

## SITING THE NORTH CAROLINA LOW-LEVEL RADIOACTIVE WASTE FACILITY

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### ABSTRACT

On December 8, 1993, the North Carolina Low-Level Radioactive Waste Management Authority selected a site in Wake County as the preferred site for the North Carolina low-level radioactive waste disposal facility. This facility will replace the Southeast Compact's current facility in Barnwell, South Carolina. Five days later, the Authority's contractor, Chem-Nuclear Systems, Inc., filed a license application for the facility. These two actions culminated six years of work by the Authority and constitute the achievement of a major milestone in the project. Work leading up to this point included field studies, facility design, performance assessment calculations, and a variety of public outreach activities. Pending regulatory approval of the license application, North Carolina is scheduled to open the Southeast Compact's second LLRW disposal facility in January 1996.

### INTRODUCTION

The Southeast Compact is a sited region for low-level radioactive waste because of the current facility at Barnwell, South Carolina. North Carolina has been designated as the second host state for the compact, and the North Carolina Low-Level Radioactive Waste Management Authority is the agency charged with developing the new facility.

This paper describes some of the important work that led up to the selection of a preferred site for the facility on December 8, 1993 and the filing of a license application 5 days later. It also includes a brief summary of ongoing efforts to achieve the opening of the facility in January 1996.

### INITIAL WORK

After its inauguration in 1987, the Authority began its siting effort by adopting rules describing the procedures and criteria by which a site would be selected. These rules described a multi-stage screening process that began by considering the full land area of the state of North Carolina.

Following the initial state-wide screening efforts by Ebasco Services and the hiring of Chem-Nuclear Systems, Inc. as the Authority's site development and operations contractor, Chem-Nuclear narrowed the search down to four site areas which were subjected to preliminary field studies. Finally, in April 1990, the Authority accepted Chem-Nuclear's recommendation that two of the site areas be accepted for full scale characterization studies. One is in Richmond County, near the town of Hamlet and less than 3 miles from the South Carolina border. The other straddles the Wake/Chatham County line, about 16 miles southwest of the state Capitol of Raleigh and immediately adjacent to Carolina Power and Light's Shearon Harris nuclear power plant.

### SITE CHARACTERIZATION

The first stage of site characterization was the development of site-specific characterization plans and the submittal of these plans to the state regulatory agencies for review. The lead agency, the Division of Radiation Protection, is assisted by about a dozen other agencies with cognizance over different areas of the project. After more than a year of review, discussions and modifications, the plans were approved in August 1991. Field work began on the Wake/Chatham site almost immediately but was delayed for a few months at the

Richmond site by legal challenges relating to the studies' alleged potential environmental impacts.

The field work lasted for nearly two years and cost in excess of \$30 million for the two sites. About 400 core borings and wells were drilled, ten trenches were dug, and six aquifer tests were conducted to study the geology and hydrogeology of the sites. In addition, the ecology, meteorology, archaeology, cultural and mineral resources, and socio-economics of the areas were investigated.

All of the site characterization work was carefully monitored by the same regulatory agencies that reviewed the characterization plans, and periodic changes to the plans were adopted as work progressed and preliminary results became available. In addition, each of the three sited counties appointed Site Designation Review Committees and hired technical consultants to follow the progress of the work.

One of the main results of the site characterization work was a hydrogeologic model for each site which was used to predict groundwater flow in the performance assessment calculations. Achieving these models presented different challenges at the two sites because of their different geologic settings.

The Wake/Chatham site consists of partially fractured sedimentary rock with intrusive features known as diabase dikes. These dikes are nearly vertical sheets of igneous rock of varying thicknesses. The principal concerns with this site were the nature and extent of the fracturing, and the hydrogeological role played by the dikes. Early studies showed a sizeable dike-free region of the site located primarily in Wake County that could be used for the facility. More detailed work concentrated in that region indicated that the fractures in the country rock formed an interconnected network that could be adequately modelled by the Equivalent Porous Medium approach.

The Richmond County site generally has more porous, sandy soil which is interspersed with horizontal clay layers or lenses. Areas of concern with this site were the possibility for rapid groundwater flow through the sandy material, the extent and hydrological role of the clay lenses, and the potential for liquefaction of the soils in a seismic event. Ultimately, soil liquefaction was determined not to be a problem, and once again Chem-Nuclear determined that the site could be modelled using the Equivalent Porous Medium approach.

## FACILITY DESIGN

Some of the characterization studies, particularly those dealing with properties such as the load-bearing capacity of the soils, provide information for the facility design. The North Carolina facility is required by state law to incorporate engineered barriers, and in March of 1991 the Authority adopted the Integrated Vault Technology recommended by Chem-Nuclear. In this technology, the waste packages are all placed in concrete overpacks which, in turn, are grouted shut and loaded into modular concrete vaults. Class B and C wastes are placed in the bottom center of the vaults, surrounded and shielded by Class A waste. As currently envisioned, the modules will be built in parallel pairs of rows and loaded from a moveable building which will provide protection from the elements. After loading, a concrete roof is poured and the vault coated with a waterproof sealer. Finally, the finished rows of modules are covered with an earthen mound and a multi-layer cap. Monitoring is provided by floor drains in each vault that lead to collection/detection points, by an impervious subsurface monitoring system beneath each row of vaults, and by rings of monitoring wells placed at varying distances from the modules.

