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U.S. CASK REQUIREMENTS AND INDUSTRY CAPABILITY SURVEY*

G. C. Allen, Jr., R. B. Pope, and J. W. Cashwell
Sandia National Laboratories, Albuquerque, NM, USA

D. S. Joy and L. B. Shappert
Oak Ridge National Laboratories, Oak Ridge, TN, USA

W. R. Menchen
Teledyne Energy Systems, Timonium, MD, USA

Shipments of commercial nuclear fuel cycle materials have been safely transported in the United States for many years. However, the deferral of reprocessing and delays in developing geologic waste disposal repositories have resulted in only limited quantities of some fuel cycle materials being shipped in the U.S. In 1979, for example, approximately 50 shipments of commercial power reactor spent fuel were made in the U.S. High-density storage racks have been or are being installed to the extent possible because reactor discharge basins are starting to fill up. This has delayed the transportation of spent fuel to an uncertain future date and has resulted in the existing small fleet of spent fuel casks now available in the U.S. not being fully utilized.

The present lack of definitive information on the volumes and destinations of spent fuel and high-level waste has created uncertainties for private companies which would provide nuclear material transportation services. While it is expected that private U.S. industry will design, license, fabricate, own, and operate all commercial fuel cycle transportation systems, the U.S. Department of Energy (DOE) is charged with the responsibility to assure the availability of systems required to meet U.S. policy. Specifically, transportation systems must be available for supporting future away-from-reactor (AFR) and geologic nuclear waste repositories.

The purpose of this paper is twofold. The first objective is to provide an estimate of spent fuel shipping cask requirements for reactor to away-from-reactor (AFR) storage facility shipments from the present time until late in this century. These estimates will provide a basis for assisting government agencies and industry in assessing transportation alternatives. The second objective is to determine and document the willingness and capability of private industry to provide required future transportation services. In order to meet this objective, the Transportation Technology Center at Sandia National Laboratories sponsored Teledyne Energy Systems to conduct a survey of U.S. industry. The results of tasks completed to carry out the stated objectives will be reviewed.

In order to determine future shielded cask requirements, Oak Ridge National Laboratories has developed transportation logistics models to simulate operating waste transportation systems,[1] which operate using a spent fuel data base[2] consistent with the information provided to the U.S. Department of Energy Spent Fuel Storage Program. The data base describes historical discharges and projects future discharges of spent fuel from operating and proposed reactors. Spent fuel shipments

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DISCLAIMER

from U.S. reactors to AFRs represent only one of the paths shown in Figure 1 that will require shielded shipping casks. Details of the cask requirements for many of the other paths are not yet fully developed, and depend upon the date when waste repositories become available. For path B (domestic power reactor to AFR) there are three estimates of quantities of material to be moved (shown in Figure 2), and there are four possible destinations under consideration (AFR potentially located in the southeast, northeast, midwest, and western U.S.). The hardware requirements for each of the twelve possible scenarios have been calculated. The spent fuel logistics programs developed at ORNL have been used to predict the number of both truck and rail spent fuel casks required as a function of time for these specific scenarios. The cask estimates for the U.S. reactor to AFR shipments (Path B) do not include the equipment required for reactor to reactor shipments where transshipment is an option. Results for one of the twelve scenarios is shown in Table 1, which represents the reactor to AFR cask requirements for the planning base with the AFR located in a northeastern U.S. site. The effects of the different volume options on total (rail and truck combined) cask requirements are shown in Figure 3. The impact of different mutually exclusive location options for the planning base volume is shown in Figure 4.

Table 1

Reactor to AFR Shipments Cask Fleet Requirements
Projected Planning Base
AFR Located in Northeastern U.S. Site

Year	Number of Rail Casks	Number of Truck Casks
1981	1	2
1982	1	1
1983	1	1
1984	2	2
1985	2	5
1986	2	7
1987	2	11
1988	3	9
1989	4	9
1990	5	12
1991	8	12
1992	11	18
1993	11	20

