August 22, 2008

MEMORANDUM TO: Timothy J. Kobetz, Chief
Reactor Inspection Branch
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation

FROM: Joshua Palotay/***RA***/
Health Physics Team
Reactor Inspection Branch
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation

DATE & TIME: September 10, 2008
Time: 1:00 pm – 4:00 pm

LOCATION: U.S. Nuclear Regulatory Commission
One White Flint
Room 3B4
11555 Rockville Pike
Rockville, MD 20852

PURPOSE: Public meeting with NEI to discuss several issues related to the oversight of health physics programs at operating nuclear power reactor facilities.

PARTICIPANTS:

NRC	Industry
Timothy Kobetz, NRR	Ralph Andersen, NEI
Steven Garry, NRR	George Oliver, NEI
Roger Pedersen, NRR	Industry Representatives
Joshua Palotay, NRR	Public
Others, NRR and Regions	

CATEGORY 2: This is a category 2 meeting*. The public is invited to participate in this meeting by discussing regulatory issues with the Nuclear Regulatory Commission (NRC) at designated points identified on the agenda. A telephone bridge line will be available. Contact the individual named below for more information for accessing the telephone bridge line.

CONTACT: Roger Pedersen, NRR
301-415-3162
roger.pedersen@nrc.gov

Enclosures:
Agenda; Draft RIS - Multiple Dosimetry and EDE; and, Draft RIS - Low Level Waste Storage

* *Commission's Policy Statement on "Enhancing Public Participation in NRC Meetings,"67 *Federal Register* 36920, May 28, 2002. For information regarding participating via teleconference, please contact Roger Pedersen at 301-415-3162 or roger.pedersen@nrc.gov at least 24 hours prior to the meeting.

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AGENDA
Public Meeting
September 10, 2008

Time: **1:00 pm ~ 4:00 pm** (Attendees are encouraged to arrive 10 to 15 minutes early to facilitate an on-time start)

Location: **NRC HQ - One White Flint North - Room 3B4**

I. Administrative

A. Introductions

B. Agenda Review

C. Category 2 Public Meeting reminder

II. Review and Discussion of Draft RIS on Multiple Dosimetry

A. Use of Effective Dose Equivalent vs. DDE

B. Summary of San Onofre Safety Evaluation and ANSI/HPS N13.41-1997

C. Intent and utility of the draft RIS for licensees implementing multiple dosimetry

III. Review and Discussion of Draft RIS on Low Level Waste Storage

A. NRC current guidance on LLW storage in SECY 94-198

B. Use of EPRI storage guidelines

IV. Minor / More Than Minor Performance Deficiencies

A. NRC examples

B. NEI examples

V. Other Current Health Physics Topics To Be Determined

VI. Closing

Enclosure

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

August XX, 2008

NRC REGULATORY ISSUE SUMMARY 2008-XX
USE OF MULTIPLE DOSIMETRY AND COMPARTMENT FACTORS IN DETERMINING EFFECTIVE DOSE EQUIVALENT FROM EXTERNAL RADIATION EXPOSURES

ADDRESSEES

All U.S. Nuclear Regulatory Commission (NRC) Licensees, Agreement State Radiation Control Program Directors, and State Liaison Officers.

INTENT

The NRC is issuing this regulatory issue summary (RIS) to inform licensees of an acceptable method for determining Effective Dose Equivalent (EDE) from external sources of radiation. This method includes the use of "Compartment Factors" described in American National Standard Institute, Inc. (ANSI) Health Physics Society Standards Committee (HPS) HPS N13.41-1997 "Criteria for Performing Multiple Dosimetry." These compartment factors (based on the ICRP 26 tissue weighting factors) may be used as part of a licensee's multiple dosimetry program, when combined with approved practices, for demonstrating compliance with NRC regulations.

BACKGROUND

Effective January 3, 2008, the definition of Total Effective Dose Equivalent (TEDE) in 10 CFR Part 20 was amended (72 *Federal Register* 68043; December 4, 2007). The amendment re-defined TEDE as "the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures)." This change clarified that the use of EDE from external sources (EDE_{ex}) could be used to demonstrate compliance with TEDE-based regulations.

In addition, 10 CFR Part 20.1201, paragraph (c) was revised, to require that when external exposure is determined by measurement with an external personal monitoring device, the DDE must be used in place of the EDE_{ex}, unless the EDE_{ex} is determined by a dosimetry method approved by the NRC. The method described in this RIS is such an approved method. As demonstrated by NRC RIS(s) 2002-06, 2003-04, and 2004-01, the NRC has approved several methods for determining EDE_{ex}, and has encouraged the use of EDE_{ex} in place of DDE for demonstrating compliance with the TEDE requirements in 10 CFR Part 20.