The facility design, and particularly its size, is also influenced by waste volumes. Under the Southeast Interstate Compact agreement, each host state is required to operate its facility for 20 years or until 32 million cubic feet of waste have been received. While both sites are big enough to accommodate the full 32 million cubic feet, conservative estimates of anticipated volumes predict that only about 7 to 7.5 million cubic feet of waste will be received at the facility during its 20-year life. Allowing a roughly 50% safety margin, the Authority adopted 11 million cubic feet as the design and licensing volume. This reduces the land requirement for the facility and sends the clear message that North Carolina does not intend to accept out-of-region waste.

The design effort for the facility has progressed from a conceptual design, through the design-basis specification phase, to the moderately detailed, site-specific designs necessary for the license application. Final detailed design work for the preferred site will be accomplished during the 15 months allocated for regulatory review of the application.

## PERFORMANCE ASSESSMENT AND LICENSING

Both the site characterization data and the facility design provide input to the performance assessment calculations, and then all three of these feed into the license application. Preparation of two draft license applications, one for each site, was an ongoing effort by Chem-Nuclear during the latter stages of site characterization work and beyond.

Performance assessment calculations begin with a conservative estimate of the radionuclide inventory expected to be present in the waste. Then, using conservative assumptions about the performance of the various barriers to waste migration and using site specific information on things like hydrogeology and rainfall, estimates are made of hypothetical doses to an inadvertent intruder or to a citizen living at the facility boundary. Results obtained by Chem-Nuclear and their subcontractors show calculated doses of the order of 1 mrem per year and less than 3% of the regulatory limits.

Having obtained these results, Chem-Nuclear reported to the Authority last fall that the facility could be built at either

site and fulfill all regulatory requirements. By the terms of Chem-Nuclear's contract with the Authority, this attestation carried with it the acceptance of liability for any release of radioactivity in excess of licensing limits during facility operation and the 100-year institutional control period. This was an important step leading to the preferred site selection.

## PREFERRED SITE SELECTION

Another important step toward the preferred site selection was accomplished when the Authority amended its siting rules. As adopted in 1988, these rules had naturally focused on the earlier phases of the site selection process. The principal amendments included the voting procedure that would be used in the preferred site selection, the definition of conflict of interest by which an Authority member might excuse himself from the selection process, and the addition of two criteria to be considered only in the preferred site selection. These criteria were relative costs for facility development at the two sites and the displacement of residents and businesses. The rule amendments went into effect in August 1993.

The rule amendments also spelled out the information to be considered by the Authority in selecting a preferred site. This included the Site Characterization Report, the draft Safety Analysis Report and the draft Environmental Report (a total of over 7000 pages) prepared by Chem-Nuclear for each site. Given the scope of this material, the Authority hired Ebasco Services to extract summary information on each of the 51 site selection criteria, with references to the applicable sections of the reports for those wanting more detail.

The Authority also considered site descriptions prepared by its staff. These included the approximate boundaries of the land that would need to be acquired based on the previously approved disposal cell locations and Chem-Nuclear's facility designs. The delineated areas were smaller than the original sites selected for characterization and placed the boundaries of the facility totally within Wake County at the "Wake/Chatham" site.

The Authority sought public input to the site selection decision by holding public hearings in the vicinity of each site. There was also an open records period in which citizens and government officials were encouraged to submit written comments.

The Authority also considered material supplied by Richmond, Wake and Chatham Counties. Since these reports frequently contained statements contradicting or challenging Chem-Nuclear's conclusions, three informal review teams of two members each analyzed the counties' comments in preparation for the preferred site selection meeting.

The selection meeting was scheduled to convene on December 7 (the anniversary of the bombing of Pearl Harbor, as the Authority was frequently reminded) and to carry over to December 8, if necessary. The Authority began by reviewing each of the 51 siting criteria, discussing the summary information prepared by Ebasco and hearing the reports of the informal review teams. This process consumed the entire first day. The next morning was devoted to a general discussion of the sites.

The overwhelming concern expressed was safety and the protection of the public. Here, the performance assessment results from Chem-Nuclear and the associated sensitivity analyses were important. Another major concern was licensability. While licensability must ultimately be decided by

the regulators based on a detailed review of the full license application, the Authority had several indications that both sites are likely to prove licensable. These include Chem-Nuclear's licensability assessment backed up by its assumption of liability.

Beyond these basic requirements, a variety of factors were mentioned by Authority members in their discussions. Those that seemed to carry the most weight, however, were the two added criteria of cost and displaced residents. Both favor the Wake site. Significantly, there are 147 residents that would have to be relocated at the Richmond site while there are none on the Wake site. The resulting lower relocation costs combined with the lower construction costs at the Wake site made this the economically favored choice as well.

