 435.1¹. Radioactive waste is composed of three types or categories. These are high-level waste (HLW), transuranic waste (TRU), and low-level waste (LLW), defined as follows:

HIGH-LEVEL WASTE. High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. [Adapted from: *Nuclear Waste Policy Act of 1982*, as amended]

TRANSURANIC WASTE. Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61. [Source: *WIPP Land Withdrawal Act of 1992*, as amended]

LOW-LEVEL WASTE. Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e. (2) of the *Atomic Energy Act of 1954*, as amended), or naturally occurring radioactive material. [Adapted from: *Nuclear Waste Policy Act of 1982*, as amended]

High level waste is primarily composed of wastes arising from the reprocessing of spent nuclear fuel. Disposal of such wastes generally requires isolation by emplacement in a geologic repository. However, some wastes arising from reprocessing activities or management of HLW, which are determined to be safely manageable as LLW or TRU through the incidental to reprocessing determination process, need not be managed as HLW. These wastes can safely be disposed as low-level wastes or, if their content of transuranic radionuclides is sufficient, as transuranic waste.

DOE 435.1 lays out specific requirements for WIR determinations in the HLW chapter (DOE M 435.1, II.B). These requirements establish two means of identifying wastes as incidental to reprocessing. These are the citation process and the evaluation process. The citation process applies to certain materials such as contaminated job control wastes (e.g., clothing, tools) that obviously do not need geologic isolation. The evaluation process is a means of determining

whether other HLW wastes (i.e., those that are not cited or not obviously WIR) can safely be managed as either TRU or LLW.

The evaluation process for WIR to be managed as LLW requires that the wastes:

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and
2. Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and
3. Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

This report compares the Department of Energy requirements for disposal of low-level radioactive waste with the performance objectives of 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste". The comparison shows that the Department of Energy low-level waste disposal requirements provide comparable protection to the public and the environment as the 10 CFR 61 performance objectives. Thus, any solid waste that meets the Savannah River Site waste acceptance criteria for low-level waste disposal at the E-Area Low-Level Waste Facility "will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*" and, thus, meets one of the waste incidental to reprocessing requirements of DOE 435.1 (i.e., DOE M 435.1, II.B (2)(a) 2).

3. 10 CFR 61

The Nuclear Regulatory Commission (NRC) requirement for disposal of LLW, 10 CFR 61, was issued on 12/27/1982. It was developed to provide specific regulations for the disposal of low-level radioactive waste (LLW) in near-surface disposal facilities^{2,3,4}. A near-surface disposal facility is a land disposal facility in which radioactive waste is disposed within the upper 30 meters of the earth's surface. A geologic repository is not considered a land disposal facility.

There are seven subparts and 57 sections of 10 CFR 61, as listed below:

<u>Subpart</u>	<u>No. of Sections</u>
A. General Provisions	11
B. Licenses	19
C. Performance Objectives	5
D. Technical Requirements for Land Disposal Facilities	10
E. Financial Assurances	3
F. Participation by State Governments and Indian Tribes	4
G. Records, Reports, Tests, and Inspections	5

3.1 10 CFR 61 Performance Objectives

Subpart C of 10 CFR 61 lists the five performance objectives, which are reproduced below:

Section 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 established in the performance objectives in Secs. 61.41 through 61.44.

Section 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. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable.

Section 61.42 Protection of individuals from inadvertent intrusion.

Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.

Section 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, except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by Section 61.41 of this part. Every reasonable effort shall be made to maintain radiation exposures as low as is reasonably achievable.

Section 61.44 Stability of the disposal site after closure.

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

Each of the performance objectives is briefly discussed in the following sections.

3.2 General requirement (10 CFR 61.40)

The general requirement essentially states the objective of shallow land disposal of LLW that all aspects of the disposal operation; selecting the site, designing the facility, operating the facility, closing the facility, and controlling it after closure, work together to provide "reasonable assurance" that the performance objectives will not be exceeded.