On December 20, 2004, Southern California Edison submitted (to the NRC) a request to utilize the compartment factors found in the ANSI/HPS N13.41-1997 standard, as part of a proposed method of multiple dosimetry (ML0436300361). The NRC staff found the ANSI/HPS standard deficient in certain areas for compliance with TEDE-based regulations. One example is a lack of specificity in the ANSI/HPS standard for the placement of personal monitoring devices.

However, on May 10, 2005, the NRC approved the method proposed by the licensee, with the expectation that the licensee adhere to commitments made in its submittal when using the compartment factors found in the standard (ML0513201940). The NRC staff concluded that with the application of these commitments, the multiple dosimetry method to estimate EDE_{ex} using the weighting factors listed in Table 1 of the ANSI/HPS standard, as proposed by Southern California Edison, was technically sound and acceptable for the purposes of demonstrating compliance with the TEDE-based requirements in 10 CFR Part 20.

The method provides an adequate estimate of EDE_{ex}. Since May 10, 2005, the NRC has granted approval for use of the method to several licensees, on a case-by-case basis. With the issuance of this RIS, licensees are allowed to use this method, as described below, for demonstrating compliance with TEDE-based regulations. Therefore, licensees are no longer required to apply for individual approval.

SUMMARY OF ISSUE

The multiple dosimetry method in the ANSI/HPS standard divides the whole body into seven separate compartments. Each compartment, or composite compartment (since the ANSI/HPS standard allows combining adjacent compartments), is monitored separately. The dose measurement for each compartment is the personal dose equivalent for penetrating radiation at a depth of 10 mm, or $H_p(10)$. The $H_p(10)$ is then weighted with the associated "compartment factor" (W_c). The compartment factors are listed in Table 1 of the Standard (shown below).

Area of the Body / Compartment	Compartment Factor (W_c)
Head and neck	0.10
Thorax, above the diaphragm	0.38
Abdomen, including the pelvis	0.50
Upper right arm	0.005
Upper left arm	0.005
Right thigh	0.005
Left thigh	0.005

$$H_E = \sum W_C \, H_{p,c}(10)$$

Where H_E = effective dose equivalent, W_c = compartment Factor (from Table 1 of the Standard), and $H_{p,c}(10)$ = personal dose equivalent for a single compartment, or the average measured dose equivalent in a given compartment or the highest measured dose equivalent in an adjacent compartment if a compartment is not measured)

The factor for each compartment was developed by summing the stochastic weighting factors given in ICRP 26 (Part 20 organ ω_T) for all the organs located within that compartment. For each tissue that resides in more than one compartment (e.g., red bone marrow), the weighting factor is apportioned between the compartments based on the fraction of the total mass of the tissue residing in each, using the information in ICRP 23. The resulting weighted doses are then summed to determine the EDE_{ex} for the whole body (H_E).

To ensure that the estimates of EDE_{ex} are conservative, the licensee must measure the dose to each compartment (or composite compartment) by locating the dosimeter (calibrated to DDE) at the highest exposed portion of the respective compartment. The dosimeter location for each compartment is subject to the same criteria currently used for demonstrating compliance with 10 CFR 20.1201(c). If all compartments are combined into a single compartment, this results in a dosimeter placement consistent with 10 CFR 20 for determining DDE.

Fundamental to the ANSI/HPS standard method of determining EDE_{ex} are the assumptions that: (1) The average dose to the tissues in each compartment can be reasonably measured (with one or more dosimeters); and, (2) The dose distribution across the compartment is sufficiently constant so that this average dose can be applied to each tissue in the compartment. The compartments defined in the Standard are small enough so that under most normal exposure situations these assumptions are met and a single determination of DDE in each compartment is sufficient. However, this may not be the case in those unusual situations where a significant dose gradient exists across one or more compartments (particularly the thorax and abdomen compartments). In these cases, the number and placement of dosimeters in each compartment become critical to ensuring that the EDE_{ex} is not underestimated.

When recording or reporting doses in situations where the EDE_{ex} is assessed instead of the DDE, the value of the EDE_{ex} is entered in place of the DDE in recording or reporting forms such as NRC Forms 4 or 5. For those monitoring periods where external exposure has been measured using DDE and EDE, the sum of those values shall be entered into forms 4 or 5 where DDE is to be recorded. Currently, the NRC is changing Form 4 and 5, in response to the recent revisions to 10 CFR 20.

CONCLUSION

NRC licensees may use the compartment factors of the ANSI/HPS standard and methodology described in this RIS for implementing a multiple dosimetry program in compliance with TEDE-based regulations. This methodology is consistent with the NRC Safety Evaluation, and its associated conditions, issued to Southern California Edison on May 10, 2005 (ML0513201940). It should be noted that the NRC has not directly approved the ANSI/HPS N13.41-1997 Standard, in of itself, for use by licensees in a personnel monitoring program. Only use of the Compartment Factors and associated method for calculating Effective Dose Equivalent (H_E), as described in this RIS, has been approved for use in a multiple dosimetry program when combined with the method presented herein.

