KEY ISSUES ASSOCIATED WITH ON-SITE STORAGE AT NUCLEAR UTILITIES

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ABSTRACT

Congress passed the Low-Level Radioactive Waste Disposal Act in 1980 and the Low-Level Radioactive Waste Policy Amendments Act in 1985. The legislation encouraged the use of interstate compacts to provide for the establishment and operation for regional management of low-level radioactive waste. In addition, each state is responsible for providing for the capacity for disposal of low-level radioactive waste generated within its borders after 1992. Progress in the development of new disposal facilities has been slow. The lack of disposal facilities may force utilities to store their low-level radioactive waste on-site until regional disposal facilities are available. This paper discusses regulatory, licensing, facility design, administrative and waste form issues associated with interim on-site storage for nuclear utilities.

INTRODUCTION

Congress passed the Low-Level Radioactive Waste Policy Act of 1980 and the Low-Level Radioactive Waste Policy Amendments Act of 1985 to eliminate a growing concern in the Nuclear Industry; Low-Level Radioactive Waste (LLRW) disposal. The governors of the three States with operational LLRW disposal facilities at the time, South Carolina, Nevada and Washington, were concerned that their States had become the repository for all LLRW generated in the United States. Therefore, Congress passed legislation to shift the responsibility for LLRW disposal to the States in which the waste is generated.

Progress in the development of these facilities has been slow. For many LLRW generators, the lack of progress in their States or Compacts will result in the application of penalties cited in the legislation ultimately resulting in denial of access to current LLRW disposal facilities at the end of 1992 (12). For most generators, denial of access will require interim on-site storage of LLRW.

Nuclear utilities as a group generate most of the volume of LLRW in the United States. Interim storage of LLRW for most utilities, will require the construction or installation of facilities which have been specifically designed and evaluated for this task. The design of a storage facility will depend on various factors many of which will be specific to each site. Different storage options are available and no one design will necessarily be the correct one for all utilities.

BACKGROUND

The Low-Level Radioactive Waste Policy Act of 1980 and the Low-Level Radioactive Waste Policy Amendments Act of 1985 (together, the Act) provide the framework for the current Compact process for LLRW disposal in the United States (14). This legislation shifted the responsibility for LLRW disposal to the states in which the LLRW is generated. The formation of regional compacts was encouraged to reduce the burden on States with generators of LLRW that do not produce significant volumes and for whom the development of an independent LLRW disposal facility would not be cost effective or ultimately in the best interests of the public (2). Nine regional LLRW Compacts have been created which account for 42 States. Eight States are independently developing their own LLRW disposal capacity as are the District of Columbia and Puerto Rico. Table I lists the current LLRW Compacts and the associated States (18).

Only three Compacts, the Northwest Compact, the Rocky Mountain Compact and the Southeast Compact, currently have LLRW disposal facilities within their regions. Of these, only the Hanford, Washington site is expected to continue operation. The Governor of Nevada has decided to close the Beatty facility and the members of the Rocky Mountain Compact are expected to join with the Northwestern Compact at that time. There have been efforts in the Southeastern Compact to keep the Barnwell, South Carolina Disposal Facility open at least until North Carolina can get a new site operational, however, these efforts have not been conclusive and the Barnwell site is still expected to close. Of the remaining Compacts, only the Southwestern Compact (California), the Central States Compact (Nebraska) and the Central Midwest Compact (Illinois) have submitted license applications for operation of a facility. The others have made moderate to poor progress toward the development of new LLRW disposal facilities (18).

In several compacts, generators of LLRW, including hospitals, research institutions, universities and industries as well as utilities have formed associations to promote the needs of LLRW generators. Some of these associations, such as ACURI, CAL-RAD, MICHRAD, NELRAD, NYSLLWG and ORMUG have been effective in promoting a generator's

TABLE I

LLRW Disposal Compacts

Appalachian	PA, MD, DE, WV
Central-Midwest	IL, KY
Central States	NE, AR, KS, LA, OK
Midwest	OH, IN, IA, MN, MO WI
Northeast	CT, NJ
Northwest	WA, AK, HI, ID, MT, UT, OR
Southeast	NC, SC, AL, FL, GA, MS, TN, VA
Southwestern	CA, AZ, ND, SD
Rocky Mountain	NV, NM, WY, CO
<u>Independent States</u>	
Maine	Massachusetts
Michigan	New Hampshire
New York	Rhode Island
Texas	Vermont

perspective to the legislatures and providing accurate information to the public and the media. Support of these efforts will likely play an essential role in the successful siting of new LLRW disposal facilities in many compacts.