The term "reasonable assurance" is an important part of the disposal concept. It is an essential aspect of all licensing decisions by the NRC. Reasonable assurance is addressed in the licensing criteria for geologic repositories, 10 CFR 60⁵:

"While these performance objectives are generally stated in unqualified terms, it is not expected that complete assurance that they will be met can be presented. A reasonable assurance, on the basis of the record before the Commission, that the objectives and criteria will be met is the general standard that is required. For 60.112, and other portions of this subpart that impose objectives and criteria for repository performance over long times into the future, there will inevitably be greater uncertainties. Proof of the future performance of engineered barrier systems and the geologic setting over time periods of many hundreds or many thousands of years is not to be had in the ordinary sense of the word. For such long-term objectives and criteria, what is required is reasonable assurance, making allowance for the time period, hazards, and uncertainties involved, that the outcome will be in conformance with such objectives and criteria. Demonstration of compliance with such objectives and criteria will involve the use of data from accelerated tests and predictive models that are supported by such measures as field and laboratory tests, monitoring data, and natural analog studies."

The language in 10 CFR 61.40 is similar⁶.

3.3 Protection of the general population from releases of radioactivity (10 CFR 61.41)

This requirement establishes the measure for protecting the public from radioactive material that may be released from the disposal facility by any pathway (e.g., by migration through the groundwater). There are two parts to the requirement. First, the dose to the public from all pathways and all environmental media may not exceed 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ. The assignment of dose values for various organs is a consequence of the dose methodology that was accepted at the time the regulation was developed. At that time, ICRP-2⁷ was the standard dose methodology recommended by the International Commission on Radiological Protection. Part 61 requires a PA to provide reasonable assurance that this performance objective will not be exceeded.

Secondly, this section requires that the as low as reasonably achievable (ALARA) process be applied to the disposal facility.

3.4 Protection of individuals from inadvertent intrusion (10 CFR 61.42)

This requirement reflects the intent of the NRC that persons inadvertently intruding into the waste be protected. The performance objective does not state quantitative limits on exposure. However, in the Environmental Impact Statement⁴ for Part 61, a dose limit of 500 mrem/year was used to establish the waste classification scheme laid out in 10 CFR 61.55. The assessment of impacts to inadvertent intruders need not be a part of the PA required to provide reasonable assurance that the dose limit in 61.41 will not be exceeded. Rather, the site need only show that it is following the precepts of the waste classification scheme (i.e., stabilizing class B waste, providing an intruder barrier for class C waste)^{8,9}.

3.5 Protection of individuals during operations (10 CFR 61.43)

This requirement references 10 CFR 20 *Standards for Protection Against Radiation*, which contains radiological protection standards for workers and the public. DOE requirements for occupational radiological protection are laid out in 10 CFR 835 *Occupational Radiation Protection* and those for radiological protection of the public and the environment are laid out in DOE 5400.5 *Radiation Protection of the Public and the Environment*. For the purposes of this document, the standards for occupational radiological protection and the general standards for radiological protection of the public and the environment in the DOE system will be assumed to be comparable with those in the NRC system. This requirement will not be discussed further.

3.6 Stability of the disposal site after closure (10 CFR 61.44)

The long-term stability of the closed disposal site is an important element of meeting the performance objectives. Site stability is focussed on reducing the contact of water with the waste and providing assurance that there will not be a need for active maintenance following closure⁸.

4. DOE 435.1 Performance Objectives and Requirements for LLW Disposal

The requirements for LLW disposal in DOE 435.1, and its predecessor Order, DOE 5820.2A¹⁰, were developed from the framework laid out in 10 CFR 61¹¹. To show that DOE LLW disposal is as protective as the 10 CFR 61 performance objectives requires considering not only the DOE 435.1 performance objectives but also other DOE 435.1 requirements.

The DOE LLW disposal performance objectives (DOE M 435.1 IV.P (1)) are:

Low-level waste disposal facilities shall be sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following performance objectives will be met for waste disposed of after September 26, 1988:

- (a) Dose to representative members of the public shall not exceed 25 mrem (0.25 mSv) in a year total effective dose equivalent from all exposure pathways, excluding the dose from radon and its progeny in air.
- (b) Dose to representative members of the public via the air pathway shall not exceed 10 mrem (0.10 mSv) in a year total effective dose equivalent, excluding the dose from radon and its progeny.
- (c) Release of radon shall be less than an average flux of 20 pCi/m²/s (0.74 Bq/m²/s) at the surface of the disposal facility. Alternatively, a limit of 0.5 pCi/l (0.0185 Bq/l) of air may be applied at the boundary of the facility.

The other pertinent requirements are:

Performance Assessment (DOE M 435.1 IV.P (2)). A site-specific radiological performance assessment (PA) shall be prepared and maintained for DOE low-level waste disposed of after September 26, 1988. The performance assessment shall include calculations for a 1,000 year period after closure of potential doses to representative future members of the public and potential releases from the facility to provide a reasonable expectation that the performance objectives identified in this Chapter are not exceeded as a result of operation and closure of the facility.

