

# THE TRIAD: MAINE'S SITING METHODOLOGY, QUALITY ASSURANCE, AND FINANCIAL COSTS FOR A LOW-LEVEL RADIOACTIVE WASTE DISPOSAL/STORAGE FACILITY

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## ABSTRACT

Three of the most visible aspects of the siting process for a low-level radioactive waste (LLRW) disposal facility are its Siting Methodology, Quality Assurance Program, and Costs. The Siting Methodology must maintain its technical credibility to be successful; Maine has used a top-down screening of the State, combined with a volunteer program, and used technical criteria throughout, thus validating its Siting Methodology. The Quality Assurance Program must ensure that both the regulators and the public are satisfied with the process; the Authority's Quality Assurance Program continues to evolve and the *Quality Assurance Plan* has been subjected to Nuclear Regulatory Commission (NRC) review. Projected facility costs are escalating, in large part due to the high cost of litigation; Maine continues to update its facility life-cycle cost estimates as new data becomes available.

## INTRODUCTION

Maine, an unaffiliated state, has been proceeding in accordance with state and federal laws to site a storage/disposal facility within its borders, if necessary. In 1988, when the Authority decided to adopt a top-down screening methodology, it established the basis and formation of a Citizens Advisory Group (CAG), facilitated by Endispute of Cambridge, Massachusetts. The CAG has been involved with the siting methodology process since the beginning. The CAG has participated in monthly Authority meetings and their own monthly meetings, as well as Authority special committee meetings and the rule making process. The CAG has had a great deal of input and influence on the exclusion, avoidance, and preference factors.

Concern for Maine's environment has led the Authority and CAG to focus on a technical screening process as pointed out by Scott, et al (1). However, the reality is that politics will be involved in the final decision to find an acceptable site, since approval by the host community, the entire state, and the legislature is required. The search has now been narrowed down to 6 technically suitable candidate sites for characterization. A decision regarding how and which sites to select for characterization is forthcoming.

## SITING METHODOLOGY

In the very beginning, it was recognized that a Citizens Advisory Group would play a key role during every step in the low-level radioactive waste site selection process. Laws and Susskind point out that the approach of citizen involvement does not prove that their "credo" concept would succeed (2). The process established is important and must recognize basic concepts of citizen input. In fact, the Maine LLRW Authority goes to the extreme of reimbursing citizen activists for their mileage and meals for taking advantage of the opportunity to participate. This has set a precedent, since no other State agency, commission, or board pays expenses for public participation. This was initially voluntarily adopted as Authority policy and later included in the CAG's enabling legislation.

Maine's siting methodology has been described by Williams, et al (3). The siting methodology is a pragmatic basis for focusing further studies by successively identifying the most suitable regions, areas and sites for increasingly detailed investigation. The siting criteria were intended to be guidelines for generating screening maps on a Geographic Information System (GIS). These factors do not have the force of regulation. Applicable federal and state laws will take precedence in ultimately determining the suitability of any Preferred Candidate Sites (4).

The Authority utilized fundamental performance factors to identify any areas where unique natural conditions existed. These conditions would most likely enhance the long-term performance of the facility by providing barriers to groundwater flow and radionuclide migration. These are considered important for optimum site performance because they supplement the engineered barriers within the facility. Effective natural barriers will significantly retard the movement of radionuclides, in the unlikely event of a leak from the facility. Also, they provide a technical basis for determining the size of buffer zones in which long-term monitoring and remediation can be safely accomplished (5).

In addition to selecting sites based on their natural performance characteristics, the Authority has contracted the University of Maine at Orono to perform both a conceptual facility design study and a feasibility study regarding the use of engineered soils beneath the facility. The conceptual design study, completed in February 1992 and reported in *Conceptual Design for Low-Level Radioactive Waste Disposal in Maine*, recommends an above-ground, building within a building facility (6). In addition to being peer reviewed by members of the TCC, the report has been reviewed by the NRC. Although their initial comments expressed concern with the facility's design and its maintenance requirements, recent statements by Ivan Selin, Chairman of the NRC, have shown a willingness to consider new concepts.

The engineered soils study, expected to be completed by September 1993, is exploring the feasibility of using engineering techniques to improve upon the soil characteristics. The

goal is to enhance the performance characteristics of an already technically suitable site to minimize radionuclide migration and maximize adsorption.