BACKFIT DISCUSSION

This RIS requires no action or written response. Any action on part of addressees in accordance with the guidance contained in this RIS is strictly voluntary. The Commission has determined that information collections and reporting requirements are not subject to the Backfit Rule. In addition, this RIS communicate a voluntary relaxation which also does not constitute backfitting as defined in 10 CFR 50.109(a)(1). Consequently, the staff did not perform a backfit analysis.

FEDERAL REGISTER NOTIFICATION

A notice of opportunity for public comment on this RIS was not published in the *Federal Register* because this RIS is informational and does not represent a departure from current regulatory requirements.

CONGRESSIONAL REVIEW ACT

This RIS is a rule as designated by the Congressional Review Act (5 U.S.C. " 801-886) and therefore is subject to the Act.

PAPERWORK REDUCTION ACT STATEMENT

This RIS contains information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collection requirements were approved by the Office of Management and Budget (OMB), approval number 3150-0195.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a current valid OMB control number.

CONTACT

Please direct any questions about this matter to the technical contact listed below.

Michael Case, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact:	Joshua Palotay 301-415-6231 Joshua.Palotay@nrc.gov	Roger Pedersen 301-415-3162 Roger.Pedersen@nrc.gov

Note: NRC generic communications may be found on the NRC public Web site at http://www.nrc.gov/reading-rm/doc-collections/#gen.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

{date}

NRC REGULATORY ISSUE SUMMARY 2008-xx
INTERMIN LOW LEVEL RADIOACTIVE WASTE STORAGE AT NRC LICENSED FACILITIES

ADDRESSEES

All holders of operating licenses for nuclear power reactors, except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to clarify the current NRC staff position regarding the long-term, interim storage of low level radioactive waste (LLRW) at 10 CFR Part 50 facilities. Beginning July 1, 2008, LLRW generators in 36 States will not be able to ship Class B and C LLRW to a disposal facility. Therefore, facilities in those States will have to store their Class B and C LLRW for an indeterminate amount of time. Since 1979, NRC has issued a number of generic communications which contains guidance related to interim LLRW storage. This RIS will consolidate relevant information and clarify past positions. This RIS requires no action or written response on the part of an addressee.

BACKGROUND INFORMATION

The Low Level Radioactive Waste Policy Act of 1980 made states responsible for disposing of LLRW generated by commercial entities within their state. The Act also encouraged the states to form regional compacts. To date, there are 10 Compacts and all but seven States are a member of a Compact. The Low-Level Radioactive Waste Policy Amendments Act of 1985 established milestones, penalties and incentives for States or regional compacts to develop their own low-level disposal facilities. Under this Act, States with an operating disposal site were given the authority to deny access to waste generators in States or compacts which had not or were not working to develop their own disposal capabilities.

Currently, there are three operating LLRW disposal facilities in the US, in Barnwell, SC (Barnwell), Clive, UT (Clive) and Richland, WA (Richland). Barnwell and Richland accept LLRW in waste Classes A, B, and C. Clive only accepts LLRW in waste Class A. LLRW Classes A, B, and C are defined in 10 CFR Part 61, “Licensing Requirements for Land Disposal of Radioactive Waste,” at paragraph 61.55. Class A waste makes up approximately 99 percent of the LLRW and has the lowest activity. Class A waste is usually made up of slightly contaminated paper products and clothing, rags, mops, equipment and tools, and low activity filters. While Class B

and C waste makes up only a small percentage of the total, it has a higher level of activity. Class B and C can be comprised of materials such as filters, resins, and irradiated hardware.

Richland will only accept Class A, B and C LLRW from waste generators in the Northwest Compact (WA, OR, ID, MT, UT, WY, AK, and HI) and the Rocky Mountain Compact (NV, CO, and NM). All LLRW generators in the Unites States are allowed to ship Class A waste to Clive for disposal.

SUMMARY OF ISSUE

On May 12, 2008, the State of South Carolina officially notified the Atlantic Compact Commission and all other interested parties that effective July 1, 2008, only facilities in States in the Atlantic Compact will continue to have access to Barnwell to dispose of their Class A, B, and C waste. The Atlantic Compact is comprised of the States of South Carolina, New Jersey and Connecticut. The LLRW generators in the District of Columbia, the Commonwealth of Puerto Rico and the U.S. Territories and in the 36 States not part of the Atlantic, Northwest or Rocky Mountain Compact will not be able to ship their Class B and C waste to a disposal site.

Restricting access at Barnwell to only facilities in States in the Atlantic Compact is an inconvenience to licensees in the remaining 36 States due to the fact that LLRW will now have to be stored on the licensees' sites for an indeterminate amount of time. However, since 1980, there have been a number of times when licensees have had to make contingency plans for the possibility of storing their LLRW on site for an indefinite period of time.

