

SELECTING THE RECOMMENDED WASTE MANAGEMENT SYSTEM FOR THE MIDWEST COMPACT

A.A. Sutherland and B.C. Robertson
Rogers and Associates Engineering Corporation
P.O. Box 330
Salt Lake City, UT 84110

N.L. Drobny
ERM-Midwest, Inc.
2000 W. Henderson Road
Columbus, OH 43220

ABSTRACT

One of the early important steps in the evolution of a low-level waste Compact is the development of a Regional Management Plan. Part of the Regional Management Plan is a description of the waste management system that indicates what kinds of facilities that will be available within the compact's region. The facilities in the waste management system can include those for storage, treatment and disposal of low-level radioactive waste. The Regional Management Plan also describes the number of facilities that will be operated simultaneously. This paper outlines the development of the recommended waste management system for the Midwest Compact. It describes the way a data base on low-level radioactive waste from the Compact was collected and placed into a computerized data base management system, and how that data base was subsequently used to analyze various options for treatment and disposal of low-level radioactive waste within the Midwest Compact. The paper indicates the thought process that led to the definition of four recommended waste management systems.

Six methods for reducing the volume of waste to be disposed of in the Midwest Compact were considered. Major attention was focussed on the use of regional compaction or incineration facilities. Seven disposal technologies, all different from the shallow land burial currently practiced, were also considered for the waste management system. After evaluating the options available, the Compact Commissioners recommended four waste disposal technologies -- above-ground vaults, below-ground vaults, concrete canisters placed above ground, and concrete canisters placed below ground -- to the host state that will be chosen in 1987. The Commissioners did not recommend use of a regional waste treatment facility.

INTRODUCTION

The Midwest Compact is composed of the States of Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin. The nature of the Compact is such that at the beginning of the process of selecting a Waste Management System any one of the Compact states was a viable candidate for hosting one or more waste management facilities. One of the objectives of the Compact Commission was to develop a Regional Management Plan that indicates how many facilities and what kind of facilities will be needed to store, treat and dispose of low-level radioactive waste from the compact region. That collection of facilities is considered to be the Waste Management System. Determining where the elements of the system will be located is currently in progress.

The selection of a Waste Management System for the Midwest Compact began by assembling up-to-date information on the region's low-level waste. This information included the locations of waste generators and the volume, types of waste, curie content, etc., of waste that they might ship for disposal in the future. In a parallel effort, a number of alternative waste treatment and waste disposal technologies were evaluated in terms of their desirability for use in the Midwest Compact. Finally, information on the specific kinds of waste that are expected to be generated in the Compact and the characteristics of the waste treatment and waste disposal alternatives investigated were combined to determine the most feasible Waste Management System for the Midwest Compact.

At the present time, the Waste Management System takes the form of a number of recommendations because the choice of disposal and treatment systems remains largely up to the state that will be chosen to host the first facilities. This paper describes the processes of assembling the information on projected low-level radioactive wastes that will have to be handled within the Midwest Compact and of evaluating the alternative treatment and disposal technologies.

DEVELOPING THE LOW-LEVEL RADIOACTIVE WASTE DATA BASE

To assist in the development of the Regional Management Plan for the Midwest Compact, a computerized data base was assembled for low-level waste anticipated to be shipped for disposal in the late 1980's. This time period was chosen because information was available for that period and projections to later times could be made from that information. A number of sources of data were used. They include:

- Surveys by the Conference of Radiation Control Program Directors (CRCPD)
- The Annual State-by-State Assessment published for DOE
- Individual state surveys
- Other data bases
- Telephone contacts

The CRCPD surveys were provided by the individual states, and proved to be the most useful source of survey information. The CRCPD survey forms allowed

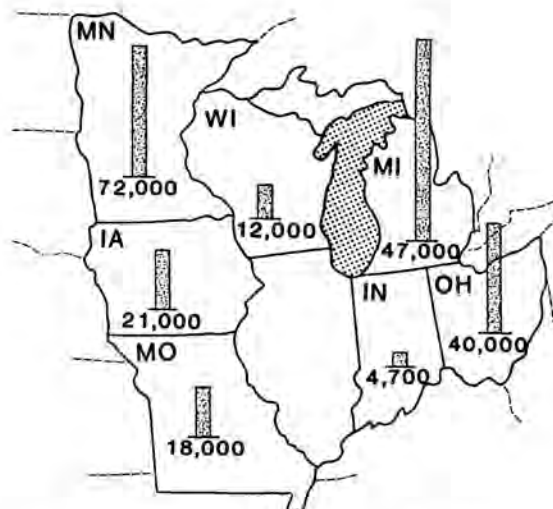
the data base to be assembled on a generator-by-generator basis and provided information on volumes of waste, waste streams, methods of treatment, curies of activity contained within each generator's waste, etc. They also provided projections, by generator, of the volumes of different waste classes that would be present in future shipments. The information was loaded into a computer data base^a on a generator-by-generator basis. In many cases the waste streams reported in the CRCPD survey were correlated with the NRC waste streams used in Ref. 1. Estimates of curie content of each generator's wastes were usually reported on the survey forms. If activity estimates were missing or incomplete they were derived from information provided by the NRC on similar waste streams.