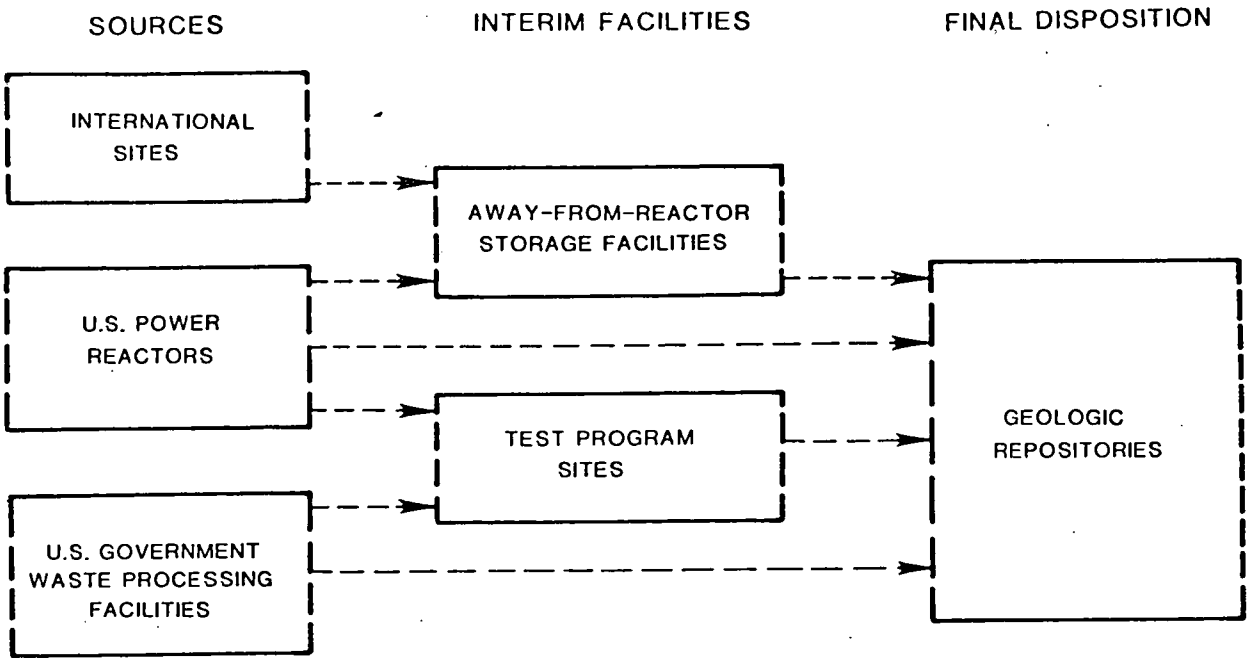

Figure 1. U.S. Transportation Paths for Shielded Spent Fuel and High-Level Waste Shipping Casks