Since 1979, a number of generic communications have been written which provide guidance for storing LLRW on licensees' sites. The following is a summary of documents which specifically address interim storage of LLRW on reactor sites.

> Generic Letter (GL) 81-38, Storage of Low-Level Radioactive Wastes at Power Reactor Sites: GL 81-38 was written in 1981 as a result of a reduction in availability of waste disposal in the US when three disposal sites permanently closed. GL 81-38 provided guidance to licensees that if the on site LLRW storage capacity was to be increased, then an evaluation must performed under the provisions of 10 CFR 50.59. If an unreviewed safety question was identified as a result of the additional LLRW storage, then the licensee was to apply to the Office of Nuclear Material Safety and Safeguards (NMSS) for a license under the provisions of 10 CFR Part 30. GL 81-38 indicated that the Part 30 was for the administrative convenience of the Commission and was not intended to be substantively different that an application for amending the Part 50 license. The Part 30 license would be issued for a 5-year term and could be renewed for additional 5-year terms if there was continued need to store LLRW on site. GL 81-38 also provide guidance to be used in the design, construction and operation of the LLRW storage facility.
>
> GL 85-14, Commercial Storage at Power Reactor Sites of Low-Level Radioactive Waste Not Generate by the Utility: GL 85-14 was written in 1985 because no additional commercial waste disposal capacity would be available by 1986 and the NRC anticipated that licensees in some states may not be allowed to dispose of their LLRW at existing disposal facilities. Also, a number of States had expressed an interest in using

nuclear power plant sites in their states as interim commercial storage for LLRW produced by other licensees in the state. GL 85-14 provides guidance for using nuclear power plants as commercial storage capacity. GL 85-14 reiterated that a Part 30 license would be required, and an amendment to the Part 50 license may also be required. If a licensee were to request an amendment to store LLRW generated by other licensees in the state, the amendment request would also have to include an environmental report per 10 CFR Part 51. The Office of Nuclear Reactor Regulation (NRR) would conduct a safety and an environmental review to determine whether the LLRW commercial storage on a reactor site would have an impact on the safe operation of the reactor.

Information Notice (IN) 89-13, Alternative Waste Management Procedures in Case of Denial of Access to Low-Level Waste Disposal Sites: IN 89013 was written in 1989 to address the possibility of restrictions for disposing of LLRW, particularly for licensees in the States of Vermont, New Hampshire and Michigan. It also provided suggestions on how to minimize possible adverse consequences of interim storage by minimizing the waste generated on site. Suggested actions included evaluate potential safety problems and technical difficulties from long term storage, review ways to minimize waste generation, and review alternative waste management and disposal methods.

In 1994, SECY-94-198, Review of Existing Guidance Concerning the Extended Storage of Low-Level Radioactive Waste, was written to provide the Commission with a review of NRC guidance on LLRW and to inform the Commission on needed changes. SECY-94-198 attempted to consolidate previous staff guidance, clarify the meaning of the 5-year limit on storing LLRW on site, remove the requirement that a Part 30 license is required to store LLRW on at a Part 50 licensee's site, and to clarify when a 10 CFR Part 50.59 evaluation is necessary. SECY-94-198 contains the most current NRC position on interim storage of LLRW.

NRC has long taken the stand that disposal of LLRW is the preferred method for handling LLRW and that interim storage should be only for the short term. Now, licensees in 36 States will have to store the Class B and C waste on site for an indefinite period of time. NRC has few regulations specifically relating to storage of LLRW. However, the operation of the LLRW storage facility must be in compliance with the requirements in 10 CFR Part 20 surveys and monitoring, labeling, reports and records. 10 CFR 20.1801 contains a requirement for the security of stored material which states that "a licensee shall secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas." While storing LLRW on reactor sites for an indefinite period of time, licensees need to ensure that the storage of LLRW has been accounted for in the licensee's radiation protection program and that occupational doses in connection with LLRW storage are ALARA (as low as is reasonably achievable). The licensee must also ensure that storing LLRW will not adversely impact the doses to individual members of the public.

The general design criteria listed in Appendix A to 10 CFR Part 50 should be considered when developing interim long term LLRW on site storage, specifically criteria 61 and 63. Criterion 61 specifies that fuel storage and handling, radioactive waste and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. Criterion 63 states that appropriate systems shall be provided in fuel storage and radioactive waste systems and associated handling areas to detect conditions that may result in loss of residual heat removal capability and excessive radiation levels and to initiate appropriate safety actions.

Much of the guidance in SECY-94-198 is still applicable. Part 50 licensees do not have to apply for a Part 30 license to storage LLRW and 5-year limit on storage is not applicable. Licensees should perform an evaluation of the safety of storing LLRW. If the results of the evaluation indicate a 50.59 evaluation is necessary for interim storage of LLRW on their sites, the licensee should document the 50.59 evaluation, and report it as specified in the license.

