

DEVELOPING A RADIOACTIVE WASTE MANAGEMENT PLAN  
FOR THE SOUTHEAST COMPACT REGION

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ABSTRACT

The Southeast Compact Commission is addressing the region's needs for waste management capabilities to succeed those currently available at Barnwell, S.C. This entails an assessment of projected demand for services, appropriate technology and location of facilities to enable evaluation of total systemwide impacts on public health and safety, the environment, and the regional economy.

Procedures were adopted by the Commission whereby a member state may volunteer to host a facility; each member state will submit the conditions under which it would agree to host a treatment and disposal facility with the intent of obtaining agreement among the members on a submitted proposal; or the Commission may designate a host state based on application of objective criteria. Dames & Moore was retained to recommend a management plan (including numbers and types of facilities needed) and host state identification criteria and guidelines for intrastate siting criteria in support of the last option, the designation process.

The study effort reported here provides the Commission with both an independent technical evaluation of alternative technologies and methodology for applying that evaluation to determine systemwide impacts. Recommendations include near term actions to meet Barnwell volume limitations and a new enhanced shallow land burial facility for operation after 1992. The Commission's planned actions and current schedules for achieving its objective of meeting long-term waste management needs at a new facility are also discussed.

SUMMARY AND CONCLUSIONS

The Southeast Compact Commission has adopted a Regional Plan<sup>1</sup> for management and disposal of low-level radioactive waste generated in its eight state area. Dames & Moore provided technical analysis and data<sup>2</sup> to support the Commission in developing its Plan in two general categories. The first deals with the wastes per se; quantities, storage, treatment and disposal ("Management Plan") and the second with the siting issues in a multi-state region ("Siting Methodology").

The effort in the "Management Plan" involved characterization of the waste source requiring Commission action and an evaluation of available management facilities and treatment technologies. The recommendations made for both near-term action (through 1991) and longer-term action involving a new facility are summarized in Table I. These were reached by application of quantifiable technical criteria with relative importance weightings assigned to the criteria in a Delphi participation process by members of several committees appointed by the Commission. Protection of public health was the fundamental concern in all decisions. The successful efforts to address near-term issues on a national level (in accordance with the Low-Level Waste Policy Act Amendments passed in December 1985) made the near-term recommendations academic. However, the Commission was ready to assume its responsibilities as of January 1, 1986 had the bill not been passed (a distinct possibility in summer 1985 when this effort was completed). The basic

long-term recommendations are reflected in the Commission's Regional Plan which provides for a single new, land-based disposal facility to be in operation by July 1991. The facility must as a minimum meet all Federal requirements concerning the land disposal of low-level radioactive waste, be designed to operate for at least 20 years at annual receiving rates between 800,000 and 1,600,000 cubic feet. Facility design specifications and ancillary treatment are not mandated in the Regional Plan but would be considered the responsibility of the host state.

The "Siting Methodology" provided a basis for the Commission's designation of a host state and guidance to that state in its site selection effort. Designation of a state to host a disposal facility would be accomplished prior to designation of another state for a treatment facility (if any) under procedures adopted by the Commission. The criteria adopted by the Commission for disposal facility designation are shown in Table II. Similar criteria were recommended to the Commission as guidance for host state site selection efforts. It was noted that the scale and level of detail available for intrastate investigations may result in identifying an acceptable site in area excluded from consideration in the regional screening.

Subsequent Commission action is needed to weight each of these criteria, and apply them in ranking the states in order to designate the host for a new facility. This process is in progress and is currently scheduled to result in host state designation in July 1986.

Table I

## Summary of Management Plan Recommendations

## Short Term (Through 1991)

- o Arrange for continued access to Richland for the small quantities of material (such as liquid scintillation vials, contaminated oil, absorbed liquids, and naturally occurring materials such as radium) not accepted at Barnwell because of waste characteristics.
- o Based on the nominal waste projections in this period the South Carolina volume disposal limitation at Barnwell, 1.2 million ft<sup>3</sup>/year, would be exceeded if specific actions are not taken.

The recommended action is to increase the disposal limit at Barnwell so that all regional wastes can be accepted. (Nominally this would require the acceptance of 1.4 million ft<sup>3</sup> from the region in 1991 and lesser quantities in earlier years.

