

THE LOW-LEVEL WASTE SITE SELECTION

DEMONSTRATION PROGRAM AT EPRI

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ABSTRACT

This paper discusses the current Electric Power Research Institute (EPRI) Site Selection Demonstration Program. The purpose of this program is to assure timely availability of new low-level radioactive waste disposal sites. EPRI is currently working with the Texas Low-Level Radioactive Waste Disposal Authority in a demonstration of site selection in an arid environment. Most of the work described here is related to the arid demonstration. Parallel efforts to evaluate shallow land disposal at humid sites, to develop better computer models for humid sites and to begin a cooperative effort with an entity seeking a low-level waste disposal site in a humid area are also described.

INTRODUCTION

This paper describes the content, status, and plans for the Electric Power Research Institute (EPRI) Low-Level Waste Site Selection Demonstration Program. The program has three major goals:

- Show that acceptable new low-level waste (LLW) disposal sites can be developed in the U.S.
- Exercise and crystallize the 10 CFR 61 licensing process for new LLW sites.
- Help assure the timely availability of new LLW facilities in order to minimize the utility costs for short-term on-site storage.

The EPRI Site Selection Demonstration Program is part of a LLW Technology Development Program at EPRI. The Technology Development Program also encompasses the development and transfer of LLW technology. Technology development currently includes developing computer codes to describe the effects of waste subsidence on the ability of LLW trench covers to prevent high rates of water infiltration and the development of better models to describe those rates at which different radionuclides are released from trenches used in shallow land burial. It is anticipated that these codes and models will be used in the portion of the Site Selection Demonstration Program that pertains to humid sites. Technology transfer will take the form of twice-annual reports on the Site Selection Demonstration Program, topical reports, and a revision to the EPRI low-level waste disposal handbook. (1)

THE ARID SITE DEMONSTRATION

The EPRI Site Selection Demonstration Program is divided into two parts: one for arid sites and one for

humid sites. Arid sites are found where the potential annual evapotranspiration significantly exceeds the average annual rainfall. The arid site demonstration has been under way since the fall of 1983. The humid site demonstration is in the formative stage pending identification of compacts.

The Texas Arid Site Selection Demonstration Program

The EPRI Site Selection Demonstration Program is currently focussed on the efforts by the Texas Low-Level Radioactive Waste Authority (TLLRWDA) to develop a facility for disposal of wastes from Texas. Texas has been pursuing a vigorous search for a new low-level waste facility and will likely obtain early experience in siting, licensing, and operating a LLW facility. For these reasons, EPRI identified the Texas effort as one which can provide lessons that can help resolve licensing issues and expedite other state's and compact's programs. The EPRI Arid Site Demonstration Program is providing informal technical assistance and closely tracking TLLRWDA's efforts. Currently, Texas has finished a thorough search for candidate sites within the state and identified and rated 50 such sites. It is anticipated that one or more sites will be selected for detailed characterization in the spring of 1984. Progress on candidate site selection has been influenced by the fact that the Texas Authority does not have power of eminent domain and therefore must negotiate the purchase of any land it hopes to use, preferably before detailed characterization begins. Several papers on the Texas effort are provided in the section on "Regional Plans for the Storage and Disposal of LLW."

The EPRI demonstration program is working with the TLLRWDA in several technical areas. These include:

- Review of the Site Selection Process
- Preliminary Site Analysis

- Methodology for Site Characterization
- Closure Requirements and Operations
- Review of the Texas Licensing Plan
- Monitoring Texas Site Characterization

The current status of work in these areas is described in the sections below.

Review of the Site Selection Process

RAE reviewed the Texas site selection process from draft documents provided by TLLRWDA. The primary purpose of this effort was to compare the Texas procedure with that outlined in the EPRI handbook and to develop insights from the practical process of selecting one of the first low-level radioactive waste disposal sites since promulgation of 10 CFR 61. The insights will be used in preparing a revised EPRI handbook for publication in 1985. A secondary goal of this effort was to compare the Texas and EPRI site selection criteria with those appearing in a DOE Handbook⁽³⁾ to determine the degree of similarity between the four sets of criteria.

The process used for site selection in Texas to date is very similar to that described in the EPRI handbook. Considerably more details were provided in the portion of the procedure in which specific candidates were rated according to a large number of characteristics and this section of the handbook will be strengthened as a consequence. The site selection process began with exclusion of large portions of Texas due to their relative unlikelihood of containing sites for disposal because of geology, meteorology, land use, etc. Fifteen Potential Siting Areas were defined. Further use of exclusionary criteria and more area-specific data led to grouping these 15 categories based on the potential for finding good sites within each. The top category contained 8 Preferred Siting Areas and the subsequent search focussed on them. From the Preferred Siting Areas 50 potential sites were chosen and rated against a comprehensive list of factors that bear on their technical, economic, engineering and socio-political suitability. It is from among the best rated potential sites that Texas will choose one or more locations for detailed characterization. An important factor in the final choice will be the ability to purchase land for the site, since the Texas Authority does not have power of eminent domain. A paper by staff members of the TLLRWDA and their contractor provides more details on the Texas site selection process in the section on "Regional Plans for the Storage and Disposal of LLW."