If the evaluation indicates that an unreviewed safety question exists due to interim storage of LLRW, or if a change to the Technical Specifications is needed as a result of LLRW storage, then the licensee must submit to NRR a request to amend the Part 50 license and include an environmental evaluation which considers the increased amounts of LLRW which will accumulate on the site and the potential impact to the members of the public.

As stated in SECY-94-198, LLRW should be placed into storage in a form suitable for disposal but only if there is sufficient assurance that the waste form will be ultimately acceptable for disposal. Licensees could also store LLRW in a form that is acceptable for shipment by current standards but also allows the waste to be easily repackaged into a form meeting any future requirements. Licensees may also choose to store LLRW in a form that does not attempt to meet any disposal facility waste form standards but allows the material to be safely stored.

In May 2008, Nuclear Energy Institute (NEI) submitted the final draft report, Guidelines for Operating an Interim on Site Low Level Radioactive Waste Storage Facility, prepared by EPRI. Information contained in this report included guidelines for records and recordkeeping, waste containers and waste forms and monitoring and inspecting for extended storage. The Guidelines Report is available for industry to use as a guidance resource for the interim storage of LLRW.

The Guidelines Report also contains information relating to the consolidation of Class B and C waste into Greater than Class C (GTCC) waste. GTCC is defined in 10 CFR Part 72 as LLRW that exceeds the concentration limits of radionuclides established for Class C in 10 CFR 61.55. While NRC feels that generally volume reduction of LLRW waste is appropriate, at this time there is no official staff position on consolidating Class B and C into GTCC.

In 2007, NRC's Standard Review Plan, NUREG-0800, Chapter 11.4, Solid Waste Management System, was revised in anticipation of receiving new reactor license applications. This chapter specifies the information that NRC staff has determined should be included in a Construction and Operating License Application. Appendix 11.4-A, Design Guidance for Temporary Storage of Low-Level Radioactive Waste provides specific guidance to licensees for increasing on site LLRW storage capacity. Included in Appendix 11.4-A is guidance on the level of physical security that should be considered for interim on site storage.

NRC RIS 2008-12, Considerations for Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees, was issued to inform fuel cycle and materials licensees of considerations that may be necessary for materials licensees as a result of interim storage of LLRW.

The Attachment to this RIS, Guidance on Extended Interim Storage of Low-Level Radioactive Waste by 10 CFR Part 50 Licensees, was an attachment to SECY-94-198 and is based on GL 81-38. It contains guidance which is still applicable to interim storage of LLRW.

BACKFIT DISCUSSION

This RIS requires no action or written response and is, therefore, not a backfit under 10 CFR 50.109. Consequently, the staff did not perform a backfit analysis.

FEDERAL REGISTER NOTIFICATION

A notice of opportunity for public comment on this RIS was not published in the *Federal Register* because the RIS is informational and does not represent a departure from current regulatory requirements.

SMALL BUSINESS REGULATORY ENFORCEMENT FAIRNESS ACT of 1996

The NRC has determined that this action is not subject to the Small Business Regulatory Enforcement Fairness Act of 1996.

PAPERWORK REDUCTION ACT STATEMENT

This RIS does not contain information collections and, therefore, is not subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget (OMB), approval numbers 3150-0009, 3150-0011, and 3150-0014.

PUBLIC PROTECTION NOTICIATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

CONTACT

This RIS requires no specific action or written response. Please direct any questions about this matter to the technical contact listed below.

Timothy J. Kobetz, Chief
Reactor Inspection Branch
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation

Technical Contact: Elaine M. Keegan, NRR
301-415-8517
E-mail: Elaine.keegan@nrc.gov

Attachments:
1.
2. References

3. Guidance on Extended Interim Storage of Low-Level Radioactive Waste by 10 CFR Part 50 Licensees (Based on Generic Letter 81-38)
4. List of Recently Issued NRC Regulatory Issue Summaries

Note: NRC generic communications may be found at the NRC public website at http://www.nrc.gov under Electronic Reading Room/Document Collections.
DISTRIBUTION:
RIS File
R/F IHPB

REFERENCES

NUREG-1853, History and Framework of Commercial Low-Level Radioactive Waste Management in the Unites States. January 2007.

Generic Letter GL-81-38, Storage of Low-level Radioactive Wastes at Power Reactor Sites. November 10, 1981.

Guidelines for Operating an Interim On Site Low Level Radioactive Waste Storage Facility, EPRI, April 2008.

NUREG/CR-4062 Extended Storage of Low-Level Radioactive Waste: Potential Problem Areas. December 1985.

Information Notice 89-13. Alternative Waste Management Procedures in Case of Denial of Access to Low-level Waste Disposal Sites. February 8, 1989

Generic Letter GL-85-14, Commercial Storage at Power Reactor Sites of Low level Radioactive Waste not Generated by the Utility. August 1, 1985.

