THE STATUS OF THE TEXAS NEAR-SURFACE LOW-LEVEL RADIOACTIVE WASTE DISPOSAL REPOSITORY

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ABSTRACT

In passing House Bill 1567 in May of 2003, the 78th Texas State Legislature Regular Session, gave a new life to the formerly moribund Texas Low-Level Radioactive Waste Disposal Compact repository. This bill authorized the Texas Commission on Environmental Quality (TCEQ) to be the lead agency to issue a license to a private company for the administration of a near-surface low-level radioactive waste disposal facility. In response to this authorization TCEQ has developed a multi-phased approach to implementing the provisions of HB 1567.

The first phase involved the process of revising rules to accommodate HB 1567. This process was initiated on June 1, 2003. Rules were adopted and became effective with stakeholder participation, on January 8, 2004, 222 days later. The application preparation process for a near-surface low-level radioactive waste disposal facility began January 10th and will conclude 180 days later on July 7th of this year. TCEQ will then accept applications for 30 days (July 8th to August 6th). The TCEQ expects to select the applicant that will move forward through the technical review process by May 3, 2005. The final facility licensing decision should be made by December 9, 2007. Construction should be completed within a 2-year period as well as the beginning of full-scale operations in 730 days (December 8, 2009).

The site of the near surface disposal facility will be restricted to the central and northern counties of West Texas. The site must be located in an arid area (less than 20 in/yr precipitation), not along selected river segments, and more than 62 mi (100 km) north of the Mexican border. Near-surface site designs of any type, either above or below grade, may be submitted without prejudice with the understanding that they will be subject to review by the lead Texas agency, the stakeholders, and the appropriate federal and state agencies.

INTRODUCTION

The national system for the disposal of commercial low-level radioactive wastes in designated state or compact repositories is in serious disarray, if not defunct. [1] How we got to this discouraging point in the low-level radioactive waste disposal saga is a long and complex story. Historically, it dates back to the Atomic Energy Act and the ceding of the Atomic Energy Agency (AEA) authority to the Atomic Energy Commission (AEC). The AEA then became the statutory authority over all aspects of atomic energy, including radioactive waste. The AEC, formed in 1946 after World War II, eventually relinquished its authority to three agencies: Department of Energy (DOE), Nuclear Regulatory Commission (NRC), and the Environmental Protection Agency (EPA).

Disposal of radioactive waste became a national issue resulting in the passage of the Low-Level Radioactive Waste Policy Act of 1980 (LLRWPA of 1980). This legislation was passed at a time when preceding, less sophisticated methods of siting, disposal, engineering, and management were the norm.

Prior to the passage of the LLRWPA of 1980, the formerly active low-level radioactive waste disposal facilities at Sheffield, Illinois; West Valley, New York; and Maxey Flats, Kentucky, were closed due to a variety of environmental problems. There were only two available sites extant and these were reported to be in process of closing. During this period, there was rapid expansion of nuclear power plants with a consequent accompanying increase in waste volumes. In response to rapidly increasing costs for disposal the industry developed an aggressive waste minimization program in response to the problem. [2,3] Unfortunately, per cubic foot costs for low-level radioactive waste remain expensive today. Although Congress enacted legislation to alleviate the low-level radioactive waste repository problem with the LLRWWPA of 1980 and subsequent amendment, new facilities have not been realized.

It is well to remember that since the 1970s there has only been one new low-level radioactive waste disposal site licensed in the United States – Envirocare of Utah. The only remaining general public site, that is full service, is at Barnwell, South Carolina. This site is in process of immediate reduction and subsequent closing down of its national service. It is and will be accepting normal volume waste only from the Northeast Compact states of South Carolina, Connecticut, and New Jersey after 2008. The facility at Richland, Washington, services only member states of the Rocky Mountain and Pacific Northwest compacts. The lack of disposal options has propelled the development of a Texas low-level radioactive waste disposal facility.