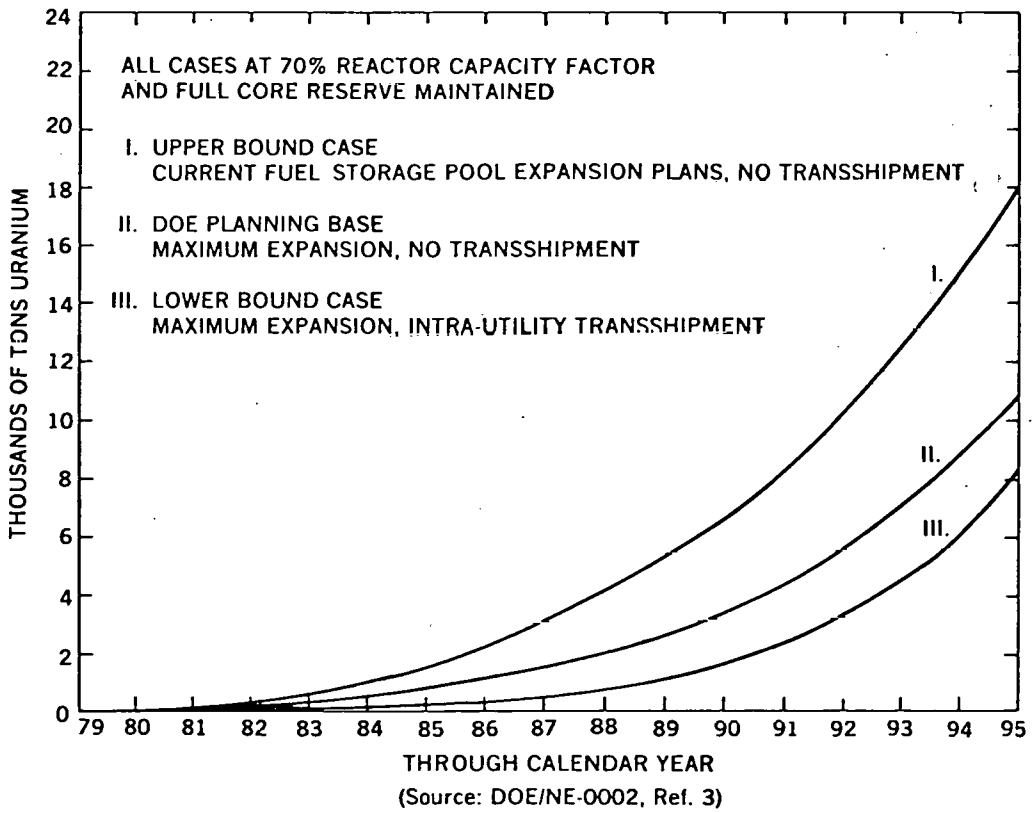

Figure 2. Cumulative Spent Fuel Shipment to AFR Storage Facilities from U.S. Power Reactors

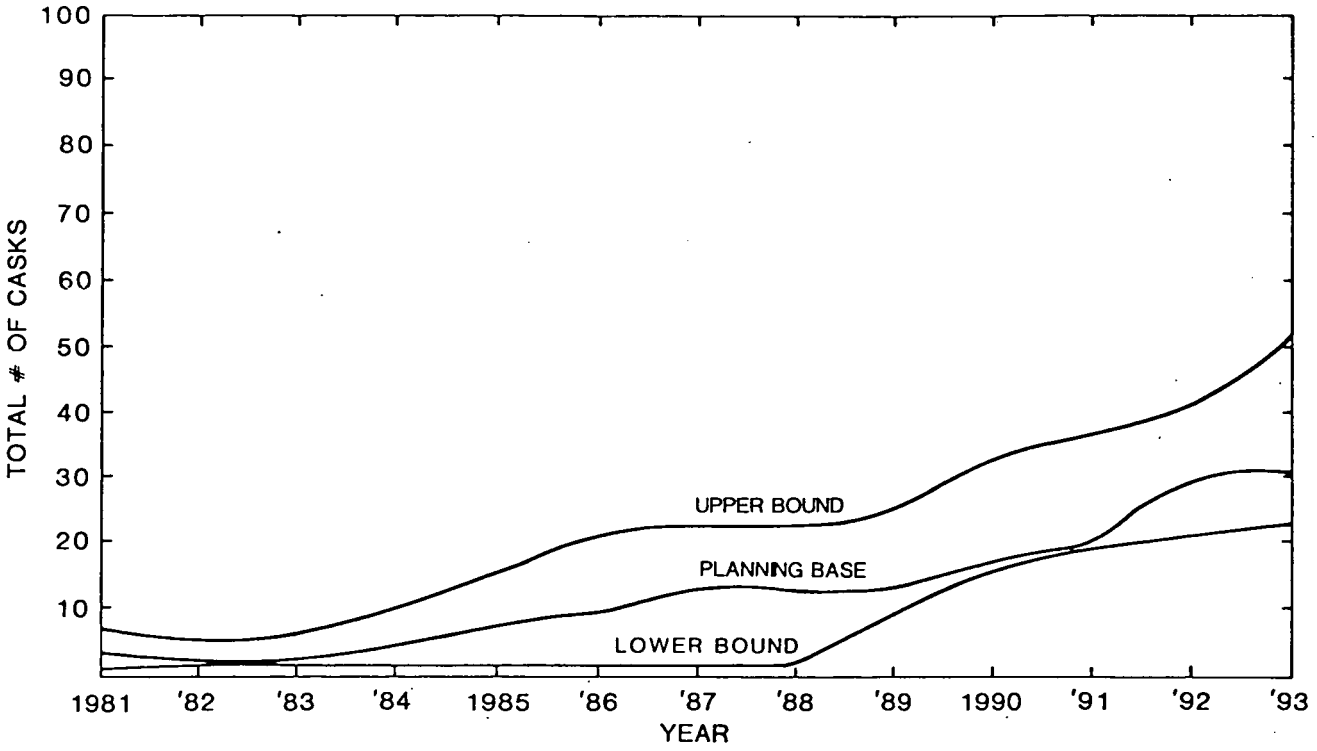

Figure 3. Total Cask Fleet Requirements for Shipments from Reactor to AFR by Data Base AFR Located in Northeastern Region