The Act provided incentives to the States for the development of a disposal facility in the form of penalties to be imposed if the published milestones for progress were not met. These penalties include the imposition of disposal surcharges on the generators of LLRW beginning in 1990 and denial of access to existing disposal facilities at the end of 1992 (2).

Many utilities are faced with denial of access to existing LLRW disposal facilities at the end of 1992 since the key milestone, having a facility operational by 1993, has not been met by most of the compacts. During the period from denial of access to existing facilities and the start of operations at the new compact facilities, LLRW generators may be required to store their LLRW. Nuclear utilities, due to the volumes of LLRW they generate, are most likely to provide their own storage capabilities at the site of generation or at another utility owned site.

REGULATORY ISSUES

The Nuclear Regulatory Commission (NRC) has provided guidance for on-site storage of LLRW (*16*). A summary of the applicable regulatory documents is provided in Table II (20).

In addition to Federal Regulations, storage requirements may be affected by individual Compact disposal regulations. These differing State requirements will impact the interim storage options available to each utility and may in some cases, dictate the storage requirements. These proposed regulations must be considered before a storage facility design and operational philosophy are finalized.

The NRC regards storage of LLRW as an alternative only to be used when disposal capacity is unavailable and only for as long as is necessary (12,14). In support of this, NRC guidance to date has placed a five year limit on the storage of LLRW. The NRC stated in Generic Letter 81-38 that LLRW

TABLE II

LLRW Regulatory Guidance Documents

- 10 CFR 20 - Standards for Protection Against Radiation.
- 10 CFR 50 - Domestic Licensing of Production and Utilization Facilities
- 10 CFR 71 - Packaging of Radioactive Material for Transport and Transportation of Radioactive Materials Under Certain Conditions
- 40 CFR 190 - Environmental Radiation Protection Standards for Nuclear Power Station Operations
- 49 CFR 173 - Shippers - General Requirements for Shipments and Packagings, Subpart I - Radioactive Materials
- Regulatory Guide 1.143, Design Guidance for Radioactive Waste Management Systems, Structures and Components Installed in Light-Water-Cooled Nuclear Power Stations
- Regulatory Guide 8.8, Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Reasonably Achievable
- Regulatory Guide 8.10, Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable
- Standard Review Plan Section 11.4, Solid Waste Management System
- Branch Technical Position ETSB 11-3, Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Reactor Station
- Appendix 11.4A, Design Guidance for Temporary On-site Storage of Low-Level Radioactive Waste
- Generic Letter 81-38, Storage of Low-Level Radioactive Wastes at Power Reactor Sites, including GL 81-38-SG, radiological safety guidance for On-site Contingency Storage Capacity
- Generic Letter 89-13, Alternative Waste Management Procedures in Case of Denial of Access to Low-Level Waste Disposal Sites
- Information Notice 90-09, Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees
- IE Circular 80-18, 10 CFR 50.59 Safety Evaluations for Changes to Radioactive Waste Treatment Systems
- SECY 90-318, Low-Level Radiation Policy Amendments Act Title Transfer and Possession Provisions
- NRC Inspection Procedure 84900, Low-Level Radioactive Waste Storage
- SECY 91-306, Analysis of Comments Received on Title-Transfer and Possession Provisions of the Low-Level Radioactive Waste Policy Amendments Act of 1985

storage facility design should be limited to that capacity necessary to store the LLRW anticipated to be generated for a five year interval (12). Information Notice 90-09 states that NRC approval for requests of license amendments for storage of LLRW will generally be for a period of no more than five years (14). Storage in excess of five years requires a license amendment or re-licensing of the facility and additional NRC review and approval (14). NRC's justification for this position has been that authorization for longer periods of time would be not be consistent with national policy as expressed in the Act (16). Despite these statements, the NRC staff has stated that there is no law or regulation that prohibits storage in excess of five years (16). Development of a utility plan for LLRW storage must consider the provisions of the current regulations and NRC's position regarding greater than five-year storage balanced against the real potential that a disposal facility may not be available within that time limit.

The NRC's position on storage duration affects utility storage facility plans in two major ways. First a storage facility may only be licensed for a single five year period regardless of the length of time a utility may expect to store waste (12,14). A license amendment may have to be initiated at the end of the five year period if access to a disposal facility is not restored. Utilities that limited their facility design to a short term application may face expensive and technically difficult modifications to upgrade their facility to meet new licensing requirements.

