LLRW DISPOSAL FACILITY DEVELOPMENT STATUS FOR THE SOUTHEAST REGIONAL COMPACT

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ABSTRACT

North Carolina is the designated host state for development of a regional LLRW disposal facility for the Southeast Regional Interstate Compact. Site characterization and analysis of the selected site in Wake County stalled in 1995 as a result of a protracted licensing effort and funding concerns of the Southeast Compact Commission (SECC). In late 1996, the project resumed on the basis of a "Consensus Licensing Work Plan" (LWP) developed by the North Carolina LLRW Management Authority (the Authority), the state regulator, and other involved state agencies. The LWP formed the basis for resumption of funding by the SECC.

Seven milestones or "decision points" are included in the four-year program. Since project restart, the licensing team has achieved two of the major milestones and set the project on a positive course toward the ultimate licensing decision. The centerpiece of the process is frequent regulatory consultation with open and continuous public involvement. This successful process is described along with lessons learned regarding approaches to technical site characterization, regulatory interaction and public involvement.

In late 1997, a project funding dispute arose between the Authority and the SECC leading to a second stoppage of work. Mediation efforts between the Authority and the SECC have failed, and the Authority is evaluating alternatives including Assured Isolation and Decay In Storage. Most recently, the Authority has begun an investigation into the advantages and disadvantages of using Decay In Storage for disposal of most of the LLRW, while continuing to develop permanent disposal for longer-lived LLRW.

INTRODUCTION

The Southeast Compact (SEC), consisting of the states of Florida, Georgia, South Carolina, North Carolina, Virginia, Alabama, Mississippi and Tennessee, was ratified by Congress in 1983. In accordance with the process established in the compact law, North Carolina was selected as the second host state, after South Carolina which was the host of the first facility at Barnwell. North Carolina proceeded to fulfill its obligations as host state by passing legislation in 1987 establishing the North Carolina Low-Level Radioactive Waste Management Authority (the Authority) with the responsibility for siting and development of the necessary facilities.

In 1988, the Authority selected a developer/operator who began the state-wide site selection process. Two candidate sites were eventually selected, in Richmond County in the south and on the Wake/Chatham County border south of the capital city of Raleigh. As required by the State's siting law, both sites were characterized and license applications prepared before the final preferred site was selected.

The Wake/Chatham site was selected as the preferred site in December, 1993, and its license application was formally submitted to the North Carolina Department of Environment, Health and Natural Resources, Division of Radiation Protection (DRP), which is the Agreement State Agency authorized to implement the State's radiation control regulations. DRP proceeded with the technical review of the license application and conducted numerous consultations with the applicant.

DRP's initial technical review generated 594 interrogatories (technical review questions) which were transmitted to the applicant. The following table presents the status of these interrogatories, as provided by the DRP on May 6, 1996.

Interrogatory Categories	**Number of Original Interrogs.**	**Responses Received**	**Adequate Responses**	**Responses Inadequate, Incomplete, Unreviewed, or Otherwise Unsatisfactory**	**Interrog. That Remain Open**
Closed (1)	65	65	44	21	21
Geology/Hydrology	105	47	11	36	94
Pre-Operational Environmental Monitoring	133	84	37	47	96
Other	291	58	0	58	291
Total	594	254	92	162	502

In the course of the technical review, significant tensions developed between the applicant's team and the regulator's team, and the licensing process failed to progress as expected. Over 500 interrogatories remained unresolved in May of 1996, and the incomplete technical review was at a virtual standstill.

Out of frustration with the lack of progress, the SEC cut funding to the project in late 1995. About $100 million had been spent between the applicant's costs and the costs of the Authority and the DRP. The SEC had been providing the site development funding from fees collected at the operating disposal facility at Barnwell, South Carolina. Authority and DRP funding was being provided by appropriations from the North Carolina State Legislature. These state funds are to be repaid to North Carolina out of operating receipts at the new facility. At this time, South Carolina had withdrawn from the SEC, and as a result, no additional funds were being provided from collections at the Barnwell site. This left the SEC with a fixed amount of money with which to complete the project.

When development funds were cut, the Authority was forced to order its contractor to cease all project work. This left the project, its records and equipment in a precarious position relative to the potential for restart of the project. Nevertheless, the Authority, with two of its support contractors, Harding Lawson Associates (HLA) and Applied Geosciences, Inc. (AGI), began discussions between all of the parties to develop an agreed process for restarting the project.

The result of these discussions was a Licensing Work Plan (LWP) which enjoyed the consensus of the applicant, the Authority, and the regulator agencies. On the promise of this LWP, the SEC agreed to continue funding of the project subject to demonstrated progress in meeting the milestones in the LWP and certain other conditions related to North Carolina's performance in licensing the facility. The Authority contracted with HLA to restart and manage the project in October 1996.