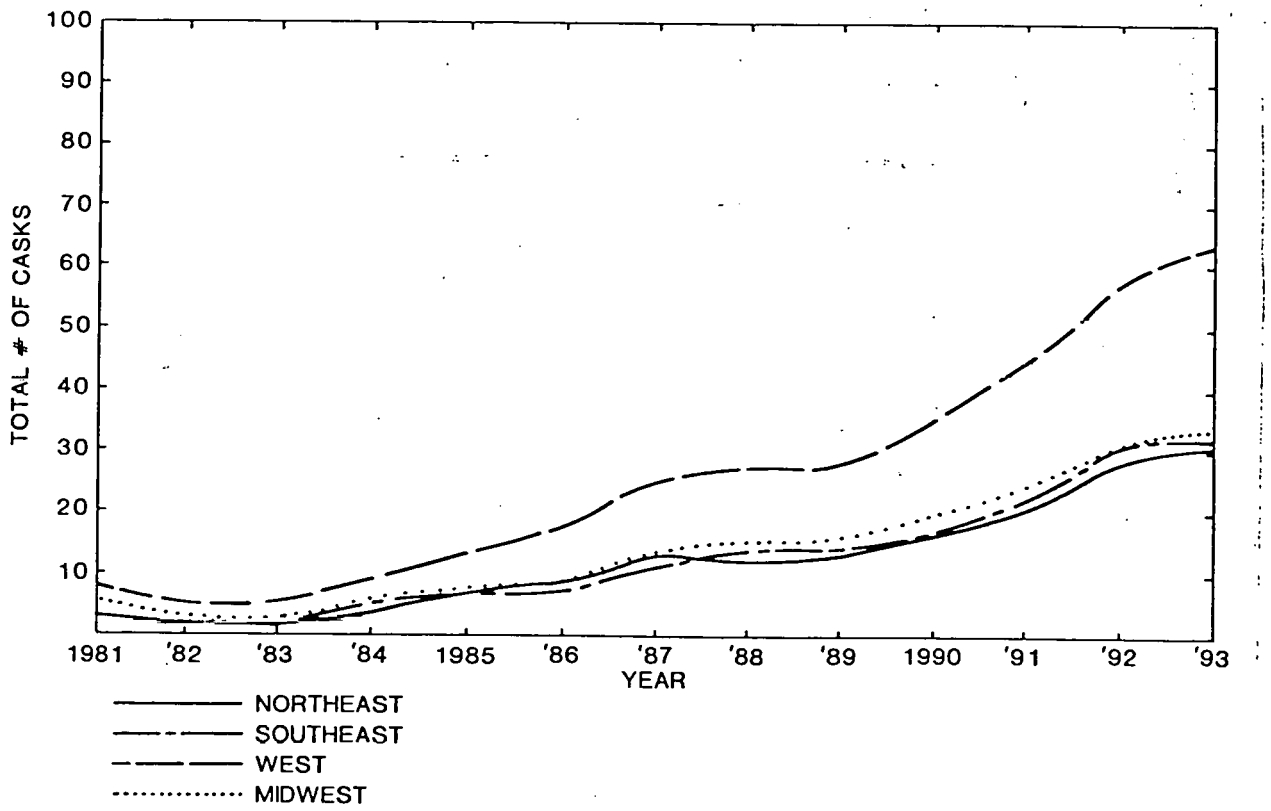

Figure 4. Total Cask Fleet Requirements for Shipments from Reactor to AFR by AFR Location Option Planning Base

As noted earlier, definition of casks required for the other shipment legs depends upon the date when a repository for these materials becomes available in the U.S. Repository startup dates range from as early as 1989 to as late as 2006. The current reference time frame used by the U.S. National Waste Terminal Storage program is for the first repository to become operational between 1997 and 2006. If a repository was available in the 1990s, the number of shipping casks required to meet the requirements of U.S. Government waste processing facilities up to the year 2000 would be less than 40 rail cask equivalents.