Releases ALARA (DOE M 435.1 IV.P (2)(f)). Performance assessments shall include a demonstration that projected releases of radionuclides to the environment shall be maintained as low as reasonably achievable (ALARA).

Water Resource Protection (DOE M 435.1 IV.P (2)(g)). For purposes of establishing limits on radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts to water resources.

Inadvertent Intruder (DOE M 435.1 IV.P (2)(h)). For purposes of establishing limits on the concentration of radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts calculated for a hypothetical person assumed to inadvertently intrude for a temporary period into the low-level waste disposal facility. For intruder analyses, institutional controls shall be assumed to be effective in deterring intrusion for at least 100 years following closure. The intruder analyses shall use performance measures for chronic and acute exposure scenarios, respectively, of 100 mrem (1 mSv) in a year and 500 mrem (5 mSv) total effective dose equivalent excluding radon in air.

Disposal Site Stability (DOE M 435.1 IV.Q (1)). A preliminary closure plan shall be developed and submitted to Headquarters for review with the performance assessment and composite analysis. The closure plan shall be updated following issuance of the disposal authorization statement to incorporate conditions specified in the disposal authorization statement. Closure plans shall:

- (a) Be updated as required during the operational life of the facility.
- (b) Include a description of how the disposal facility will be closed to achieve long-term stability and minimize the need for active maintenance following closure and to ensure compliance with the requirements of DOE 5400.5, *Radiation Protection of the Public and the Environment*.

Disposal Facility Closure (DOE M 435.1 IV.Q (2)(c)). Institutional control measures shall be integrated into land use and stewardship plans and programs, and shall continue until the facility can be released pursuant to DOE 5400.5, *Radiation Protection of the Public and the Environment*.

5. DOE 435.1 Requirements Compared to 10 CFR 61 Performance Objectives

This section will compare each of the 10 CFR 61 performance objectives with the pertinent requirements of DOE M 435.1 to show the essential comparability of the protectiveness of DOE LLW disposal requirements with those of 10 CFR 61.

5.1 General Requirement

The preamble to the DOE 435.1 performance objectives (DOE M 435.1 IV.P (1)), "Low-level waste disposal facilities shall be sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following performance objectives will be met for waste disposed of after September 26, 1988", is nearly identical to that of the general requirement in 10 CFR 61 (i.e., 10 CFR 61.40). The DOE requirement adds the concept of maintenance, which is implicit in the NRC requirement. The DOE requirement does not mention control after closure,

but this concept is embodied in the DOE requirements for closure, specifically DOE M 435.1 IV.Q (2)(c), which requires DOE control until it can be shown that release of the disposal site for unrestricted use will not compromise DOE requirements for radiological protection of the public.

Thus, the DOE requirements for LLW disposal are comparable to the NRC general requirement.

5.2 Protection of the General Population

The first DOE performance objective (DOE M 435.1 IV.P (1)(a)) is essentially identical to 10 CFR 61.41. The only difference is the terms used to describe the dose. The NRC requirement uses terminology (i.e., 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ) that reflects the standard dose methodology in use at the time Part 61 was promulgated, which was ICRP 2⁷. The DOE requirement uses terminology (i.e., 25 mrem (0.25 mSv) in a year total effective dose equivalent, TEDE) reflective of the standard dose methodology now in use¹². The measure of protection, 25 mrem, is the same. The NRC recommends using ICRP-30 dose methodology in computing potential dose from a LLW disposal facility to compare with this performance objective^{13,a}. Both NRC and DOE require a PA to provide reasonable assurance of meeting this requirement.

The DOE requirements go beyond this NRC performance objective by requiring an assessment of the impacts of LLW disposal on water resources (i.e., DOE M 435.1 IV.P (2)(g)). At SRS, this requirement is interpreted to mean that groundwater at the point of compliance is not to exceed the requirements for public drinking water sources. One of these requirements is that no member of the public may receive an annual dose of more than 4 mrem from man-made beta- or gamma-emitting radionuclides¹⁴. Thus, for these radionuclides, which includes fission- and activation-products that comprise much of DOE LLW, the DOE requirement, as implemented at SRS, is more stringent than the NRC requirement.