Telephone interviews were conducted with large waste generators or those with unusual wastes, to establish additional details about the waste or to fill in any information that may have been missing on the survey forms (and, in some cases, when survey forms were not available). Information from the CRCPD forms was used directly for six of the seven states in the Compact. Michigan had issued its own slightly revised version of the CRCPD questionnaire and information from Michigan was obtained from responses to that survey.

A number of useful summaries of information about the Compact's wastes were derived from the computerized data base (2). These includes estimates of the centroids of volume of waste to be shipped from each state in the late 1980's (Fig. 1) and state-by-state estimates of the annual volume to be shipped in the late 1980's (Fig. 2). Also, for the purpose of visualizing the potential transportation requirements to any low-level waste treatment or disposal facilities that the Compact may elect to use, information was derived about the major centers of waste generation within the Compact (Fig. 3). Data of these kinds was used to perform transportation analyses and is being used as one factor in selecting a host state for the Compact's first disposal facility.



Fig. 1. Centroids of Waste Shipped from Each State in the Late 1980's.



SOURCE: MIDWEST DATA BASE 4/21/86

RAE-101888

Fig. 2. State Contributions to the Region's Low-Level Waste in the Late 1980's as Presently Treated (ft³/yr).

Detailed information was stored in the data base regarding the name and location of each waste generator and the waste streams that each generator is projected to produce. Therefore, it was possible by identifying specific waste streams as being treatable in a certain manner to determine the potential value of regional waste treatment facilities to the Compact and to do analyses of relative transportation risks. This use of information from the data base is discussed in a subsequent section of this paper.

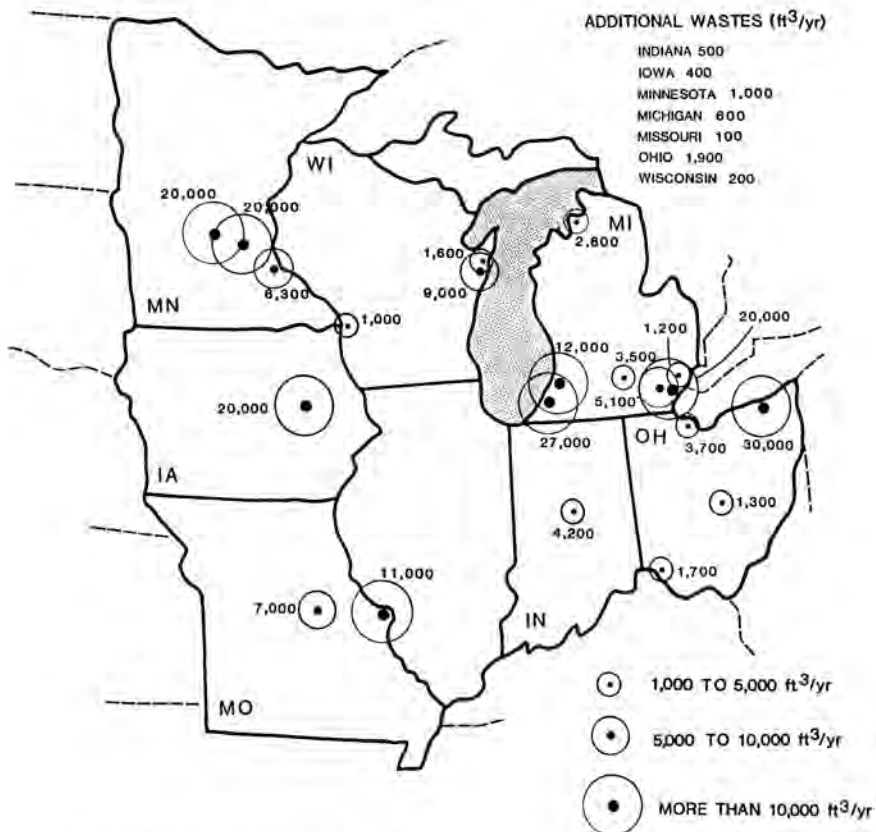
EVALUATION OF WASTE TREATMENT AND DISPOSAL ALTERNATIVES

A number of waste treatment alternatives were evaluated for their suitability for the Midwest Compact region (3). They included:

- Source Reduction
- Storage for Decay
- Compaction
- Incineration
- Solidification
- Evaporation/Dewatering

Source reduction is an activity that can only be conducted by the individual generators. The Compact Commission decided that the Midwest Compact will encourage source reduction as a means of removing both volume and activity from the waste stream that must be treated and disposed (4). The Commission also recommends solidification whenever the waste is incinerated, in order to create a more suitable waste form than the ash that is the residue of incineration. It was also determined that evaporation and dewatering were already being applied to almost all wet wastes, and therefore it is not necessary for the Compact to actively support increased activity in this area of waste treatment.

^a The data base support was provided by EG&G Idaho under funding by the U.S. Department of Energy.



SOURCE: MIDWEST DATA BASE 4/21/86

RAE-101146

Fig. 3. Major Centers of Waste Generation (1000 ft³/yr or more)

As a result of the decisions described above, most of the analysis of treatment alternatives for the Midwest Compact region centered around the viability of storage for decay, compaction, or incineration at a regional treatment facility. The regional facility was envisioned to take waste from a number of generators and treat it before it was passed on to the disposal facility.

Seven alternatives to shallow land burial were considered for the disposal of the region's low-level waste (3). They were:

- Improved Shallow Land Burial (burial at a greater depth)
- Above-Ground Vaults
- Below-Ground Vaults
- Modular Concrete Canister Disposal
- Earth Mounded Concrete Bunkers
- Mine Cavities (new and existing)
- Augered Holes (lined and unlined)

A preliminary evaluation of these disposal alternatives was conducted using a multiattribute utility analysis in which the disposal alternatives were evaluated in terms of eleven assessment factors. The Compact Commissioners were polled to determine the weights assigned to the assessment factors for use in the analysis. Table I provides a list of assessment factors and the average weight (averaged over the seven states) assigned to each assessment factor. It can be seen that more than half the total weight was given by the Compact to the first three factors, all of which are related to health and safety.

TABLE I

Weights Assigned To Disposal Assessment Factors

Assessment Factors	Average Weight Assigned
Impact on Disposal System Performance	23
Confidence in Technology	16
Radiation Exposure to Workers	
Ease of Remedial Action	13
Environmental Interactions	10
Licensability	8
Impacts on Institutions	8
Impacts on Surface Development	4
Impact on Disposal Facility Siting Requirements	3
Efficiency of Land Use	2

Costs	

Based on the preliminary analysis, a number of disposal alternatives were eliminated. Mined cavities were dropped from the list because of their potential cost and complexity and because they may be difficult to license. Augered holes were eliminated because they do not make efficient use of the available land area and because they were developed for very high specific activity waste. The above-ground tumulus portion of the earth mounded concrete bunker was dropped from consideration because it was considered to be more susceptible to weather effects and intruders than other alternatives. Improved shallow land burial was subsequently eliminated when the Compact Commissioners stated that they would not recommend any variation on shallow land burial (5).

In the final analysis of disposal alternatives for the waste management system, the below-grade concrete monolith portion of the earth mounded concrete bunker was considered to be essentially the same as a below-ground vault. A new technology, modular concrete canisters placed above ground, was added. The four disposal technologies considered in the final evaluation of Waste Management Systems for the Compact were:

- Modular Concrete Canister Disposal (below-ground)
- Modular Concrete Canister Disposal (above-ground)
- Below-Ground Vaults
- Above-Ground Vaults

COMBINING INFORMATION FROM THE DATA BASE AND THE EARLY ASSESSMENT OF ALTERNATIVES

At the end of the first phase of evaluation of alternative technologies, the Compact was left with the four candidate disposal technologies described above and three potential treatment technologies -- storage for decay, compaction, and incineration. The computerized data base described earlier was used to help reduce the number of possibilities into a manageable set of candidate Waste Management Systems.

An estimate was made of the largest possible volume of waste not presently being stored for decay that could benefit from a regional facility for long term storage for decay. Using information from the data base on the nuclide content of the region's waste, it was estimated that the very largest possible volume of such waste will not exceed 17,000 cubic feet per year. This is less than 10 percent of the region's waste (estimated to be about 200,000 cubic feet per year). The low volume of additional waste that could be treated at a regional storage facility, coupled with a stated preference on the part of the generators of this waste to store for decay it at the point of generation, led to the rejection of a long term storage facility as an activity that would be part of the Compact's Waste Management Plan. Development of a regional storage facility by some other agency, however, is not discouraged.

