

SELECTION PROCESS FOR NEW NUCLEAR MATERIAL SHIPPING CONTAINER DESIGN AGENT

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Abstract

The Department of Energy (DOE) National Nuclear Security Administration (NNSA) in April 2006 acted on a need to replace the Department of Transportation (DOT) 6M Specification 110-gallon container with a modern performance-based container. The new container needed to be certified and ready for use either before, or soon after, October 1, 2008, when the DOT Specification packages can no longer be used. Discussions about starting a design effort for this container had been occurring within the DOE's Secure Transportation and Packaging Steering Committee for some time without action being taken despite several DOE Program Offices needing this container. The NNSA has two container design centers having extensive experience with nuclear material shipping containers. These two design agencies, Savannah River National Laboratory and Y-12, were asked to provide concepts for the new package.

The NNSA requested information from each design agency concerning their concept for developing a replacement container. The NNSA provided a set of questions to be answered by each site regarding their design concept. These questions formed the framework for the site's proposals and for NNSA in evaluating each concept. While the standard cost, scope, and schedule elements were a part of the selection criteria, they did not take precedence over other factors in making the decision. The strength of each design concept and unique features was considered along with how soon each site could start the design. Other elements considered during the evaluation process included the current and future workloads of each design center along with their available manpower.

This paper will describe the situation within the NNSA packaging program at the time the decision was made. The overall status of the packaging program was also factored into the decision. The paper will also present the evaluation criteria and describe the evaluation process leading to the selection decision. Both concepts received were very solid, and either proposal would have resulted in a very viable new container. The decision was made by evaluating the strengths versus the risks of each proposal. The paper will describe how BWXT Y-12 was selected to develop the new ES-4100 container.

Introduction

After September 30, 2008, the Department of Transportation (DOT) 6M Specification Packages can no longer be used for offsite transportation. The Department of Energy (DOE) National Nuclear Security Administration (NNSA) has utilized a wide range of 6M packages and has instituted a number of new designs to replace the aging 6M designs. Discussions about starting a design effort for the large 6M 110-gallon container had been occurring within the DOE's Secure Transportation and Packaging Steering Committee for some time without action being taken despite several DOE Program Offices needing this container. After a number of inquiries on the continuing need for the 6M 110-gallon replacement package, it was determined that there was a significant NNSA need for this type of container. Additionally, there were also needs from other DOE program offices as well as some university research reactor sites. The NNSA Packaging Program undertook the responsibility to begin work on a new replacement design.

The NNSA has two container design centers, Savannah River National Laboratory (SRNL) and BWXT Y-12 (Y-12), that have extensive experience with Type B nuclear material shipping containers. Previously this design assignment would have been given to the Y-12 packaging design center since most NNSA users of the 110-gallon package were associated with Y-12 in some way. However, the NNSA Packaging Program felt that a design competition could lead to numerous benefits. In April 2006, these two design centers were asked to provide concepts for a new container to replace the 6M 110-gallon container with a modern performance-based container.

This paper discusses the DOE proposal requirements, both design centers' proposed designs, and the DOE design selection process. This competitive selection process resulted in a bonus that occurred after the award. The bonus was an evolution in the design configuration for the new container. That improved design will be described and is the current design that DOE is pursuing.

DOE Request for Conceptual Designs

In April 2006, the NNSA Packaging Program requested that Y-12 and SRNL provide conceptual designs for replacement of the 110-gallon 6M container. Note that new NNSA general purpose containers are designed to comply with all the applicable regulatory requirements of 10 CFR 71. The Packaging Program developed a set of design parameters to be evaluated to aid in the selection of a design agency for the new container. The design centers were requested to prepare a proposal containing this and any other information they thought pertinent to evaluation of the designs.

A summary of requested design information follows:

- Is this a new or modified design?
- Package weight
- Containment Vessel (CV) diameter and length
- Projected heat load and heat dissipation design
- Length and vertical stability issues
- Unique features, description, and available drawings
- Proposed certification agency
- Development costs for design, testing, and certification along with funding profile

- Fabrication cost for a quantity of 100 containers
- Development and certification schedule

Design Summaries

Once the proposals were received, the Packaging Program prepared a table highlighting the pertinent details of each design. Several rounds of clarification questions and responses occurred between the Packaging Program and the design centers to ensure that the details of both proposals were completely understood prior to the down-selection decision.

