ROUTING GUIDELINES FOR RAIL TRANSPORT OF RADIOACTIVE MATERIALS - IS CONSENSUS POSSIBLE?

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ABSTRACT

Consensus is possible for rail routing of radioactive materials. The heavily shielded casks moving spent fuel and other radioactive waste provide a high degree of safety. The major goal in choosing an appropriate rail route is to reduce public fear of radioactive materials. The choice will be made on the basis of certain rail routing facts, which are few and uncomplicated. Ever since the 1920's, the choice of rail routes has become more and more limited as the railroad industry consolidates to preserve its more profitable routes along limited high-density corridors. The mainline routes are well-known. Routing models can identify the high-use mainline track and proven carriers. Most tonnage in fact moves on this better track, which also experiences fewer accidents than the poorer track. Attempts to route around cities inevitably require use of poorer track and invite more accidents. Consensus is possible in choosing the ordinary routes. By using these routes and achieving safe transport, the consensus-makers can attain the goal of minimizing public fear.

ROUTING GOALS

For consensus to be possible, there must be willingness to reason together, and our reasoning must begin with asking, "What is the goal in choosing rail routes for radioactive materials?" That goal should not be to select routes that will reduce the already minimal risk of a nuclear release. Why? Because such a choice is superfluous to the intrinsic safety of the package and another, more practical, goal will be lost.

In 35 years of transporting radioactive materials, there has never been any injury or death resulting from any radioactive release. In its 1986 review of hazardous materials transportation throughout the Nation, the Congressional Office of Technology Assessment unequivocably found from technical evidence and prior cask performance that the shipping cask provides "a very high level of public protection -- much greater than afforded in any other current hazardous material shipping activity."(1) OTA concluded "that the probability of an accident severe enough to cause extensive damage to public health and the environment caused by a radiological release from a properly constructed cask is extremely remote."

Similarly, the U.S. Department of Transportation (DOT) acknowledged in its rulemaking proceeding in HM-164 that packaging constitutes "the primary safety measures in radioactive materials transportation."(2) It recognized that "the present packaging requirements are adequate to protect the public" and that the risks were "too low to justify the. . .local. . .bans and other severe restrictions on the highway mode of transportation."(3)

DOT found no consensus was possible on highway routes, since there were so many of them and State and local interests had created a "patchwork of State and local routing requirements." Finding no consensus possible, DOT imposed a solution -- not to reduce risk, but to address the "State and local concerns" that had arisen.(4)

DOT was more hopeful regarding the possibility of consensus on rail routing of radioactive materials. It found that the "routing choices available in rail operations with regard to populated or congested areas. . .are considerably more limited than in highway transportation."(5) Hence, there were fewer opportunities for State/local concerns to arise or to conflict with National interests in the rail movement of radioactive materials. In such a context, there was at least the possibility of attaining consensus.

ROUTING FACTS ARE FEW AND UNCOMPLICATED

DOT recognized in HM-164 that railroad routing facts are few and uncomplicated. The railroad industry had begun in this country in the early nineteenth century by connecting the smaller cities in the East and then the large population centers. Later, Western population centers had

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grown away from the rivers around rail junctions and mainlines as the railroads spread across the country.

By the 1920's, the railroads formed a vast network throughout the country. Although it contained only about six percent of the world population, this country now had about one-third of the total world railroad mileage.(6) Highways, waterways, and airways formed subsidiary networks but, in their absence, "the railway network would still serve the bulk of the population."(7)

Railroad consolidation began at first with the creation of large railroad systems controlled by a few individuals or banking groups. Following the 1920's, the railroads entered a further period of consolidation, accelerated by the nationwide Depression. This new period of consolidation has continued unabated ever since.

The new form of consolidation includes industry-wide reductions in track operated and new emphasis on preserving and improving only the most profitable routes.(8) Selected mainlines become high-use corridors for rail shipments. The railroads install new and improved track, high-tech traffic control devices, and target maintenance to the high-use corridors.(9) Fewer trains with more cargo per average train and steadily increasing average hauls result.

Fewer railroads survive each year in this new regime. As a direct result of this continuing consolidation process, today there are only 18 Class I railroads remaining in business.(10)

The primary result of this long-term process of consolidation from the shippers' standpoint is that the major railroad traffic moves over limited routes or traffic corridors.(11) In fact, the routes are so well-established that computer programs have been created that predict with extreme accuracy the probable route of movement from origin to destination that the railroads would normally choose to follow.(12) Experienced traffic managers do not ignore these major routes of movement, nor do they attempt to direct the railroads to use unique routes for this traffic.

ATTEMPTS TO ROUTE AROUND CITIES BUMP INTO TROUBLING STATISTICS

Routing around cities requires the use of poorer branch line track than using mainlines that run through or near cities. Although the poorer track comprises a small percentage of total trackage, it is involved in a large percentage of rail accidents. Routing around cities, therefore, risks more accidents that, while posing no real safety threat, promise heightened media attention and the very real likelihood of inflaming public fear.

