

DOE'S DOT Specification 7A Type A Packaging Program—An Update and Future Directions

D.A. Edling¹

¹EG&G Mound Applied Technologies, Miamisburg, Ohio, United States of America

INTRODUCTION

Type A packagings were first introduced into the United States Department of Transportation (DOT) regulations in 1968. Seven years later, in 1975, an additional requirement was imposed on the use of Type A packagings. This requirement as stated in 49 Code of Federal Regulations (CFR) 173.415 (a) was that:

"Each shipper of a Specification 7A must maintain on file for at least one year ... and shall provide to DOT on request, a complete documentation of tests and an engineering evaluation or comparative data showing that the construction methods, packaging design, and materials of construction comply with that specification."

The Department of Energy funded EG&G Mound Applied Technologies to conduct a testing and evaluation program to determine which of the packagings then used by the DOE and its contractors met the DOT Type A requirements. Appropriate packagings were identified, and a testing and evaluation program initiated. Upon completion of the testing and evaluation portion, a document was prepared listing those packagings which met the Type A packaging requirements, providing information on the testing that was done, and showing the results, restrictions, and specifications on the use of the packagings. This document, Certification of ERDA Contractor's Packaging with Respect to Compliance With DOT Specification 7A Performance Requirements, Phase II Summary Report, June 12, 1975, was distributed widely and used by U.S. industry and DOE alike as a catalogue of approved Type A packagings. Prior to the change in the DOT regulations of July 1, 1985, DOE again funded EG&G Mound to update the Type A Program based on the upcoming regulations. Many new questions and issues not previously encountered were raised and addressed prior to initiating this 1985 phase of the Type A Program. Many of these are discussed in my paper presented at PATRAM '86, entitled, Type A Packaging Compliance, May 1986. Again, packagings used by DOE and its contractors were identified and tested/evaluated for compliance with the DOT 7A performance require-

ments. Those packagings that were judged to meet the requirements were listed in an evaluation document, DOE Evaluation Document for DOT Type A Packaging, March 1987. (Future references to this 1987 document will use the word Document.) In most cases the information provided below applies both to the past Type A Program and to the recent Type A Program. Obviously, as the regulations change and the approach to compliance becomes more sophisticated, our later approach to conducting the study required more rigor.

TYPE A PROGRAM OBJECTIVES

The primary objective of this program was to provide DOE contractors with a Type A Packaging document based on testing/analysis of packagings used by these contractors.

A second objective was to achieve an enhanced degree of consistency in the use, design, manufacture, testing/analysis, and shipment of Type A packages by the DOE and its contractors.

A third objective was to provide a cost effective program which served as a resource for testing and evaluation for all of DOE and its contractors.

A continuing goal was to have an on-going program which would keep the DOE data base on Type A packagings up-to-date and ever available to the shippers.

PROGRAM METHODOLOGY

In outline format, the expected approach to using this document and the resources available from the Type A Program was:

- ° The Type A Program identified those packagings that met the Type A performance requirements.
- ° These were listed in the DOE Type A Evaluation Document along with the details of the test results.
- ° A user then purchases, builds, obtains a packaging exactly as described in the Document (the level of detail necessary for the user to do this is provided or referenced).
- ° When the shipper uses the packaging exactly as described in the Document (i.e., authorized weight, type of contents, materials and methods of construction), the shipper can use the Document to meet the DOT requirement for "documentation" (49CFR 173.415[a]).
- ° The shippers are required to have a Quality Assurance program which provides assurance that the packaging they are using does in fact meet all the specifications provided in the Document.

- ° A section of the Document is devoted to Quality Assurance for each of the packagings. Guidance is provided concerning what aspects of the hardware are critical to acceptable performance, which are important, and which are relatively minor to the packaging meeting its primary objective, containment of the radioactive materials. For each of these criteria, information is provided on what to look for; i.e., If a gasket is required, then the proper size, geometry, lack of manufacturing defects, etc. would all be considered critical and identified as such.
- ° One of the most frequent questions asked is, "Where can I get one or more of these packagings?" In order to minimize the number of calls, information was provide on a user contact for each packaging.
- ° Training and orientation programs were held for DOE and their contractors concerning the Document and how it was intended to be used.
- ° The emphasis in preparing this Document was to have a Stand-Alone Document, not one which sends the reader from one reference to another to another. Thus all the test details are provided in the MLM-3245 Addendum No. 1, which is a part of the Document.

DOCUMENT STRUCTURE AND CONTENTS

The structure of the Document is given below with a summary of the purpose of the information and typical questions that have arisen from the users of the Document.

PREFACE

This section was prepared at the request of the U.S. DOT and addresses questions such as:

1. Just what is an Evaluation Document and what does it contain?
2. What are the responsibilities of the shipper?
3. What are the Quality Assurance requirements?

INTRODUCTION

The transition from the previous Type A Document to the revised Type A Document is discussed in this section. One statement from this section that conveys part of the message is:

"It is important to note that not only were there changes in the regulatory requirements, there were also significant changes in the approach to the determination of pass/fail and the evaluation of a packaging as a Type A packaging."