GAO-08-813T, Low-Level Radioactive Waste, Status of Disposal Availability in the United States and Other Countries. May 20, 2008.

SECY-94-198, Review of Existing Guidance Concerning the Extended Storage of Low-Level Radioactive Waste. August 1, 1994

ATTACHMENT

GUIDANCE ON EXTENDED INTERIM STORAGE
OF LOW-LEVEL RADIOACTIVE WASTE
BY 10 CFR PART 50 LICENSEES
(Based on Generic Letter 81-38)

General

The objective of this technical position is to provide radiological safety guidance for the storage of low-level radioactive waste (LLW). It applies to the design and operation of extended interim LLW storage facilities constructed and operated by 10 CFR Part 50 licensees. Necessary design features and administrative controls for LLW storage will be dictated by such factors as the waste form, concentrations of radioactive material in individual waste containers, total amount of radioactivity to be stored, and retrievability of waste. This guidance should be used in the design, construction and operation of the LLW storage facility.

Safety and Licensing Reviews
For proposed increases in storage capacity for LLW generated by normal reactor operation and maintenance, the safety of the proposal must be evaluated. Generally, Part 50 licensees are already authorized under 10 CFR Part 30 to possess byproduct materials produced by the operation of their facility, within the limits of their operating license, and will have described storage of LLW in their safety analysis report. In cases where no changes in the facility or procedures, as described in the safety analysis report are involved for storage of LLW, the licensee should prepare safety evaluations of such storage in accordance with 10 CFR 20.1501 and maintain a record of the results in accordance with 10 CFR 20.2103(a).

In cases where the provisions of 10 CFR 50.59 apply, the licensee may provide the added capacity, document the §50.59 evaluation and report it to the Commission annually or as specified in the license. When §50.59 evaluations are required, note that Inspection and Enforcement Circular No. 80-19, dated August 22, 1980, provide information on preparing §50.59 evaluations for changes to radioactive waste treatment systems.

If you determine that an unreviewed safety question exists, or that a change in the technical specification is required, as specified in §50.59, or that an existing license condition needs to be changed to accommodate LLW storage, authority for storage should be requested through application for an amendment to your Part 50 license to the Office of Nuclear Reactor Regulation (NRR), accompanied by an environmental evaluation that considers the incremental impact as related to reactor operations. Application should also be accompanied by a showing that the storage provisions will not impact on the safety of reactor operations and will not foreclose alternatives for disposal of the wastes,

NRR will notice the receipt of application in the Federal Register, offer opportunity for public hearing, and will perform an environmental assessment to determine if the proposed activity will significantly affect the quality of the environment. Facility construction before the staff's determination would be carried out at the licensee's risk. Nuclear Regulatory Commission jurisdiction will be retained in Agreement States in accordance with 10 CFR 150.15(a)(1) for

storage of LLW generated and stored on-site. Indemnity coverage will be provided under and in accordance with your existing indemnity agreement with the Commission.

Planning for temporary waste storage should be for a period of time based on the status of the licensee's State or regional compact disposal facility program.

Before any implementation of additional on-site storage, necessary safety review and environmental assessments should be conducted to assure adequate public health and safety and minimal environmental impact. The acceptance criteria and performance objectives of any proposed storage facility, or area, will need to meet minimal requirements in areas of design, operations, safety considerations and policy considerations. For purposes of this technical position, the major emphasis will be on safety consideration in the storing handling and eventual disposition of the radioactive waste. Design and operational acceptability will be based on minimal requirements which are defined in existing Standard Review Plans (SRPs), regulatory guides, and industry standards for proper management of radioactive waste. Considerations for waste minimization and volume reduction will also have to be incorporated into an overall site waste management plan and the on site storage alternative. Additional waste management considerations for as low as reasonably achievable (ALARA), decontamination, and decommissioning of the temporary storage facility, including disposal, should be performed as early as possible. Facility design and operation should ensure that radiological consequences of design basis events (fire, tornado, seismic event, flood) should not exceed a small fraction (10 percent) of 10 CFR Part 100, i.e., no more than a few rem whole body dose.

Where possible, waste should be processed before storage, packaged in a form ready for transport and disposal at the end of the storage period in accordance with the requirements in 49 CFR Parts 170-189 and 10 CFR Part 61 respectively, and clearly labeled in accordance with 10 CFR 20.1904(a) and 20.2006. Adequacy of the waste form or package may have to be reassessed before disposal. In the absence of waste acceptance criteria for disposal, the waste form and waste package should comply with any special requirements needed for safe storage, and preliminary acceptance requirements for waste disposal, where there is assurance that these will not change. Where a disposal route has not yet been defined, waste should be processed and stored safely in a form that will not unreasonably foreclose future options.