The NRC requirement also includes maintaining releases to the environment ALARA. Although this is not included in the DOE performance objective, it is included in the PA requirements (i.e., DOE M 435.1 IV.P (2)(f)).

Thus, the DOE requirements for LLW disposal are comparable, if not more stringent, to the NRC requirement for protection of the general population from releases of radioactivity.

5.3 Protection of Individuals from Inadvertent Intrusion

The DOE LLW disposal requirement that the PA shall include an assessment of the impacts on a person inadvertently intruding into the disposal facility (DOE M 435.1 IV.P (2)(h)) is more stringent than the NRC requirement. The NRC waste classification system is based on intruder calculations using a 500 mrem per year dose limit⁴. The DOE requirement uses a 100 mrem per year limit for chronic exposures and a 500-mrem limit for acute exposures.

Thus, the DOE requirements for LLW disposal are more stringent than the NRC requirement for protection of the inadvertent intruder.

^a NUREG-1573 states (Section 3.3.7.1.2, page 3-79): "As a matter of policy, the Commission considers 0.25 mSv/year (25 mrem/year) TEDE as the appropriate dose limit to compare with the range of potential doses represented by the older limits that had whole-body dose limits of 0.25 mSv/year (25 mrem/year)."

5.4 Stability of the Disposal Site After Closure

The DOE LLW disposal requirements address consideration of the long-term stability of the site by requiring description of how closure will achieve stability in the closure plan and a description of how closure will minimize the need for active maintenance following closure (DOE M 435.1 IV.Q (1)(b)). Additionally, one of the PA requirements (DOE M 435.1 IV.P (2)(c)) states: "Performance assessments shall address reasonably foreseeable natural processes that might disrupt barriers against release and transport of radioactive materials." Thus, the PA must include a projection of the long-term stability of the site, such as erosion, degradation of waste packages, etc. Implicit in the development of the PA and closure plan is the control of water because water is the primary means by which radionuclides are transported from the waste.

Thus, the DOE requirements for LLW disposal are comparable to the NRC requirement for stability of the disposal site after closure.

6. Implementation of DOE 435.1 LLW Disposal Requirements at the SRS E-Area LLW Facility

At the Savannah River Site, the DOE requirements for LLW disposal have been implemented. The implementation of the requirements can be viewed as a sequence of activities that, taken together, provide reasonable assurance that the exposure of the public and the environment to radioactive materials released from the LLW disposal facility will not exceed DOE standards, which have been shown to be comparable to or more stringent than those of the NRC. These activities are discussed below.

6.1 Performance Assessment

The Savannah River Site has completed a PA of its LLW disposal facility, the E-Area Low-Level Waste Facility¹⁵. The PA has been reviewed and approved by DOE Headquarters¹⁶. The PA considers all the elements of the design of each of the disposal units (e.g., concrete vaults, earthen trenches), the current and projected radionuclide inventory, the physical and chemical processes that control the release of radionuclides from the disposal unit and their transport through the environment, and reasonably expected future human activities, to project potential impacts to human health and the environment. Additionally, a closure plan for the E-Area Low-Level Waste Facility (LLWF)¹⁷ has been developed to ensure the long-term stability of the facility. As required by DOE 435.1, a maintenance program has been developed to reduce uncertainty in the PA¹⁸.

6.2 Waste Acceptance Criteria

The PA results are used to calculate radionuclide inventory limits for each disposal unit and each performance measure (e.g., 25 mrem/year to any member of the general public, 100 mrem/year from chronic exposure to an inadvertent intruder). For each disposal unit and radionuclide, the inventory limits are examined to determine which performance measure is most restrictive. The most restrictive limits, as well as design details, and other requirements (e.g., criticality safety) are used to establish waste acceptance criteria (WAC). The WAC¹⁹ limit the types and quantities of LLW that may be emplaced in each disposal unit.

6.3 Waste Characterization and Certification

To ensure accurate and reliable determination of the radionuclide content of each waste package to be received at the E-Area LLWF, procedures for waste characterization²⁰ and for certifying a generator's waste characterization program²¹ have been developed and implemented.

7. Conclusion

The Department of Energy requirements for disposal of low-level radioactive waste have been shown to be at least as protective as the performance objectives of 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste". Thus, any solid waste that meets the Savannah River Site waste acceptance criteria for low-level waste disposal at the E-Area Low-Level Waste Facility "will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*" and, thus, meets one of the waste incidental to reprocessing requirements of DOE 435.1 (i.e., DOE M 435.1, II.B (2)(a) 2).

