Packaging Development Programs
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W. S. Edwards

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Westinghouse Hanford Company
P.O Box 1970
Richland, Washington

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PACKAGING DEVELOPMENT PROGRAMS RECOMMENDED FOR THE U.S. DEPARTMENT OF ENERGY

W. Scott Edwards
Westinghouse Hanford Company
P. O. Box 1970, G2-02
Richland, WA 99352
(509) 376-2522

ABSTRACT

U.S. Department of Energy facilities were visited to determine their specific packaging needs. Those individual site needs were analyzed to determine widespread packaging needs. Those packaging needs are: replacements for aging Type B packagings, plutonium packaging, overpacks for large containers, heavily shielded Type B packaging, large radioactive liquid packaging, standardized waste packaging, and packaging for explosives.

I. INTRODUCTION

The packaging requirements of many U.S. Department of Energy (DOE) sites were evaluated by the Packaging Needs Assessment program. The Needs Assessment involved site visits and meetings with personnel involved with transportation and packaging of hazardous materials at 24 DOE facilities during fiscal years 1994 and 1995. This assessment was sponsored by the Office of Transportation, Emergency Management, and Analytical Services (EM-76) within the DOE Office of Environmental Management and was conducted by Westinghouse Hanford Company. The Needs Assessment originated because the introductory phase of any packaging development effort sponsored that had the potential for DOE-wide use, involved searching the entire DOE Complex for specific uses for the proposed packaging. During those searches it was found that a wide range of packaging and associated transportation needs had no formal mechanism for being addressed by DOE. Therefore, the Needs Assessment began to investigate the different DOE programmatic packaging requirements and needs, evaluate the determined needs as compared to existing packaging resources, evaluate the needs compared to potential DOE developmental efforts, and, finally recommended new packaging development programs.

The following report presents the conclusions of the two year Packaging Needs Assessment effort. The report also discusses how information on packaging needs was obtained from each site visited and which sites were visited. More detailed information and the results of each site visit are listed in three periodic progress reports on the Needs Assessment.1,2,3

II. SITE PRESENTATION FORMAT

At the opening of each Needs Assessment meeting at a DOE facility, the role of EM-76 within DOE and its role in packaging development activities was discussed. Specific examples of packaging developed, or under development, within DOE — such as the Tritium Waste Package, Type A liquid sample packaging, and Type B Drum — were then presented. The presentation evolved as new packagings that could be used throughout the DOE Complex were discovered or when common needs were recognized. Ongoing regulatory activities including Performance Oriented Packaging (POP), Docket HM-169A to align U.S. transportation rules with international regulations, and other possible regulatory revisions were also discussed. During these meetings, an active discussion between the presenters and the attendees was encouraged and always occurred. After the presentations were complete, the sites were then asked to discuss any packaging needs they may have that are not being satisfied and any packaging they may have developed which could be of use to other DOE facilities. Finally, any unique packaging or shipping facilities were visited.

The attendees at these meetings were, in general, personnel in the packaging and transportation function
within the site organization. Other personnel from site organizations (e.g., waste management or remediation) that make large numbers of shipments or have future packaging needs also attended these meetings. Representatives from local DOE offices sometimes attended the meetings or were visited separately after the meeting. The format of the meetings was successful in gathering the most information possible from each DOE site. Site visits typically lasted for an entire day.

III. DOE SITES VISITED

The following DOE sites, as well as the Hanford Site, were visited as part of the Packaging Needs Assessment activity (see Figure 1):