LICENSING WORK PLAN

The Licensing Work Plan addressed the need for a plan that would resolve the technical issues surrounding the licensing of the Wake/Chatham preferred site. Development of this LWP was prompted by the Division of Radiation Protection's (DRP) January 16, 1996, reaction to the Applicant's 1996 Comprehensive Site Assessment and proposed licensing work plan, limited progress in resolving technical issues, and a request on February 12, 1996, from the Chairman of the North Carolina Interagency Committee on Low-Level Radioactive Waste to attempt to develop a consensus work plan.

The objective of the LWP was to guide activities necessary to resolve key geologic, geochemical, geophysical, hydrological, engineering, and performance assessment issues and outstanding interrogatories raised by the DRP. A revised License Application is expected to result from the work described in the LWP from which the DRP can make a well-informed and technically sound licensing decision.

The LWP was developed through technical meetings among the Authority's subcontractors and state regulatory agencies. Representatives from Wake and Chatham Counties also attended these technical meetings.

The scope of work described in the LWP, which focused on the then current disposal area and buffer zone, was comparable to previous work to characterize the larger site area. The schedule presented with the LWP anticipated submittal of a revised License Application to the DRP in late 1998 and a DRP licensing decision in early 2000.

LWP Tenets

The LWP has seven key tenets important to achieving the objectives of the Authority:

- Provision of a technically driven plan with cost and schedule as secondary considerations;
- Integration of the work of key technical disciplines;
- Integration of site characterization, facility design, and performance assessment activities;
- Sharing of a real-time database with the DRP;
- Integration of existing data into future planning and analysis;
- Frequent interactions with the DRP to review and revise the planned studies as needed. These meetings will be open to interested parties; and
- Establishment of key decision points described below.

The seven decision points, identified in the LWP and described below, are sequential and each is dependent on successful completion of each preceding decision point. Several of the initial decision points have three possible outcomes: continue site and field investigations as planned; modify site and field investigations (with needed cost and time adjustments); or cease further work at the site.

Decision Point 1 - GM - 1 Trench Studies; Evaluation of New Techniques; Data Integration

The objectives of these field studies were to test new investigative techniques and to integrate results. A specific topical meeting with the regulator and other interested parties was held after field investigations along the GM-1 trench were completed and data were compiled, analyzed, and integrated. The purpose of the meeting was to assess the suitability of both the field methods and the comprehensive approach to site characterization. The assessment was intended to lead to a decision whether to proceed with work as planned, modify the characterization approach, or cease work at the site. The primary objectives were to:

- Evaluate the suitability of the investigation techniques and their protocols;
- Evaluate the methodologies and strategies for a comprehensive approach to site characterization;
- Evaluate the scale and detail needed for site-wide studies;
- Confirm/modify/refute hypotheses developed during analyses of existing data and
- Evaluate convergence or divergence of integrated lines of evidence (i.e., Can different data sets be integrated to build a predictive model for the Site?).

Decision Point 1 was concluded with positive findings on all five of these objectives. Agreement was reached with the regulator on the investigative tools, techniques and protocols necessary to complete the site characterization. Agreement was also reached on the scale and detail needed for these studies.

Decision Point 2 - Facility Layout And Design Relative To Potential Groundwater Discharge

The layout of the disposal area and buffer zone was to be assessed based on the potential for groundwater discharge to the surface within the License Area as well as any re-evaluation of the project waste volumes. Input to support these evaluations were to come from related activities including:

- Site conceptual model updates;
- Drainage studies;
- Infiltration testing;
- Site recharge evaluation;
- Subsurface Drainage and Monitoring System layout;
- Results of long-term high water evaluation from historical records and characterization data; and
- Results of preliminary groundwater flow simulations.

The reassessment concluded that there was a potential for groundwater discharge to the surface within the proposed site boundary. This was principally in the buffer zone areas to the east. This finding caused the project team to reconfigure the site layout to avoid these potential discharge areas and focus

on areas with deeper groundwater to the west of the proposed site. The conceptual design of the subsurface monitoring system was also modified.

Decision Point 3 - Site Infiltration Capacity

Infiltration of water through the Facility without causing an unacceptable rise in the water table or producing unacceptable interface pathways to points of exposure is a critical issue at the Site. The infiltration capacity of the Site will be evaluated using both field and laboratory hydrologic testing of materials beneath the facility footprint and incorporating the test results into a numerical model of the disposal system. The numerical model will include the components of the engineered system, as well as the soils and rocks beneath the Site to the groundwater table. As part of these analyses, the potential effect of water infiltrating through the Facility into the groundwater table will be evaluated.