HISTORY OF TEXAS DEVELOPMENTS (1981-2003)

In 1981 the state legislature formed the Texas Low-Level Radioactive Waste Disposal Authority (TLLRWDA) to site and operate a low-level radioactive waste repository. In its 18-year history, the Authority presented three candidate sites for a low-level radioactive waste repository; these were:(1) South Texas (McMullen County), (2) Fort Hancock, and (3) Sierra Blanca (Faskin Ranch), the last two sites are in Hudspeth County in Far West Texas. [4]

The South Texas (McMullen County) facility was selected in 1985 from a final list of some 15 counties. Selection was made on the basis the area's simple layer-cake geology and central location. The legislature, however, removed it from consideration in response to public reaction. In the following year, the South Texas site was abandoned. The resultant legislation moved the selection area out to the state-owned lands that are predominantly located in West Texas. [4]

In 1987 the TLLRWDA selected three sites in Hudspeth County: Dell City area, Pump Station Hills, and the Fort Hancock area. The Dell City area was rejected on the basis of hydrological and proximity problems. The Precambrian rocks at the Pump Station Hills were too highly fractured to be seriously considered. The Fort Hancock site, some 15 mi (24 km) north of the town was selected as a potential site. The site location was considered to be environmentally and geologically flawed in a second opinion developed by representatives of El Paso County. The ensuing litigation on the second location at Fort Hancock in Hudspeth County resulted in a defeat in a court case held in El Paso County in 1991. [5, 6]

In the 1991 legislative session, a geographic box was drawn in Hudspeth County in which a potential site had to be located. The block drawn in Hudspeth County (Eagle Flat Study Area) encompassed 400 square miles (1,035 square kilometers). There were other activities occurring in Texas while Hudspeth County was being evaluated for potential sites. In 1993, Texas approved a compact agreement that included the states of Maine (ratified 1993) and Vermont (ratified 1994). The United States Congress officially approved the Texas Compact in 1998. In a related action in 1997, Waste Control Specialists, a private company, proposed the development of a low-level radioactive waste disposal facility for U.S. Department of Energy radioactive waste to be situated in Andrews County, Texas.

Study of the Hudspeth County area resulted in the selection of the Sierra Blanca (Faskin Ranch) site. The site was ideally located with reference to transportation with both an east-west railroad and Interstate Highway 10 immediately available. The Texas Natural Resources Conservation Commission (TNRCC), based on preliminary characterization work at Faskin Ranch, issued a draft license and an Environmental Impact Statement (EIS). However, two Administrative Law Judges and the TNRCC's commissioners (October 1998) subsequently denied the site. Each of the proposed repositories under consideration in Texas over the last 24 years have failed judicial and legislative tests on the basis of perceived political issues (e.g., proximity to Mexico, Environmental Justice, etc.) and natural system grounds (e.g., hydrological and geological hazards such as seismic activity, contamination of surface and subsurface waters, surface fissuring, faulting, etc.). [7]

After the rejection of the Sierra Blanca disposal site, the Authority (TLLRWDA) actively examined and researched an Assured Isolation Facility (AIF) option. The reality seems to clearly indicate that low-level radioactive waste in an assured isolation facility is very likely much more acceptable to the general public than any belowground near-surface disposal facility. The public perception is much more positive when it sees a visible surface structure being controlled, maintained, and monitored. Unlike other options, an AIF does not carry with it the idea of a hidden menace lurking below ground threatening to contaminate the hydrosphere and biosphere.

The placement of the assured isolation facility in the less densely populated regions of either northern or western Texas would seem to be a viable option. The view in the late 1990s was that an AIF could be built virtually anywhere in this area. Establishing such a facility addresses the need for immediate centralization of waste into a single locale in Texas as well as providing locale for the temporarily stored low-level radioactive wastes in Maine and Vermont.

