Nuclear Waste Transportation System: Cask Interface and Physical Performance Specifications

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ABSTRACT

This paper describes the current status and strategy for the development of civilian nuclear waste transportation cask interface and physical performance specifications. These specifications are required to support the development and evaluation of future transportation packages that will convey commercial spent fuel and other waste forms to government storage and disposal facilities in the late 1990's.

INTRODUCTION

With enactment of the Nuclear Waste Policy Act (NWPA) of 1982 [1] and the subsequent issue of the Office of Civilian Radioactive Waste Management (OCRWM) Mission Plan [2], the U. S. Department of Energy (DOE) established a commitment to assure that a safe, environmentally acceptable, and cost effective transportation system be operable when needed. Under provisions of the NWPA, the DOE will take title to spent fuel at the reactor site and arrange for the transportation of this radioactive material to repositories or interim storage facilities.

A multi-phase program has been established by DOE to develop the necessary transportation capability to ship nuclear waste from existing utilities and waste processing facilities to storage facilities that have yet to be built. The majority of facilities from which the nuclear waste will originate are currently in existence and many have significantly different features and transportation interfaces. As such, future transportation systems must have considerable flexibility and versatility in order to interface with each of the components within the entire system. The nuclear waste shipping packaging or "cask" is central to nearly every aspect of transportation and is therefore a focus of initial program planning and concept development.

The overall transportation system program development consists of four phases; 1) systems definition; 2) engineering development and certification; 3) cask fleet procurement and carrier negotiations; and 4) transportation operations. The systems definition phase, currently underway, includes definition of the waste forms to be shipped, transportation modes and logistics, and the specification of optimal design envelopes for each of the modes (truck, rail, barge, etc.) To support the development and certification of future transportation packages, a significant effort is continuing toward the identification and subsequent definition of cask physical performance and interface requirements. These requirements will ultimately assume the form of design specification envelopes within which future cask designs will be evaluated. The cask interface and physical performance specifications will be used to define critical cask features that are needed to have an integrated transportation system.

The engineering and development phase, which will be initiated soon, will be based upon the elements identified in the previous phase and performed through multiple contractural arrangements with industry. Fleet procurement and carrier negotiations are expected to begin in the early 1990's with full scale transportation operations scheduled to begin in the mid to late 90's. To meet this starting date a mini-fleet will be tested throughout the system (reactors, processing facilities, and storage site(s)) for approximately two years. Necessary modifications to any of the cask designs or interfaces will be initiated following evaluation of the operational tests.

Development of Interface Criteria

The transportation system is made up of the five basic component groups that are illustrated in Figure 1. If the five component groups are to work together smoothly, the common boundaries or "interfaces" between each group must be carefully studied and clearly defined. The component groups are: 1) Waste Forms; 2) Casks; 3) Transporters; 4) Facilities; and 5) Regulators. Within existing regulatory guidelines, the transportation components have three primary interfaces with the remainder of the system. These are: 1) Waste form-to-Cask; 2) Cask-to-Transporter; 3) Cask/Transporter-to-Facility. Each of the three interface areas involves a wide variety of hardware items, equipment tools, design considerations and regulatory guidelines. For example, the waste form-to-cask interface involves the handling of intact as well as disassembled boiling-water-reactor and pressurized-water-reactor fuel assemblies that have a wide range of irradiation and decay histories. The waste form, which generally comes from water storage pools at utility sites, must be capable of being inserted into a shielded cask in an efficient and safe manner for subsequent transport. The information and guidance that is required in order to design the interface related hardware and systems have been written in the form of criteria. These criteria were developed during FY84 and provide the framework from which more detailed cask physical performance specifications will be developed.

