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Report to the Chairman, Committee on
Governmental Affairs, U.S. Senate

September 1988

NUCLEAR HEALTH AND SAFETY

DOE Needs to Take Further Actions to Ensure Safe Transportation of Radioactive Materials

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United States
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Washington, D.C. 20548

**Resources, Community, and
Economic Development Division**

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September 27, 1988

The Honorable John Glenn
Chairman, Committee on
Governmental Affairs
United States Senate

Dear Mr. Chairman:

This report presents the results of our review on how effectively the Department of Energy is self-regulating its transportation of high-level radioactive materials. It includes recommendations to the Secretary of Energy designed to strengthen Energy's regulation of its transportation program.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to appropriate congressional committees; the Secretary of Energy; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

This work was performed under the direction of Keith O. Fultz, Senior Associate Director. Other major contributors are listed in appendix IV.

Sincerely yours,

A handwritten signature in cursive script that reads 'J. Dexter Peach'.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Annually, the Department of Energy (DOE) makes thousands of shipments of radioactive materials as part of its national defense responsibilities. Federal regulators consider the required containers, or “packages,” enclosing the radioactive materials to be the primary protection against serious hazards to human health, property, and the environment while the materials are in transit. These packages fall into three categories: strong, tight containers used to ship materials with very low levels of radioactivity, Type A packages used for materials with higher levels of radioactivity but which present a very small hazard, and Type B packages used for highly hazardous materials with radioactivity exceeding Type A package levels.

The Chairman of the Senate Committee on Governmental Affairs asked GAO to determine whether DOE is effectively self-regulating its transportation of high-level radioactive materials. To do this, GAO centered its work on the adequacy of DOE’s actions to resolve previous safety concerns regarding non-weapons packages and the extent to which problems exist with DOE’s certification of packages for transporting nuclear weapons materials.

Background

DOE transports high-level radioactive non-weapons and weapons materials, such as fuel elements for nuclear reactors and components for nuclear weapons, in Type B packages. These packages range from small containers to 100-ton casks used to move spent nuclear fuel, and they must withstand normal shipping conditions and survive severe accidents without a dangerous release of their contents.

Federal regulations and DOE policies require that packages developed by DOE for transporting these materials meet standards equivalent to those prescribed by the Nuclear Regulatory Commission for commercial shipments. The regulations allow DOE to certify its own packages for transport via public highways and other modes.

The packages are designed, manufactured, and tested under the direction of DOE contractors at various field offices. DOE reviews the contractor-prepared “safety analysis report for packaging”—a comprehensive technical description of the design and test results, the operational and maintenance procedures, and the contractor’s quality assurance program—for each package type to establish that it meets safety regulations. Testing determines whether the package can withstand conditions such as vibration, compression, puncture, high temperatures, and a 30-

foot drop. If the safety analysis report is satisfactory, DOE issues a certificate of compliance for the package design, which is used by the contractor to make individual packages.

Results in Brief

Two recent studies, one by the Nuclear Regulatory Commission and the other by a DOE contractor, found safety-related concerns with DOE-certified, non-weapons, Type B packages. One major DOE response was to remove certifying responsibility for many of these packages from its operations offices around the country and consolidate it in a headquarters office. DOE did this to help ensure that all applicable regulations are met and to remove the potential conflict between the operations offices' dual responsibilities for achieving program goals and certifying package safety. Another DOE response was to remove many of these packages from service. Both responses should improve DOE's management of its non-weapons packaging; however, GAO believes additional guidance is needed.

GAO's review of documentation supporting Type B packages used in DOE's nuclear weapons program also disclosed a number of problems, some of which were similar to those found in the non-weapons package studies mentioned above. GAO is recommending actions by DOE to ensure that the nuclear weapons packages meet all applicable safety regulations and that potential conflicts of interest stemming from competing program demands are not involved in certifying these packages.

Principal Findings

Added Guidance Needed for Resolving Safety-Related Concerns

In 1980, the Nuclear Regulatory Commission started raising a series of questions with DOE about the structural integrity of a Type B package used to ship spent fuel elements. In 1985, while the package was still under review by the Commission, a DOE operations office issued its own certificate on the package and began using it. This prompted the Department of Transportation to (1) question whether DOE was evaluating its packages against standards equivalent to those prescribed by the Commission and (2) direct DOE to stop using the package until all outstanding issues were resolved. Consequently, DOE removed certification authority for most of its non-weapons packages from its operations offices and consolidated it at headquarters. The Commission was still reviewing this package in July 1988.

In response to revisions in federal packaging regulations, a DOE contractor completed an assessment in 1987 of the documentation supporting some of DOE's non-weapons packages to determine whether they would meet the regulations' revised standards. The contractor found that 28 of 41 packages had potential safety-related concerns, including (1) lack of documentation to fully demonstrate that the packages met all applicable safety requirements, (2) use of nonconservative analyses, and (3) calculation errors. For eight of the packages, reviewers found potentially significant concerns, such as the possibility that a package might not retain its contents in an accident. Although all eight packages were eventually removed from service, four remained available for more than 3 months after DOE learned of the concerns.

According to DOE officials, concerns about the packages kept in use did not represent safety threats. GAO, however, found that the concerns were not always promptly addressed and that specific guidance is needed to ensure that such concerns are fully considered and resolved. DOE regulations authorize the agency to develop such guidance, but it has not yet done so. Such guidance could also aid in ensuring that safety-related concerns are not tipped in favor of program demands.