If the preferred alternative cannot be implemented, two options are available. They are, in order of preference:

1. Installation of a super compactor at the Barnwell site to reduce the volume of compactible Class A wastes to conform to the total site disposal limit. (With maximum compaction the nominal estimate is 0.8 million ft<sup>3</sup> in 1991).
2. Implement volume limitations for all nuclear reactor facilities and other large volume generators sufficient to enable the region to conform to the Barnwell disposal volume limitations.

## Long Term (1992 and beyond)

- o Continue current efforts and plans to have in place a new enhanced shallow land burial facility designed in accordance with 10 CFR 61, by July 1991, capable of receiving up to 2 million ft<sup>3</sup>/year. (This single facility will accommodate all of the region's waste volume through 1996 and beyond.)

Compaction and/or concrete containerization could supplement the basic SLB to provide additional waste stability rather than simply to achieve volume reduction.

TABLE II

Disposal Facility Criteria  
For Host State Identification\*

- o Potentially Suitable Areas (PSAs)
  - Physiographic Regions
  - Coastal Zone Areas
  - Aquifer Recharge Areas
  - Depth to Bedrock
  - Structures
  - Population Centers
  - Protected Areas
- o Volume Shipped for Disposal (Class A, Class B, Class C)
- o Distance from Low-Level Radioactive Waste Generators (Class A, Class B, Class C)
- o Density of Transportation Systems in PSAs
- o Population Density of PSAs
- o Meteorology of PSAs

\* Adopted by the Commission on December 2, 1985.

The Commission action to date has enabled it to comply with the provisions of the Southeast Compact requiring a regional plan for waste management as well as the revised ground rules for near term actions as a result of the negotiated continued access by non-regional generators in accordance with the Low-Level Radioactive Waste Policy Act Amendments of 1985<sup>4</sup>. Implementation of the Plan requires continued good faith actions by each of the member states.

The major obstacle to agreement in most regions of the country has been identifying the location of a new disposal facility. The Commission's procedures for identifying the location of a new facility<sup>5</sup> were developed to give the member states as much flexibility as possible and thereby encourage continued cooperation and achievement of uninterrupted safe waste management in the region. Any state may volunteer to host the facility and such proposals would be evaluated by the Commission. Independently, each member state is to submit a detailed proposal of the conditions under which it would host a facility. The goal of this approach is to reach agreement among the States to meet such conditions and thereby identify the next host state in a "participation" process. Only if these two approaches are unsuccessful will the Commission utilize its authority to designate a host state.

Background

In accordance with the Compact entered into by Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee and Virginia, the existing low level waste disposal facility at

Barnwell, South Carolina will close at the end of 1992. Subsequent disposal will be at a new facility located in a state other than South Carolina. The Compact Commission is charged with developing a Regional Plan to determine what that facility will consist of (or if more than one facility is needed), and where it will be located.

To discharge this responsibility, the Commission adopted several procedures which it has been following in parallel. This gives participating states as much flexibility as possible in defining their own participation in the program and encouraging interstate negotiations that will result in disposal capability being available in the region with no interruptions.

Key to all of these approaches is the development and adoption of a Regional Plan by the Commission. Facilities identified as needed in the Regional Plan may be sited as the result of a state's volunteering to host the facility; by Commission acceptance of plans which each state submits to the Commission in accordance with the "participation" process; or, if necessary, by the Commission's designating a host state based on the application of objective criteria for such selection. The actual facility site selection is the responsibility of the selected host state and will be conducted in accordance with guidance provided by the Commission to the state.

Dames & Moore was selected by the Commission to support the designation process.

#### Dames & Moore Effort

Dames & Moore provided to the Commission technical analysis of the needs for low-level waste management in the region and the alternative technologies for meeting those needs, and site selection criteria both on the interstate and intrastate scale.

##### 1. Management Plan

Recommendations on the number and types of facilities needed in the region were developed in a two step process. First, the projected waste volumes, sources and characteristics were developed. This involved a detailed analysis of waste shipped for disposal in 1983 and projections to 1996 to reflect needs at a new facility. The projection method involved applying assumed growth rates for individual source categories (e.g., institutional, industrial and nuclear power reactor) for existing generators, and inclusion of anticipated new generators (new nuclear units coming into service). Large volume generators were contacted directly to determine what specific plans had been made for equipment and/or procedural changes that would affect the projected waste volumes.

