ANTICIPATED PROBLEMS WITH INTERIM STORAGE OF LOW-LEVEL RADIOACTIVE WASTE GENERATED BY BIOMEDICAL RESEARCH PROGRAMS

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ABSTRACT

Interim storage is being suggested as an option which may be used by generators if access to low-level radioactive waste burial sites is denied. Problems associated with storage of biomedical low-level radioactive waste include waste form and container integrity. The site specific criteria related to acceptable waste form and containers is not currently available for developing burial sites; therefore, it is important for volume reduction efforts to result in a stable waste form. Many of the problems specific to the storage of low-level radioactive waste being generated by biomedical research programs may be solved by incineration. Recommendations for generators faced with interim storage include: become involved in the local politics of waste management; develop low-level radioactive waste management plans; minimize the waste volume requiring interim storage; and, utilize volume reduction techniques to the fullest extent possible.

INTRODUCTION

Public Law 96-573, "Low-Level Radioactive Waste Policy Act of 1980" (LLRWPA) and Public Law 99-240, "Low-Level Radioactive Waste Policy Amendments Act of 1985" designate states as responsible for disposing of the waste generated within their borders. States must decide to provide for disposal in their state or seek agreements with states on a regional basis. By January, 1990 host states had to either submit a license for a low-level radioactive waste disposal facility or the Governor had to submit a certification that the state would be capable of providing for, and will provide for, the storage, disposal, or management of any low-level radioactive waste generated within its borders and requiring disposal after December 31, 1992. One requirement of the certification was to address plans for the period between 1993 and when a state or regional site would be available to the state's generators. It appears several states opted for the concept of interim storage by the generators. The Nuclear Regulatory Commission (NRC) has issued guidance for interim storage and is currently developing policy in this area. The potential problems associated with interim storage for periods of up to five years are addressed.

In the early 1980's, EG&G Idaho, Inc. investigated the available options for low-level radioactive waste management in a series of reports (1). Yale was awarded a subcontract with EG&G Idaho, Inc. to investigate the potential problems of adopting interim storage as an option in the national management plan. The following is a brief summary of the major issues identified in that study which remain relevant (2):

- utilizing the interim storage option will allow generators to continue with the products and services that they provide to consumers;
- provisions for interim storage for generators are available in existing regulations;
- no changes are required in transportation regulations to allow for interim storage;
- storage space will be expensive which may lead to decreased waste volumes held for disposal;
- technology is presently available for the safe storage of low-level radioactive waste, however the availability of incineration for biological wastes will be subject to changes in policy and public acceptability;
- implementing interim storage on a regional basis could precede access to new burial sites;
- interim storage will cost more than present disposal methods;
- low-level radioactive waste has been handled for several decades and can be managed safely and, with interim storage available, inappropriate disposal of wastes should be deterred; and,
- burial should be for non de minimis levels of waste and the end product of volume reduction techniques.

The study identified four major considerations which would require solution prior to the implementation of any organized effort to institute an interim storage strategy:

- cost of storage and ultimate disposal;
- packaging criteria expected for interim storage and ultimate disposal;
- disposition of chemical and biological wastes; and,
- prevention of interim storage site becoming a permanent disposal site.

In implementing an interim storage plan a generator will need to keep in mind and address the issues and concerns mentioned above. The cost of storage must be manageable for generators and the provision for ultimate disposal must be affordable. The packaging for storage and

disposal must be established prior to initiating the interim storage process. Provisions for the management of chemical, biological, and medical mixed waste must be in place prior to initiating interim storage of waste. The mechanism for preventing the interim storage process from becoming a permanent disposal site should be established prior to interim storage.

LICENSE AMENDMENT GUIDANCE

A license amendment to either a Nuclear Regulatory Commission (NRC) license or a state license will be needed prior to initiating interim storage operations. Most licensees are currently authorized to hold waste for decay. This authorization is usually limited to material with half-lives below some arbitrary time such as 65 days.

The NRC has issued some general guidance on preparing an amendment application (3). The following items are emphasized by the NRC:

- storage is not a substitute for disposal;
- waste should be processed prior to storage;
- stored waste should be protected from the elements;
- waste should be stored so it may be inspected;
- procedures and equipment for repackaging may be needed;
- consideration must be given to gas generation due to decomposition and chemical reactions;
- the need for additional shielding must be evaluated; and,
- stored waste must be in a restricted area and secured.

The NRC notice addresses the issue of storage not being used as a substitute for disposal but does not adequately address the problems associated with biological, chemical and medical mixed waste, waste form criteria, or packaging criteria. No mention of cost is made by the NRC. Interim storage has two cost elements: (a) it will be expensive to maintain the storage effort, and (b) it will cost an increased amount to dispose of the waste in the future at a new facility. Current estimates range from $ 500. to $ 1,000. per cubic foot for disposal of low-level radioactive waste in a small regional facility.

The NRC is presently addressing interim storage as it impacts on the title transfer and possession provisions of the LLRWPA of 1985 (4). The NRC is considering a five year limit on licensing interim storage.

GENERAL CONCERNS

General concerns relate to the public safety of the interim storage facility. Nuclear reactor facilities have made provisions for on site interim storage and are licensed to hold for periods of up to five years. Reactors produce primarily dry solid waste and spent resins. Hospitals produce primarily short lived material which can conveniently be held for decay prior to disposal as medical waste. However, biomedical research facilities and radiopharmaceutical manufacturers produce a wide range of wastes and are faced with complex storage problems. When developing a site specific interim waste storage plan the items in Table I. will need to be considered and addressed in the plan and explained in the license amendment application.

