Industry-Wide Effects of New Transportation Regulations on the Shipment of LSA Material From Nuclear Facilities

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INTRODUCTION

The Nuclear Regulatory Commission (NRC) is currently proposing to essentially adopt the most recent International Atomic Energy Agency (IAEA) Safety Series No.6 regulations for determining transportation classification. In addition, NRC is proposing to increase its threshold of control from greater than Type A to 2xA1 for LSA material. At the same time, the NRC is proposing to increase packaging requirements for LSA material under its control.

Assuming adoption of IAEA standards, the Department of Transportation (DOT) will establish an upper limit for LSA material. Under current regulations, LSA material is defined solely in terms of specific activity with no upper limit on the total activity per package. Under new regulations, LSA is still defined in terms of specific activity; however, an upper limit has also been established based on an external radiation level of 1 R/Hr at three meters without intervening shielding. Material that exceeds this 1 R/hr at 3 meters may no longer be shipped as LSA. Adoption of IAEA standards will increase packaging requirements for LSA material by requiring the use of Industrial Packages (IP-1, 2 and 3).

At the request of the Electric Power Research Institute (EPRI) in support of the Nuclear Management and Resource Council (NUMARC), the Nuclear Transportation Group (NTG) and the Utility Nuclear Waste Management Group (UNWMG), Analytical Resources evaluated the effects of these new

regulations on the utility industry. The evaluation was based on EPRI's extensive utility radwaste data base which provides detailed information on radwaste generation rates, sources and characteristics from approximately 96% of operating U.S. nuclear reactors.

OBJECTIVE

The objectives of this evaluation were to utilize EPRI's data base of radwaste volumes, sources and characteristics to evaluate the impact to the industry of NRC's proposed rule changes with respect to:

- Potential increase in the total number of Type A shipments
- Potential increase in the total number of Type B shipments
- Costs associated with increased or decreased number of Type A and/or Type B shipments

PROPOSED METHODS (NRC ADOPTION OF IAEA STANDARDS)

Depending on the new grouping for LSA materials (LSA-II or LSA-III), the average specific activities for LSA quantities may not exceed $10E^{-04}$ A_2 per gram or $2x10E^{-03}$ A_2 per gram, respectively. In addition, IAEA has established an upper limit for LSA packages based on an external unshielded radiation level of 1 R/hr @ 3 meters.

The NRC is proposing to use 2 times the revised A_1 values as its threshold of control for LSA material. LSA material that exceeds this level will require a modified Type B package.

The results of the proposed NRC and DOT regulatory changes are illustrated in Fig. 1. The comparison of current versus proposed regulations is based on the average PWR isotopic distribution for dewatered bead resin shipped in a 14-195 liner (at ≈9,800 lbs). The figure shows that under current regulations, the NRC assumes regulatory control at around 12 curies of activity; at which point, an NRC certified container is required. Below that level, DOT requires shipment in a strong tight container. At approximately 1,200 curies, a Type B package would be required. Under proposed regulations, NRC control would not begin until approximately 40 curies. At this threshold, however, a package meeting Type B requirements is required for shipment.

EVALUATION PARAMETERS

Waste and Container Parameters: In order to thoroughly evaluate the impact of proposed low level radioactive waste transportation regulation changes, a variety of waste

parameters typical of the commercial nuclear power industry were selected. For these evaluations, specific waste streams, waste types, waste forms, and shipping container configurations were considered separately in all of the various combinations possible. The following parameters were used:

Plant Type:	Boiling Water Reactor (BWR)
	Pressurized Water Reactor (PWR)
Resin Type:	Bead
	Powder (BWRs Only)
Resin Grade:	Primary
	Non-primary
Waste Form:	Dewatered in High Integrity Container
	Solidified in Steel Liner
Container:	6-80
	8-120
	14-195 (Non-primary Resins Only)

This evaluation concentrated exclusively on ion exchange material generated from liquid waste stream processing, which represents the majority of wet waste shipped for disposal.

Cask Lease Rates: Several Type A and Type B casks were identified for use in this evaluation. Cask/liner combinations for the 6-80, 8-120 and 14-195 were assumed based on the most efficient combinations available, using the casks shown in Table I.