A. Fermi National Accelerator Laboratory
B. Argonne National Laboratory
C. New Brunswick Laboratory
D. EG&G Mound Applied Technologies
E. Fernald Environmental Management Project
F. West Valley Demonstration Project
G. Lawrence Berkeley Laboratory
H. Stanford Linear Accelerator Center
I. Brookhaven National Laboratory
J. Princeton Plasma Physics Laboratory
K. Waste Isolation Pilot Plant
L. Rocky Flats Environmental Technology Site
M. Savannah River Site
N. Oak Ridge National Laboratory
O. Idaho National Engineering Laboratory
P. Pantex Plant
Q. Los Alamos National Laboratory
R. Lawrence Livermore National Laboratory
S. Sandia National Laboratory-Livermore
T. Battelle-Columbus
U. Portsmouth Gaseous Diffusion Plant
V. Sandia National Laboratory-Albuquerque
W. DOE-Albuquerque Operations Office
X. Kansas City Plant

IV. REQUIRED PACKAGING DEVELOPMENTS

During each Needs Assessment site visit, personnel have either identified materials that need to be shipped which do not have existing packagings or recommended specific packaging development programs which would satisfy their needs. All packagings identified below could be used by more than one DOE facility or program, as long as the requirements of all potential users are considered and incorporated as options during the packing design. Each of the following packaging development activities have been recommended by multiple facilities during the course of the Needs Assessment. If development programs for the following packagings are not started well in advance of the date they are needed, the length of time needed for development and/or certification may cause program schedules to be missed.

A. Replacements for aging Type B packagings

Many DOE facilities are using Nuclear Regulatory Commission (NRC)- or DOE-certified Type B packagings that do not meet current Type B packaging standards, but are acceptable for use today because of a grandfather clause placed into the Type B packaging regulations. That grandfather clause permits continued use of these older packagings as long as they were fabricated before August 1986. Examples of these packagings are the B-3 and B-1 M-1 casks, and the FI-10, and Super Tiger containers. The certificates of compliance for these packagings will allow fabrication of replacements, so as the packagings age or are damaged, replacements cannot be obtained. Some of these packagings are at least 25 years old and are used by newer programs, including for medical radiotopic production. Therefore, new packaging development programs are necessary to ensure that replacement packagings are available when the existing packagings can no longer be used or become obsolete.

B. Packaging for plutonium

The Savannah River Site is developing new packagings for plutonium metal and plutonium oxide, which are known as the 9972-9975 containers. Those packagings, which will primarily be used for plutonium that is not contaminated with other isotopes or materials, are still going through the certification process. However, packagings are needed for transuranic (TRU)-contaminated waste, residue material at Rocky Flats, and, if the decision is made to dispose of excess weapons-grade plutonium, vitrified plutonium. The TRUPACT II container will be able to ship some of the waste material, but as a result of restrictions in the amount of fissile material and gas generation allowed within the TRUPACT II, some waste and all residue and vitrified plutonium will need alternative packaging. No other existing packaging can reasonably ship the rest of this material. The Type B Drum, a packaging that has a completed conceptual design and design criteria, could ship most of the plutonium waste and residue material, as well as vitrified plutonium. However, budget cuts have suspended further development work on the Type B Drum. Otherwise, an entirely new packaging development will be necessary.

C. Overpacks for large volume items
Many facilities have stored waste in containers that have worn to the point of becoming unusable, but now must ship that waste to disposal sites. Most of these containers are either 55-gal drums or 1.2 m by 1.2 m by 1.8 m (4 ft by 4 ft by 6 ft) boxes. Industrial packaging and Type A overpacks sized to fit these existing containers would prevent facilities from needing to repackage all of this waste. Several other facilities have boxes containing Type B quantities of waste (mainly TRU) that are at least 1.2 m by 1.2 m by 2.4 m (4 ft by 4 ft by 8 ft). A Type B overpack would allow these large items to be shipped to either a central location for repackaging into containers that fit inside of the TRUPACT II container (which would reduce the number of sites required to repackage the waste) or actually shipped to Waste Isolation Pilot Plant if its waste acceptance criteria is changed to permit the use of packagings other than the TRUPACT II or the NuPac 72-B.