Decision Point 4 - Completion Of Field Studies

As part of ongoing project status review, the project will periodically evaluate whether sufficient field studies have been completed to resolve technical issues. At some point in the process, a decision will be made that no additional field investigations are necessary. The DRP will be given the opportunity to provide input as this decision is made.

Decision Point 5 - Dose Assessment

The potential transport of radionuclides from the engineered facility through the natural system will be analyzed. A number of potential pathways will be considered, including groundwater, surface water, air, and biota. Once the pathways, transport, and exposure assessment analyses are completed, potential doses to a hypothetical receptor will be calculated. Calculated doses will then be compared to regulatory standards to determine if facility performance is acceptable.

Decision Point 6 - Monitoring Plan

Existing data and new data from field tests described in this LWP will be used in concert with the conceptual and numerical simulation models to evaluate the feasibility of one or more monitoring approaches. Based on the selected approach and the corresponding field evaluations, an integrated monitoring plan will be developed that describes the approach to be taken to monitor the engineered and natural systems. The monitoring plan will provide the rationale and justification for the monitoring approach.

Decision Point 7 - Licensing Decision

The seventh and last decision point follows the independent review of the revised License Application by the DRP. Following that review, the DRP licensing decision will mark completion of the work described in the LWP.

PROJECT RESTART

The Authority contracted with HLA to manage the project's restart and all activities covered in the LWP. This work began in October 1996. HLA assembled a team in Morrisville, North Carolina and reactivated pertinent site monitoring activities. Protocols were developed for all of the new site characterization techniques which were to be tested and subcontracts were procured to carry out the pilot study activities

associated with Decision Point 1. All testing protocols and plans were reviewed by the regulator agencies before being finalized and implemented.

RESULTS TO DATE

The first two milestones, Decision Points 1 & 2, were achieved before the end of 1997. Decision Point 1 is related to the suitability of proposed site characterization tools and techniques and the ability to integrate results into an updated site conceptual model. The Authority's team reached agreement with the DRP on a set of six tools for continuing the geologic investigations at the site. Agreement was also reached on the general approach and strategy to complete the characterization of the site. The results of this milestone and the information from the pilot study will be used to adjust the scope, cost estimate and schedule for completing the project.

Decision Point 2 related to the suitability of the proposed site in regard to the potential for groundwater discharge to the surface. One of the site suitability requirements in 10 CFR Part 61, as adopted by North Carolina, states that,

"Groundwater from the hydrogeologic unit used for disposal shall not discharge to the surface within the boundaries of the site."

Based on their initial technical review, DRP had questioned whether this requirement was met at the site. Discussions with the Applicant and their contractors had failed to address this issue, therefore, the LWP included a reevaluation of the existing data. The Authority's team reanalyzed the site topography and the groundwater level information which had been collected, and collected additional surface water and groundwater geochemical data. The results of this analysis indicated that there was the potential for groundwater discharge within the site boundary, principally in the buffer zone areas on the eastern side of the site.

As a result of these findings, the focus area for further site characterization activities was adjusted to avoid these areas of potential groundwater discharge and investigate areas with deeper groundwater to the west. When the project is re-scoped, this new area will be the subject of the continuing characterization efforts.

LESSONS LEARNED

The principal lesson learned by the project team is that frequent and regular consultation with the regulator is and will be necessary to maintain adequate communications and consensus with the implementation of the LWP. The LWP was established through the broad participation of the applicant, the Authority, the DRP, its consultants and supporting agencies, and members of the interested public. In the course of the project after restart, the project was nearly derailed due to misunderstandings related to completion of Decision Point 2. The Authority's team had thought that all issues had been resolved , when in the final meeting the regulators made it clear that they felt many of the requirements agreed to in the LWP had not been fulfilled.

As a result of this misunderstanding, the LWP Steering Committee which had negotiated the scope of the LWP was reconvened to improve communications and oversee the work going forward. The Steering Committee is made up of an equal number of members from the regulator and the Authority's team. The new process requires that the LWP Steering Committee review all work products in draft before they are finalized, and that the Committee make formal amendments to the LWP as necessary going forward. The Committee also makes recommendations to the Authority and the DRP on all Decision Points before

findings are made. This is an admittedly arduous process which requires more time, effort and expense up front; but it is expected to pay dividends by way of an expedited technical review later. All parties are committed to this frequent and regular consultation to keep the technical program moving with the consensus of the group.