In order to permit a reasonably valid cost comparison for this effort, a standard daily cask lease rate for both Type A and Type B casks was required. Table I shows the daily cask lease rates assumed, based upon actual utility contracts.

Table I

Cask Lease Rates and Transportation Assumptions

CASK TYPE	DAILY RATE	Weight	Miles Per Day
HN 100	$ 330	Legal	600 Miles
HN 200	$ 1,000	Overweight	400 Miles
CNS 6-80	$ 545	Legal	600 Miles
CNS 14-195H	$ 510	Legal	600 Miles
CNS 8-120A	$ 1,700	Legal	600 Miles
CNS 8-120B	$ 1,925	Overweight	400 Miles

Transportation and Disposal Charges: The evaluation included actual transportation distances and standard per mile

charges, obtained from Tri State Motor Transit. Actual radioactive waste disposal rates in effect as of 11/1/87 for Hanford and 1/15/88 for Barnwell were used, including all surcharges, fees and taxes.

Potential cost savings for shipments less than 2 x A1: The NRC's proposed rule changes essentially established a lower limit of control (2 x A1), below which the NRC will no longer regulate. Therefore, NRC certified containers will no longer be required for shipments below this lower limit, resulting in a potential cost reduction from the use of non-certified containers.

To estimate the potential cost saving of non-certified versus certified containers, the CNSI 14-195H was compared to the CNSI 14-195L. Actual plant data indicated that costs for a non-certified container are 10% to 12% less than for certified containers. To be conservative, we estimated that a plant will realize a 15% reduction in cask lease costs for all shipments less than the NRC's lower limit of control.

EVALUATION RESULTS

Impact to Total Number of Shipments: The results of these evaluations are summarized in Table II. The table summarizes the results assuming all resins are shipped in the container indicated and dewatered in High Integrity Containers (HICs). The relative results for solidified resins are similar.

Keeping in mind that the evaluation was based on industry average data, which resulted in zero Type B shipments under current regulations, significant results are as follows:

- For primary-grade waste, the relative difference between adoption of the IAEA standards and NRC's proposed 2 x revised A1 values with respect to the increased number of Type B shipments is insignificant.

- For non-primary grade resin, a significant increase in the total number of Type B shipments could result from adoption of NRC's 2 x revised A1 values, relative to both current regulations and IAEA's 1 R/hr @ 3 meters. The overall increase is dependent upon whether or not plants would continue to ship in large-size liners.

- The actual number of Type A versus Type B shipments will be dependent upon numerous variables. These variables include, among others, availability of Type B casks (currently only 7 are used), relative cost of future Type B casks and plant operating conditions.

Table II

Total Number of Type A and Type B Shipments by Scenario

Resin Grade	Regulation*	Case Evaluated	# Type A Shipments	# Type B Shipments
Primary	Current	CNS 6-80	343	0
	IAEA	CNS 6-80	98	245
	NRC	CNS 6-80	95	248
Primary	Current	CNS 8-120	250	0
	IAEA	CNS 8-120	71	179
	NRC	CNS 8-120	64	186
Non-Primary	Current	CNS 6-80	***	***
	IAEA	CNS 6-80	2,913	0
	NRC	CNS 6-80	2,821	91
Non-Primary	Current	CNS 8-120	***	***
	IAEA	CNS 8-120	1,970	65
	NRC	CNS 8-120	1,758	277
Non-Primary	Current	CNS 14-195	1,613	0
	IAEA	CNS 14-195	1,522	98
	NRC	CNS 14-195	1,145	505

* IAEA based on 1 R/hr @ 3 meters, NRC based on 2 x Revised A1 values

*** Under current regulations, CNS 6-80 or 8-120 containers would not typically be used; therefore, the scenario was not evaluated.

Detailed Cost Breakdown: Based upon 1988 packaging, transportation and burial costs, the increased cost to the industry for both regulation changes (1 R/hr @ 3 meters or 2 x revised A1 values) is estimated at about $ 1,000,000 per year for primary grade resins.