It has been recognized by the Commission that evaluation of projected waste volumes will need to be repeated periodically to reflect changes that will occur with time. The Regional Plan provides that projections will be updated annually to take

account, for example, of actions taken by nuclear power reactor operators to comply with the continued access limitations in the Waste Policy Act Amendments, relocation of industry or academic research programs, and facility decommissioning. Projections based on current practice and detailed future actions, however, are the best basis for achieving the immediate objective of choosing a host state since the other changes are equally likely to occur regardless of state and the extent and timing of their impact is speculative at present.

Published information on treatment and disposal technologies for managing low-level radioactive waste was reviewed and documented to provide a basis for choosing among alternatives. Five alternative disposal technologies were described (shallow land burial with and without concrete containerization, mined cavities, aboveground vaults, belowground vaults and augered holes) as were two alternative treatment technologies (incineration and compaction) and total system impacts. Criteria for choosing among these alternatives were recommended to the Commission's Technical Committee members who were responsible for guiding the Dames & Moore effort. A Delphi Workshop was conducted during which designated Commission representatives (primarily members of the Technical Committees and Host State Identification Committee) assigned relative weights to each criterion. Criteria related to protection of public health received high weight while cost was consistently considered of little importance. These weighted criteria were combined with a comparative technical assessment of the alternatives to develop relative figures of merit which were used by Dames & Moore as the basis for the Management Plan recommendations. The figures of merit are given in Tables III and IV for disposal and treatment technologies, respectively. This comparison involves application of engineering judgment to technologies in varying stages of development or operation and therefore there is not a unique solution. A sensitivity analysis was performed to investigate the impact of different (more optimistic) technical evaluations and criteria weights on the figures of merit for disposal. The results of this analysis, shown in Table V, indicated that the Management Plan recommendations for a single enhanced shallow land burial facility remain valid even under these conditions.

Total system impacts were evaluated with respect to the five criteria listed in Table VI. This enabled facility interactions and transportation effects to be compared both for disposal only and for treatment and disposal. The range of impacts based on location with respect to sources of waste generation were also included. It was determined that addition of treatment facilities to a disposal-only system did not significantly reduce any of the criterion impacts. Therefore, treatment was not recommended as a basic feature of the Management Plan. It was recognized, however, that specific host state concerns over volume reduction or waste stability might result in treatment being included in the eventual facility design.

TABLE III

Summary of Relative Figures of Merit For  
Alternative Disposal Technologies

Criterion	Technologies Evaluated					
	Shallow Land Burial		Mined Cavity	Aboveground Vault	Belowground Vault	Augered Hole
	Reference 10CFR61	Concrete Containerized				
Proven Technology	19.6	9.8	9.8	4.9	6.5	19.6
Public Exposure	16.6	16.6	16.6	8.3	16.6	16.6
Site Monitorability	14.0	14.0	7.0	4.7	14.0	14.0
Long-term isolation of all regional waste	13.2	13.2	13.2	2.6	6.6	2.6
Occupational Exposure	11.4	5.7	2.8	3.8	5.7	11.4
Institutional Control	3.7	5.5	11.0	2.8	5.5	5.5
Remediation	3.7	7.4	3.7	7.4	7.4	3.7
Cost	4.8	2.4	1.2	1.6	1.6	1.6
Land Requirements	2.0	2.0	1.0	2.0	2.0	2.0
TOTAL	88.9	76.6	66.3	38.1	65.9	77.0

TABLE IV

Relative Figures of Merit For  
Alternative Treatment Technologies

Criterion	Compaction	Incineration
Public Exposure	18.9	9.5
Proven Technology	18.5	9.8
Product Stability	7.9	15.9
Occupational Exposure	12.5	6.3
Portion of waste treatable	11.0	11.0
Regional Scale	9.0	9.0
Cost	6.0	6.0
Regional volume reduction	2.5	5.0
Land requirements	3.2	3.2
TOTAL	89.5	75.7

TABLE V

Sensitivity Analysis Summary  
of Figures of Merit for Disposal Technologies

Disposal Technology	Reference Rating	Optimistic*	Criteria**	
		Technical Rating	Weighting Range	High Low
Shallow Land Burial	88.9	N.C.	95.1	83.7
Augered Holes	77.0	77.7	82.0	70.0
Concrete Containerize	76.6	93.8	80.1	70.5
Mined Cavity	66.4	69.6	72.3	58.6
Belowground Vault	65.9	75.8	71.3	59.9
Aboveground Vault	38.1	58.2	41.1	35.5

\* The Figure of Merit is calculated from the average weighting of the criterion as determined by the Delphi process and a technical assessment by Dames & Moore reflecting a most optimistic view of that criterion for each of the disposal technologies. The reference rating, column 1, remains Dames & Moore's best judgement.