A comparison of the proposed designs is shown in Table 1.

110-gallon 6M Replacement Comparison

Attribute	SRNL Concept	Y-12 ES-4100
Package Weight	550 lb or 675 lb	600 lb
CV Height	53" or 71"	58"
CV Diameter	5" with higher option	5" with higher option
Outside Dimensions	22.5"×70" or 30"×88"	19.37"×70.56"
Heat Load Capacity	10-20 W	30W
Vertical Stability	Drum ends permit vertical or horizontal transport of package	Greater than current 6M; possible use of ballast to lower CG
Unique Features	Chalfont closure, polyurethane foam overpack, utilizes design features of DOE 9977 package	Modification of DOE ES-3100 package, NRC is familiar with base design, load or unload either in overpack or outside
Certification Agency	NRC	NRC
Other Information	SRNL has not licensed a container with NRC	NRC is licensing ES-3100
Development Cost	\$1.84M	\$2.49M plus review support costs
Fabrication Cost	\$6-9K	\$6.9K
Schedule	July 2006 thru September 2009	August 2006 thru May 2009

Table 1

Design Selection

The NNSA design selection was based primarily on an assessment of risk versus benefit. The SRNL design was a new design that would utilize concepts from the existing DOE 9977 package. Costs and schedules were judged to be optimistic for a new design. The use of polyurethane foam in the overpack was a preferred feature. However, accumulating SRNL experience with licensing another General Purpose Fissile Package with the DOE Environmental Management Program was progressing slower than expected. Additionally, the SRNL packaging design program staff was smaller than Y-12's, and they had several packages they were currently designing or were going to design in the immediate future so there was some concern about their ability to successfully complete the volume of work.

The Y-12 proposal was for a lengthened version of their ES-3100 design that they were working on for NRC certification. Costs and schedules were judged to be fairly realistic given all the shared features with the ES-3100. The Y-12 proposal was hindered by concerns that engineering resources would not be available because of the large volume of competing, concurrent projects underway at Y-12. Also there were concerns that an additional package using kaolite in the overpack could increase overall program risks if kaolite was to develop any type of performance problem in the future. In the authors' opinions, both designs had vertical stability and drop test slap down concerns.

The strengths of the Y-12 ES-4100 proposal included proven NRC licensing experience on a sister design (ES-3100), good cost and schedule performance history, and the fact that a majority of users will already have loading equipment by virtue of utilizing a design compatible with the existing ES-3100 loading equipment. The ES-4100 design was selected for further development in July 2006.

Bonus – Design Improvements

This process did not end with initial selection of the long, slender design originally proposed by the Y-12 team. The vertical stability concerns still remained. The Packaging Program was still hopeful that the best possible design would be produced from this competitive process. Perhaps the competitive environment fostered by the NNSA Packaging Program stimulated the Y-12 design team to further explore additional design concepts before completing the container's System Requirements Document and initiating final development activities. Whatever the reasons, the Y-12 team submitted an alternate design that solved concerns for vertical stability and also improved trailer loading operations.

NNSA approved this design which retains the ES-4100 designation. The design features four CVs in a single overpack. The design retains the kaolite impact absorbing material along with a neutron absorbing material envisioned in the original proposal. The increased diameter of the multiple CV configuration significantly reduces the stability concerns. The new innovative ES-4100 design is shown in Figure 1. The ES-4100 container will be used primarily to ship long items. Most items will not be shipped singly and will require multiple packages, so the four CV concept increases transportation efficiency.