8. References

1. U.S. DOE. *Radioactive Waste Management*, Order 435.1, U. S. Department of Energy (7/9/99).
2. Federal Register, Vol. 47, No. 248, p 57446 (12/27/82).
3. U.S. Code of Federal Regulations, 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste".
4. U.S. NRC, *Final Environmental Impact Statement on 10 CFR Part 61 "Licensing Requirements for Land Disposal of Radioactive Waste"*, NUREG-0945, 11/82.
5. U.S. Code of Federal Regulations, 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories".
6. D. E. Wood, et al, *Performance Assessment Task Team Progress Report*, DOE/LLW-157, Rev. 1, 5/94.
7. International Commission on Radiological Protection, Report of ICRP Committee II on Permissible Dose for Internal Radiation, ICRP Publication 2, Pergamon Press, New York, 1959.
8. U.S. NRC, *Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility*, NUREG-1199, 1/87.
9. U.S. NRC, *Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility*, NUREG-1200, 1/87.
10. U.S. DOE, *Radioactive Waste Management*, Order 5820.2A, 9/26/88.
11. U.S. DOE G 435.1-1, Appendix A, *Technical Basis and Considerations for DOE M 435.1-1* (7/9/99).

12. International Commission on Radiological Protection, *Limits for Intakes of Radionuclides by Workers*, ICRP Publication 30, Pergamon Press, New York, 1979.
13. U.S. NRC, *A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Recommendations of NRC's Performance Assessment Working Group*, NUREG-1573, 6/2000.
14. U.S. Code of Federal Regulations, 40 CFR 141, "National Primary Drinking Water Regulations".
15. L. McDowell-Boyer, et al, *Radiological Performance Assessment for the E-Area Low-Level Waste Facility*, WSRC-RP-94-218, Rev. 1, 1/31/2000.
16. J. E. Rhoderick and W. E. Murphie, *Savannah River Site E-Area Low-Level Waste Facility Performance Assessment Revision*, 9/6/2000.
17. J. R. Cook, et al, *Closure Plan for the E-Area Low-Level Waste Facility*, WSRC-RP-2000-00425, Rev. 1, 10/12/2000.
18. Solid Waste Management Division, *Performance Assessment and Composite Analysis Maintenance Program, FY 2001 Implementation Plan*, SWD-SWE-2001-00001, 1/31/2001.
19. WSRC 1S Savannah River Site Waste Acceptance Criteria Manual, Procedure WAC 3.17, *Low-Level Radioactive Waste Acceptance Criteria*, Rev. 5, January, 2001.
20. WSRC 1S Savannah River Site Waste Acceptance Criteria Manual, Procedure 2.02, *Low Level, Hazardous, TRU, Mixed, and PCB Waste Characterization Requirements*, Rev. 5, 6/15/2000.
21. WSRC 1S Savannah River Site Waste Acceptance Criteria Manual , Procedure WAC 1.02 *Waste Acceptance Criteria Program Requirements for Radioactive Waste*, Rev. 5, 08/28/2000.

Distribution:

P. H. Stevens, 703-H (3 copies)
B. T. Butcher, 773-43A
J. N. Dewes, 703-H
K. J. Collins, 703-H
M. D. Johnson, 703-H
V. G. Dickert, 703-H
T. J. Lex, 703-H
B. E. Long, 241-197-H
D. E. Lott, 241-197-H
W. T. Goldston, 705-3C
P. I. Hudson, 7-5-3C
J. E. Black, 773-A
W. E. Stevens, 773-A
J. R. Cook, 773-43A
L. B. Collard, 773-43A
WPT File, 773-43A
STI, 703-43A (4 copies)

Westinghouse Savannah River Company Document Approval Sheet

Document No.
WSRC-RP-2001-00341

Title
Comparison of LLW Disposal Performance Objectives 10 CFR 61 and DOE 435.1

Requested Approval Date
4-23-2001

Primary Author/Contact (Must be WSRC) Elmer Wilhite	Location 773-43A	Phone No. 5-5800	Position Sr. Advisory Scientist	User ID T3881
--	---------------------	---------------------	------------------------------------	------------------

Organization Code L3200	Organization (No Abbreviations) Waste Processing Technology
----------------------------	--

Other Authors	Key Words (list 3) Incidental Waste, Evaluation, HLW, LLW Disposal,
---------------	--