In the 1999 legislative session, the AIF disposal option concept was widely discussed and favorably viewed by the appropriate House and Senate committees. The answer to the legal question as to whether an AIF would comply with the state's current Compact obligations was submitted to the Texas Attorney General's office. His opinion, issued on May 18, 1999 [8], stated that the development of an AIF facility complied with the state's current Compact obligations. However, the question of whether it meets permanent isolation or disposal obligations remained an issue in the opinion. Whether it will ultimately be an option for "permanent" disposal and thereby satisfy the Compact is not predictable. It was noted at this time that an AIF could, at a future date, transfer either selected or all waste modules to another disposal site or it could be closed in situ. [4, 9, 10]

The AIF-related bill, even with its broad support, died as a joint House-Senate bill that could not be agreed upon prior to the close of the legislative session.

In a late legislative action the Authority (TLLRWDA) was sunseted effective as of September 1, 1999. Its responsibilities, funding, and personnel were merged with the Texas Natural Resource Conservation Commission, which subsequently became the Texas Commission on Environmental Quality (TCEQ). The Commission, immediately upon assumption of the responsibilities of the Authority, continued the AIF studies with an extensive examination by an outside consultant, Rogers and Associates. [11] The legal considerations related to low-level management techniques were completed in 2000 by TCEQ staff attorneys P.A. Hershey and A. Medina of the Environmental Law Division of the Office of Legal Services. [12] Actions taken by the 77th Texas State Legislature did not profoundly affect the problem of developing a low-level radioactive waste disposal facility.

THE TEXAS NEAR-SURFACE LOW-LEVEL RADIOACTIVE WASTE FACILITY

In passing House Bill 1567, the 78th Texas Legislature Regular Session, in May of 2003, gave a new life to the moribund Texas Low-Level Radioactive Waste Disposal Compact repository. This bill authorized the Texas Commission on Environmental Quality (TCEQ) to be the lead agency to issue a license to a private company for the administration of a near-surface low-level radioactive waste disposal facility. In response the TCEQ has developed a multi-phased approach to implementing the provisions of HB 1567. [13, 14]

The bill's passage required developing key changes in statutory policies and concepts, especially with reference to the rules regarding low-level radioactive waste disposal. The primary rules requiring alteration were those concerned with the privatization of the disposal facility; the waste acceptance criteria for federal facility radioactive wastes; and procedures concerning fees received at the Texas Facility that are to be deposited in the General Fund. The licensing process required examination, revision, and clarification of primarily Title 30, Texas Administrative Code (TAC), Chapter 336 (Radioactivity Materials License). The first phase of the process, the revision of the rules to accommodate HB 1567, was initiated on June 1, 2003. Specific rulemaking was involved with the following: chapters of Title 30 TAC: Chapter 37 (Financial Assurances for Near Surface Land Disposal of Low-Level Waste); Chapter 39 (Public Notice); Chapter 305 (Consolidated Permits); and Chapter 336 (Radioactive Substance Rules).

The Texas Commission on Environmental Quality (TCEQ) called the first stakeholders meeting on July 18th with some 36 in attendance. An open, public hearing on August 6th presented an initial Commission rulemaking proposal followed by 47 days of public comment period (8/6-9/23/03). Another public hearing was held on September 16th. A response to public comment took place between September 23rd and November 21st. Adoption of the rules was made by the TCEQ Commissioners on December 17th and the new rules became effective January 8th of this year.

This first phase, adopting rules for the licensing process, of the seven-phase process was completed with stakeholder participation on January 8, 2004. Rulemaking was completed on an accelerated timeline - 222 days since the process was initiated. Phase II, the application preparation process for a near-surface low-level radioactive waste disposal facility, began January 10th and will conclude 180 days later on July 7th of this year. TCEQ will then accept completed applications for 30 days (July 8th to August 6th), completing the 210-day Phase II. In the multi-stepped, 225-day Phase III (8/7/04-3/19/05) the applicant(s) will be given Administrative Notices of Deficiencies (ANOD) with three opportunities for responses addressing the deficiencies by the applicant(s) and, if requested, additional requests for information (RFI). Comparative Merit (CM) inquires will be issued on the second and third ANOD. The Phase III process concludes with a favorable Notice of Administrative Completeness (NOAC) on March 19, 2005. Occurring concurrently with the Phase III Administrative Review process is the Comparative Merit Review process, Phase IV, which will be completed in 270 days (8/7/04-5/3/05). At the end of the Comparative Review process, the one application with the highest merit will be selected to undergo a thorough technical review and continue through the remaining phases of the process. Phase IV overlaps with Phase V of the process with the opportunity for public hearings in potentially impacted counties of Texas. The multi-stepped, 540-day Phase IV (3/20/05-9/10/06) starts with public hearings called by TCEQ and ends with the agency issuing a draft license and the opportunity for administrative hearing.