The second major affect is the initial capacity of the LLRW storage facility. Facility designs are limited to the amount of waste generated during a nominal five-year period (12). The method used to estimate this quantity should be based on historical waste generation rates and should take into consideration volume reduction and waste minimization programs and the need for surge capacity from operations or modifications that may generate unusually large amounts of waste (12,20). This means LLRW storage facilities cannot be initially designed with capacity for greater than five year storage. Those utilities who do not anticipate access to a disposal facility within the time limit should consider facility designs that allow for easy expandability should the need arise.

The primary incentive to the States to develop LLRW disposal facilities is contained in Section 5(d)(2)(C) of the Act which requires the states to take title and possession of the LLRW generated within their borders at the request of the generators by January 1, 1993 and in any event by January 1, 1996 (12,19). The NRC has determined that no regulatory action is required for the transfer of title of LLRW to the States however there will be licensing action to be taken at the time of transfer of possession (16,19). Most States have taken the position that they may accept title to the LLRW at the end of 1993 if so requested by the generator or at the end of 1996 as required by law however, possession will be maintained by the generator until the State has a disposal facility available. This places the generators, and especially the utilities in the position of potentially maintaining possession of some one else's (i.e., the States) LLRW. The liability and insurance issues that may arise from this situation are not entirely clear but almost certainly will result in increased costs to those utility(s) maintaining possession of the LLRW.

The "take title" provision of the Act is currently being challenged in the Supreme Court (24) as a result of a suit initiated by the State of New York in 1980. The suit argues that this provision of the Act violates the constitutional principles of federalism that make state governments answerable to their citizens, and is inconsistent with the Tenth Amendment which reserves for the states any powers not specifically given to the federal government or prohibited by the Constitution (24). If the Act is overturned, extended storage of LLRW by the generators could become a real possibility.

Current regulations clearly state that LLRW in storage must be classified and packaged in a manner suitable for transportation and final disposal (12,14). Extended interim storage of LLRW raises the possibility that wastes processed for storage to meet current disposal requirements will not meet the requirements of the new disposal facilities.

STORAGE FACILITY ISSUES

Licensing Issues

In addition to the long-term regulatory issues discussed above, utilities must consider other factors to ensure their storage facility is appropriately licensed. A determination to apply for a Part 30 license or amendments to the Part 50 license must be based on a thorough safety evaluation as described in 10 CFR 50.59 (12,14,15,19). The technical issues described in Generic Letter 81-38 should be specifically addressed for the safety evaluation to be considered adequate. In addition, the NRC Staff positions and other regulatory guidance documents referenced in Table II should be reviewed and considered.

Safety evaluations performed for interim storage of LLRW must thoroughly address both the commitments made in previous licenses applications and any new issues raised by changes in regulations or processing methodologies. A determination whether an "unreviewed safety question" exists is a key element of the evaluation (12,19). The safety evaluation must be commensurate with the significance of the proposed changes to the utilities Safety Analysis Report and must address the bases and criteria used in the determination (12,14,19).

Many utilities take advantage of LLRW volume reduction technologies and services provided by off-site vendors. Continued utilization of these services will require that LLRW be transported back to the utility's facility for interim storage. Most utility's operating licenses do not specifically allow the receipt back of their own LLRW and may require an amendment to do so (19). In addition, provisions to maintain segregation of one utility's waste from another to the maximum extent practicable should be considered.

Facility Design Issues

Each Utility faces different issues which will affect the design and operation of their LLRW storage facility. Some of these issues relate to the terrain, weather and operational characteristics that are specific to each utility's site. Each of these must be evaluated and balanced against each other and the regulations to determine the optimal facility design.

Generic Letter 81-38 recommends that LLRW storage facilities be located within the plant protected area if possible (12). Transportation and handling safety factors are enhanced by a storage facility location that is as close as possible to existing LLRW processing facilities. A storage facility located at some distance from the site of generation will require transportation of the LLRW in accordance with applicable

NRC and DOT regulations, a physical security program and a restricted area for radiation protection purposes (12).