The comparison of siting criteria revealed a very close similarity between characteristics for favorable sites described by Texas, EPRI, NRC and DOE. The greatest similarity was between Texas and the NRC.

Preliminary Site Analysis

The primary purpose of the preliminary site analysis was to assist TLLRWDA by employing a site performance assessment code developed for EPRI⁽⁴⁾ to conduct preliminary analyses of some of the potential sites in Texas. This effort involved developing a Texas LLW inventory for use as a source term in the analyses, reviewing conceptual designs proposed for the Texas facility and estimating the performance of candidate sites. At the present time only one preliminary performance assessment has been conducted because data is not yet available in sufficient detail to analyze most candidate sites.

The Texas LLW Inventory

The Texas Authority developed an estimate of the volumes and kinds of LLW that will be generated in Texas over the lifetime of the facility to be built.⁽⁵⁾ RAE took that estimate and used the waste streams defined by the NRC to develop an isotope by isotope source term for Texas, including the longer-lived isotopes of concern after disposal and the isotopes used by the NRC and by Texas for waste classification.^(6,7)

It was determined that there are important differences between the average U.S. waste reported by the NRC and waste projected for Texas. The projected wastes for Texas do not include several source terms such as uranium processing and fuel fabrication wastes. Also, the projected reactor wastes are a much greater fraction of the total Texas waste volume than for the national average.

Table 1 lists the percentage of each individual NRC waste stream in the Texas source term. Table 2 is based on categorizing the individual NRC source terms used in the Texas source term into the various classes of waste according to the Texas Regulation for Control of Radiation Part 45 (TRCR45). That is, if the average concentration in the waste stream PWR ion exchange resins (P-IXRESIN) place it in Class A, all such wastes are assumed to be Class A. The average concentrations, on a nuclide by nuclide basis, for the Texas Source Term are shown in Table 2 for each class of waste. Therefore, if the three classes of waste are buried separately the concentrations given in Table 2 constitute class-by-class source terms for Texas wastes.

The last line in Table 2 indicates the fraction by volume of the Texas Source Term which falls into each class. Note that there are no Class C wastes and the vast majority of the waste in the Texas Source Term is Class A. Based on average nuclide concentrations, all Texas wastes except the very small amount of sealed sources (N-SOURCES) are readily suitable for burial in land facilities.

Analyses of the effects of nonhomogeneity in the waste streams in the Texas source term and the effects of potential volume reduction were also conducted. In neither case did the relative volumes of Class A, B or C waste in Texas change significantly.

Review of the Conceptual Site Design

A review was conducted of the conceptual design for the Texas facility. The main purpose of this review was to identify features of the design that will be modeled in the preliminary performance assessments. The design was found to be technically conservative, including the use of a clay cap and liner and 5 meters of cover over Class A and B wastes. A description of the conceptual design is provided by staff from the TLLRWDA and their contractor in the section titled "Regional Plans for the Storage and Disposal of LLW."

Preliminary Performance Assessment

Most of the preliminary performance assessment estimates for candidate Texas disposal sites remain to be done. However, RAE did conduct a preliminary analysis of the Hudspeth County, Texas potential site based on RAE staff observations during a visit to that location and other information readily available. The analysis assumes no aquifer exists between the surface and the rhyolite basement rock a short distance below the surface. This eliminates groundwater pathways for potential spread of radionuclides from the waste to the environment. It was also assumed that due to a general lack of groundwater and the arid nature of the site no farming will take place

TABLE 1

FRACTION OF THE NRC WASTE STREAMS
IN THE TEXAS SOURCE TERM

<u>NRC WASTE STREAM</u>	<u>PERCENT OF TEXAS SOURCE TERM</u>
<u>Reactor Wastes</u>	
P-IXRESIN	2.48
P-CONCLIQ	24.33
P-FSLUDGE	0.31
P-FCARTRG	1.55
P-COTRASH	30.30
P-NCTRASH	15.53
Subtotal	74.50
<u>Institutional Wastes</u>	
I-COTRASH	3.59
I+COTRASH	3.59
I-LQSCNVL	3.77
I+LQSCNVL	3.77
I-ABSLIQD	0.42
I+ABSLIQD	0.42
I-BIOWAST	0.77
I+BIOWAST	0.77
Subtotal	17.10
<u>Industrial and Federal Wastes</u>	
N-SSTRASH	2.52
N+SSTRASH	2.52
N-LOTRASH	0.71
N+LOTRASH	0.71
N-SSWASTE	0.89
N-LOWASTE	0.85
N-ISOPROD	0.10
N-HIGHACT	0.04
N-TRITIUM	0.05
N-SOURCES	0.01
N-TARGETS	0.02
Subtotal	8.40

there at any time in the foreseeable future. This eliminates the possibility that someone may someday dig up the waste, spread it on the surface and grow food or forage in contaminated soils.