The 455 days of Phase VI (9/11/06-12/9/07) consist of a yearlong State Office Administrative Hearing followed by a 3-month period in which the TCEQ will issue a final facility licensing hearing that will become effective on December 9, 2007. If a license is issued by the TCEQ the final 730-day Phase VII

starts December 10, 2007. The construction of the near-surface low-level radioactive waste facility is expected to be completed in a 2-year period. The beginning of full-scale operations is expected at the end of 2009.

The proposed site of the near surface disposal facility will be restricted to the central and northern counties of West Texas. The site must be located in an arid area (less than 20 in/yr precipitation), not along selected river segments, and more than 62 mi (100 km) north of the Mexican border. The near-surface site designs of any type, either above or below grade, may be submitted without prejudice with the understanding that they will be subject to review by the lead Texas agency, the stakeholders, and the appropriate federal and state agencies. [15]

LICENSE APPLICATION

A guidance document for the application for a license to authorize a near-surface land disposal of low-level radioactive waste was published January 23, 2004. [13,14] An informal selection of some of the requirements follows. In writing the application, the applicant needs to include compliance with all the associated regulations and statutes of the Texas Health and Safety Code (THSC) Chapter 401 and Title 30 of the Texas Administrative Code (TAC) Chapter 33. The presentation of the applicant's information must be complete and well developed for quality. Organization represents a critical function. The application should be well indexed for ease of locating specific data and clearly written for understanding of the content. The applicant is expected to act promptly and in a timely manner in response to the review process. Appropriate data dealing with expected exposures to humans that might potentially take place during the siting, construction, operation, closure, and post-closure of the designed facility is expected. [14]

It should be noted that anyone (individual, corporation, or other entity) who disposes of radioactive waste must obtain a license pursuant to THSC Chapter 401. The application must be signed by the applicant or authorized designee. It is important to note that any applicant should not commence construction or operation or accept low-level radioactive waste for disposal without a license. The application to TCEQ consists of one signed copy and five copies organized into three-ring binders. The applicant must ensure that the application contains adequate information to allow a detailed technical review of all sections of the document and the administrative review requisites of 30 TAC §336.807(d). [14]

The cost of submitting the application is a non-refundable $500,000. If the price of the application processing exceeds the initial payment, the TCEQ can collect additional money to cover costs. Each applicant pays for providing notices of public meetings and meeting costs. Additionally, the costs of notification of application in the newspapers will be born by the applicant. In the problem area of confidential information, TCEQ, in general, recommends against submitting it unless necessary for the application processing. It is necessary to only submit material essential to staff for recommendation development. All engineering plans, specifications, and related documents must be sealed, signed, and dated by a Texas professional engineer (P.E.). A new requirement is that all geosciences documents must be prepared by or under the guidance of a Texas licensed professional geologist (P.G.). [14] For guidance in preparing an application, the TCEQ recommends the following suitable U,S. Nuclear Regulatory Commission documents: NUREG–1274 (August 1987), NUREG–1199 (January 1991), NUREG–1200 (April 1994), NRC Regulatory Guide 4.18 (June 1983), NUREG–1300 (April 1987), and NUREG–1573 (October 2000). [14]

PERFORMANCE ASSESSMENT

Texas is a U.S. Nuclear Regulatory Commission (NRC) authorized Agreement State, which has the responsibility of performing the license review for a low-level radioactive waste facility. The Texas