The best available estimate is that over 80 percent of rail traffic moves over Class 4 or better trackage(13) along the major corridors. At the same time, those corridors account for less than one quarter of rail accidents. The great bulk of the accidents, therefore, occurs on the poorer, low-density, track.(14)

Actually the absolute number of annual rail accidents has declined dramatically over the last decade. From an annual average of nearly 10,000 accidents in the 1975-77 period, the 1988 total was under 3,000 accidents; yet, as the two groups of figures show, the distribution over the various classes of track remains about the same:

DISTRIBUTION OF ACCIDENTS BY CLASS OF TRACK HISTORIC AND CURRENT PERIODS

	Total Accidents			
Track Class	1988(15)		1975-77 Ann.Avg.(16)	
	No.	% Total	No.	% Total
Unknown	136	4.4%	-	-
1	1,418	46.5	5,054	50.6%
2	533	17.5	1,851	18.5
3	412	13.5	1,791	17.9
4	469	15.4	1,040	10.5
5 & 6*	83	2.7	245	2.5
Total	3,051	100.0%	9,981	100.0%

Confirming the fact that larger railroads operate the better trackage are data showing accident rates by size of railroad. In 1988, the large Class I railroads had 4.76 accidents per million train-miles, the smaller Class II railroads had 5.5 accidents, and the smallest (the Class III's) had 6.83.(17)

On the other hand, for even the large well managed railroads, the same pattern is found of more accidents on lower quality track:(18)

TOTAL ACCIDENTS BY TRACK CLASS FOR MAJOR CLASS I RAILROADS 1986-88

Railroad	1	2	3	4	5	6*
ATSF	159	42	74	65	34 1	
BN	450	103	96	240	10	0
CNW	442	33	48	21	2	0
CR	193	58	87	66	4	1
CSX	370	199	196	154	14	0
NSX	272	110	87	108	1	0
UP/MKT	654	204	138	215	13	1

*Best track class.

In other words, the branch line trackage of even the larger railroads experiences more accidents than the better mainline track. Routing around large cities over branch lines of major railroads creates more accident risks than routing over mainlines.

CONDITIONS FOR CONSENSUS ARE PRESENT

The intrinsic safety provided by the packaging of radioactive materials is well proven and now beyond argument. The rational goal to be achieved in choosing a rail route is to minimize public fear of radioactive materials shipments.

The facts surrounding the creation and maintenance of the mainline routes will promote a consensus. The mainline routes, as we have seen, are products of our National history. They are the routes employed in normal day-to-day transport of most rail traffic. These common routes are readily identified. Routing models are available to perform that function.

Consensus is achievable around the fact that the use of normal mainline routes of proven carriers reduces accidents. With low-risk transportation, some of the causes of public fear and, hence the fear itself, will decline. We should all, therefore, be able to agree that the ordinary rail routes are the best routes for transporting radioactive materials.

REFERENCES

1. Transportation of Hazardous Materials, Summary, Office of Technology Assessment, OTA-SET-305, p. 43 (1986).
2. 45 Federal Register 7142, January 31, 1980.
3. 46 Federal Register 5299, January 19, 1981.
4. 46 Federal Register at 5299-5300.
5. 45 Federal Register at 7151-52.
6. The Modern Railway, by Jules Parmalee, Longmans Green & Co., N.Y., p. 13 (1940); Principles of Inland Transportation, by Stuart Daggett, Harper & Bros., N.Y., p. 8 (1928).
7. Parmalee, supra, at 26.
8. For the steady decline in railroad miles of trackage since 1930, see Moody's Transportation Manual, 1989, page a2; "Railroad Facts, 1988," Assoc. of American Railroads, p. 42. The ICC, for example, permitted the abandonment of 3,000 miles of trackage in 1988 alone, which was up from the 2,000 miles of abandonments in each of 1986 and 1987. ICC Annual Report to Congress, 1988, p. 45.
9. For a more detailed discussion of these investment decisions, see "Rail System Investment Analysis - Description of the Railroad Investment Process," by Ernst & Ernst for the U.S. Department of Transportation, DOT-TPI-10-78-33, February 1978.
10. See ICC Annual Report to Congress, 1988, p. 1432. For a list of the 18 remaining Class I railroads, see Moody's Transportation Manual, 1989, page a2.
11. Professor Locklin describes ten of the major corridors in his Economics of Transportation, 4th ed., Rich. D. Irwin, Inc., Homewood, IL, pp. 129-32 (1954).
12. A. Kornhauser and others at Princeton University created the earliest of these models in the 1970's under contract to the U.S. Department of Transportation. A later updated version of this model called "Interline" was developed at the Oak Ridge National Laboratory. It, too, was "designed to simulate the routing practices on the U.S. rail system." Information Services Directory, U.S. Department of Energy, DOE/RW-0038, May 1987.
13. DOT classifies trackage in six categories from very slow trackage (Class 1) to ultra high-speed trackage (Class 6). 49 CFR 213.9. There is very little Class 6 trackage nationwide. Maximum operating speeds also are typically much lower than the posted maximums on all classes of track.
14. "Event Probabilities and Impact Zones for Hazardous Materials Accidents on Railroads," by Arthur D. Little, Inc., for the U.S. Department of Transportation, DOT/FRA/ORD-83/20, p. 46 (November 1983). See also "Benchmark Estimates of Release Accident Rates in Hazardous Materials Transportation by Rail and Truck," by Glickman, publ. in Transp. of Haz. Materials, 1988, of the Transp. Research Board, Nat'l Research Council, Record 1193, p. 24 (1988).
15. Accident/Incident Bulletin, No. 157, Calendar 1988, U.S. Department of Transportation, p. 21 (June 1989).
16. "Event Probabilities...(etc.)," supra, pp. 32-37.
17. Accident/Incident Bulletin, No. 157, supra, p. 57.
18. Source of data is a U.S. Department of Transportation, Federal Railroad Administration, computer run of January 10, 1990, of the 1986, 1987, and 1988 accident data.