Through the combination of a technically suitable site, an engineered, above-ground, building within a building facility, and soil enhancements, all performance standards can be met or exceeded.

We are all aware that facility siting is difficult due to the "Not In My Back Yard" (NIMBY) syndrome. There are opportunities for wide disagreement in our CAG process, and to achieve success will be most difficult, since many of the stakeholders have little or no faith in government.

Maine has sought acceptable sites through a volunteer process and many landowners came forward but not one town in Maine has volunteered. One community expressed some interest, but no suitable parcel of land was found, based on the established performance factors. This was part of the Authority's dual track system (3).

All aspects of the siting process have included citizen involvement, communication with municipal officials, and landowner interest. Every site evaluated had strong citizen participation with outside activists infiltrating the community and establishing fear in the minds of many local citizens. Municipal acceptance was discouraged through officials' fear of not being re-elected, the "Not In My Term Of Office" (NIMTO) syndrome. The only major success came with volunteer property owners who wanted to sell land. This was done with great protest from anti-nuclear activists classifying the option payments as "blood money" or "bribe money." Any tactic possible was used to discourage landowners from coming forward. Many landowners of some sites did not want to sell, nor do they today, because of potentially bad public relations. They too would rather ignore the issue. However, the few cooperating landowners have allowed us to find suitable sites in Maine that appear to meet the Authority's established criteria.

### CITIZENS ADVISORY GROUP

The Authority is committed to obtaining advice and recommendations from a varied cross-section of the citizens of Maine. Additionally, the Authority recognizes the importance of providing information to the public to foster an understanding of the issues surrounding LLRW. To achieve these goals, the Authority founded and continues to support the activities of its Citizens Advisory Group. The goals of the CAG are to:

- Advise and make recommendations to the Authority which will result in the safest possible management of Maine's LLRW;
- assist the Authority in evaluating its siting policies; and,
- understand and share information with interested groups and citizens in order to help the Authority and the people of Maine reach the wisest and fairest decisions in managing Maine's LLRW.

The CAG represents a diverse group of concerned citizens and representatives from organizations interested in and knowledgeable about LLRW generation and disposal. Due to cost concerns and a desire to utilize in-state expertise wherever possible, the Authority terminated its contract with Endispute in March 1992, and hired John Selser, from Readfield, Maine, to serve as interim facilitator of the CAG. In July, John Selser was hired as permanent facilitator, based on a unani-

mous recommendation of the CAG's Facilitator Nominating Committee.

The CAG was established statutorily via legislation signed in late March of 1992. The legislation specifies that the CAG must consist of at least 20 members, representing such groups as business, labor, environmentalists, public interest organizations, LLRW generators, municipal officials, government agencies and any other interested citizen or group. Unfortunately, to date virtually no representation from the business field has surfaced. The legislation went on to define the duties of the CAG, which are to:

- Assist the Authority to accomplish its purpose in a constructive and effective manner;
- advise the Authority with respect to Authority policies and procedures;
- analyze issues before the Authority and provide the Authority with constructive comments and analysis in regard to these issues;
- consider, on its own initiative, any issue or policy relating to LLRW; and,
- consider and advise the Authority with respect to storage requirements, waste reduction and the disposal of LLRW.

The legislation also specifies the Authority's responsibilities to CAG, which are, in consultation with the CAG, to:

- Develop and adopt procedures that encourage active public participation in matters before the Authority;
- develop and adopt guidelines that encourage active public participation by all members of the CAG;
- develop agendas for the CAG with respect to matters that are before the Authority; and,
- provide a facilitator to organize and operate the meetings of the CAG and to keep the CAG focused on its responsibilities.

This group of citizens, as a majority, have slowly and painfully come to realize that Maine cannot abandon its responsibility under federal and state law. This is with the caveat of the recent Supreme Court decision regarding the so-called "take title" provision. A small minority of the CAG want to shut the Authority down based on that decision. Fortunately, the majority want to act responsibly, to work towards a solution, keeping the process technical as far as possible. The Authority wants a technically suitable site that could be licensed under state and federal law.

### QUALITY ASSURANCE

The goal of the Authority's Quality Assurance (QA) Program is to someday have a successfully sited, designed, constructed and operating LLRW disposal facility. To achieve this rather lofty goal, the Authority must satisfy both the regulators, to obtain permits or licenses, and the public, to obtain acceptance for the facility. The Authority's QA Program is designed to help achieve this goal and satisfy all parties.