D. Heavily shielded Type B packaging

This packaging would be used for accelerator targets generated for research and development experiments and for older sources that are stored at facilities throughout the DOE Complex that no longer have certified packaging. As an example, Brookhaven National Laboratory has a 30,000 Ci of Co$^{60}$ source and a 46,000 Ci Sr$^{90}$ source that will eventually need to be shipped. Any packaging developed for these needs would have to be able to ship a wide variety of contents, because many of the accelerator targets generated and older sources are one-of-a-kind in nature (unusual radionuclide composition).

E. Large volume radioactive liquid packaging

At present, there is no available packaging certified for offsite use that can ship more than 1 L (3 gal) of radioactive liquid. The PAS-1 cask has almost completed the certification process to be able to ship up to 4 L (1 gal) of Type B liquid. Three DOE sites (Hanford, Oak Ridge, and Savannah River) have purchased or are purchasing the LR-56 packaging that can ship up to 4,000 L (1,057 gal) of Type A radioactive liquid offsite and Type B liquid onsite. Many DOE sites indicated the need to ship 55-gal drums of Type A quantities of radioactive liquids. However, there is no other packaging development effort underway that will specifically be able to ship those 55-gal drums of radioactive liquid.

F. Standardized waste packaging

Several sizes of standardized packaging are needed that meet all requirements for transportation, storage, and disposal. These include five different sizes of boxes and a 55-gallon drum. Both industrial packaging and Type A versions of all of these packagings would be used. The specifications for these containers should be written so slightly activated metals, which exist in large quantities throughout the DOE Complex, can be used to manufacture these waste packagings, if desired. Standardizing waste packaging will simplify disposal site operations, reduce costs by eliminating the need for each site to develop its own packaging specifications, and will make it easier for sites to combine procurements to reduce overall costs.

The M-100 box, which was developed as part of the Recycle 2000 program, has recently developed a specification for a standard 1.2 m by 1.2 m by 1.8 m (4 ft by 4 ft by 6 ft) box. Four different versions of the M-100 box are available, each of which satisfies different transportation or burial site criteria or can be fabricated out of recycled, previously contaminated, metal. Similar development programs for different sizes of containers may make DOE packaging operations more efficient.

G. Performance Oriented Packaging for explosives

Revisions to Department of Transportation regulations will take effect on October 1, 1996, and will affect the way all non-radioactive hazardous materials, including explosives, are packaged. Two explosives packagings will be complete in time to meet the October 1 deadline, but at least one more packaging is needed.

The M-100 box, which was developed to enable some existing DOE explosives packages that do not meet the new regulations by themselves to be shipped after October 1, 1996. Development of a Multipurpose Explosives box-shaped packaging is underway that will able to ship over one-half of existing DOE explosives packages before the deadline. However, several sites have rocket motors and other explosives packages that are too large to fit inside the Multipurpose Explosive drum- or box-shaped packagings. Another explosive packaging that has dimensions of at least 0.6 m by 0.6 m by 2.4 m (2 ft by 2 ft by 8 ft) would be able to ship most remaining explosives. Therefore, after October 1, 1996, many DOE explosives shipments will have to be suspended until alternative packagings are developed.

V. CONCLUSION

The Needs Assessment performed by EM-76 has identified many needed packaging development programs across the DOE. The packaging development programs listed above are required by multiple facilities to support on-going or future missions or to improve the efficiency of
DOE operations. Few of the above programs are currently being supported, although all packagings will take at least one year to develop, and some may take up to five years. Without some effort to develop these packagings, some DOE programs may be adversely impacted by the lack of packaging.

ACKNOWLEDGEMENTS

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REFERENCES


Figure 1 - Sites Visited

- Hanford
- Lawrence Berkeley
- Stanford
- Lawrence Livermore
- Sandia-Livermore
- INEL
- Rocky Flats
- New Brunswick
- Argonne
- Fermi
- Kansas City
- Mound
- Fernald
- Pantex
- Battelle-Columbus
- West Valley
- Brookhaven
- Princeton
- Portsmouth
- Savannah River