

LICENSING OF ALTERNATIVES TO SHALLOW LAND BURIAL

THE NRC PERSPECTIVE

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ABSTRACT

The regulatory basis for licensing land disposal of low-level radioactive waste is codified in 10 CFR Part 61. The NRC staff has published guidance regarding the implementation of Part 61 for alternative disposal methods. The staff will prepare additional guidance as interest in specific alternatives becomes focused. There are several concepts which are likely to streamline the licensing process for any disposal method: standardization; prequalification; and prelicensing interaction. Licensing issues that are likely to be relevant for six specific alternatives to shallow-land burial are highlighted.

INTRODUCTION

On January 15, 1986, the President signed into law the Low-Level Radioactive Waste Policy Amendments Act of 1985. The Act requires that, by January 1987, the NRC identify alternative methods for disposal of low-level waste and establish and publish technical guidance regarding licensing facilities that use such methods. By January 1988, NRC is to identify technical information that a license applicant must provide to the Commission in order to pursue such methods, together with the technical requirements that must be satisfied. These actions must be undertaken by NRC in consultation with states and other interested persons.

For several years prior to the enactment of the amended Act, the NRC staff has been aware of the interest by states and compacts in alternatives to shallow land burial. The NRC has evaluated five generic alternative disposal concepts. This evaluation was based on a study performed by the U.S. Army Corps of Engineers under NRC direction.

While the staff has received and answered general requests for guidance on alternative disposal concepts, NRC is now encouraging states and the industry to develop questions about specific alternatives in which they are interested. This will assist the NRC staff in developing expanded guidance and, if necessary, developing specific technical requirements for alternatives. NRC has completed and will soon distribute a draft guide entitled "Standard Format and Content of License Applications for Near-Surface Disposal of Radioactive Waste" and is currently developing Standard Review Plans as part of internal staff procedures.

The ultimate goal of the NRC low-level waste program waste is the timely receipt of complete applications leading to issuance of licenses for the construction and operation of safe and environmentally sound disposal facilities. There are several concepts which are likely to expedite this process, namely, standardization of design, prequalification by regulatory agencies of certain systems and components, and early interaction between applicants and regulators through pre-licensing consultation.

Ideally, these concepts, integrated into the licensing process, will lead to the expeditious review of license applications for low-level waste disposal facilities.

BACKGROUND

The regulatory framework for licensing the land disposal of radioactive waste was established with the issuance of 10 CFR Part 61. Since Part 61 was issued, there has been increasing interest in alternative methods for disposal of low-level waste (other than shallow land burial) among states and the nuclear industry. Along with that interest, questions arose as to the applicability of some of the technical requirements in Part 61 to these alternatives. To help address these questions, NRC entered into an agreement with the U.S. Army Corps of Engineers to examine the applicability of technical criteria in the regulation to five specific alternatives to conventional shallow land burial.

The five alternatives selected for the Corps study were techniques that either had been proposed as alternatives to shallow land burial or have been used in other countries either for storage or disposal. Shallow belowground vaults are being used for storage of low-level wastes in Canada and for storage of transuranic wastes in the U.S. at Oak Ridge National Laboratory National in Tennessee. Aboveground vaults are being used in Canada for storage. Earth mounded concrete bunkers have been used in France for disposal of low and intermediate level wastes since the late 1960's. Mined cavities have been used in West Germany for disposal of both radioactive and hazardous wastes. The U.S. Department of Energy and the Tennessee Valley Authority have studied the feasibility of mined cavity disposal of low-level radioactive waste. Augered hole, or shaft disposal is being demonstrated by the Department of Energy at its Nevada Test Site and Savannah River plant. In Canada variations of augered holes are used for storage of low-level waste from power reactors.

The result of the study by the Corps was a five volume report (NUREG/CR-3774) entitled "Alternative

Methods for Disposal of Low-Level Radioactive Wastes." In that report the Corps assessed the applicability of Part 61 technical criteria to four of the alternatives considered. The Corps also suggested additional technical considerations and made recommendations for further research efforts directed toward licensing these alternatives.

It should be noted that the Corps' evaluation of mined cavities was not included in NUREG/CR-3774. The Corps' conclusions regarding technical requirements for licensing mined cavities confirms the NRC staff evaluation that mined cavity disposal may involve a sufficient departure from other near-surface disposal technologies covered by 10 CFR Part 61 such that additional requirements need to be developed. However, the licensing process in Part 61 can be used to license mined cavities. The varying siting and technical considerations for mined cavities can be most efficiently dealt with on a case specific basis. The NRC staff is currently evaluating the recommendations made by the Corps of Engineers regarding technical requirements for mined cavity disposal prior to publication of a separate volume of NUREG/CR-3774 on that disposal method.