Has an invention disclosure, patent application or copyright application been submitted related to this information? Yes No If yes, date submitted _____

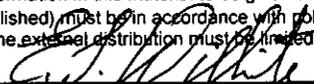
Disclosure No. (If Known) _____ Title _____

If no, do you intend to submit one? Yes No If yes, projected date _____

Information Product Description <input type="checkbox"/> Technical Report <input type="checkbox"/> Semiannual <input type="checkbox"/> Annual <input type="checkbox"/> Final <input type="checkbox"/> Topical <input type="checkbox"/> Other _____ <input checked="" type="checkbox"/> Administrative Report <input type="checkbox"/> Semiannual <input type="checkbox"/> Annual <input type="checkbox"/> Final <input type="checkbox"/> Topical <input type="checkbox"/> Other _____ <input type="checkbox"/> Videotape/Multimedia <input type="checkbox"/> External Web Page URL _____ <input type="checkbox"/> Brochure/Booklet <input type="checkbox"/> Procedure/User Guide <input type="checkbox"/> Drawing <input type="checkbox"/> Software Package (for submission to ESTSC)	<input type="checkbox"/> Journal Article Journal Name _____ Book/Book Chapter Book Name _____ <input type="checkbox"/> Conference Submission* <input type="checkbox"/> Abstract <input type="checkbox"/> Conf. Paper <input type="checkbox"/> Conf. Proceeding <input type="checkbox"/> Slides/poster/display <input type="checkbox"/> Other _____ *Conference Title _____ *Conference Location (City, State, Country) _____ *Conference Dates _____ m/d/y thru _____ m/d/y *Conference Sponsor _____
--	---

References Approved for Release/PUBLICLY Available Included as Attachment(s) Routing Concurrently Other _____

I understand that for the information in this material to be given external distribution, approvals by both WSRC and, as appropriate, DOE-SR are required. Distribution (verbally or published) must be in accordance with policies set forth in WSRC management requirements and procedures (MRP 3.25) and in DOE-SR orders, and the content of the external distribution must be limited to that actually approved.

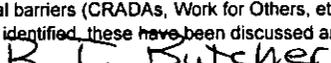
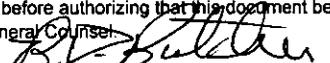

 Author's Signature 3/8/2001
 Date

Approvals by Author's Organization:

Derivative Classifier <u>W. Stearns</u>	Classification <u>U</u>	Topic <u>LLW Disposal</u>
--	----------------------------	------------------------------

Intended Distribution <input checked="" type="checkbox"/> Unlimited (release to public) <input type="checkbox"/> Limited (see explanation)	Explanation for Limited Dist. <input type="checkbox"/> Site Use Only <input type="checkbox"/> Corporate/University Partner <input type="checkbox"/> Other DOE facility(ies) only <input type="checkbox"/> Other _____
--	---

I understand and have considered whether any potential intellectual property rights (patents, copyrights, etc., in accordance with MP 1.09 and MRP 1.07) or any contractual barriers (CRADAs, Work for Others, etc.) may be involved before authorizing that this document be proposed for public release. If any concerns were identified, these have been discussed and resolved with General Counsel.


 Manager's Name (Print) 
 Manager's Signature 3/8/2001
 Date

Classification Information (To be Completed by WSRC Classification Office)

Classification (Check One for Each) Overall <input type="checkbox"/> S <input type="checkbox"/> C <input type="checkbox"/> UCN <input checked="" type="checkbox"/> U Abstract <input type="checkbox"/> S <input type="checkbox"/> C <input type="checkbox"/> UCN <input type="checkbox"/> U Title <input type="checkbox"/> S <input type="checkbox"/> C <input type="checkbox"/> UCN <input checked="" type="checkbox"/> U	<input checked="" type="checkbox"/> OPSEC Review Classification Guide Topics
---	---

WSRC Classification Officer's Name (Print) <u>AL Shankle</u>	WSRC Classification Officer's Signature 	Date <u>3/13/01</u>
---	--	------------------------

Export Control Review (To be Completed by Export Control Reviewing Official)

Export Control Related <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Limitations
---	-------------

Export Control Reviewer's Name (Print) <u>AL Shankle</u>	Export Control Reviewer's Signature 	Date <u>3/13/01</u>
---	--	------------------------

STI Program Use Only

OSTI Subj. Category No. <u>SC-54</u>	Routing <u>CLASS/EC/DOE</u>	Editor/Illustrator/On-line Support	MSD Project No.
---	--------------------------------	------------------------------------	-----------------

NOTE OSR 17-8 must be completed in addition to this form when submitting information for review and approval.