\*\*The figure of merit ratings in this column tabulates the maximum and minimum values as developed using the individual criterion weighting of each participant (as opposed to the group average Delphi determined weightings).

TABLE VI

## Weighted Total System Impact Criteria

Criterion	Group Mean	Standard Deviation	Range
Truck Miles	33.1	8.8	19-55
Public Exposure	29.7	9.1	5.5-46
Occupational Exposure	21.6	6.4	5.5-32.5
Cost	9.9	5.9	0.1-15.6
Total Truck Trips	5.7	6.9	0.9-27.5

## 2. Siting Methodology

The criteria for identifying a host state for the next disposal facility (Table II), once weighted by the Commission members, will be applied to an objective data base developed consistently for the seven eligible states. The criteria weighting is independent of any evaluation of the data to avoid bias in any state's favor. The product of this exercise will be a rank ordering of the states indicating their relative attractiveness from a technical standpoint. This ranking will be one input into any necessary designation decision. Public hearings will also be held to solicit additional local input that may affect the decision.

The first criterion in Table II, a regional screening, is currently being performed by Dames & Moore. Its purpose is to estimate the total area in a state which is not eliminated by the application of the seven subcriteria listed in Table II. The remaining area, the Potentially Suitable Area (PSA), can be used to compare the states on the basis that the probability of finding a site is proportional to area if major features known to be unsuitable are excluded. For example, metropolitan statistical areas and buffer zones related to population size would be excluded, as would areas prone to flooding or having highly complex geology that would make modeling and licensing difficult.

The volume and waste type criteria will be applied to the data developed for the Management Plan portion of this effort.

The areas identified in the regional screening are further characterized by the distance waste would have to be transported so that transportation impacts, both radiological and non-radiological, can be compared. Ease of access to these areas on existing transportation networks will be compared based on the number of miles of interstate and defense highways present in the identified areas.

The population density in the identified areas will also be a comparative tool. The final criterion listed, meteorological conditions, will be measured by comparing the ratio of potential evapotranspiration to precipitation for the identified areas. This is used as an indication of the amount

of water available for infiltration into waste disposed in a given area.

Implementation

The passage of the Low-Level Radioactive Waste Policy Act amendments necessitates some formal procedures for accomplishing continued access by out of region generators and coordination of these procedures with the other sited regions. The Commission is addressing these questions now. The Southeast Commission's schedule as specified in the Compact requires a new disposal facility to be in operation by July, 1991. This is earlier than the December 31, 1992 deadline specified in federal legislation and therefore there will be no conflict in this area.

This will be a busy spring for both the Commission and the member states as they proceed to identify a host state for the next disposal facility by July 22, the Compact mandated deadline. The weighting of the selection criteria is being done by mail by the Commissioners so that final weights will be available by the end of February. The regional screening data developed by Dames & Moore will be submitted subsequent to the decision on the criteria weighting. This enables the criteria to be considered on their own merits in terms of weighting their relative importance rather than reflecting the potential impact on a given state's potential for designation. This ranking will be made public by the end of April.

The participation process is proceeding concurrently. The end of January is the deadline for each state to submit its proposed conditions for acceptance of a facility. Details of how and when these proposals will be reviewed and compared have not yet been adopted. For a state's proposal to be binding, one of the Commissioners from that state must move to adopt the plan and two-thirds of the Commissioners must concur.

The region continues its leadership role in identifying and meeting its needs for safe management of low level waste, recognizing that such action is a delicate balancing of technical, sociopolitical and economic considerations with the ultimate goal of protecting public health.

## REFERENCES

1. "A Plan for Safe Disposal of Low-Level Radioactive Wastes in the Southeast Region, Southeast Compact Commission, October 29, 1985.
2. "Final Report on Management of Low-Level Radioactive Waste in the Southeast Compact Region", Dames & Moore, July, 1985.
3. Southeast Compact, Article 4, Section E.
4. "Low-Level Radioactive Waste Policy Amendments Act," Section 5. Limited Availability of Certain Regional Disposal Facilities During Transition and Licensing Periods. December 19, 1985.
5. "Procedures for Identifying Host States," as revised, Southeast Compact Commission, August 1985.