As the discussion wound down, the Authority prepared to begin voting. The voting procedure adopted by the Authority called for a series of random order, roll-call votes with the opportunity for discussion between ballots. There are fifteen Authority members, one of whom excused himself in accordance with the Authority rules for the sole reason that his employer owned property at one of the sites. This left fourteen voting members. On the first ballot, with a bank of television cameras recording the drama, every one of the fourteen members voted for the Wake site. Five days later Chem-Nuclear filed a license application with the Division of Radiation Protection.

### LITIGATION

One obstacle that was encountered in the Authority's efforts to select a preferred site was litigation related to two separate matters. Each has been resolved in the Authority's favor.

Shortly after the two potentially suitable sites were recommended for characterization, Richmond and Chatham Counties each filed suit against the Authority and Chem-Nuclear. Wake County later joined with Chatham County as a co-plaintiff. The original claim by Richmond County dealt with the need for an environmental impact statement before commencing characterization activities. Later, both suits made similar allegations of inadequacies in the site selection and contractor selection processes. These latter allegations were dismissed in the fall of 1991 for "lack of ripeness" based on a recent ruling of the N.C. Supreme Court in a hazardous waste siting case. The dismissal was upheld on appeal, with the Supreme Court reaffirming its position that the courts should not enjoin an administrative process deemed by the General Assembly to be of vital importance until that process has reached its logical conclusion and a permit has been issued.

In a totally separate matter, the N.C. Press Association and several local newspapers sued the Authority claiming that all contractor records are public documents, whether or not they have been received by the Authority. The Authority contended that this is contrary to the clear definition of public documents under North Carolina law, and this suit generally seemed to be an effort to expand the scope of the state's public records law. The initial ruling in the case was clarified on appeal and upheld the Authority's position that contractor documents are not public records until received by the Authority in the proper exercise of its discretion. The courts further stated that there were no allegations or evidence of the abuse of that discretion by the Authority.

### FINANCES

All of the work of the Authority and Chem-Nuclear, including litigation expenses has been funded by two principal sources, State appropriations and funds raised by the Southeast Compact Commission from generators in the region. The State has appropriated approximately \$20 million to date to initiate this project. Another \$45 million has come from access fees and surcharges paid by southeast generators for waste disposed at Barnwell. By the time a license is issued, the Authority will have spent approximately \$90 million, of which about \$25 million will be in state appropriations. All monies which the state has spent in the development of this facility will be repaid with interest from fees charged at the North Carolina facility. Therefore, the waste generators will eventually pay the entire cost, including reserves set aside for monitoring and maintaining the facility during the 100-year institutional care period.

Presently, the Authority plans to finance the cost of facility construction through revenue bonds or private debt financing after the license has been issued. The latest estimate for detailed engineering, facility construction and preparations for initial operations is \$68 million.

### PUBLIC OUTREACH

Just as financing is a necessary support to the Authority's mission, another important underpinning of the North Carolina LLRW siting effort is its ongoing program of public outreach and involvement. During the statewide screening, public outreach activities spanned the entire state. During the characterization phase it was concentrated in the areas around the two sites, and with the preferred site selection it is now focused in the Wake/Chatham county area.

During the characterization phase of the project our main interface with the affected counties was through the Site Designation Review Committees established by North Carolina statute. These committees were appointed by the Boards of County Commissioners and funded by the General Assembly. They received copies of all major project documents, reviewed the ongoing work of the Authority and its contractors, hired technical consultants, and reported to the county commissioners. With the selection of the preferred site in Wake County, the statute provides for the review committees to be replaced by a Preferred Site Local Advisory Committee performing a similar function and funded by a one-time fee paid by Chem-Nuclear.

In addition, both the Authority and Chem-Nuclear produce newsletters, direct mail pieces and newspaper advertisements. Numerous meetings with local landowners and residents have also been important, and trips to the current facility at Barnwell, South Carolina have proven to be very effective at giving a "feel" for the project. Finally, Chem-Nuclear operates a Mobile Information Resources Center which is displayed at schools, shopping malls, conferences, and fairs. An active speakers bureau and radiation science educational program have reached thousands of citizens.

North Carolina law currently provides for a proposed package of benefits to be available to the host community that is finally selected. The Authority has recommended modifications to that package and these recommendations are currently in the hands of a legislative oversight committee.

**SUMMARY**

Since the establishment of the North Carolina Low-Level Radioactive Waste Management Authority in 1987, the siting and development of the disposal facility has proceeded in accordance with the process outlined in the General Statutes and the Authority's siting rules. While the effort has grown in scope, duration, and cost, there has been steady, methodical progress.

The selection of the preferred site and the filing of the license application in December 1993 achieves one of the three milestones which have been established for the facility

development. The review of the license application is underway, with a recent declaration that the application contains enough information for the detailed review to begin. This process is scheduled for completion by the second milestone date, March 15, 1995. Arrangements for property acquisition, detailed design, preparation of the Environmental Impact Statement, and plans for construction are proceeding in order to begin construction immediately upon issuance of the license. This should enable the Authority to open the facility by January 1996, the third milestone date.