

## SELECTION OF CANDIDATE SITES FOR A LLRW DISPOSAL FACILITY IN CONNECTICUT

Ronald E. Gingerich  
Connecticut Hazardous Waste Management Service  
Hartford, Connecticut

George R. Holeman  
Yale University  
New Haven, Connecticut

James A. Hileman  
Battelle Memorial Institute  
Windsor, Connecticut

### ABSTRACT

Connecticut, one of the two members of the Northeast Interstate Low-Level Radioactive Waste Management Compact, has been directed by the Compact Commission to site a facility to manage the low-level radioactive waste (LLRW) generated in Connecticut. The Connecticut Hazardous Waste Management Service (CHWMS) has been given the responsibility to identify a site in the state for a LLRW disposal facility. The CHWMS has decided to plan for a site with an operating life of 50 years. A site of at least 160 acres will be needed to accommodate the expected volume of LLRW and meet state and federal site requirements.

A Site Selection Plan establishing the process and criteria to be used in siting a facility was adopted by the CHWMS in November 1990. The Plan calls for a stepwise screening of the state using published data to identify three candidate sites. A preferred site will be selected from among the candidate sites using onsite testing. The site selection criteria, which closely follow state and federal statutory and regulatory requirements, are divided into three types: exclusionary, avoidance and preference. Battelle Memorial Institute was selected as the contractor to assist the CHWMS in site screening.

With guidance from the CHWMS, Battelle undertook screening of the state by applying the exclusionary, avoidance and preference criteria in three steps to identify from eight to twelve potential sites. The CHWMS Board of Directors had decided that it wanted to be closely involved in the selection of the three candidate sites and to do so in a way that precluded the political and parochial pressures that are inevitably associated with a siting process. To meet these two goals a geographically neutral approach was devised for candidate site selection.

In June, 1991 the CHWMS, with assistance from Battelle, conducted a three day workshop, open to the public, in which eight sites were presented to the Board. Data on the sites were presented in a way that did not disclose the geographic location of the sites. Three candidate sites were selected by the Board after which the location of the sites was revealed to the Board and, simultaneously, to the local elected officials and the public.

### INTRODUCTION

The Low-Level Radioactive Waste Policy Act (Public Law 96-573), enacted by Congress in December 1980, established as federal law the requirement that states take responsibility for providing disposal capacity for commercial low-level radioactive waste (LLRW) generated within their borders. The formation of regional, interstate compacts for managing LLRW was encouraged by this Act. The Low-Level Radioactive Waste Policy Amendments Act (Public Law 99-240) reaffirmed the policies established by P.L. 96-573, established a schedule of milestones and deadlines for the development of new LLRW disposal facilities and provided Congressional approval for seven regional LLRW management compacts. The Northeast Interstate Low-Level Radioactive Waste Management Compact was one of the seven compacts approved.

The members of the Northeast LLRW Compact are Connecticut and New Jersey. The Northeast LLRW Compact Commission has directed both Connecticut and New Jersey to develop a full-service LLRW disposal facility capable of receiving an equitable portion of the LLRW generated by the party states. The Commission recommended that each state

develop a facility capable of managing the LLRW generated in the state.

Connecticut's LLRW disposal facility development law (Connecticut General Statutes section 22a-163 et seq.) assigned the Connecticut Hazardous Waste Management Service (CHWMS) major responsibilities for the development of a facility. The CHWMS is responsible for the following:

1. Selecting a site for a LLRW disposal facility;
2. Selecting a LLRW disposal technology to be used at the facility; and,
3. Selecting a private firm to obtain the required approvals and to develop and operate the facility.

The CHWMS is a nonregulatory, quasi-public corporation established by the legislature in 1983. The CHWMS's original mission was planning for and promoting the appropriate management of hazardous waste generated in the State. That, along with its LLRW responsibilities, continues to be one the CHWMS's primary missions. The CHWMS is directed by a ten-member Board of Directors. Four of the members are the heads (or their designees) of state agencies. The other six are appointed by the Governor for staggered four-year terms. One of the appointed directors must be from

each of Connecticut's six Congressional districts. Two of the six must represent the public, two the business community and two the scientific community. During the screening of sites for a LLRW disposal facility and the selection of three candidate sites, the Board of Directors consisted only of the six gubernatorial appointees. The four state agency heads were added later as non-voting members which they will continue to be until a preferred site is selected for a LLRW disposal facility. The governor selects the chair of the Board who also serves as executive director of the CHWMS.

