USE OF TRANSPORTATION FACTORS IN HOST STATE SELECTION IN THE MIDWEST COMPACT REGION

Neil L. Drobny, P.E.
ERM-Midwest, Inc.
Columbus, Ohio 43220

ABSTRACT

The Midwest Compact's management plan uses waste quantities and transportation considerations in the host state selection process. To consider the waste transport implications of selecting a member state to host the first facility, two analyses were conducted. Each state was divided into quadrants with a hypothetical regional facility at the centroid. Both analyses involved the minimum transport distance from all LLW sources in the region to the centroid of each quadrant. In the first analysis, the total LLW transported along a given road was multiplied by the length of the route to determine the total of cubic-feet miles of waste transported. The second analysis was similar but focused on safety. The volume-distance analysis suggests that five states compare approximately equally --- Iowa, Indiana, Michigan, Ohio, and Wisconsin. Locations in Minnesota or Missouri would require hauling more waste over more miles than locations in any of the other states. The safety analysis suggests a somewhat different ranking. Indiana and Iowa compare equally favorably. Grouped in a middle range are Michigan, Minnesota, Ohio and Wisconsin. The safety analysis favors Missouri least.

INTRODUCTION

The Midwest Interstate Low-Level Radioactive Waste Commission (the Commission) is comprised of Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. In discharging its responsibilities under the Low-Level Waste Policy Act and the 1985 Amendments, the Commission is pursuing a dual approach to the selection of a state to host the first regional LLW disposal facility.

One approach has been an attempt to attract a state to volunteer for this role, offering a comprehensive package of incentives and compensation to be provided to the host state and host community. A second approach has been to develop procedures and criteria that the Commission will employ to designate a host state, if a volunteer is not forthcoming.

In developing the procedures for designating a host state, numerous alternatives were considered. These included area screening, development of a pool of sites in each of the member states, a lottery, and inviting prospective site operators/developers to bid.

Typical screening methods that employ environmental, geologic, and other natural and land-use criteria were ruled out on the basis that an inordinately fine (and hence costly) screening grid would be required to prevent inadvertent exclusion of areas which contained smaller sub-areas that would make suitable sites. Further it was concluded that such analyses would not produce results that would provide a meaningful basis for discriminating among the states with respect to their relative suitability as a host state. This is because the Commission believed that all member states contained numerous areas that would be suitable for a regional LLW disposal facility.

The option of developing a pool of sites was ruled out because of the time and expense that would be needed to qualify sites in each of the states. The lottery concept was discarded as being non-scientific. And the concept of inviting bids from prospective operators/developers also was discarded because it would remove the host state selection decision from the hands of the Commission and place it in the hands of a site operator/developer.

In the final analysis, a host state designation procedure was selected based on two factors: types and amounts of LLW generated, and waste transportation considerations. This paper describes the approach taken in the development of waste transportation criteria for host state designation.

CONCEPTUAL APPROACH

In order to consider the waste transport implications of selecting the member state to host the first facility, two related analyses were conducted. In both, each state was divided into quadrants with a hypothetical regional facility at the centroid of each quadrant. Thus, 28 separate cases were examined (seven states multiplied by their quadrants).

Both analyses were conducted using transport routes involving the minimum distance from all regional LLW sources to the centroid of each quadrant.

In the first analysis, the total cubic feet of LLW transported yearly along a given road segment was multiplied by the length of the road segment to determine the total number of cubic-feet miles of waste transported. Then, the total cubic-feet miles per year were summed across the region from all sources to determine for each of the 28 cases the number of cubic-feet miles shipped by interstate and non-interstate roads. As necessary, mileage from outside the region, i.e., Illinois, was included.

The second analysis was similar to the first except that the focus was on safety considerations. Specifically, for the minimum distance routing used in the volume-distance analysis, a safety index was calculated using data on accidents for those routes. For

each road segment, the volume of waste transported was multiplied by the number of accidents per year reported on that road, resulting in a safety index called cubic-feet accidents.

ANALYTICAL FRAMEWORK AND METHODOLOGY

The LLW sources employed in the transportation analysis were derived from survey information on the region's generators (1).

The waste transport analyses conducted in support of this work were carried out with the assistance of a planning model provided through the courtesy of the Bureau of Transportation Planning of the Michigan Department of Transportation. This planning model was recommended by the Commission for consideration by ERM-Midwest to conduct the required assessment.

The model was very appropriate for this project. Basically, it is a program that finds the minimum distance path through a roadway network. This network, once identified, is used along with the location data on waste quantities/sources to calculate cumulative waste volumes transported to the various hypothetical disposal site locations and to calculate the safety index.

RESULTS

For each of the 28 quadrants, output from the model provided the total number of cubic-feet miles of wastes that would be transported per year (on interstate and non-interstate roads) using the minimum distance routing from each source to the centroid of the respective quadrant. These data were normalized (divided) by the minimum cumulative distance for all quadrants, which occurred for quadrant 21 in Indiana. This means that if the disposal site were located at the centroid of quadrant 21, the cubic-feet miles of LLW waste transported per year would be less than for any other of the 27 locations evaluated. Therefore, with respect to this consideration alone, quadrant 21 is the most desirable location for the regional disposal site.

The results of the volume-distance analysis are summarized in Table I where the normalization shows that the number of cubic-feet miles of waste is 2.3 times greater in quadrant 9 than in quadrant 21.