The *Code of Federal Regulations*, Title 10, Part 61 (10 CFR 61), states that a quality control program must be in place for site characterization and subsequent phases of the project (7). NUREG-1199, *Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility*, suggests that a quality assurance program be developed to



accompany the quality control program required in 10 CFR 61 (8). NUREG-1293, *Quality Assurance Guidance for a Low-Level Radioactive Waste Disposal Facility*, provides an outline for developing a QA program which satisfies the requirements of 10 CFR 61 (9). The 18 criteria in NUREG-1293 are similar to those developed for 10 CFR 50, Appendix B (10). Although 10 CFR 50, Appendix B is not a regulatory requirement for a LLRW disposal facility, its criteria are considered basic to any QA program.

### **The Authority's Approach**

The NRC requires that a QA program be in place prior to the start of the characterization phase. The Authority decided to begin development and implementation of its QA Program well in advance of the NRC mandate. The Authority also adopted a phased, or modular, approach to the development and implementation of its program. In this manner, as each phase of the project (pre-characterization, characterization, design, construction, operations, operational monitoring, closure, post-closure and post-closure custodial maintenance) is initiated, it will have the QA Program tailored to it as necessary.

There are advantages from both the Authority's early start in developing and implementing its QA Program and in its utilizing a modular approach to the program's development and implementation. These advantages are:

- Being able to "fine-tune" our QA Program in a real-life environment before it is mandated.
- Validating the data collected during the pre-characterization phase, thereby supporting the decisions which have been made, based on this data, regarding which sites to study further.
- Allowing the Authority to judiciously allocate its available resources.

### **Quality Assurance Program**

In addition to being modular, the Authority's QA Program is multi-layered. The components of the program are: *Quality Assurance Plan*

The Authority's *Quality Assurance Plan*, which was initially developed for the Authority by Stone & Webster Engineering Corporation, consists of 20 sections (11). The first 18 sections correspond to the 18 criteria laid out in 10 CFR 50, Appendix B and NUREG-1293. The last two address additional concerns specific to the siting process; field operations, criteria 19, and data gathering and analysis, criteria 20. These criteria were adopted from the Environmental Protection Agency's QAMS 004/80 and 005/80 (12,13).

As an additional method of ensuring that our QA Program is fully functional prior to the NRC mandate, the Authority's *Quality Assurance Plan* was submitted to the NRC for review in July of 1992. While generally satisfied with the Authority's plan, the NRC did have some concern that the scope of the plan was inadequate. Since the current revision of the Authority's plan is specifically tailored to pre-characterization, there are some areas which have purposely not yet been addressed. These areas will be addressed in subsequent revisions of the *Quality Assurance Plan* as it evolves throughout the phases of the project.

### **Quality Assurance Manual**

The Authority's *Quality Assurance Manual* resides below the *Quality Assurance Plan* and contains its implementing procedures and guidelines. Information contained within these procedures and guidelines pertains to the operations of both the Authority and its contractors.

### **Quality Management Procedures**

Quality Management Procedures (QMPs) implement the requirements established in the QA Plan. QMPs are criteria-specific; therefore, some criteria may not have QMPs associated with them for any phase of the project. The QMPs describe the activities that must be performed to satisfy a particular criteria. QMPs also assign the responsibilities for each activity.

### **Quality Management Guidelines**

Quality Management Guidelines (QMGs) provide specific guidance on how activities described in their associated QMPs are carried out. QMGs are used to further explain activities which are sufficiently complex to require such explanation. As most activities in the QMPs are straightforward, most do not have associated QMGs.

### **The Pre-Characterization Phase**

The initial *Quality Assurance Plan* was adopted early in the pre-characterization phase. The original plan was very broad-based and purposely general in nature. Revision 1 of the plan, adopted in May 1992, begins to detail the quality process, through references to a series of Quality Management Procedures. These QMPs cover such areas as: Graded approach to QA; training guidelines; procurement; document control; supplier evaluation; handling and storage of samples; records management; and, auditing and corrective/preventative action. Several of these QMPs have been completed and approved; those remaining will be completed by mid-1993. This plan, in conjunction with Stone & Webster's *Quality Assurance Plan (Management Plan for Project Quality) for Site Pre-Characterization*, was the basis for the QA/QC activities during pre-characterization and leading into characterization (14).

