

## CHARACTERIZATION PLAN FOR A LOW-LEVEL

### RADIOACTIVE WASTE SITE IN TEXAS

Ruben A. Alvarado, P. E.  
Texas Low-Level Radioactive Waste Disposal Authority

#### ABSTRACT

Since September 1982, the Texas Low-Level Radioactive Waste Disposal Authority has been aggressively pursuing a site for the shallow-land burial of low-level radioactive waste. In February 1983, the Authority started the site selection process intended to produce one suitable site. Following site selection, a three-step site characterization program will quantify the parameters which must be evaluated.

Step I will be a prequalification of techniques and procedures. The purpose of Step I will be to identify those parameters critical to the characterization of an arid site and the methodologies most relevant to obtaining satisfactory data.

Step II will be the actual on-site characterization studies. For ease in conducting the work, the studies will be broken down using three environmental regimes: surface, subsurface, and radiological.

Step III will be a critical evaluation of the entire process to identify preferred methodologies and to provide guidance to other states and compacts, particularly those in arid regions.

The program will be conducted in cooperation with the U.S. Department of Energy.

#### INTRODUCTION

The Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974 give the Nuclear Regulatory Commission (NRC) the responsibility for the licensing and regulation of commercial nuclear facilities. The NRC is also responsible for seeing that these facilities comply with the National Environmental Policy Act of 1969. Pursuant to this authority, the NRC promulgated 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Wastes".

The State of Texas is an agreement state and has, therefore, adopted compatible regulations at the state level. The Texas Department of Health, Bureau of Radiation Control, adopted Part 45 of the Texas Regulations for the Control of Radiation. These regulations establish the general requirements for licensure of a low-level radioactive waste disposal facility. The Regulations are intended to reasonably assure that a site will meet the following performance objectives:

1. Concentrations of radioactive material which may be released to the general environment shall not result in an annual dose above background, exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, or 25 millirems to any other organ of any member of the public.

2. Design, operation, and closure of a land disposal facility shall ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.

3. Operations at the land disposal facility shall be conducted in compliance with the established standards for occupational exposures. Effort shall be made to maintain radiation exposures as low as reasonably achievable.

4. The disposal facility shall be sited, designed, operated, and closed to achieve long-term stability of the disposal site and to eliminate, to the extent practicable, the need for ongoing, active maintenance of the disposal site following closure so that only surveillance, monitoring, and minor custodial care are required.

In order to reasonably assure that the performance objectives will be met, the disposal site must possess natural characteristics suitable to long-term isolation of the waste. Further, the site must be located so that natural processes such as erosion or meteorological conditions will not adversely affect site performance. In order to demonstrate that, site specific, technical, and environmental data must be submitted during licensing.

The following technical and environmental data is required by the Bureau of Radiation Control in a license application.

1. Pathway analyses which demonstrate that the general public will be protected from releases of radioactivity. These analyses shall include air, soil, groundwater, surface water, plant uptake, and exhumation by animals.

2. Demonstrations that waste classification and segregation, as well as intruder barriers, will protect inadvertent intruders.

3. Occupational exposure analysis.

4. Analysis of the long-term stability of the disposal site and the need for ongoing, active maintenance after site closure. This shall include analysis of such processes as erosion, mass wasting, slope failure, waste settlement, and infiltration.

5. Analysis of nonradiological releases from the site shall demonstrate compliance with all

applicable rules and regulations of the State of Texas.

The process by which the technical and environmental data is gathered to demonstrate compliance with the previously mentioned criteria is commonly referred to as site characterization.

#### SITE CHARACTERIZATION PLAN

The development of the Texas characterization plan involved a survey of the existing documentation regarding activities of this type. Unfortunately, since no sites have been licensed under 10 CFR Part 61, there is no historical data base upon which to draw.

The NRC, in a branch technical position, NUREG 0902, "Site Suitability, Selection and Characterization," describes, in detail, 67 parameters which should be determined during site characterization.

The Texas Low-Level Radioactive Waste Disposal Authority, after reviewing these criteria and discussing them with the Bureau of Radiation Control, felt that some parameters were much more important than others, and that investigations suggested in NRC documents were intended to be very conservative and all-encompassing. Generally, the parameters mentioned can be broken into two broad groups: those dealing with surface characteristics and those dealing with subsurface characteristics.