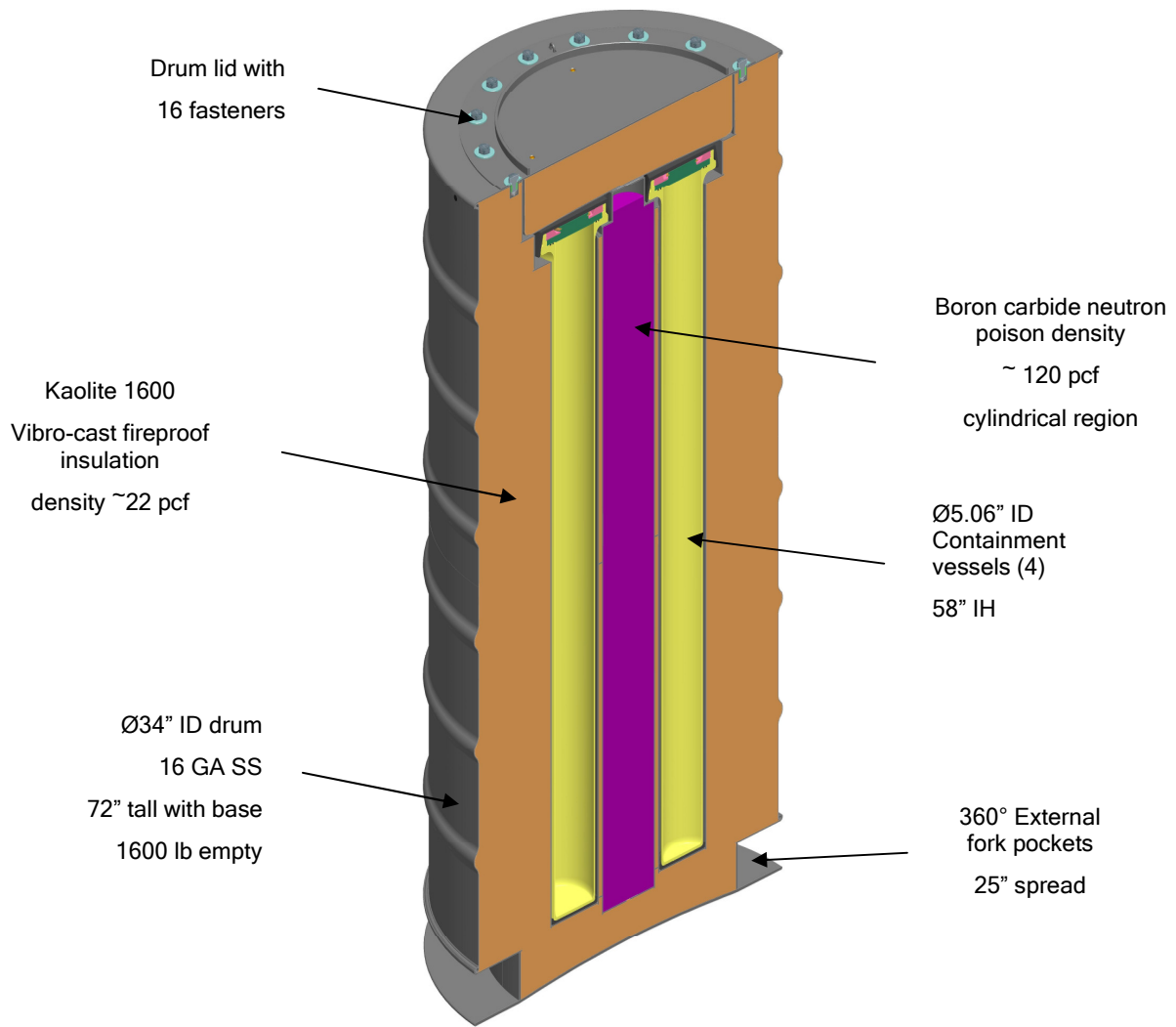


Figure 1. Innovative ES-4100 Design

CONCLUSIONS

The DOT 6M series of specification packages are being phased out by DOT as of September 30, 2008. DOE users of the 6M 110-gallon container were late in confirming the need for a replacement package in spite of numerous efforts to identify those needs. The NNSA Packaging Program took the lead on developing a replacement package that meets current regulatory standards. The NNSA decision to conduct the design agency selection competition for the replacement of the large 110-gallon 6M package resulted in a design that exceeded expectations. Both DOE design agencies were receptive to the competitive approach and should expect to compete for future package designs.