For non-primary grade resin, adoption of IAEA's 1 R/hr @ 3 meters would result in a relatively insignificant economic impact if plants continued to use large size liners. Adoption of NRC's 2 x revised A1 values, however, could result in a significant increase in the number of Type B shipments (more than 500 additional Type B shipments which would increase total costs by about $4 Million based on current Type B cask fees). NRC's proposal could, however, lead to an increase in costs of up to $15 Million per year (based on 1988 costs) if demand for Type B casks exceeded supply and plants were forced to ship in smaller size liners. As Type B cask costs

escalate due to increased demand, the additional cost to the industry will also increase.

Effects of Increased Type B Cask Costs: As discussed above, NRC's proposal to use 2 x revised A1 values as its threshold of control has the potential to either:

1) Increase the relative number of Type B shipments without significantly increasing the total number of shipments, or

2) Depending on the availability and cost of future Type B casks, the total number of shipments could be increased significantly.

To evaluate the effects of increased Type B cask costs relative to total industry costs and total number of shipments, Type B cask lease rates were escalated based on multiples (2, 3, 4, etc.) of current costs. All other costs, including Type A cask lease rates, remained unchanged from the previous economic evaluations.

For Primary Grade Resin, it becomes slightly less expensive to ship smaller size containers as Type B cask costs increase. For Non-Primary Grade Resin, if demand would cause Type B cask costs to increase by a factor of 4 - 5 relative to current Type B cask costs, then it would become more economical for plants to ship a greater number of Type A shipments in smaller containers rather than ship fewer large containers.

Composite Scenario: ARI was asked to define a "representative industry scenario" to quantify the effects of the proposed regulations. Assumptions relative to defining this scenario are as follows:

For Primary Grade Resin, 50% by volume is shipped in 6-80 size casks and 50% by volume is shipped in 8-120 size casks. For Non-Primary Resins, the 14-195 scenario, as defined, was representative for non-primary grade resins. This scenario assumed that non-primary grade resins were shipped in a large size container (14-195) unless radiation levels prevented its use, in which case smaller (6-80) containers were used.

Increased demand for Type B casks will increase Type B cask costs by 50% relative to current costs. Reduced costs for material less than the NRC threshold of 2 x A1 remained at 15% savings from the use of non-certified containers.

Based on the assumptions outlined above, the results of the evaluation relative to current regulations are as follows:

Reduced Number of Annual Shipments in Type A Casks:	684
Increased Number of Annual Shipments in Type B Casks:	722
Increased Number of Total Annual Shipments (A + B):	38
Increased Annual Industry Cost:	$ 7.8 Million

A 50% increase in Type B cask costs was assumed for this scenario; however, this may or may not be an accurate assumption. Figure 2 illustrates the economic impact to the industry relative to Type B cask costs, based on adoption of NRC's proposed changes.

REFERENCES

The references listed herein have been reviewed during the course of this project and have contributed to the preparation of this document.

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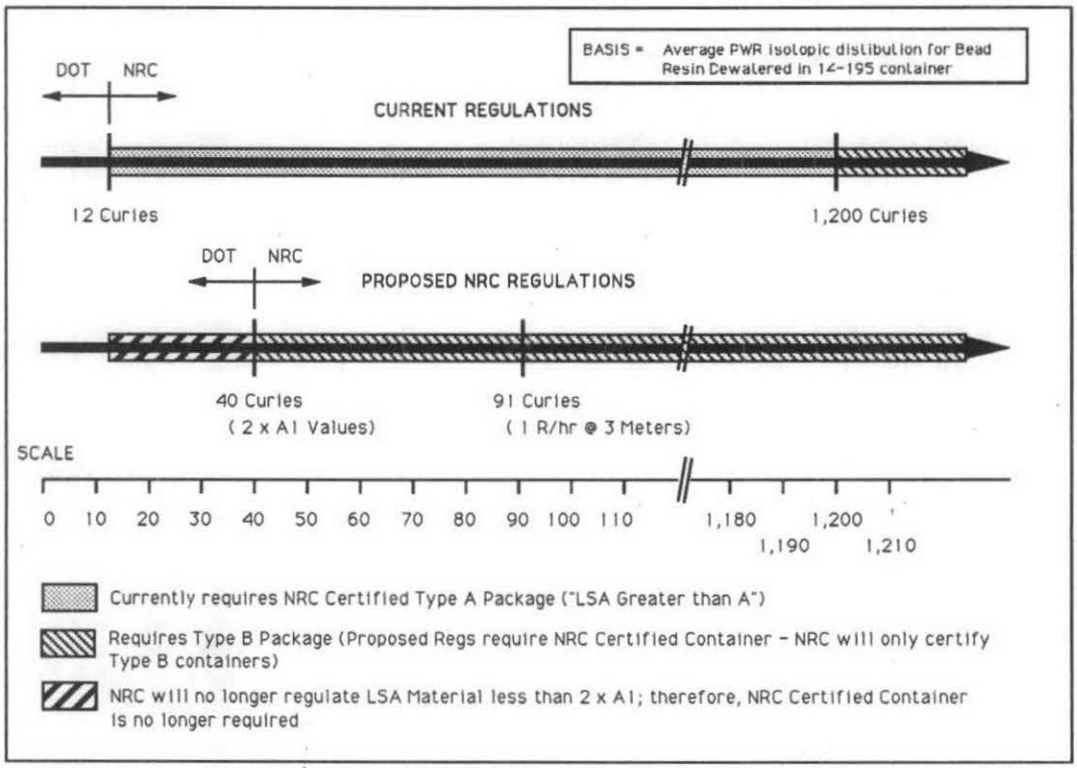