TABLE I

General Concerns of Interim Storage

Security provisions
Fire protection plan
  Prevention
  Detection
  Suppression
Natural disasters
Record keeping
Conflicting regulations regarding mixed wastes
Uncertain storage time
NRC decommission plan and required financial assurance
Community right to know provisions of OSHA

Many biomedical research facilities are located in urban environments and the neighbor's risk perception of interim storage may present local problems of acceptance.

SPECIFIC CONCERNS

Several specific concerns of generators associated with interim storage relate to the waste form and the related processing, and are given in Table II (5).

Interim storage will not be just a warehousing operation. Additional elements which may be factored into the process include: segregation of the waste by half life to allow for as much disposal by decay as feasible; volume reduction by effective means such as incineration, compaction, and solidification; waste classification and packaging to reduce handling and minimize volume.

Mixed radioactive and biological wastes will generate gases and liquids during storage. The rates and quantities of gases and liquids generated will depend on the microbes present, the nature of the biological wastes, and the environmental conditions (6). To reduce the volume of biological waste requiring interim storage, the biological waste may be processed by incineration, freeze drying or desiccating in some other way, or grinding for dispersion in the

sewer. The ash or residue will need processing and storage if incineration or freeze drying is utilized.

TABLE II

Specific Concerns of Interim Storage

General waste form criteria
- 10 CFR Part 61 criteria
- Facility design specific criteria

Biological waste

Mixed waste-medical
- EPA regulations
- State regulations

Mixed waste-hazardous
- TSDF
- 90 day storage limit
- Decommission of TSDF

Liquid waste storage

Super compaction

Potential generation of radiolytic gases

Solidification
- Liquid
- Incinerator ash

Continued availability of current alternatives

Mixed waste (both radioactive and hazardous) presents several difficult problems. If the waste is generated, it can be held only 90 days without a transfer, storage and disposal facility (TSDF) permit. There is currently no licensed facility to bury mixed waste. Due to this dilemma and lack of capacity, Environmental Protection Agency (EPA) has recently approved a two year national capacity variance for mixed waste. If mixed waste is generated the waste can be stored for up to two years without being a permitted TSDF facility. The EPA does not have the authority to extend the variance beyond the two years. The logical way to confront this situation is to have a goal of minimizing the use of hazardous chemicals.

Hazardous waste in storage must be inspected weekly. There apparently is no guidance on what constitutes an acceptable inspection. One interpretation being used is that one must be able to inspect two sides of the containers. Another interpretation is that drums can be stacked two high, two across in an infinite line.

It has been estimated that mixed waste will cost $ 15,000. per cubic foot when a disposal facility licensed by the NRC and permitted by EPA is available. This compares with current estimates of $ 1,000. per cubic foot for future radioactive waste disposal at a regional site.

How can mixed waste be effectively managed ?:

- apply for EPA permit Part A; and, consider a Part B application later;
- treat mixed waste in the waste container, if possible, to change properties so the material is no longer considered mixed waste;
- discharge waste under the Clean Water Act; and,
- use the below regulatory concern (BRC) provision with appropriate record keeping.

The waste itself must meet waste form criteria. Presently, 10 CFR Part 61 list the following waste performance criteria (7):

- the waste form and package shall meet all applicable transportation requirements of the NRC (10 CFR Part 71) and DOT (49 CFR Part 100-199);
- the waste shall be in a free standing form which is not readily dispersible, degradable, or soluble;
- liquid waste must be solidified;
- waste must not be excessively chemically reactive, explosive or flammable;
- waste containing biological, pathological or infectious material shall be treated to minimize the potential hazard; and,
- waste accepted at the site must be reduced in volume to the extent practicable.

Compliance with the criteria in Part 61 does not mean that the waste form will be acceptable for an individual disposal facility after the interim storage period. Historically, burial site criteria have been more restrictive than federal requirements. Waste being packaged for interim storage should meet foreseeable waste disposal criteria such as (8):

- the storage containers must be small in volume, light in weight and of uniform shape so they are easily handled and stacked;
- all containers must meet a 10 year reliability requirement;
- all containers must be water tight and capable of withstanding the storage environment; and,
- the outer container must have sufficient strength to withstand stacking, meet handling criteria for storage and retrieval, and meet shipping criteria.

RECOMMENDATIONS

The following recommendations are made in an effort to foresee and effectively deal with the above issues and identified technical problems. The recommendations relate

to biomedical research facilities but are broad and may be considered by all generators:

1. Become active in state, regional and federal planning programs. Comment on proposed regulations, state and regional plans. Use influence to ease dual regulations, conflicting regulations, and excessive record keeping requirements. Promote BRC and de minimis concepts.
2. Initiate realistic planning as soon as possible. At Yale we just ended the fifth year of our previous radioactive waste management plan and are beginning the first year of a comprehensive three year management plan.
3. Develop a series of options for segregation, processing and storage.
4. Develop a waste program based on minimizing volume generation rates and begin implementation as soon as possible.
5. Reduce mixed waste as much as possible by altering the waste so it will fit into only one classification, either radioactive, hazardous or medical.
6. Consider an escrow account to help with future funding of disposal.
7. Be prepared for embarrassing public criticism. Prepare your institution for the lack of public acceptance that may be associated with on site interim storage.
8. Review the plan at least annually, and revise if necessary.

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