The characterization of the subsurface environment includes the following categories:

Geological Characterization - requires detailed documentation of stratigraphy, lithology and soils, structure, geomorphology, and regional hydrogeology.

Material Description - requires systematic description to convey engineering significance. Involved are visual description, as well as soil and rock classification.

Zoning Parameters - used to delineate lateral and vertical extent and boundaries of both soil and rock masses that are uniform in character.

Hydrogeological Parameters - provide the mechanics for subsurface modeling of water flow and solute transport involving both the saturated and unsaturated zones.

Geochemical Parameters - to identify chemical composition and characteristics of soil, rock, and water for establishing background levels of potential pollutants and deleterious materials.

Geotechnical Parameters - provides specific information from accepted test procedures for parameters such as strength, compressibility, permeability, stability, and erodibility which impact site design and operation.

The surface environment is the second area of study and will include the following categories:

Meteorology - measurements of data to support site water budget, analysis of airborne pathways, and frequency, probability, and potential consequences of severe meteorological phenomena.

Surface Water - provide data sufficient to manage surface water and mitigate potential erosional problems. Measurements required include runoff coefficients, infiltration rates, drainage system

characteristics, radiological, and nonradiological contaminants.

Air Quality - requires on-site measurements to analyze and sample both radiological and nonradiological contaminants.

Ecology - requires complete on-site flora and fauna inventory, together with analysis of impact on endangered, threatened, and protected species. Both terrestrial and aquatic species must be considered, as well as inventories of domestic livestock and crops, as required. Key species will be analyzed for radiological and nonradiological bioconcentration effects.

Land Use and Cultural Resources - document past, current, and future land use patterns and location of significant cultural resources in the areas, as well as location of residence and population centers in specified areas.

Socioeconomics - requires data to analyze the impact of the disposal facility's site and operation on the local socioeconomic environment.

The Authority has chosen to follow this division of investigation with the addition of a third area-- Radiological.

The Authority also felt that the methodology developed would be of interest to other states and to the compacts, and that based on practical experience, certain changes could be made to shorten the process and make it somewhat less expensive.

In conjunction with the Southern States Energy Board and the State of Colorado, a grant proposal was submitted to the U.S. Department of Energy to request funding for a broad characterization study. This grant will allow the Authority to investigate all of the parameters included in NUREG 0902 and to analyze the efficacy of these investigations for an "arid" site. We have, therefore, divided site characterization into three tasks: Task 1 - Prequalification of Techniques, Task 2 - Site Studies, and Task 3 - Postmortem Review and Assessment.

#### Task 1 - Prequalification of Techniques

This period is intended to allow for a thorough analysis of all the techniques and procedures which are available to quantify the various parameters which must be investigated. Existing documents such as NUREG 0902 and 3038 will be reviewed and the parameters and analytical methods will be evaluated. Since Texas will have, in all probability, an arid site, one of the principle purposes of this step will be to identify parameters and the attendant procedures and techniques appropriate for an arid site. The report resulting from Task 1 will discuss the evaluation of methods selected and the reasons for selection. Also included will be a discussion of alternate methods which might be appropriate for an arid site and those methods which have more value in characterizing a humid region. Preferred and alternate methods could be selected for site studies.

#### Task 2 - Site Studies

Task 2 will be the actual on-site characterization activities. For ease in discussing the site studies, the work has been divided among three environmental regimes. These are the surface regime, subsurface regime, and radiological regime. Each regime has principle fields. Each field has specific analyses which will be performed.

There is some overlap between environmental regimes. A prime example is geology. Surface geological conditions will be evaluated as well as subsurface geological conditions. It is also possible that in some areas the impact of certain geologic formations may impact the baseline radiological data being collected.

During this evaluation, several alternative methods or procedures may be used for the quantification of certain analyses. The results of applying the alternative methods would then be evaluated during Task 3.

### Task 3 - Postmortem

Task 3, the postmortem, is the critical review and analysis portion of the project. The purpose of this task is to carefully analyze what was accomplished during Task 1 and Task 2 and to prepare a critical evaluation of the characterization effort. This report, coupled with the Task 1 Reports, will be of immeasurable value to other states and compacts. It will assist them in designing a characterization program in a timely and effective manner.