To determine and document the willingness and capability of private industry to provide required future transportation service, the Transportation Technology Center at Sandia National Laboratories sponsored Teledyne Energy Systems to conduct a survey of U.S. industry. The objective of the survey is to gather information that can be used in the development of future Federal policy in the transportation area. The survey scope is limited to the back end of the nuclear cycle and emphasis is on shipment of spent fuel and wastes other than non-transuranic low-level waste. The survey program consists of four major tasks: (1) Development of survey questions and background information, (2) Collection of survey data from approximately 135 private companies, (3) Evaluation and assessment of the survey data, and (4) Documentation of results.

The background information prepared for distribution to industry in the survey package included a summary of the overall nuclear material transportation system, a supplier matrix of transportation services in the U.S., descriptions and projected requirements for shipping packages. Survey questions were directed at defining capabilities of package suppliers, transport service groups, carriers, special vehicle suppliers, and testing organizations. Questions regarding general issues (such as finance, marketing, personnel, and government involvement) that affect the U.S. nuclear material transportation industry were also included. The survey questionnaire was approved by the U.S. Department of Energy and the U.S. Office of Management and Budget.

The evaluation of survey data was performed by summarizing written questionnaire responses and evaluating the summarized data. Evaluation was performed with the assistance of a team of consultants to Teledyne, each having long association with U. S. nuclear transportation activities. About 50 companies provided usable responses to the survey questionnaire. This return is clearly less than anticipated since the approximately 150 questionnaire recipients were pre-selected on the basis that their capabilities matched the requirements of a nuclear transportation system. Reasons for lack of participation in the survey cannot be completely determined. However, it is clear from survey results that the current U.S. marketplace for nuclear transportation activities is generally not offering an attractive opportunity for private industry. Those who are presently most heavily involved offer considerable skepticism for future business.

The actual survey results indicate that substantial capabilities exist in every transport function except finance and insurance (see Figure 5). These latter two represent a problem in response, not capability, since the companies falling in these two categories felt they had little constructive information to offer now, but their services were available as required. Of the companies responding, the majority derive less than 10% of their revenue from nuclear material transportation with over 20 responses falling in the 0 to 1% category. Even for package fabricators who responded, all but one derive less than 10% of their business from nuclear material transportation. It is interesting to note that all but one respondent anticipated an increased percentage in the future, yet, by a 5 to 1 ratio, the same group felt that a substantial number of new employees would not be required to support a future role. This apparent inconsistency is probably explained by the small amount of total business that nuclear transportation provides to domestic industry.

Each company was asked to rate the effect that public concern has on their role in transportation. In evaluating responses to this and similar questions, it is apparent that public concern and acceptance is regarded as an important factor. Most responding companies provided answers to the general questions which addressed critical problem areas, policy, motivation and deterrents to participation in transportation activities. The three problems most often cited were regulatory uncertainty, lack of spent fuel and high-level waste facilities, and public acceptance. For those companies having container fabrication capabilities, regulatory uncertainty was the problem most often cited.

Areas of government policy most affecting a supplier function were generally responded to in a negative context. Lack of a clear overall government policy was most cited and included a perceived lack of support for industry. Other policy areas frequently mentioned were Nuclear Regulatory Commission (NRC) regulatory indecisiveness and problems with specific regulations. The latter category includes time consuming environmental regulations, NRC spent fuel safeguard regulations, mandatory quality assurance documentation and Occupational Safety and Health Adminstration regulations.