Cask Physical Performance Specifications Development

Current emphasis is toward the development of draft specifications for truck, rail, and barge casks to support design activities that are expected to

begin soon. A significant amount of the data needed to establish envelopes for these preliminary specifications has been accumulated over the years by private companies in support of spent fuel transport operations. Seven categories of interface data have been identified where it is expected that transportation packaging and service suppliers could review existing data and recommend descriptive transportation system design envelopes. As such, a shipping cask interface data collection group is being formed with the express purpose of collecting and defining envelopes of existing data, primarily related to the utility, cask and transporter components of Fig. 1.

A Transportation Interface Working Group is also being formed that is composed of representatives from each of the proposed facilities that will interface with spent fuel or nuclear waste transportation packagings. The objective of this group is to coordinate facility and cask design features as necessary to ensure system compatibility.

The cask design specifications will undergo subsequent evaluation and possibly re-definition concurrently with cask design activities as illustrated by Fig. 2. Initial specifications will be written for truck, rail and barge cask systems and used to implement design activities. The information and results generated by these design activities will then be utilized to revise the initial specifications which then can be used by cask fleet designers for final engineering development and certification activities.

Summary

The development of nuclear waste transportation system cask interface and physical performance specifications is significant because it serves as a focal point to bring together the personnel organizations that will build, operate and interface with the transportation system. The specifications will ensure that the overall nuclear waste transportation system: 1) meets the requirements and schedule of the NWPA, 2) is safe and economical, and 3) efficiently utilizes the expertise of the involved U.S. companies.

References

1. The Nuclear Waste Policy Act of 1982, as signed by the President on January 7, 1983 (Public Law 97-425, 96 Stat. 2201, 42 U.S.C. 10101).

2. Mission Plan for the Civilian Radioactive Waste Management Program, U. S. Department of Energy, Office of Civilian Radioactive Waste Management, March 23, 1984 (Draft)