Commission on Environmental Quality (TCEQ) acts as the regulator to enforce the state's applicable disposal regulations (30 TAC§336.723-727) and, additionally, the applicable, mandated NRC standards. [15] A critical part of that licensing review is the Performance Assessment (PA). A quality PA determines quantitatively what the potential impacts to the public and the environment are for the activities associated with a low-level radioactive waste disposal facility (30 TAC§336.723). This assessment includes evaluation of any potential release and transport of radioactivity into the soil, water (ground and surface), and air and ultimately into the biosphere by plant uptake and animal consumption. Scenarios are developed for all phases of public (30 TAC§336.724) and operational personnel (30 TAC§336.725) potential intersects. The problems of inherent inadvertent intrusion (30 TAC§336.726) and post-closure stability (30 TAC§336.727) must also be addressed in performance assessment. The intent of the Texas site-specific performance assessment is to arrive at a meaningful series of significant release/transport scenarios. This is to be accomplished without performing lengthy evaluations for every potential combination of release scenarios. [15]

The Texas Commission on Environmental Quality straightforward basic performance assessment essentials consists of five general components [15]:

1. A description of the site and the engineered disposal system to be utilized.

2. A description of the potential events that will likely affect the long-term performance of the low-level radioactive waste facility.

3. A description of the processes controlling the movement of radionuclides from the low-level radioactive waste facility to the general environment.

4. The computation of potential doses to the members of the general population.

5. Evaluation of the uncertainties that have been used in the evaluation system.

In essence, the purpose of a site-specific performance assessment document is to conservatively quantify the potential impacts to human health and the environment from the facility that is to be constructed. TCEQ, based on the results of this document, may consider a licensing decision for a given facility based on its addressing appropriate environmental considerations. [15] The requirements for the application and performance assessment depend on the applicant's selection of the type of low-level radioactive disposal facility that is proposed to be built.

LOW-LEVEL RADIOACTIVE WASTE FACILITY

Near-surface site designs of any type, either above or below-grade, may be submitted without prejudice to the TCEQ with the understanding that they will be subject to review by the lead Texas agency, the stakeholders, and the appropriate federal and state agencies. Near-surface low-level radioactive waste disposal facilities are regulated by 10 CFR Part 61 on the federal level and by 30 TAC Chapter 336 on the state level. Again, the proposed facility design should reflect long-term stability, reduced contact of the waste to water, and demonstrate adequate institutional care (access control, inadvertent intrusion, etc.). Near-surface disposal facilities may be informally divided into two fundamental units; they are either above-grade (above-ground) or below-grade (below-ground), with the top of the soil layer being the subdivision between the two.

In below-grade near-surface disposal, the general definition is that the emplacement of waste is within 100 ft (30 m) of the surface. Below-grade shallow land disposal is achieved in one type by constructing trenches that are approximately 30 ft (9 m) deep. In its simplest form this type of disposal is

accomplished by placing the low-level radioactive waste in barrels or other suitable packages directly into the trench and then covering the radioactive waste in the trench. The second type of shallow land disposal form is the modular concrete canister disposal in which the waste is placed in steel-reinforced concrete canisters. These canisters are then emplaced in a similar trench and covered. This is similar to the design of the proposed Faskin Ranch facility. The last below-grade facility would be that referred to as a vault. It is a structure in which the construction consists of reinforced concrete walls and roof with either a natural floor or one of reinforced concrete. [16]

In above-grade systems, a concrete structure provides containment of waste from the biosphere. An earth-mounded concrete bunker is a technique that was originally employed at Centre de la Manche, France. Class A equivalent low-level radioactive waste is stacked and placed above-grade in a hill referred to as a tumulus. Immediately under the tumulus is a below-grade vault where Class B and C-equivalent waste packages are grouted in place. The result is a monolithic concrete base for the tumulus. [16] Obviously, tumuli without a monolithic base are also possible if, as in the case of La Manche, an adequately designed cover system has been made. The last general classification is dealing with an above-grade vault which may be either earth mounded or not. This is a reinforced concrete structure filled with waste. Several different varieties of design are available; for example, one where the waste is filled from the top with an overhead crane system and usually later capped. This vault may be filled with a material (gravel, grout, etc.) at the time of emplacement or later. The second vault design is one in which the entry into the vault is at or near grade. This may be either with or without concrete canisters. This type of vault is usually what is meant when one is referring to an assured isolation facility (AIF).