Connecticut annually ships between 30,000 and 45,000 cubic feet of LLRW to disposal facilities. Approximately 70% of the LLRW comes from the state's four nuclear power plants (three PWR's and one BWR). The remainder comes from public and private research facilities, the military and a variety of industrial firms. LLRW volume projections for the planned 50-year operating life for a LLRW disposal facility in Connecticut range from 3.1 million to 9.5 million cubic feet. Currently, the most likely volume is projected to be between 4 million and 5 million cubic feet. Approximately half of the LLRW would be from decommissioning the four nuclear power plants. Even with operating license extensions, all four nuclear power plants will probably be decommissioned during the operating life of the disposal facility. To accommodate this amount of waste and the buffer and security zones required by state agencies, the CHWMS will need between 160 and 250 acres of land of which at least 70 acres will actually be used for waste disposal.

The CHWMS has not yet selected a disposal technology for use in the state but it has decided not to use shallow-land burial. It is likely that the technology that will be selected will consist of concrete canisters emplaced in above-ground, earth-mounded concrete vaults.

The CHWMS is in the process of negotiating a contract with Chem-Nuclear Systems, Inc. to become the facility developer/operator. Under state law, the facility developer/operator cannot have participated in the selection of the site for the disposal facility. Therefore, the CHWMS has used a different contractor, independent of Chem-Nuclear, for site screening, selection and characterization.

The CHWMS selected Battelle Memorial Institute as its siting contractor. As such, Battelle is responsible for assisting the CHWMS in site screening, critical testing of candidate sites, selection of a preferred site and complete characterization of the preferred site.

#### SITE SELECTION PLAN

The initial step in selecting a site for a LLRW disposal facility in Connecticut was preparation of a Site Selection Plan. The Plan sets out the approach and procedures to be followed in selecting a site and the criteria that a site must meet in order to be selected. The CHWMS published a draft Site Selection Plan in May 1989. The CHWMS conducted numerous public meetings on the draft plan and received comments from over 70 individuals and organizations. The CHWMS analyzed the comments, prepared responses to them and, where appropriate, made changes in the draft Plan. In November 1990, after 18 months of public review and comment, the Board of Directors of the CHWMS adopted the Plan.

The Site Selection Plan prescribes a stepwise approach for screening the entire state to identify a preferred site for the LLRW disposal facility. The process consists of four steps:

- Step 1. Statewide screening to identify areas that might contain potentially suitable sites,
- Step 2. Area and volunteered area screening to identify potentially suitable sites,
- Step 3. Evaluation and comparison of potentially suitable sites to identify three candidate sites for characterization, and
- Step 4. Characterization and comparison of three candidate sites to select a preferred site for full characterization.

This paper describes the methods and results of the first three steps.

Site screening and choosing a preferred site are controlled by the site selection criteria specified in the Site Selection Plan. The intent of the criteria is to provide an objective, factual basis for eliminating unsuitable sites and comparing the merits of suitable sites.

There are three types of site selection criteria:

- Exclusionary criteria - identify characteristics which, if present, eliminate land from further consideration;
- Avoidance criteria - identify characteristics which should be avoided, if at all possible, but could be present at a site; and
- Preference criteria - identify characteristics more desirable on a relative basis.

One of the CHWMS's goals in developing the siting criteria was to define at least one criterion that mirrored as closely as possible the intent of each requirement in state and federal statute and regulation related to a LLRW disposal facility. In many cases additional criteria were developed to more fully address a requirement. For example, in the draft Plan there was a criterion excluding from the disposal area land classified as federal wetland. This exactly mirrored the Nuclear Regulatory Commission (NRC) prohibition on disposing of waste in a federal wetland (Code of Federal Regulations, Title 10, Section 61.50(a)(5)). In addition, there was a criterion avoiding federal wetlands for the buffer zone and another criterion preferring land further away from federal wetlands.

While some criteria were modified in response to concerns expressed by a statutorily established advisory committee and in the public review and comment process, on the whole the criteria still implement the full intent of the state and federal laws and regulations from which they were derived. For example, in response to public comments, the federal wetland exclusion criterion was expanded to the whole site rather than just the area that would be used for disposal. That resulted in the elimination of the avoidance criterion that was in the draft Plan, but the preference criterion was retained.

This approach resulted in 94 criteria, of which 26 are exclusionary, 16 are avoidance and 52 are preference. All of the criteria used in Steps 1 and 2 were exclusionary or avoidance criteria. It was not until Step 3 that preference criteria were applied. Because the screening leading to three candidate sites was conducted using only data published on a statewide basis, not all of these criteria have yet been applied

in site screening. Most criteria have been applied and, by the time preferred site selection is complete, all will have been applied. While some have characterized the number of criteria developed by the CHWMS as excessive and overly restrictive, the CHWMS has found that the specificity that this number of criteria has allowed has been extremely helpful in conducting and defending site screening.