### SCOPE OF WORK

Each task of the characterization effort is divided into three environmental regimes as previously described. In order to adequately accomplish the work, several principle fields (geology, surface hydrology, etc.) are broad in themselves and the work will be divided into analyses within each principle field. A general plan describing the scope of work is shown in Fig 1.

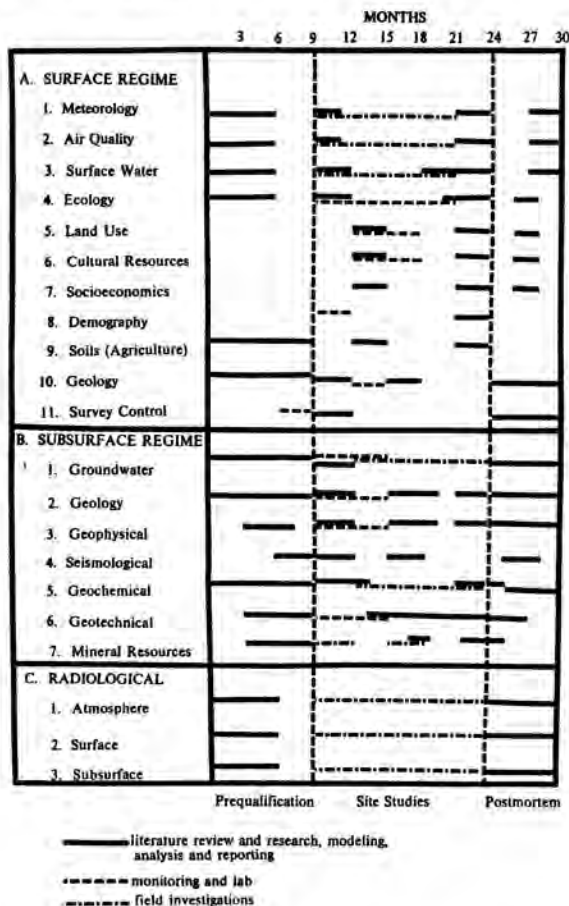


Fig. 1. Principle element time line.

The work to be accomplished in evaluating each field will be divided into specific analyses and study components. Study components are: literature review and research; field investigations; monitoring; modeling; and analyses and report. Fig. 2 shows, graphically, the amount of time that will be required in each step for each study component. As can be seen from the figure, a certain amount of literature review and research will be required in each task. It can also be seen that monitoring will be concentrated completely in Task 2. The time line shows approximately 30 months of effort. In actuality, the lines will overlap and it is estimated that the total project may be completed in 18 to 20 months.

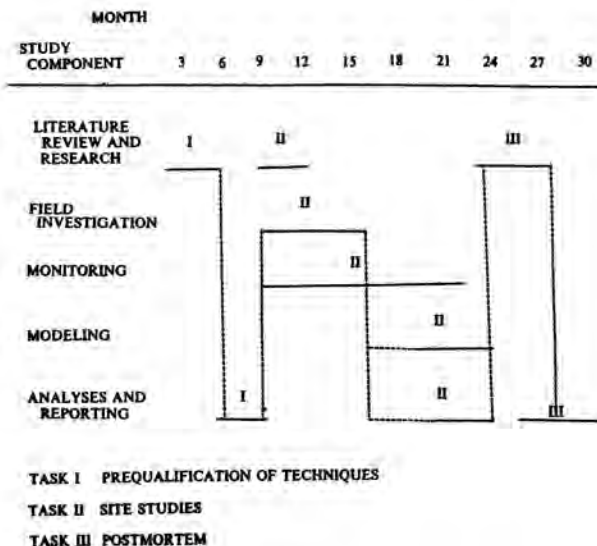


Fig. 2. Characterization flow chart.

### BUDGET

The budget represents the required 18 to 20 work months of effort and is itemized according to the work structure discussed previously.

The total estimated cost for the project is approximately \$1.5 million.

### CONCLUSION

The final result of this study will be three reports. The first, which should be of most value to other regions, states, and compacts, will discuss the rationale for conducting the Texas site characterization. This will include an analyses of alternative procedures and methodologies and a discussion of why each method utilized during the site studies was selected.

The second report will be the basis for the environmental section of the Authority's application for licensure. It will also provide the site-specific data required for final design and the final site environmental monitoring program.

The third report will be a critical analysis of the entire process which will detail those items which could/should have been accomplished using alternate methods.