The value of regional facilities that employ either supercompactors or incinerators was analyzed using information from the data base. Waste streams that could be compacted using a supercompactor or incinerated were identified and the maximum annual volumes of these kinds of waste were estimated. Of

the two treatment approaches, incineration showed the largest maximum potential volume reduction. If all the incinerable waste in the region was burned, it was estimated that up to a 26 percent reduction in annual waste volume for disposal could result.^a The corresponding figure for supercompaction was 28 percent. On the other hand, if it is assumed that generators currently treating their own waste continue to do so, supercompaction provides a significantly larger net potential volume reduction than incineration. That volume reduction is as much as 45,000 cubic feet per year, or about 22 percent of the region's annual waste volume. Under the same circumstances, a regional incinerator would produce a maximum net volume reduction of 30,000 cubic feet per year, or about 12 percent of the region's annual waste volume.

The Compact Commission decided that the latter scenario (generators that are reducing the volumes of their wastes will not use a regional facility even if one is available) is more likely. Therefore incineration was eliminated as a candidate for a regional waste treatment facility that would be part of the Compact's Waste Management System. At the end of the initial screening of waste treatment and disposal alternatives, the Compact Commission had narrowed the choices to those shown in Table II.

TABLE II

Intermediate List of Treatment and Disposal Technologies Used to Define Waste Management Systems

- Modular Concrete Canister Disposal (below grade)
 - Regional Supercompactor Facility
 - No Regional Treatment Facility
- Modular Concrete Canister Disposal (above grade)
 - Regional Supercompactor Facility
 - No Regional Treatment Facility
- Below-Ground Vaults
 - Regional Supercompactor Facility
 - No Regional Treatment Facility
- Above-Ground Vaults
 - Regional Supercompactor Facility
 - No Regional Treatment Facility

In subsequent deliberations the Commission decided the Compact should not actively pursue establishing a regional waste treatment facility as part of its Waste Management System because the maximum potential volume reduction is not high enough. Regional treatment facilities sponsored by other agencies are encouraged, however. The Commission also decided that it would not choose among the four waste disposal alternatives that resulted from the initial screening process, since all appear to provide good containment of the waste. Consequently, the four waste management systems listed in Table III have been recommended to the host state for consideration in making its choice on how to develop the Waste Management System within its borders (4).

^a All volume reduction figures presented here are upper bounds and could probably not be realized in practice.

TABLE III

Final Recommended Alternatives for
Waste Treatment and Disposal

Waste Treatment:

No regional facility sponsored by the Compact.
Regional treatment facilities sponsored by
other agencies are encouraged.

Waste Disposal:

Four recommended disposal technologies:

- o Modular Concrete Canister Disposal
(below-ground)
- o Modular Concrete Canister Disposal
(above-ground)
- o Below-Ground Vaults
- o Above-Ground Vaults

SUMMARY

This paper describes the way the Midwest Compact determined its recommended Waste Management System. It demonstrates the interplay between a good computerized data base on the projected waste characteristics of the region and the selection of a Waste Management System. Because the data base was able to provide estimates of the maximum waste volume reductions that could occur if a regional waste treatment facility was sponsored by the Compact, it assisted the Compact in deciding whether there was a significant value in sponsoring such a facility. The data base was also used to demonstrate that the projected waste from the Midwest region would allow a wide range of

disposal technologies to be implemented. The deliberations of the Compact Commission produced four recommended waste management systems, although the host state has the opportunity to choose other treatment and disposal technologies if it desires.

REFERENCES

1. U.S. Nuclear Regulatory Commission, "Draft Environmental Impact Statement on 10CFR61 'Licensing Requirements for Land Disposal of Radioactive Waste'." NUREG-0782, (September 1981).
2. A. A. SUTHERLAND, "Assessment of Waste Characteristics and Waste Management Practices for the Midwest Compact Region," Rogers and Associates Engineering Corporation for the Midwest Interstate Low-Level Radioactive Waste Commission, Deliverable 28, (June 1, 1986).
3. R. D. BAIRD and A. A. SUTHERLAND, "Review of Alternative Waste Management Methods for the Midwest Compact Region," Rogers and Associates Engineering Corporation for the Midwest Interstate Low-Level Radioactive Waste Commission, Deliverable 4A, (February 28, 1986).
4. A. A. SUTHERLAND, "Identification of the Recommended Waste Management Systems and System Development Schedules," Rogers and Associates Engineering Corporation for the Midwest Interstate Low-Level Radioactive Waste Commission, Deliverable 5A, (July 28, 1986).
5. Resolution adopted by the Midwest Interstate Low-Level Radioactive Waste Commission (March 19, 1986).