To add a degree of conservatism to the process, the CHWMS decided to apply the avoidance criteria as if they were exclusionary, providing suitable lands remain for consideration.

The site selection criteria are also grouped into categories of relative importance. The Board was assisted in developing these categories by a statutorily established citizens advisory committee. These ranked categories determine when a preference criterion is first applied in the screening process. The criteria are ranked by subject areas as follows:

High Rank	Water quality
	Hydrogeology
	Geology
	Hydrology
Medium-High Rank	Demography
	Transportation
Medium Rank	Site size
	Adverse economic impact
	Land use
	Natural resources
	Environmental resources
	Habitat areas
	Site acquisition cost
	Cultural/aesthetic
Low Rank	Air Quality

#### GEOGRAPHICALLY NEUTRAL APPROACH

In preparing the Site Selection Plan and during the early phases of site screening, the Board of Directors made some decisions that had a profound effect on the conduct of site screening and the selection of candidate sites. The Board decided the following:

1. It wanted to be an active participant in the selection of the three candidate sites;
2. It wanted to eliminate political pressures and geographic and parochial biases, either real or perceived, from the candidate site selection process, and to be strictly impartial in its deliberations.

To meet these Board requirements, CHWMS staff and Battelle devised a geographically neutral approach for the Board's selection of three candidate sites. The term "geographically neutral approach" implies that data that describe the potential sites are presented to the Board in a manner that the true geographic locations of the sites are not evident. This approach has several components and implications.

Consistent with the Site Selection Plan, activities and intermediate results in the site screening process were not made public. In addition, to allow for a geographically neutral approach, intermediate results were not revealed to the Board. Therefore, when the Board selected the three candi-

date sites, it knew the characteristics of the sites, but not their locations. Neither the Board nor the public knew the locations of the sites until after the selection was made.

The Board's desire to be an active participant in the selection of the candidate sites meant that it wanted to make the decision rather than merely approving a recommendation from staff. To accomplish this, it was decided to present to the Board between eight and twelve potential sites with extensive data on each. Neither the CHWMS staff nor the contractor made any recommendations on the candidate sites.

To eliminate political pressures and geographical and parochial biases from the decision-making process, the results of intermediate steps in the site screening process could not be revealed to the Board, which also meant that they could not be revealed to the public. This approach also had the effect of reducing the number places in the state that could be subject to the negative impacts arising from simply being identified as under consideration for a LLRW disposal facility. The strict impartiality of the results is supported by the fact that the sites are quite close to one another and that one site is in the home town of a Board member.

#### SITE SCREENING

After the Board adopted the Site Selection Plan in November 1990, Battelle began to implement the Plan. Site screening was performed according to the process specified in the Plan to select eight potential sites which were considered by the Board.

As the exclusionary and avoidance criteria were applied, land was eliminated and boundaries of sites were changed. Site boundaries were not changed as preference criteria were considered, except as some lands were deferred for steep slopes. Boundaries were also changed as a Step 3 demography criterion was re-evaluated in the final stages before the Board workshop.

##### Step 1 Screening

Step 1 exclusionary criteria removed lands with characteristics such as public drinking water sources and watersheds, protected aquifers, major watercourses, river conservation zones, 100-year floodplains, coastal storm surge areas, state parks and forests, and historic places and districts. The avoidance criteria removed urban centers, rural community centers, urban growth areas, and existing preserved open spaces.

At the end of Step 1 screening, over 700 areas covering approximately 33 percent of the state's total land area remained under consideration.

##### Step 2 Screening

Step 2 exclusionary criteria removed federal wetlands and areas with less than 160 acres, the minimum size of a facility in Connecticut. The avoidance criteria removed state wetlands, certain agricultural lands, and municipal open spaces and forests. Wetlands are numerous and distributed widely across Connecticut. Application of the wetlands criteria had a substantial impact on the screening process.

Battelle sent a letter soliciting volunteered land areas to the chief elected official of each town in Connecticut, to each public utility and to real estate associations. As a result of this letter and general publicity about the project, 11 areas were identified as possible volunteered sites. These land areas were integrated into the screening process near the end of Step 2.

Nine of these areas were not suitable because of the exclusionary and avoidance criteria. The two remaining areas were deferred later by the criterion to prefer lands with slope less than 15 percent.

At the end of Step 2, the amount of land under consideration had been reduced from 33 percent to about 11 1/2 percent, but the number of discrete units of land under consideration had increased from about 700 to about 950. The increase occurred because the elimination of wetlands divided several of the larger Step 1 areas into two or more smaller Step 2 potential sites.