Figure 1. Current Regulations vs. NRC's Proposed Regulations

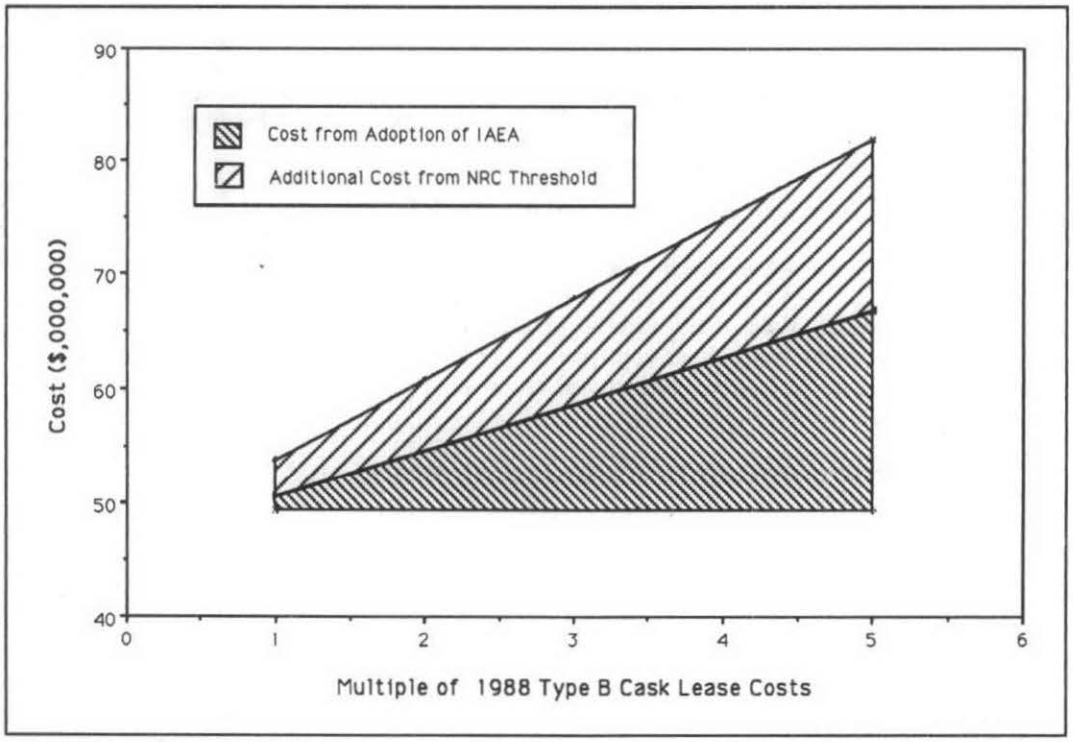

Figure 2. Industry Radwaste Costs vs Type B Cask Costs: Composite Scenario of Primary and Non-Primary Grade Dewatered Resin