### **The Characterization Phase**

For the characterization phase, the QA Program will build upon the current (pre-characterization) program, and add specifics as necessary. QMPs, and their associated QMGs, will be developed to address: Control of processes; control of measuring and test equipment; control of nonconforming items; site operations and management; and, data gathering and analysis.

### **Total Quality Management**

In its constant quest for quality and excellence, the Authority has embarked upon the Total Quality Management (TQM) journey. The Authority's TQM Program will integrate both those functions which are traditionally considered QA and administrative functions. This will allow all Authority operations to exist and be carried out under the Total Quality umbrella.

### **The Future**

While none of us can foresee the future, it is evident that the process of siting, designing, constructing and operating a LLRW facility will be long and arduous. The facility, and the

process, must satisfy a disparate group of "customers." Regulators must be satisfied that all performance objectives have been met or exceeded; the public must be satisfied that the facility will protect both the public and the environment from releases of radiation; and, the generators must be satisfied that the facility provides safe, cost-effective disposal of LLRW. We feel that with today's technology and an absolute commitment to quality, we can achieve these goals.

#### NATIONWIDE COSTS AND PROSPECTS FOR SUCCESS

As shown in Table I - "SITING COSTS", thus far the cost in the U.S. has been nearly 300 million dollars, with no disposal site yet established in any of the nine compacts or ten unaffiliated states. Opposition groups have been very successful to date in blocking any new disposal facility being built. They challenge knowledgeable expertise with unfounded fear and our lack of guarantees. The public perception created is that radiation is bad, due to the past two generations of atomic bomb detonation, the Department of Energy's past track record of poor public relations about the disposal issue, and the three commercial LLRW disposal sites that have been closed due to operational problems.

When Congress established the Low-Level Radioactive Waste Policy Act in 1980, and the Low-Level Radioactive Waste Policy Amendments Act in 1985, it did not envision the protracted pace of siting as pointed out by Gruber (15,16,17). New York, Connecticut, and Vermont were the first states

unable to establish a site based on their processes. Then came the large compact states of California and Illinois, who got bogged down after spending over 100 million dollars. Nebraska is now tied up in the legal process without being successful in finding a site, largely due to politics. When Congress, in 1980, made a decision based on the three sited states' action, it was political because three states were responsible for taking waste without fairness and equity. Should Congress have taken the responsibility of establishing equity for those states? Hindsight is often 20/20.

At Beatty, Richland and Barnwell we have disposed of 122,880 m<sup>3</sup>, 338,492 m<sup>3</sup>, and 660,705 m<sup>3</sup>, respectively (18). These states claim that they have done their fair share. What if no state in the U.S. succeeds in the process of siting a LLRW facility?

The hospitals, pharmaceutical firms, medical research and academic institutions will have to close or discontinue their treatment and research. Congress will be forced to revisit the LLRW Policy Act and its Amendments Act. If we, as public administrators, have to communicate policy to the public then it should be good policy. Bad policy can never lend credibility to government. However, we need the support of the silent majority on this issue.

#### COSTS AND BENEFITS IN MAINE

As well meaning as we have been in Maine in carrying out our policy, the process has been costly. Table I lists the costs and comparisons between compacts and states. The cost per

TABLE I  
Siting Costs

Compact (Host State) or Unaffiliated State	Costs as of 2/31/92 (\$M)	Number of Commercial Reactors	Cost per Reactor (\$M)	Population (Millions) 1990 Census	Cost per Capita (\$)
Appalachia (PA)	15	11	1.36	19.2	0.78
Midwest (OH)*	0	10	0	0	0
Central (NE)	45	7	6.43	21.7	2.07
Central Midwest (IL)	85.6	13	6.58	15.2	5.63
Rocky Mountain (CO)	0	0	0.00	6.0	N/A
Southeast (NC)	30	33	0.91	47.3	0.63
Southwestern (CA)	41	8	5.13	34.8	1.18
Northeast (CT,NJ)	5	8	0.63	11.0	0.45
Northwest (WA)	0	2	N/A	13.3	0.00
Maine	8	1	8.00	1.2	6.67
Massachusetts	1	2	0.50	6.0	0.17
Michigan*	6.6	5	1.32	9.3	0.71
New York	35	6	5.83	18.0	1.94
Texas	18	4	4.50	17.0	1.06
Vermont	4	1	4.00	0.5	8.00
Washington, D.C.	0	0	N/A	0.6	0.00
New Hampshire	0	1	N/A	1.1	0.00
Puerto Rico	0	0	N/A	N/A	N/A
Rhode Island	0	0	N/A	1.0	0.00
Totals	294.2	112	2.63	N/A	N/A