### **Step 3 Screening, Exclusionary and Avoidance Criteria**

Step 3 screening used exclusionary and avoidance criteria, as in prior steps, as well as preference criteria. The Step 3 exclusionary criteria concern known natural resources and critical habitats for threatened and endangered species. Data for both criteria consisted of point locations that were compared with the areas being considered. Other Step 3 exclusionary criteria, deferred because the required data were not available until onsite studies are possible, address capability for hydrologic modeling, surface geologic processes, local flooding or ponding, and the effects of nearby facilities on site performance objectives.

Step 3 avoidance criteria removed lands with seasonal high water table (less than 5 feet deep), projected population growth, ancient burial places and critical habitats. Other Step 3 avoidance criteria, deferred because they required data not available until onsite studies are possible, address surface and subsurface water sources in 50-year water plans, surface geologic processes and poor drainage.

After all the exclusionary and avoidance criteria in Steps 1, 2, and 3 had been applied, only about 7 percent of the state's area remained for consideration as approximately 550 separate areas.

### **Step 3 Screening, Preference Criteria**

The purpose of the preference criteria is to compare sites that are otherwise suitable, i.e., not having characteristics that cause land to be excluded or avoided. Most of the preference criteria are qualitative factors. Preference is given to sites that cause less impact, are farther from certain conditions, are easier to evaluate, etc. The preference criteria are grouped according to the criteria ranking (high rank, etc.) discussed earlier. This ranking gives a relative importance to groups of preference criteria, but does not give, or imply, a numerical weighing.

Within the high rank preference criteria, the criterion to prefer land with slopes less than 15 percent is unique because it has a stated threshold and also differentiates significantly among potential sites. Although listed as a geology criterion, it also relates to several other criteria. For example, steep slopes generally imply a short distance to bedrock and, therefore, little soil cover to aid in retardation of radionuclides if a release were to occur.

Steep slopes were identified by using both soil classifications and topographic maps. Applying this slope criterion resulted in identifying 45 potential sites as preferred over other sites having significant portions of their land with slopes greater than 15 percent. A Step 3 criterion to avoid lands with projected population growth was re-examined during two

workshops convened by Battelle and attended by CHWMS staff and contractors. This re-examination caused 17 sites to be avoided leaving 28 remaining for consideration.

Data were compiled, as available, for each remaining preference criterion for potential sites. For each criterion, grading standards were developed so that the sites could be graded relative to each other. Data compilers assigned initial grades of A, B, or C. Both the grading standards and the assigned grades were reviewed by a panel of CHWMS staff and contractors for initial application, and by the Board for application to the final round of sites.

A stepwise weighing approach was used to apply the preference criteria. The highest rank preference criteria were applied first to identify the better potential sites to be carried forward to the next lower rank. The process continued rank-by-rank until the desired number of potential sites were identified. Sites not carried forward were deferred for possible later consideration, but were not eliminated. This method places the most weight on the high rank preference criteria, less weight on the medium-high rank preference criteria, and still less weight on the medium rank preference criteria.

The 28 potential sites were considered using the high and medium-high rank preference criteria during the CHWMS staff and contractor workshops. The workshop panel was composed of professionals with expertise in hydrogeology, hydrology, geology, environment, engineering, the Site Selection Plan, and the federal licensing process. At the end of the two workshops, eight final round sites had been identified for consideration by the Board.

The Board considered the eight final round sites during a properly noticed public workshop. At the Board's request, the sites and site data were presented to them in a manner that did not reveal the geographic locations of the sites. The Board examined the data, grading standards and grades for all criteria for the eight sites. The Board was presented with the same data in a format allowing the sites to be compared. The grades were combined by assigning 3, 2 and 1 for grades A, B, and C respectively, and summing the scores for each rank of the criteria. The Board then selected the three preferred sites using a stepwise weighing approach similar to that used in the CHWMS staff and contractor workshops.

The three candidate sites selected are the following:

- Griffin Road Site, a site lying across the eastern portion of the town line separating East Windsor and South Windsor,
- Frog Hollow Road Site, a site lying in the southwest corner of the town of Ellington,
- Pinney Road Site, a site also lying in the southwest corner of the town of Ellington.

The three sites are close to each other (within two miles of each other) and are located in the north central part of the state about 12 miles northeast of Hartford.

As described above, site screening was performed according to the process specified in the Site Selection Plan resulting in eight potential sites which were presented to the Board. The Board, in a workshop, selected the three candidate sites following the geographically neutral approach devised by Battelle and CHWMS staff. With identification of the site locations to the Board and the public, the process for selecting three candidate sites was completed.