Guidance similar to that provide here has been incorporated in NUREG-0800, NRC/NRR Standard Review Plan, July 1981, as Appendix 11.4-A to SRP 11.4, Solid Waste Management Systems, NUREG/CR-4062, "Extended Storage of Low-Level Radioactive Waste: Potential Problem Areas," also contains useful information on safety hazards associated with the storage of LLW and can be considered in safety reviews and analyses.

Staff Guidance

I. General

a. The quantity of radioactive material allowed and the shielding configuration will be dictated by the dose rate criteria for both the site boundary and unrestricted areas on site. The 40 CFR Part 190 limits will restrict the annual dose from direct radiation and effluent releases from all sources of uranium fuel cycle and 10 CFR 20.1301 limits the exposure rates in unrestricted areas. Off-site doses from on site storage must be sufficiently low to account for other uranium fuel cycle sources (e.g., an additional dose of $\leq$ 1 mrem/year is not likely to cause the limits of Part 190 to be exceeded). On-site dose associated with temporary storage will be controlled per 10 CFR Part 20, including the ALARA principle of 10 CFR 20.1101.

b. Compatibility of the container materials with the waste forms and with environmental conditions external to the containers is necessary to prevent significant container corrosion. Container selection should be based on data that demonstrate minimal corrosion from the anticipated internal and external environment for a period well in excess of the planned storage duration. Container integrity after the period of storage should be sufficient to allow handling during transportation and disposal without container breach.

   Gas generation from organic materials in waste containers can also lead to container breach and potentially flammable/explosive conditions. To minimize the number of potential problems, the waste form gas generation rates from radiolysis, biodegradation, or chemical reaction should be evaluated with respect to container breach and the creation of flammable/explosive condition. Unless storage containers are equipped with special vent designs that allow depressurization and do not permit the migration of radioactive materials, resins highly loaded with radioactive material, such as boiling water reactor water cleanup system resins, should not be stored for a period in excess of approximately 1 year.

   A program of at least periodic (quarterly) visual inspection of container integrity (swelling, corrosion products, breach) should be performed. Inspection can be accomplished by use of TV monitors; by walk-throughs if storage facility layout, shielding, and the container storage array permit; or by selecting waste containers that are representative of the types of waste and containers stored in the facility and placing them in a location specifically designed for inspection purposes. All inspection procedures developed should minimize occupational exposure. The use of high integrity containers (300-year lifetime design) would permit an inspection program of reduced scope.

c. If possible, the preferred location of the additional storage facility is inside the plant protected area. If adequate space in the protected area is not available, the storage facility should be placed on the plant site and both a physical security program (fence, locked and alarmed gates/doors, periodic patrols) and a restricted area for radiation protection purposes should be established. The facility should not be placed in a location that requires transportation of the waste over public roads unless no other feasible alternatives exist. Any transportation over public roads must be conducted in accordance with NRC and the Department of Transportation (DOT) regulations.

d. For LLW and Solidified LLW Storage:

   1. Potential release pathways of all radionuclides present in the solidified waste form shall be monitored per Part 50, Appendix A. Surveillance programs shall incorporate adequate methods for detecting failure of container integrity and measuring releases to the environment. For outside storage, periodic direct radiation and surface contamination monitoring shall be conducted to ensure that levels are below limits specified in 10 CFR 20.1502, and 20.1096, and 40 CFR 173.397. All containers should be decontaminated to these levels or below before storage.

2. Provisions should be incorporated for collecting liquid drainage, including provisions for sampling all collected liquids. Routing of the collected liquids should be to radwaste systems if contamination is detected or to normal discharge pathways if the water ingress is from external sources and remains uncontaminated.

3. Waste stored in outside areas should be held securely by installed hold-down systems. The hold-down system should secure all containers during severe environmental conditions up to, and including, the design basis event for this waste storage facility.

4. Container integrity should be ensured against corrosion from the external environment; external weather protection should be included where necessary and practical. Storage containers should be raised off storage pads, where water accumulation can be expected to cause external corrosion and possible degradation of container integrity.

5. Total curie limits should be established, based on the design of the storage area and the safety measures provided.

6. Inventory records of waste types, contents, dates of storage, shipment, etc., should be maintained.

II. Wet LL Storage

a. Wet radioactive waste is defined as any liquid or liquid/solid slurry. For storage considerations, wet waste is further defined as any waste that contains free liquid in amounts which exceed the requirements for disposal as established by the disposal facility licensing authority.

b. The facility supporting structure and tanks should be designed to prevent uncontrolled releases of radioactive materials because of spillage or accident conditions.

c. The following design objectives and criteria are applicable for wet radioactive waste storage facilities:
   1. Structures that house liquid radwaste storage tanks should be designed to seismic criteria as defined in the SRP, Section 11.2. Foundations and walls shall also be designed and fabricated to contain the liquid inventory that might be released during a container/tank failure.