THE LICENSING FRAMEWORK FOR ALTERNATIVES

The regulatory framework of 10 CFR Part 61 establishes procedures, criteria, terms, conditions and forms the basis upon which the NRC will issue and renew licenses for the land disposal of low-level radioactive waste. The subparts of the rule which cover general provisions and licensing procedural aspects, performance objectives, financial assurances, state and tribal participation, and records, reports, tests and inspections apply equally to all methods of land disposal of radioactive waste. Some of the technical requirements in Subpart D are currently specified only for near-surface disposal methods. Based on NRC staff evaluation of the Corps of Engineers study and related analyses, staff has determined that the Part 61 technical requirements provide a satisfactory basis for licensing decisions related to alternative methods of near-surface land disposal. These alternative methods include, for example, disposal by emplacement in belowground vaults, aboveground vaults, earth mounded concrete bunkers, shafts or boreholes, caissons or pipes, and engineered container systems. Specific considerations for each of these is discussed further herein.

The NRC staff has recently published guidance on alternative disposal methods in the form of a Federal Register notice. Initially, guidance will focus on broad licensing questions an applicant would have to address. As interest among states, compacts and industry becomes focused on specific disposal designs and practices, the NRC will develop more specific guidance.

It must be kept in mind that the applicant is responsible for demonstrating that the Part 61 performance objectives and technical requirements will be met in the siting, construction, and operation of a proposed disposal facility.

Until interest is focused on specific disposal methods, NRC staff will concentrate efforts on technical questions common to several disposal alternatives. For instance, the staff is currently examining the long-term durability and performance of engineering materials common to several of the disposal methods studied.

In conjunction with the development of technical guidance, the NRC staff has also identified three concepts which should help to facilitate the licensing process. These are standardization, prequalification, and prelicensing consultation.

The NRC believes that there are advantages to the development and use of standardized approaches to waste disposal. Standard disposal design features can foster safe and environmentally sound disposal by concentrating the resources of the waste management industry on particular approaches, and by stimulating standardized programs of construction practice and quality assurance. The use of standardized approaches and design concepts can also permit more effective and efficient licensing and inspection processes.

The NRC is moving ahead to provide information which will help to ensure the timely review of applications to construct and operate disposal facilities. However, the NRC staff will evaluate innovative disposal designs that might later be reflected in a license application. To promote timely regulatory decisions, designers, vendors, and prospective license applicants are encouraged to submit detailed technical information on proposed disposal facility designs in advance of formal license application. This will permit NRC staff to evaluate fundamental safety and performance aspects and provide pre-licensing guidance. However, such information should only be submitted when the designs are a part of a specific application being prepared, represent work sponsored by a potential applicant, or are based on some other type of commitment by a potential licensee. Advance review, and where feasible, approval of designs and related technical information can reduce considerably the time needed for review of a license application.

The NRC staff also encourages early interaction through prelicensing consultation between applicants and regulatory authorities. By fostering an early dialogue, major licensing issues can be identified and addressed in a timely manner. Potential technical problems can be discussed and means of mitigation, if possible, can be identified. Early interaction can also lead to the identification of "fatal flaws" in a particular design, saving the potential applicant time and resources in the pursuit of a license application which will lead to an unfavorable licensing action. This is particularly important in light of the tight milestone schedules provided for states under the Policy Act Amendments, and the penalties that will apply should milestones be missed.

SPECIFIC TECHNICAL CONSIDERATIONS FOR ALTERNATIVE DISPOSAL CONCEPTS

The remainder of this paper discusses some important licensing considerations for several alternative disposal concepts, including those evaluated by the Corps of Engineers.

Aboveground Vaults

The major factor to be considered for an aboveground structure would be the heavy reliance on the structure to meet the performance objectives. An applicant would have to address, through materials testing, analysis and extrapolation, the long-term durability of structural materials. Extreme events such as earthquakes, tornadoes and major precipitation events would have to be considered, along with the chronic effects of routine climatic events such as precipitation, temperature and humidity. The performance of an aboveground structure would

undoubtedly be affected by routine climatic changes and natural phenomena such as freeze thaw cycles and chemical constituents in precipitation (acid rain, for example).

Depending upon design considerations and construction sequence, there may be a need to develop and demonstrate the utility of special handling equipment and shielding procedures to meet operational requirements and safety standards for worker protection. The applicant will also have the added responsibility associated with demonstrating minimal long-term active maintenance and surveillance implicit with this disposal technique.

A well defined quality assurance program is imperative for above-ground vaults, as well as other disposal methods involving engineered structures.

Belowground Vaults

A belowground vault would be less susceptible to the chronic climatological stresses that could affect the long-term performance of an aboveground structure. However, because all surfaces of the vault will be in contact with the host media, an applicant will have to address the compatibility of the host media with structural materials of the vault and the long term durability of the structure. An assessment will be necessary to demonstrate the physical stability of the vault structure.