OBJECTIVES

These have been outlined previously so they will not be discussed in

any further detail. However, one can demonstrate that these objectives have been effectively met by this program.

RESPONSIBILITIES

Even though the regulations rely on the shipper fulfilling his responsibilities, "What are these responsibilities?" This Document outlines the responsibilities with respect to:

- ° Use
- ° Reuse
- ° Design
- ° Fabrication of the packaging
- ° Testing, analysis, and evaluation
- ° Quality assurance and documentation

THE REGULATIONS INVOLVED

Each of the paragraphs from the U.S. DOT regulations is copied verbatim, and text is provided giving an "unofficial" view of what the regulation intended to achieve. Then a statement is documented concerning how this packaging(s) meets this requirement. The credibility of the "unofficial" idea of what the intent of the regulation really is comes from the fact that the U.S. DOT reviewed the Document prior to its being issued and provided a letter saying - "We have reviewed the subject document and concur with its purpose and contents."

QUALITY ASSURANCE

Quality Assurance elements for phases such as design, testing, evaluation, fabrication, procurement, use, reuse, and maintenance are discussed in detail. In addition as mentioned previously, in each section for a particular packaging, a section on Quality Assurance is provided for that specific packaging.

DETAILED (INDIVIDUAL) PACKAGING DESCRIPTION

This section of the Document includes:

- ° Sketch with basic design information and dimensions
- ° Table with detailed dimensions
- ° Materials and methods of construction
- ° Authorized contents - Forms No. 1, 2, or 3. (See explanation below)
- ° Authorized gross weight
- ° Restrictions/specifications on the use
- ° Quality assurance
- ° Additional information

IMPLEMENTATION

This document was enthusiastically received the first time it was issued and the response the second time was the same. The level of detail in the second issue was much more extensive and the

requirements placed on the shippers/users of Type A packagings was much more exhaustive than in the first issue. This fact resulted in many questions initially. Typical questions were:

1. What if I want to change the contents a little?
2. The Document specifies 40 ft-lb. of torque to the bolt closure of most metal drum systems. Even though the torque is at 40 ft-lb. at the time of closure, if it is checked later, in many cases it is no longer at the prescribed level of 40 ft-lb. What do I do?
3. The Document provides a package (with given dimensions) and I need a package just slightly larger/smaller. Can I make slight changes in the dimensions and still use the Document to meet the DOT documentation requirements?
4. I have a cement matrix containing a solid particulate radioactive material (FORM No. 1 or 2). Can I call this FORM No. 3?

As mentioned earlier, three material forms were introduced as part of the planning for this study.

FORM NO. 1 - Solid, particulate radioactive materials, typically intended for "fine" or small particle sized materials. The contents used to simulate FORM NO. 1 were flour and fluorescein (a finely divided material which fluoresces under ultraviolet light).

FORM NO. 2 - Solid, particulate radioactive materials, with large particle size; i.e., sand, concrete debris, soil, etc.

FORM NO. 3 - Materials with no significant removable or dispersible radioactive contamination (as defined in 49 CFR 173.443 Contamination Control).

These FORMS were introduced to facilitate the need to comply with the DOT regulatory requirement that during testing, the contents were simulated as closely as possible. In each of the individual sections for a particular packaging, in the Restriction/Specifications section, the contents authorized for a particular packaging are given. In some cases the authorized contents (FORM) vary depending on the packaging methods used.

- ° With this as a background, one can see the basis for the questions raised previously. In each case the shipper is required to document the basis for his determination of FORM No. and this then becomes another part of the total documentation packet required by the DOT.

Questions concerning implementation sometimes have simple and direct answers and at other times they do not. Answers to those questions listed above would take up much more space than allowed, so they may be the subject of a future paper. THE FACT THAT THESE QUESTIONS ARE BEING ASKED SO MANY TIMES BY SO MANY DIFFERENT INDIVIDUALS INDICATES A HIGH LEVEL OF AWARENESS FOR THE REGULATIONS IN GENERAL, THE REGULATIONS APPLICABLE TO TYPE A PACKAGINGS IN PARTICULAR, AND FOR THE RESPONSIBILITIES OF THE SHIPPERS OF RADIOACTIVE MATERIALS. The fact

that these questions are now being asked, indicated that the much greater level of detail provided in the 1987 issue of the Document has reached and been received by the shippers in the U.S. The obvious objective is to maintain this high level of awareness and compliance responsibility. Some of the questions have resulted in detailed studies to determine whether there is a communicable answer. The question of the torque relieving itself at times was studied for a number of hardware configurations, torque application methods, amount of torque applied, and sequence of torque application. Within the resources and time available, no resolution was reached for this problem. It is recognized that bolt closure systems will relieve themselves over time, and we did not identify any reasonable method of prevention. The approach taken by the Document is to describe the "torqueing and tapping" methodology to be employed for appropriate metal drum bolt closure systems. The words that appear in the latest additions to the Document are given below:

"Bolt closure tightened to minimum of 40 ft-lb. with tapping of ring during tightening - the minimum effort should be four cycles, commonly referred to as '34 and 4'.