   2. All tanks or containers should be designed to withstand the corrosive nature of the wet waste stored. The duration of storage under which the corrosive conditions exist shall also be considered in the design.

   3. All storage structures should have curbs or elevated thresholds, with floor drains and sumps to safely collect wet waste, assuming the failure of all tanks or containers. Provisions should be incorporated to remove spilled wet waste to the radwaste treatment systems.

   4. All tanks and containers shall have provisions to monitor liquid levels and to alarm potential overflow conditions.

5. All potential release pathways of radionuclides (e.g., evolved gases, breach of container, etc.) shall be controlled, if feasible, and monitored in accordance with Part 50, Appendix A (General Design Criteria 60 and 64). Surveillance programs should incorporate adequate methods for monitoring breach-of-container integrity or accidental releases.

6. All temporarily stored wet waste will require additional reprocessing before shipment offsite; therefore, provisions should be established to integrate the required treatment with the waste processing and solidification systems. The interface and associated systems should be designed and tested in accordance with the codes and standards described in the SRP Section 11.

III. Solidified LLW Storage

a. Solidified radwaste for storage purposes shall be defined as that waste which meets disposal facility solidified waste criteria. For purposes of this document, resins or filter sludges dewatered to the above criteria should be considered under the waste classification/criteria in Section (d) which follows.

b. Any storage plans should address container protection as well as any reprocessing requirements for eventual shipment and burial.

c. Casks, tanks, and liners containing solidified radioactive waste should be designed to State and local codes to preclude or reduce the probability of occurrence of uncontrolled releases of radioactive materials because of handling, transportation or storage. Accident mitigation and control for design basis events (e.g., fire, flooding, tornadoes, etc.) must be evaluated and protected against unless otherwise justified.

d. The following design objectives and criteria are applicable for solidified waste storage containers and facilities:
   1. All solidified radwaste should be located in restricted areas where effective material control and accountability can be maintained. Although structures are not required to meet seismic criteria, protection should be afforded to ensure the radioactivity is contained safely. State and local building codes should be met. In addition, other measures, such as the use of curbs and drains to contain spills of dewatered resins or sludges, should be utilized.

   2. If liquids exist that are corrosive, proven provisions should be made to protect the container (i.e., special liners or coatings) and/or to neutralize the excess liquids. If deemed appropriate and necessary, highly non-corrosive materials (e.g., stainless steel) should be used. Potential corrosion between the solid waste forms and the container should also be considered. In the case of dewatered resins, highly corrosive acids and bases can be generated that will significantly reduce the longevity of the container. The Process Control Program should implement steps to ensure the above does not occur: provisions on container material selection and precoating should be made to ensure that container breach does not occur during temporary storage periods.

   3. Provision should be made for additional reprocessing or repackaging because of container failure and/or, as required for final transportation and disposal as per DOT

and disposal facility criteria. Contamination isolation and decontamination capabilities should be developed. When significant handling and personnel exposure can be anticipated, ALARA methodology should be incorporated as per Regulatory Guides 8.8 and 8.10.

4. Procedures should be developed and implemented for early detection, prevention and mitigation of accidents (e.g., fires). Storage areas and facility designs should incorporate good engineering features and capabilities for contingencies so as to handle accidents and provide safeguard systems such as fire detectors and suppression systems (e.g., smoke detector and sprinklers). Personnel training and administrative procedures should be established to ensure both control of radioactive materials and minimum personnel exposures. Fire suppression devices may not be necessary if combustible materials are minimal in the area.

IV. Dry LLW Storage

a. Dry LLW is classified as contaminated material (e.g., paper, trash, air filters) that contains radioactive material dispersed in small concentrations throughout large volumes of inert material and contains no free water. Generally, this consists of dry material such as rags, clothing, paper, and small equipment (e.g., tools and instruments) that cannot be easily decontaminated.

b. Licensees should implement controls to segregate and minimize the generation of dry LLW to lesson the impact on waste storage. Integration of volume reduction hardware should be considered to minimize the need for additional waste storage facilities.

c. The following design objectives and criteria are applicable for dry LLW storage containers and facilities.

    1. All dry or compacted radwaste should be located in restricted areas where effective material control and accountability can be maintained. Although structures are not required to meet seismic criteria, protection should be afforded to ensure that the radioactivity is contained safely by use of State and local codes.

    2. The waste container should be designed to ensure radioactive material containment during normal and abnormal occurrences. The waste container materials should not support combustion. The packaged material should not cause fires through spontaneous chemical reaction, retained heat, etc.

    3. Containers should generally comply with the criteria of 10 CFR Part 71 and 49 CFR Part 170 to minimize the need for repackaging for shipment.

    4. Increased container handling and personnel exposure can be anticipated; consequently, methodology for maintaining exposures ALARA should be consistent with Regulatory Guides 8.8 and 8.10.