The other significant lesson learned relates to the significant effort and expertise required to provide "real time" access to all data for the regulator. In the negotiations on the LWP, tight review schedules were committed to by the regulator based on the agreement to provide virtually immediate access to data as it was being collected, validated and qualified. There is a tremendous amount of project data, and to avoid the use of invalid data, HLA developed a unique Oracle data base which is provided on a regular schedule to all parties. HLA has responsibility for the collection, validation and qualification of all data. HLA maintains the official data base and provides duplicates or updates to the others, so that at any time, all parties are dealing with the latest version of the complete data base.

Having virtually all of the data available in digital form has also demonstrated its utility in fostering effective communications and understanding between the project team and the regulators. HLA's Applied Information Technology tools and capabilities have been used to provide analysis and visualization of the characterization data which has expedited the regulators' review and understanding of the data.

PROJECT STATUS

In 1997, the project was successfully restarted and positive momentum was established in the site characterization and regulatory review. Two of the seven milestones were achieved and the project reached the point where the project scope, schedule and cost could be refined. Unfortunately, late in 1997, a policy dispute arose between the State of North Carolina and the other party states of the SEC related to responsibility for funding of the project. As a result, the project was mothballed and the necessary re-scoping of the project based on the results of the first two milestones is on hold. This delay in funding will undoubtedly result in further cost increases to the overall project, and increase the build-up of waste materials being stored at generators' sites throughout North Carolina.

Representatives of the Authority and the SEC entered into informal mediation in an attempt to resolve the issues and find a way to resume funding of the project. Unfortunately, these attempts were unfruitful. The Authority staff is continuing to conduct evaluations of management alternatives, including Assured Isolation and Decay-In-Storage, to determine if these may represent cost-effective ways to manage North Carolina's, and potentially the SEC's, LLRW.

DECAY IN STORAGE

Decay in Storage (DIS) involves storing LLRW in an actively maintained, above-ground, secure facility until decay of the radioactive elements are sufficiently complete that the waste materials can be removed from the facility for recycling or disposal as non-radioactive materials. Licensing of a DIS facility should be simpler and quicker than for a traditional land disposal facility based on the expectation that the facility could be licensed under existing regulations. This would require concurrence and support of the regulatory agency.

Construction

The facility would consist of concrete buildings where the waste packages would be stored until they could be removed for non-radioactive processing or disposal. Ancillary support facilities would be

similar to the traditional disposal facility, consisting of a waste receipt and inspection building, an equipment repair building, a laboratory, and an administration building.

Facility Operations

Waste would be received in steel drums and steel boxes. Class A waste materials would be stored for radioactive decay and then removed from the facility for non-radioactive recycling or disposal. Some Class B and C materials could also be stored until access to a suitable radioactive waste disposal facility was available. Waste receipt would cease after 20 years, but active maintenance and monitoring of the facility and stored waste packages would continue for 100+ years until all waste materials were removed.

Advantages of DIS

- Leaves future options open for management of the waste. Problems can be corrected and scientific advances can be incorporated.
- Greater public acceptance is likely.
- Up to 85% or more of the LLRW could be disposed of at a DIS facility.
- Surcharges on waste storage could generate funds for licensing and development of a disposal facility for the remaining 15% of the waste.
- Does not require special, natural site conditions for waste isolation.

Disadvantages of DIS

- Cannot dispose of all LLRW. A small traditional disposal facility would still be necessary, or access to a traditional disposal facility elsewhere could be provided.
- May require additional waste processing by generators
- Requires acceptance of the concept by the regulator for quick implementation
- May require refinements to the North Carolina regulations

Cost Implications

- The costs for licensing and construction of a DIS facility should be substantially less.
- The operational costs of the facility should also be less since concrete over-packages would be eliminated, and operational construction activities would be reduced.
- Long-term maintenance of the facility would be somewhat increased.

PROCEDURAL MATTERS

The North Carolina Attorney General's office has indicated that there is no prohibition against a DIS facility as a management option for the State and Compact waste materials. However, if the Authority chooses to proceed with such a facility, it will be necessary to receive the Legislature's approval. In

January 1999, the Technical Committee of the Authority held a public meeting to review the details of the DIS alternative and receive public input on the concept. Comments were received from about 50 groups and individuals. The Technical Committee plans to respond to public questions and prepare a recommendation to the full Authority on whether to make a specific proposal to the Legislature in the upcoming session, or not.

CONCLUSION

Licensing of the Southeast Regional LLRW Disposal Facility in North Carolina has been stalled by funding disputes between the Compact's party states. The Authority is evaluating lower cost alternatives, most specifically, Decay In Storage, as a means to fulfill their statutory obligations. The project may only resume when funding is released to pursue whichever alternative is preferred. If DIS is selected by the Authority as the preferred approach, Legislative approval will be required.