\* The compact has recovered 1.9 million in funds that were transferred to Michigan from utilities operating in the other member states. Michigan's membership in the Midwest Compact was revoked. Ohio has been designated the new host state.

capita column is perhaps the most striking. Illinois (host state for the Central Midwest Compact), has spent \$5.63 per person thus far, with a population of 15.2 million. In comparison, Maine has spent \$6.67 per person with a population of 1.2 million. Vermont has the highest per capita expenditures, \$8.00 per person, while New Hampshire, with one reactor, has not spent anything in its siting process. Can we conclude that New Hampshire may have made the right decision?

Most critics in Maine say that the Maine LLRW Authority's process is destined to fail. Its search thus far has been costly and controversial. The current legislature in Maine wants to make some changes. A "top-down" approach is considered doomed by many. To begin with, who would vote for such a facility in their back yard? The answer: only people who are fully educated, want to volunteer, and are not coerced in any way. In Maine, we thought the elimination of deadlines and the CAG process with volunteers would come as close as one could to a combined approach. Maine now realizes the costs for disposal of our small volume of waste will be very high. In Vermont, a 30-year life-cycle was estimated at \$130 million. Most Maine legislators did not know or realize how costly this process can be and some now want to impose a two-year moratorium on the siting process.

In Maine, the money spent to date has provided benefits that extend far beyond the actual site search process. We have provided much of the basic equipment, and significant staff hours, for a Geographic Information System (GIS) that has enabled the state to upgrade their total mapping capabilities. This included the development of a digital GIS database, at the Maine Geological Survey, which could be used to exclude certain surficial geology units from siting consideration. Some of these were: sand and gravel aquifers, surface water features, wet areas and wet soils, fish and wildlife management areas, state and federal parks and wilderness areas, lands above 2700 feet elevation, built up areas, and buffer areas to state and national boundaries.

Funds were also used to provide equipment to set up a GIS training program at the University of Maine at Farmington. Students from this location have undertaken some of the digitizing work and provided necessary staff hours to carry out part of the Authority's program.

Additional information layers have been digitized and are available for use by other agencies. These data layers include State Parks, State Recreational and Trust Lands, Maine Forest Service Property, Maine Wildlife Preserves, State Fish Hatcheries and other State owned lands, along with Federal Parks, National Forests, other Federal Lands, Indian Lands, Wilderness Areas and State Monuments.

There is also a trickle down effect from the Authority's process in that considerable information and technical data is now being used not just by other state agencies, but also by various county and municipal boards. The Maine Waste Management Agency has been involved in the siting process for an ash disposal site and several regional landfill locations. There has been no need for them to expend resources to secure the geographical and technical information that is necessary for their siting process as it is already complete and available.

The Authority has entered into several cooperative projects with the U. S. Department of Agriculture, the University of Maine, the Department of Inland Fisheries and Wildlife and the Natural Heritage Program of the Office of Community Development. The purpose of these projects was to secure more detailed information once candidate regions and

areas were determined. This valuable information is now more complete and has provided benefits to these agencies as well as the siting process. This has resulted in a total benefit of approximately \$1.5 million to the citizens of the State of Maine.

## SUMMARY

Siting a LLRW facility in Maine, or any other state, is not going to be easy because of the politics surrounding this pernicious issue. The technology being applied today is light years ahead of that used in 1962. We are faced with totally different environments and performance standards. New technology is now available to consider.

Our *Quality Assurance Plan* has received positive reviews and it is the Authority's objective to have the overall Quality Assurance Program fully accepted prior to the start of site characterization.

Costs are going to continue to be a major factor in the public's perception of the process. It will remain difficult to explain and justify the magnitude of the costs to a public which doesn't understand all that is involved. Costs will continue to soar, and the perception becomes that if it costs so much, it must be inherently "dangerous." This tends to fuel the unfounded fears.

The only way to ensure the possibility of success is to utilize the best technology available, communicate openly and honestly with the public, and establish and maintain the highest standards of quality and ethical conduct.

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