There was very definite agreement on what would motivate industry to be more involved in nuclear transportation. Industry wants a clear view of the market so that business prospects can be reasonably assessed. As a corollary to a better market, industry desires clear Federal and state policy with emphasis on government commitment toward nuclear power. DOE's expressed philosophy is that transportation capability will be provided by private industry. Furthermore, government policy will strive to reduce risks and improve incentives for private industry participation. The survey included questions on incentives the government could offer in the transportation business area. Here responses were more diverse. Most frequent responses mentioned were a dependable licensing schedule (regulatory stability) and government programs that provide R&D funds and opportunities for hardware fabrication. Funding by the Federal government was usually tied to statements about implementation of a national waste storage policy. A question on deterrents to industry participation yielded similar results to the earlier question on industry willingness to participate in this activity. At present, industry cannot assess risks and the profit and market growth potentials in nuclear material transportation. Company responses indicated that these problems, coupled with poorly defined national waste policy and the psychological impact of changing political positions over the last ten years, makes the market relatively unattractive. These points were emphasized by those companies with a history of activity and an understanding of the market.

Although the current nuclear transportation market leaves much to be desired from domestic industry's viewpoint, there is little question that ample private industry capability exists to meet the marketplace's needs through the year 2000. The survey asked a number of specific questions related to container fabrication capabilities for truck and rail spent fuel casks, high-level and intermediate waste casks, and TRU overpacks. A key result of the survey is the composite response to the question on domestic manufacturing capability to build various containers for spent fuel and waste transport. Table 2 shows this capability based on the thirteen responses received from companies with presently existing production facilities.

The near-term U.S. cask needs are based on reactor-to-reactor, reactor-to-AFR and waste disposal test program requirements. Shipments to geologic repositories are not expected to occur until approximately the year 2000. It is clear that domestic capability far exceeds the near-term national requirements based on only the thirteen responses. Many companies with known manufacturing capability did not choose to respond to the industry survey and the survey was only mailed to

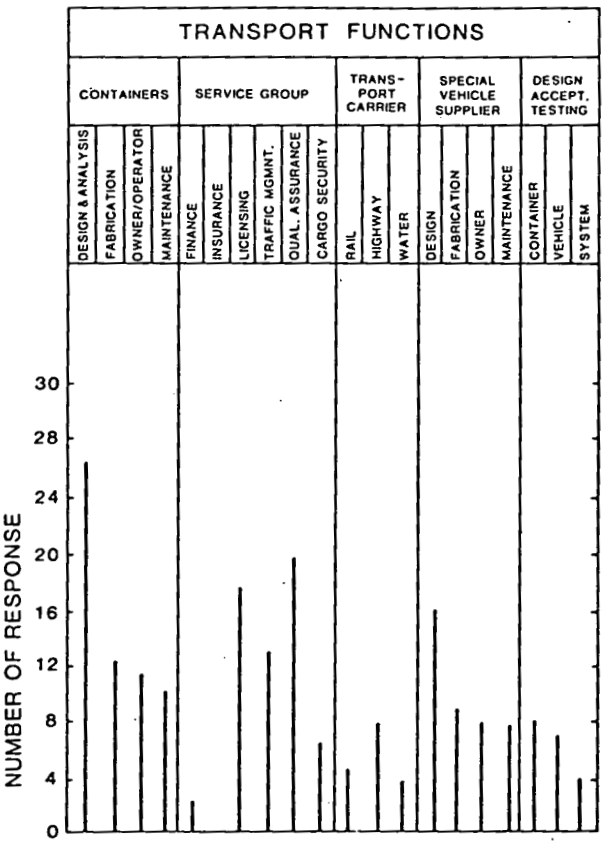

Figure 5. Present Capabilities of U.S. Companies Responding to the Industry Survey

Table 2

Number of Units Per Year That Could Be Produced
With Present Capabilities of Responding Companies

	Spent Fuel Casks		High-Level Waste Casks		Intermediate Level Waste Casks	TRU Overpacks
	Truck 20-30T*	Rail 50-100T	Truck 20-30T	Rail 50-100T	Truck & Rail 15-25T	Truck & Rail 5-15T
Business as Usual	63	28	60	24	113	40
Priority Over Other Jobs	117	61	89	33	159	63

* T = tons; 1 ton = 0.91 tonne

a very small fraction of the overall potential manufacturing population. Consultants currently evaluating the survey data agree that existing manufacturing capability far exceeds the known hardware requirements of the transportation system. Utilization of this capability must, of course, take into account the problem areas, deterrents and incentives which have been described earlier.

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