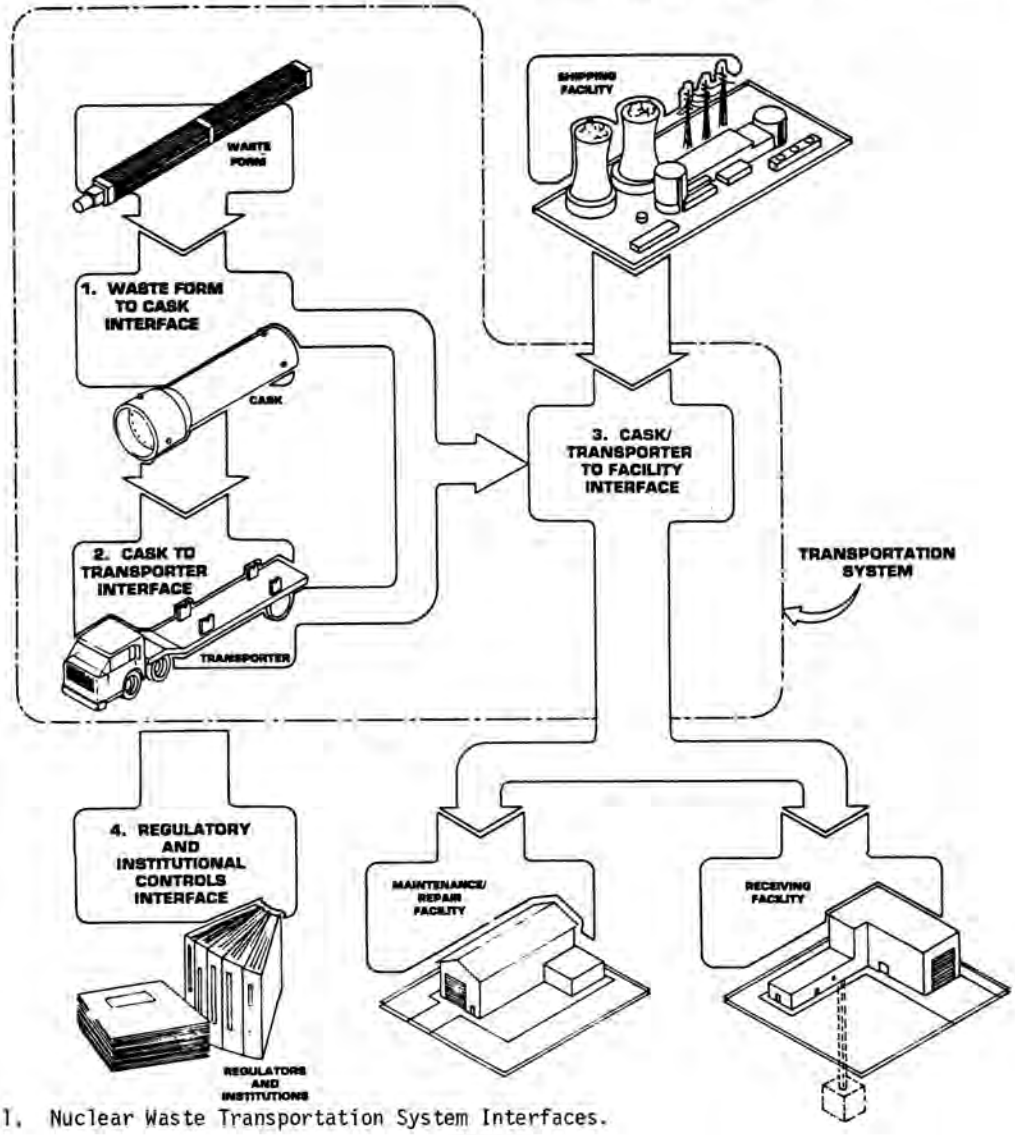

Fig. 1. Nuclear Waste Transportation System Interfaces.

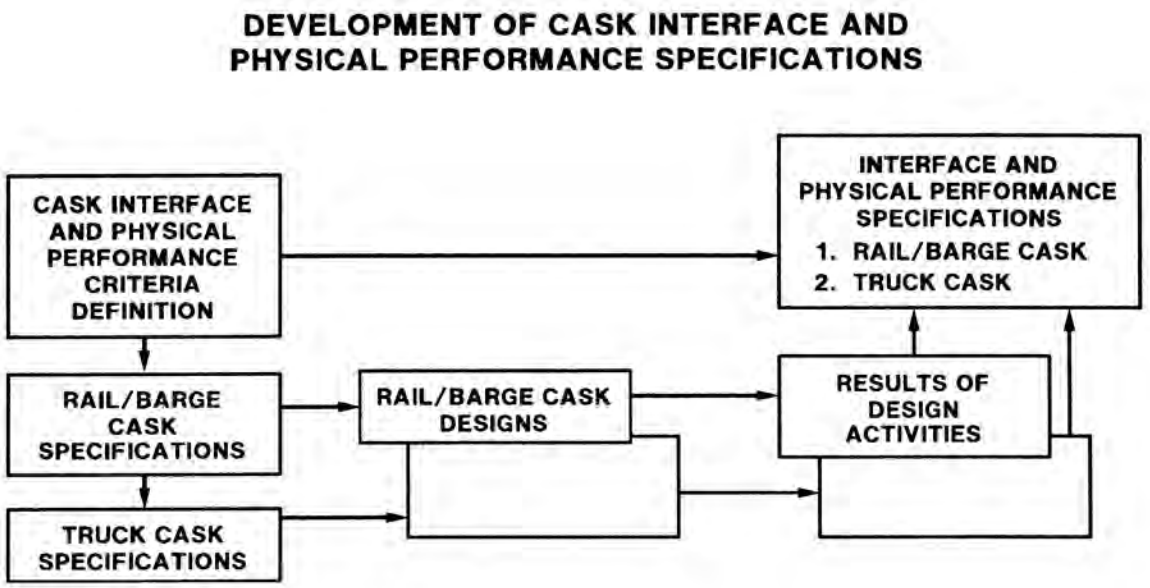

Fig. 2. Development of Cask Interface and Physical Performance Specifications.