Westinghouse
Savannah River Company

P.O. Box 616
Aiken, SC 29802

March 13, 2001

RECEIVED
01 MAR 13 PM 2:31

WSRC-RP-2001-00341
MSD-STI-2001-00591

Ms. W. F. Perrin, Technical Information Officer
U. S. Department of Energy - Savannah River Operations Office

Dear Ms. Perrin:

REQUEST FOR APPROVAL TO RELEASE SCIENTIFIC/TECHNICAL INFORMATION

The attached document is submitted for classification and technical approvals for the purpose of external release. Please complete Part II of this letter and return the letter to the undersigned by 4/23/2001. The document has been reviewed for classification and export control by a WSRC Classification staff member and has been determined to be Unclassified.

Kevin Schmidt
Kevin Schmidt, WSRC STI Program Manager

I. DETAILS OF REQUEST FOR RELEASE

Document Number: WSRC-RP-2001-00341

Author's Name: E. L. Wilhite

Location: 773-43A

Phone 5-5800

Department: Waste Processing Technology

Document Title: Comparison of LLW Disposal Performance Objectives 10 CFR 61 and DOE 435.1

Presentation/Publication:

Meeting/Journal:

Location:

Meeting Date:

N/A

OSTI Reportable

II. DOE-SR ACTION

Date Received by TIO 03/13/2001

- Approved for Release
- Approved Upon Completion of Changes
- Approved with Remarks
- Not Approved
- Revise and Resubmit to DOE-SR

Remarks: _____

W. F. Perrin

W. F. Perrin, Technical Information Officer, DOE-SR

3/28/01
Date

US DEPARTMENT OF ENERGY
ANNOUNCEMENT OF U. S. DEPARTMENT OF ENERGY (DOE)
SCIENTIFIC AND TECHNICAL INFORMATION (STI)

RECORD STATUS (select one):

New Revised Data Revised STI Product

Part I: STI PRODUCT DESCRIPTION

A. STI PRODUCT TYPE (select one)

..... 1. Technical Report

a. Type: Topical Semiannual Annual Final Other (specify) _____
b. Reporting Period (mm/dd/yyyy) thru

..... 2. Conference

a. Product Type: Conference Proceedings Conference Paper or Other (abstracts, excerpts, etc.) ____
b. Conference Information (title, location, dates) _____

..... 3. Software Manual (The actual software package should be made available simultaneously. Follow instructions provided with ESTSC F 1 and ESTSC F 2.)

4. Journal Article

a. Type: Announcement citation only Preprint Postprint
b. Journal Name _____
c. Volume _____ d. Issue _____ e. Serial identifier (e.g., ISSN or CODEN) _____

..... 5. S&T Accomplishment Report

..... 6. Book

..... 7. Patent Application

a. Date Filed (mm/dd/yyyy) ___/___/___
b. Date Priority (mm/dd/yyyy) ___/___/___
c. Patent Assignee _____

..... 8. Thesis/Dissertation

B. STI PRODUCT TITLE Comparison of LLW Disposal Performance Objectives 10 CFR 61 and DOE 435.1

C. AUTHOR(s) E. L. Wilhite
E-mail Address(es): _____

D. STI PRODUCT IDENTIFIER

1. Report Number(s) WSRC-RP-2001-00341
2. DOE Contract Number(s) DE-AC09-96SR18500
3. R&D Project ID(s) _____
4. Other Identifying Number(s) _____

E. ORIGINATING RESEARCH ORGANIZATION Savannah River Site

F. DATE OF PUBLICATION (mm/dd/yyyy) 3/28/2001

G. LANGUAGE (if non-English) English

(Grantees and Awardees: Skip to Description/Abstract section at the end of Part I)

H. SPONSORING ORGANIZATION _____

I. PUBLISHER NAME AND LOCATION (if other than research organization) _____

Availability (refer requests to [if applicable])

J. SUBJECT CATEGORIES (list primary one first) 54
Keywords Incidental Waste Evaluation HLW LLW Disposal

K. DESCRIPTION/ABSTRACT

This report documents that waste disposed according to DOE M 435.1 requirements for LLW disposal (i.e., performance, objectives, performance assessment (PA), waste characterization, and other requirements) meets safety requirements comparable to the 10 CFR 61 performance objectives.