ASSURED ISOLATION FACILITY

The assured isolation facility is an outgrowth of an earlier concept [17] and was originally termed assured storage facility. [18] Due to confusion caused by the use of the term "assured storage," the term was dropped in favor of assured isolation [19,20]. The original definition of assured isolation is: "a management system for safely isolating waste, while preserving options for its long-term management, through robust, accessible facilities; planned, preventive maintenance; and sureties adequate to address contingencies or implement future alternatives [18]." Assured isolation has been interpreted as being neither disposal (as envisioned in Title 10 of the Code of Federal Regulations Part 61) nor temporary (interim) storage. The legalities of the system have been addressed in a series of studies [11,12,21,22]. The conclusions are generally positive; however, there may be some issues that Texas and the U.S. Nuclear Regulatory Commission will have to contend with [12]. The costs involved with adopting AIF have been examined in considerable detail [11,18,23,24,25,26,27]. The balance of these reports indicate that the AIF to be financially equivalent or superior to a permanent disposal repository. The assured isolation facility as currently envisioned in Texas can be either converted to a permanent repository in the future (the convert category) or have the waste retrieved and sent to a final designation elsewhere in the future (the retrieve category).

What is the inherent difference between a standard below-grade disposal facility and an assured isolation facility? It is the basic dependency of below-grade disposal systems on the natural system and, specifically, the geological, hydrological, and climatological components. The fundamental element for the acceptance of any disposal site is the production of a computer-based model and performance assessment. Rating risks inherent in the components of a natural system is at best a guessing game that is always taken to the most conservative extremes – extremes that are often taken several orders of magnitude beyond reality. [10] The difficulty with using conservative extremes is that a very low probability exists for almost all possible scenarios to occur in a given natural system. The important key is for conservatism to be judged by a measure of reasonable assurance. However, the concept of reasonable assurance is subjective by its nature. It is impossible to scientifically state that an earthquake will never take place at any area with the least history of seismicity. It is equally difficult to say that there

will never be any further eruptions in a volcanically active area no matter how low the priorities of occurrence. What kind of a climatologist would be willing to predict with precision the weather pattern 5 centuries into the future? Engineering and institutional parameters are much more reasonably quantifiable and realistic. [10]

As developed by Newberry, Kerr, and Leroy [19,20], the below-grade repository is firmly based in the natural system. It is secondarily dependent on the engineering system and least affected by an institutional system. In assured isolation, the conceptual system is completely reversed. The basic unit is institutional system, engineering is secondary in consideration, and least critical is the natural system. The key to the concept is that assured isolation is based on rigorous institutional responsibility and control. This works synergistically with the engineering system. Continued preventive maintenance extends the life of the engineering system indefinitely and, thus, enhances the capability of responsible institutional control by providing access, monitoring, and retrievability. The reliance on the natural system for safety and licensing is therefore much reduced. Based upon the experience developed in dealing with public reaction to earlier proposed below-grade radioactive waste repositories, radioactive waste that is solely reliant on natural systems for performance is perceived as being a major environmental threat. If that assumption is true, the only way to effectively store radioactive waste near-surface is to store it above ground in a Nuclear Mausoleum that can be viewed by the operators, the public, and the regulators.

CONCLUSIONS

This is a very interesting and unusual time for radioactive waste management in the United States. There is now movement in working toward a solution for the environmental impasse that we have in radioactive waste disposal. There is a viable process of licensing a low-level radioactive waste disposal facility in operation at the time of this WM'04. There are reports of two organizations seriously looking at the opportunity of developing a licensed Texas Low-Level Radioactive Waste Disposal facility. There is a realistic timetable developed for the efficient movement of the process by the Texas Commission on Environmental Quality. We even have a date targeted for the start of operations (December 2009). It will be interesting to observe which of the alternative repository designs will be approved. Hopefully, this process will jump start other entities nationally and internationally to seek new management and disposal solutions for radioactive waste.

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