The largest estimated potential dose rate to an individual at the site was approximately 1.5 mrem/yr if the entire cover of the waste facility was removed by erosion in a few thousand years and someone built a house on top of the site. If a person was to dig 40 hours a week in the waste 100 years after site closure the largest possible dose to that individual was estimated to be about 2×10^{-4} mrem/yr from dust inhalation.

Methodology For Site Characterization

The purpose of this effort is to recommend cost-effective methods for characterizing the one or more sites chosen for detailed characterization by Texas. Quantities to be measured, frequencies in time and space, etc., will be suggested. Since this kind of information is highly site-specific and the locations to be characterized have not been chosen, little has been done to date.

Closure Requirements and Operations

This effort will prescribe general criteria for site closure, develop a site closure configuration and describe the operations essential to achieving that configuration at an arid site. Considerations include using individual trench covers or one cover over the entire trench area, trench cover materials, slopes of trench covers to assure rainfall runoff without erosion, etc. The purposes of this work are to provide technical suggestions to TLLRWDA and to develop expanded descriptions of site closure for the EPRI handbook. The output from this work will be provided in an annual report on the EPRI Arid Waste Demonstration Project in the fall of 1984.

Review of the Texas Licensing Plan

When a Texas licensing plan is developed RAE will review it and comment on critical path items and portions that may make unusual demands on information gathering efforts. The purpose of this review is to identify points in the licensing plan that may cause unnecessary delays and to gather insights for possible use in revising the EPRI handbook.

Monitoring Texas Site Characterization

When one or more sites are chosen by TLLRWDA for detailed characterization the process will be monitored by RAE for EPRI. The primary purpose of this effort will be to gain additional insight into this critical phase of LLW facility development in order to improve the appropriate sections of the revised EPRI handbook.

HUMID SITE DEMONSTRATION

EPRI recently started work on a demonstration paralleling the one for an arid site. At the present time a particular project such as the Texas effort has not been identified, but several are under consideration. A candidate is a prospective New York State siting study. In conjunction with the Humid Site Selection Demonstration Program EPRI is sponsoring two major efforts to improve knowledge about generic humid sites. The humid site evaluation effort is reviewing the state of knowledge concerning parameters that are usually used to represent humid sites and conducting performance assessments to calculate humid site performance margins and sensitivities of performance estimates to key humid site parameters. This information will be used to identify key technical issues about disposal facilities in humid sites and recommend improvements in site selection and design.

In the humid site technology development effort EPRI is sponsoring the development of computer models of trench cover subsidence due to waste subsidence and the impact of changes to the trench cover on water infiltration rates. The computer code will be an extension of DOE's model of cover behavior of covers over uranium mill tailings.⁽⁸⁾ EPRI is also sponsoring investigations of the interaction of infiltration rate, vertical water velocity in the trench and waste form on estimated maximum individual doses from LLW disposal. Since maximum doses are usually associated with the well water pathway that mechanism for nuclide migration is receiving particular attention.

TABLE 2
TEXAS SOURCE TERM CONCENTRATIONS BY WASTE CLASS

Isotope	Concentration (Ci/ft ³)		
	Class A	Class B	Class C
H-3	3.72E-04	2.03E+01	0
C-14	2.02E-05	7.35E-07	0
Fe-55	2.21E-03	0	0
Ni-59	1.95E-06	0	0
Co-60	2.98E-03	0	0
Ni-63	5.07E-04	0	0
Nb-94	4.58E-08	0	0
Sr-90	2.12E-05	1.00E-01	0
Tc-99	1.88E-08	5.33E-06	0
I-129	5.55E-08	4.43E-08	0
Cs-135	1.88E-08	5.33E-06	0
Cs-137	5.17E-04	6.08E-02	0
U-235	1.60E-08	1.66E-07	0
U-238	6.56E-08	6.21E-07	0
Np-237	2.91E-13	8.69E-15	0
Pu-238	1.16E-06	3.21E-06	0
Pu-239	1.04E-06	9.05E-07	0
Pu-241	4.54E-05	1.16E-04	0
Pu-242	2.24E-09	1.56E-09	0
Am-241	7.70E-07	1.79E-07	0
Am-243	5.12E-08	2.04E-08	0
Cm-243	5.07E-10	2.69E-06	0
Cm-244	4.99E-07	4.70E-09	0
Volume Fraction in Class	0.9983	0.0016	0

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