It should be noted here that for any enhanced belowground technology the level of analysis that an applicant will have to perform in a license application regarding any proposed enhancement will be directly proportional to the amount of confidence the applicant is seeking from the vault in relation to the performance of the system. That is, if design of the vault is to provide for long-term stability not otherwise provided for by waste packaging, the technical analyses will have to support this claim. Similarly if the structure is designed to enhance an already satisfactory system, a less rigorous technical argument is warranted.

The design features should be viewed as a means to enhance a good site and not as a means to mitigate an unacceptable site characteristic. NRC staff's position continues to stress the primary importance of favorable site characteristics with regard to licensing a low-level waste disposal facility.

There are likely to be operational considerations associated with belowground vaults that warrant unique solutions. There may be a need for specific hardware as well as judicious use of temporary shielding and careful consideration of personnel and equipment movement to maintain operational exposures as low as reasonable achievable.

Earth Mounded Concrete Bunkers (EMCB)

Earth mounded concrete bunkers have been used in France for the disposal of low and intermediate level wastes since the late 1960's. The EMCB is a hybrid technology integrating features of trench disposal, vaults, and above-ground earth mounds, as well as controlled packaging and encapsulation.

The uniqueness of the licensing process for an EMCB would most likely center around the complexity of the facility. For example, an EMCB whose operations consist of on-site processing treatment and packaging of waste as well as disposal is a considerably more

complex facility than one whose operations consist only of disposal. The applicant will have to demonstrate how all of these systems can be successfully integrated into a safe, efficient disposal facility.

In addition, EMCB's would share with other above and belowground engineered technologies a certain subset of additional licensing considerations such as demonstration of structural durability, design life, interaction of engineering materials and resistance to climatological stresses.

Shaft Disposal/Augered Holes

Disposal in shafts or augered holes is probably the closest to shallow land burial practices of any concept evaluated in the Corps of Engineers report. For licensing purposes applications for a shaft disposal system would probably be reviewed in much the same way that an application for a shallow land burial facility would be reviewed. Depending on disposal unit configuration--shaft diameter, depth and spacing--it is conceivable that an applicant could more easily demonstrate disposal unit and cover stability for shafts than for shallow land burial facilities.

It is likely that a proposal incorporating shaft disposal would include shaft liners for remediation and added confidence. If an application relies on these shaft liners to provide physical stability or containment, a sound technical justification must be provided.

Engineered Container

A concept that has recently come to the forefront is the use of an engineered container in a conventional cut and cover or engineered trench to assure long-term stability.

From the NRC perspective the use of a disposal system which incorporates these containers is in keeping with the concept of standardization. However, in the licensing process a system which incorporates these containers will undergo rigorous scrutiny with respect to long-term performance containers. Again, the level and rigor of scrutiny will be dictated by proposed design life of the container.

SUMMARY

The recent passage of the Low-Level Radioactive Waste Policy Amendments Act has a requirement which parallels a commitment the NRC has had internally for 3 years--namely to develop guidance to applicants on alternative disposal methods, and to put in place the licensing tools and a procedural system for expeditious processing of any license application. We are now looking to the states, the compacts, and private industry to indicate which specific disposal methods they intend to pursue in the near future so we can provide any necessary specific guidance and complete the work we set out to do.

The regulatory framework for licensing the land disposal of low-level radioactive waste is contained in 10 CFR Part 61. The completion of NRC's evaluation based on the Corps of Engineers study of four specific disposal alternatives to shallow land burial affirms the validity of the technical criteria in Part 61 for a range of near-surface disposal methods. An application for a license to construct and operate a low-level waste disposal facility, whether

conventional shallow land burial or a near-surface alternative disposal method, will necessarily have to meet the standards for licensing of 10 CFR Part 61.

The NRC staff will soon publish guidance on alternative disposal methods in the form of a Federal Register notice. Initially, guidance will focus on broad licensing questions an applicant would have to address. When state interest is focused on specific disposal methods, the NRC will develop more specific guidance.

Early interaction between the regulator and license applicant, standardization of systems and components and prequalification of certain designs can promote timely development of new disposal sites. However, it is critical that States and Compacts interested in alternatives press forward with efforts to narrow their interest from general concepts to specific disposal methods at the same time that they move forward with identification of host states and selection of suitable disposal sites. Without simultaneous progress in each of these areas, it is difficult to envision that the milestones set forth in the Policy Act will be realized.

REFERENCES

1. R. D. Bennett, et al., "Alternative Methods for Disposal of Low-Level Radioactive Wastes," NUREG/CR-3774 Vol. 2-5, 1985.
2. Nuclear Regulatory Commission, Code of Federal Regulations, Title 10, Part 61, Licensing Requirements for Land Disposal of Radioactive Waste, 1982.
3. Nuclear Regulatory Commission, Regulatory Position Statement (Draft), Regulatory Position Regarding Licensing of Land Disposal of Low-Level Radioactive Waste, 1986.