The length of time a utility expects to be required to store LLRW will impact the storage facility design. Those utilities located in compacts that already have a disposal facility or expect to have one operational within a relatively short time will probably not have a need to invest in a permanent facility. On the other hand, a utility that does not anticipate access to a disposal facility in the near future may find it prudent to construct a more sophisticated storage facility that will provide additional operational flexibility. Such a facility may be less likely to require expensive modifications if the storage period extends beyond five years and a license amendment is required.

The waste form and container material must be compatible with the environmental conditions expected during storage (12,14,20,22). These conditions are likely to be different for each utility and should be specifically evaluated. The environmental conditions of the storage facility should be controlled so that the stored waste is shielded from the elements and from extremes of temperature and humidity that could otherwise degrade the integrity of the container (12,14,20,22).

The generation of flammable or toxic gases due to decomposition, biodegradation, radiolysis and chemical reactions in the waste should be evaluated with respect to container breach and the creation of explosive / flammable conditions. Plans should be in place to evaluate the waste being stored and what measures are taken to prevent these reactions. Where necessary, ventilation and fire protection systems should be modified to control or prevent flammable or toxic conditions (12,14,20).

Containers should be routinely inspected either visually, remotely or by selection of a representative sample of the containers in storage to ensure continued container integrity (12,14,20). Utilities may select an inspection method that takes advantage of the specific conditions at their facility to keep their worker's radiation exposure ALARA.

Potential release pathways of all radionuclides present in the waste must be identified and monitored in accordance with 10 CFR 50, Appendix A (12,14,20). These pathways and the monitoring capabilities will be different for each utility. Liquid drainage from within the storage facility should be collected and monitored or sampled. Provisions must exist to deal with contaminated liquids (12,14,20).

Regions susceptible to high winds and heavy rains may require additional waste protection than milder climates. Waste containers stored in the open must be secured to prevent accidental toppling or opening of the storage unit due to excessive winds (12,20). Precautions must be taken so that heavy rains do not cause accelerated container corrosion due to intrusion into the storage module. Other operational constraints such as the inability to carry out transfer or inspection activities during bad weather must be considered as well.

Administrative Issues

Not all of the above issues require resolution through engineering, many can be resolved through the use of administrative controls. Before facility designs are finalized, an evaluation should be performed to determine how the utility intends to operate the storage facility. NRC regulations and guidance allow a wide range of solutions to various issues provided the goal of public protection is achieved.

For example, effluent monitoring in the form of continuous air monitoring is not required if the exterior surface contamination levels of the waste containers meets transportation contamination limits. Frequent inspections to ensure container integrity and contamination levels will then be required to show compliance with the regulations (12,14,20). Also, procedures will have to address contingency plans and decontamination methods to be used if container integrity is compromised (12,14,20).

Waste Form and Classification Issues

The most important issue regarding interim LLRW storage is waste form acceptability. Many of the issues discussed previously can be resolved by the proper selection of the waste form and container to be stored. Careful consideration of potential regulations at the new disposal facilities must also be considered before a decision is finalized. Selection of a waste form or container based solely on current storage conditions may result in an inventory of LLRW that is not suitable for disposal. LLRW in storage should be packaged in a form that is suitable for disposal and that containers should meet Department of Transportation (DOT) regulations in 49 CFR Parts 171-177 (12,14,20,23). Each utility should work with the appropriate state regulatory authority or compact commission to determine which waste forms or containers are most likely to be acceptable for storage and ultimate disposal. State and Compact regulators should approve present processing methodologies, containers and waste forms currently approved for disposal at the new facilities.

The proposed regulations by many of the new compacts will also affect the way LLRW is classified. The current NRC requirements for LLRW characterization expressed in 10 CFR Part 61 are expected to be used by the new disposal facilities. However, the interpretation of certain parts of the requirements by the new disposal site authorities may be different (21). Some compacts are considering container dose rate limits that are far below the contact dose rates accepted by the current LLRW disposal facilities on a routine basis. The adoption of these dose rates may result in increased radiation exposures to utility workers and the public by increasing the number of containers that must be handled and shipped to the disposal facility. Any dose rate limits must be identified prior to storage to avoid re-packaging or shielding of LLRW containers at the time of disposal.

CONCLUSION

The correct answer for the LLRW storage questions and issues will be different for each utility. Varying environmental conditions, types of wastes generated and political situations will impact the way LLRW can be stored. A clear definition of interim storage and ultimate disposal requirements now is essential to the protection of the health and safety of the public in the near future. It is therefore prudent for regulators to adopt requirements for disposal that minimize the impact of LLRW interim storage on utilities and other generators.

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