US DEPARTMENT OF ENERGY
ANNOUNCEMENT OF U. S. DEPARTMENT OF ENERGY (DOE)
SCIENTIFIC AND TECHNICAL INFORMATION (STI)

DOE F 241.1 (p. 2 of 2)

Part II: STI PRODUCT MEDIA/FORMAT and LOCATION/TRANSMISSION

A. MEDIA/FORMAT INFORMATION

1. Medium of STI product is: Paper Electronic document Computer medium Audiovisual material
2. Size of STI product _____
3. File format:
 - a. If electronic document is posted at site, indicate: html pdfn sgml xml
 - b. If electronic document is transmitted to OSTI, indicate: html pdfn pdfi msword
 ___ TIFFG4 ___ WP—indicate Version (5.0 or greater) _____ platform/operating system _____
 ___ MS Word—indicate Version (5.0 or greater) _____ platform/operating system _____ Postscript
4. If computer medium or audiovisual material:
 - a. Quantity/type (*specify*) _____
 - b. Machine compatibility (*specify*) _____ c. Sound: ___ (yes) d. Color ___ (yes) e. Tables/Graphics ___ (yes)
 - f. Other information about product format a user needs to know: _____

B. LOCATION/TRANSMISSION INFORMATION

1. STI Product is available at site: Unique URL (*of specific STI Product*) http://www.srs.gov/general/sci-tech/fulltext/rp2001341/rp2001341.html
2. STI Product is being transmitted to OSTI:
 - a. ___ Electronically via FTP
 - b. ___ Via Mail or shipment (e.g., Federal Express) (*Paper products, electronic documents on CD-ROM, diskettes, videocassettes, etc.*)
3. Information Product Filename (*of transmitted electronic format*) _____

C. ADDITIONAL INFORMATION (concerning media/format or location/transmission; for OSTI internal use only): _____

(Grantees and Awardees: Skip to Contact section at the end of Part III)

Part III: STI PRODUCT REVIEW? RELEASE INFORMATION

A. ACCESS LIMITATION

1. **Unlimited Announcement** (*available to U.S. and non-U.S. public*)
- 2. **OpenNet** (*use OpenNet guidance for below*):

a. If additional source other than making it available through NTIS:	e. OpenNet Document Type _____
(1) Accession Number _____	f. OpenNet Document Keywords _____
(2) Document Location _____	
b. Field Office Acronym _____	
c. Declassification date (mm/dd/yyyy) ___/___/___	g. OpenNet Addressee _____
d. Declassification Status: ___ Declassified ___ Sanitized ___ Never classified	
- 3. **U.S. Dissemination Only**
- 4. **Copyrighted material**; Are there any restrictions based on copyright? ___ yes ___ no. If yes, list the restrictions _____
- 5. **Small Business Innovation Research (SBIR)** Release date (mm/dd/yyyy) _____
- 6. **Small Business Technology Transfer (STTR)** Release date (mm/dd/yyyy) _____
- 7. **Proprietary/Trade Secret**
- 8. **Patent Pending**
- 9. **Protected data** ___ CRADA ___ Other (specify) _____ Release date (mm/dd/yyyy) _____
- 10. **Official Use Only (OUO)**
- 11. **Program-Directed Special Handling** (*specify*) _____
- 12. **Export Control/ITAR/EAR**
- 13. **Unclassified Controlled Nuclear Information (UCNI)** _____
- 14. **Classified Classification Level/Category of**:
 - a. This form U.....
 - b. The STI Product Unclassified.....
- 15. **Other information relevant to access** (*specify; for OSTI internal use only*) _____

B. OTHER (*information useful to include in published announcement record which is not suited for any other field on this form*) _____

C. CONTACT AND RELEASING OFFICIAL

1. Contact (*if appropriate, the organization or site contact to include in published citations who would receive any external questions about the content of the STI Product or the research information contained therein*)

Name and/or Position Kevin Schmidt, Manager STI Program & Site Support
 E-mail _____ Phone (803) 725-2646
 Organization Westinghouse Savannah River Company

2. Releasing Official I verify that all necessary reviews have been completed (e.g. Patent, Copyright, ECI, UCNI, etc.)
 Released by (*name*) Kevin Schmidt Date (mm/dd/yyyy) 3/29/2001
 E-Mail _____ Phone _____ (803) 725-2646