1. Tighten the bolt to 40 ft-lb.
2. Hit the closure ring vigorously with a metal hammer approximately 8-9 times, equally spaced around the ring
3. Repeat the cycle 3 additional times
4. Torque bolt one last time to 40 ft-lb."

Heavy, bulky items with sharp corners and edges, and equipment with protrusions such as motor shafts or pipes have long been of concern. Such items could breach the containment of the Type A packaging during the 4 ft drop test. A variety of tests was conducted using 16 and 18 gauge 55-gal. steel drums and a variety of contents such as broken concrete blocks, metal plates with sharp corners, angle iron, motors, and pipes. Test results were communicated at a past DOE Packaging and Transportation meeting. The general conclusion was that a shipper must be very cautious in packaging these types of materials, because in many of our tests containment was breached when the contents penetrated the walls of the drums. These data and information have not been published in a formal report; however, photos and videotapes are available if anyone is interested in discussing the results.

Partly because of these findings, additional tests were conducted on a type of steel box (Rocky Flats Sand Box) currently listed in the Document, with contents described as heavy, bulky, and having sharp edges and corners. The 4 ft. drop test results demonstrated that for this style of steel box, additional internal protection was required against punctures from these contents. When later tests were conducted on the TRUPACT-II Standard Waste (steel) Box (TSWB), to determine its ability to comply with the Type A requirements, a "new"

material FORM was initiated - FORM No. 4. FORM No. 4 materials are the same as FORM No. 3 materials, however, instead of having no "significant removable or dispersible" contamination, FORM No. 4 materials include "removable and/or dispersible" contamination by definition. Thus, for the tests with FORM No. 4 contents, the same items (i.e., pipes, metal plates, etc.) were used as contents, but flour and fluorescein were added, and the pass/fail criteria became: no loss of flour or fluorescein from the packaging. This type of content will become a standard test content for packagings reasonably expected to be used for decontamination and decommissioning operations, for packaging of large equipment. In the instance mentioned, the Evaluation Document for the TSWB describes in detail the results of the tests on the TSWB (10 gauge metals), which in all cases passed the tests without any punctures or loss of containment. These are but two examples of the type of support the Type A Packaging program provides to the DOE and its contractors. The recognition and visibility of the program is evidenced in the number of phone calls per day received at EG&G Mound on the subject of Type A packaging.

ON-GOING TESTING OF TYPE A PACKAGING

Since the Document was originally issued, more than 25 different packagings have been tested/evaluated against the Type A packaging requirements and added to the Document. Because these soon become voluminous, a new notebook has been issued to contain just these new supplements to the Document. A brief listing of these packagings is given below:

<u>DOE Contractor</u>	<u>Type of Packaging</u>
1. Martin Marietta	Series of wooden boxes
2. Martin Marietta	Aluminum box
3. Waste Isolation Pilot Project (WIPP)	TRUPACT-II Standard Waste Box (TSWB)
4. DOE West Valley Project	Square Steel Drums (4 styles) 71-gal.
5. Los Alamos National Laboratory (LANL)	Packaging for gases
6. LANL	Aluminum packaging
7. Rocky Flats	Steel drum 35-gal.
8. EG&G Mound	Packaging for tritium gas
9. Westinghouse Materials Company of Ohio (WMCO)	Family of banded wooden boxes (re-evaluation of previously listed series of wooden boxes; see MLM-3245 Page C-41, 1987 Issue.)

COST EFFECTIVENESS

This is a worthy objective of any program and is readily apparent in the accomplishments of EG&G Mound's Type A Program. The cost to the DOE funding agency in FY-1988 was a total of about \$38,000 and the costs for FY-1989 to date have been about \$31,000. Consider the fact that there are more than 50 users of just the 16 gauge 55-gal. steel

drum, which is referred to in the U.S. as a DOT Spec 17C. For this packaging alone, if each user were to test, evaluate, and document the results per DOT requirements, it would cost approximately \$500,000 (50 x \$10,000) for that package. The Type A Program has completed this task for over 200 packagings.

THE FUTURE

Two regulatory rulemaking activities will have an impact on the radioactive materials shippers of the U.S. The first of these is DOT HM-181, which will take the U.S. from its specification-based packaging system to a performance-based system. Currently, the Type A Program uses a reference to a specification packaging in many cases. In the performance-based system of the future, many of these specification packagings will not exist. Thus, the Type A Program will have to adapt to this development.

Secondly, in the next U.S. effort to further incorporate the IAEA regulations into the domestic regulations, there will be several factors requiring flexibility in Type A program activities.

SUMMARY

The DOE's Type A Packaging Evaluation Program conducted by EG&G Mound has met the original objectives of the program and has gained acceptance throughout the DOE and U.S. industry as a valuable resource concerning Type A packaging and Type A packaging technology. The cost savings have been tremendous when comparing the cost that would have been incurred for individual testing/evaluation with the cost of consolidated testing, evaluation, and documentation. Add to this the benefits of having a much more consistent approach to package testing, the formats and content for "Evaluation Documents", the training that was part of the program for DOE contractors, and the data base available concerning manufacturers, and one readily sees that the program is an important element in DOE's overall program and compliance planning.