TABLE I

Relative Cubic-Feet Miles of LLW Transported to Hypothetical Disposal Site Locations

	Quadrant (whose centroid is disposal site location)	State	Cubic-Feet Miles Normalized With Respect To Quadrant 21
	21	IN	1.00
	19	MI	1.01
	20	MI	1.02
Top	22	IN	1.04
1/3	16	WI	1.16
	15	WI	1.22
	24	IN	1.22
	8	IA	1.22
	6	IA	1.24
	25	OH	1.25
	26	OH	1.26
	14	WI	1.37
Middle	27	OH	1.37
1/3	13	WI	1.38
	5	IA	1.50
	18	MI	1.51
	23	IN	1.55
	28	OH	1.63
	7	IA	1.65
	2	MO	1.65
	12	MN	1.67
Lower	1	MO	1.69
1/3	4	MO	1.70
	11	MN	1.84
	3	MO	1.99
	10	MN	2.01
	17	MI	2.08
	9	MN	2.30

These data are illustrated in Figure 1 to show the least-to-most preferred quadrants in the region.

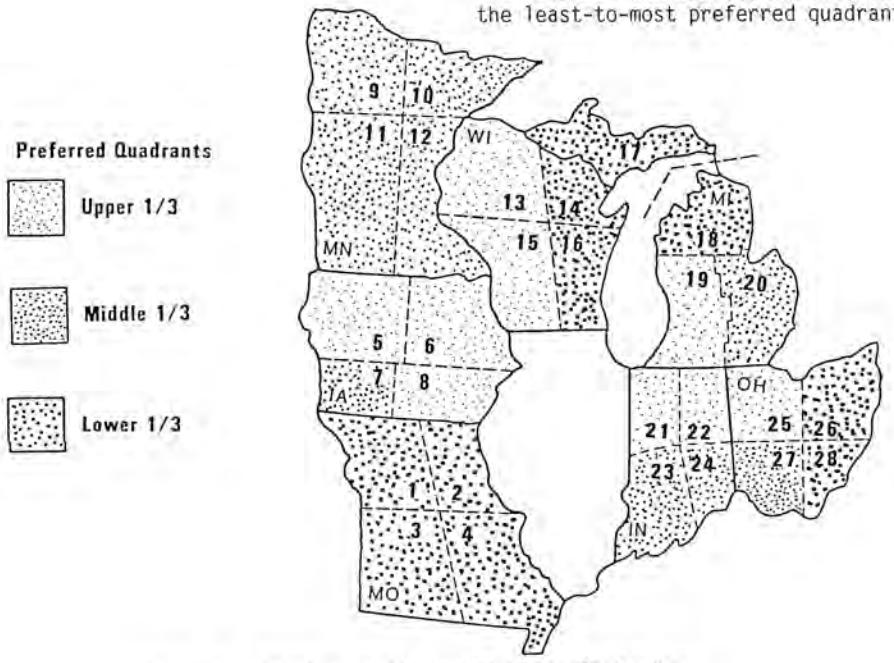

Fig. 1. Results of Volume-Distance Analysis.

A similar presentation of the detailed results of the volume-accident analyses appears in the project report entitled "Host State Screening Process" (2).

CONCLUSIONS

Tables II and III summarize the transportation analyses. In those tables the number of quadrants in each state that falls into the top, middle, and lower third groupings of quadrants are summarized. A score for each state is calculated as the sum of the normalized indices for the four quadrants in each state from Table I and an equivalent table for the safety analysis. For example, in the volume-distance analysis, the "score" for Indiana is 1.00 + 1.04 + 1.22 + 1.55 = 4.81.

TABLE II

Summary of Volume-Distance Analysis

State	Number of Quadrants in Top 1/3	Middle 1/3	Lower 1/3	Score
IN	3	1	0	4.81
IA	2	1	1	5.61
MI	2	1	1	5.62
MN	0	0	4	7.82
MO	0	0	4	7.03
OH	0	4	0	5.51
WI	2	2	0	5.13

TABLE III

Summary of Volume-Accident Analysis

State	Number of Quadrants in Top 1/3	Middle 1/3	Lower 1/3	Score
IN	2	2	0	5.45
IA	3	1	0	5.12
MI	1	1	2	7.82
MN	0	4	0	6.72
MO	0	0	4	11.42
OH	1	1	2	7.39
WI	2	0	2	7.09

The volume-distance analysis suggests that five states compare approximately equally --- Iowa, Indiana, Michigan, Ohio, and Wisconsin. Clearly any location in Minnesota or Missouri would require the transport of more waste over more miles than locations in any of the other five states.

The transportation safety analysis based on the volume-accident data suggests a somewhat different ranking. Two states, Indiana and Iowa, compare equally favorably. Grouped somewhat together in a middle range are Michigan, Minnesota, Ohio and Wisconsin. In a least favored position is Missouri.

There is one additional refinement to these analyses that should be undertaken. The volume-accident analysis was conducted without the benefit of safety data for Illinois, which were omitted from the analysis due to limited time and resources. These data should be added if this aspect of the transportation analyses is to be employed in the host state selection decisions made by the Midwest Compact. The volume-distance analysis, however, did include Illinois data and can be utilized without further adjustment.

REFERENCES

1. A. A. Sutherland, "Assessment of Waste Characteristics and Waste Management Practices for the Midwest Compact Region," Midwest Interstate Low-Level Radioactivity Waste Commission/Rogers and Associates Engineering Corporation, June 1, 1986.

2. N. L. Drobny, "Host State Screening Process," Midwest Interstate Low-Level Radioactivity Waste Commission/ERM-Midwest, Inc., Columbus, Ohio, July 29, 1986.