Need for Improved Review of Nuclear Weapons Packages

DOE performs the certification and maintains the certification files at the Albuquerque Operations Office for the packages it uses to transport nuclear explosives, nuclear components, and special assemblies (collectively known as "nuclear weapons packages"). GAO found three package designs that were used for several years without ever being certified and four package designs that had only 60-day approvals but had been available for use from 9 to 11 years. GAO identified 42 Type B nuclear weapons package designs as having certificates of compliance, but its preliminary examination of the certification files raised some questions about the adequacy of documentation or testing. GAO then judgmentally selected 14 of the 42 package designs for a more detailed review and found that 7 of the 14 files did not fully demonstrate that the packages met standards equivalent to those prescribed by the Nuclear Regulatory Commission, as required by DOE policy.

Albuquerque officials regard these as problems involving documentation, not safety. Regardless, adequate documentation is necessary to show that the packages meet all applicable safety requirements. DOE reviews have also found problems with Albuquerque's certification process, including the lack of adequate staff, which limits Albuquerque's ability to completely evaluate the contractors' safety analysis reports

for packaging. DOE plans to address this problem by augmenting Albuquerque's certification staff and having Albuquerque retain its certification authority. In GAO's view, Albuquerque's nuclear weapons production responsibilities are in potential conflict with its role in certifying safe weapons transportation packages.

Recommendations

GAO recommends that the Secretary of Energy:

- Promptly develop written guidance for addressing and resolving safety-related concerns raised about the packages used to ship non-weapons, high-level radioactive materials, as authorized by DOE Order 5480.3. This guidance should include provisions for approving the continued use of these packages by an organization that does not manage their use.
- Promptly conduct an independent review of all available documentation to ensure that nuclear weapons package designs meet all applicable safety regulations.
- Assign responsibility for certifying nuclear weapons packages to the centralized certification office at DOE headquarters, as was done for DOE's non-weapons packages.

Agency Comments

GAO discussed the facts presented in this report with officials of DOE, the Nuclear Regulatory Commission, and the Department of Transportation. DOE generally agreed with GAO's statements but recommended that certain points be clarified. The Nuclear Regulatory Commission recommended some wording changes and clarification of certain points, but neither it nor the Department of Transportation took exception to any of the statements. Their comments are incorporated where appropriate. However, as requested by the Chairman's office, GAO did not obtain official written agency comments.

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Abbreviations

DOE	Department of Energy
DOT	Department of Transportation
ES&H	Office of the Assistant Secretary for Environment, Safety and Health
GAO	General Accounting Office
NRC	Nuclear Regulatory Commission
SARP	Safety Analysis Report for Packaging

Introduction

The United States Department of Energy (DOE) carries out extensive activities that result in the need to transport radioactive materials and wastes. Nuclear fuel produced at DOE processing facilities, for example, must be shipped to nuclear reactors for research into new energy technologies and for production of special nuclear materials for defense purposes. Radioactive by-products are shipped to research laboratories, industrial plants, and medical institutions, and various types of radioactive wastes are transported to storage and disposal sites.

DOE's activities result in the transportation of radioactive materials in most of the 50 states. Shipments are made in government and commercial vehicles by truck, train, air, and water craft. In fiscal year 1987, DOE facilities made over 14,000 unclassified shipments of radioactive materials. In addition, DOE made many classified shipments involving its nuclear weapons programs and its naval nuclear propulsion programs.

Radioactive materials, if not adequately protected against accidents during shipping, can present hazards to human safety, property, and the environment. DOE management views the safe transport of radioactive materials to be of paramount importance. Protecting against the hazards presented by nuclear materials means considering many factors—vehicle condition, route taken, training of personnel, registration and permits, and others. However, federal regulators consider the primary safeguard to be the container, or "package," that holds the radioactive materials. According to DOE, during the past 40 years there have been no injuries or deaths directly related to the radioactive nature of the cargo in shipping accidents.

Types of Radioactive Materials Packages

Radioactive materials packages vary greatly in size, shape, and weight, ranging from light-weight fiberboard boxes for shipping certain medical products to 100-ton casks used to move spent nuclear fuel. They fall into three general categories—strong, tight containers; Type A packages; and Type B packages. Each category is used for a different level of radioactivity:

- Strong, tight containers are used to ship materials with very low levels of radioactivity, such as uranium ore or contaminated garments. These shipments present very little hazard to the public or the environment. The packages are designed and the contents so limited that under conditions normally incident to transportation there will be no significant release of radioactivity.

- Type A packages are used for materials with higher levels of radioactivity, such as radiopharmaceuticals for medical purposes. These materials present a very small hazard, because of their limited quantity, and do not pose a threat of death or serious injury if accidentally spilled. Packages in this category must survive penetration, temperature, vibration, compression, and other tests to demonstrate that they can retain their contents under normal shipping conditions and during minor accidents.
- Type B packages, which are the focus of this review, are used for hazardous materials with high radioactivity levels that exceed Type A package limits. Accidental releases of these materials can pose serious concerns for public health, safety, and the environment. Accordingly, these packages must undergo a series of stringent tests to ensure that they can survive a major accident without a dangerous release of their contents. Type B packages are required for most fissile materials,¹ spent nuclear fuel, and other high-level radioactive materials. DOE has over 100 Type B package designs available.

Regulatory Responsibilities for Radioactive Materials Packages

The transportation of hazardous materials, including radioactive materials, is regulated under the Hazardous Materials Transportation Act, as amended (49 U.S.C. 1801-1812), and other statutes.² DOT has developed safety standards covering the packaging and transport of less hazardous radioactive materials (those that have Type A levels of radioactivity or less). For Type B packages, including those for fissile materials, DOT relies on the standards and certification activity of the Nuclear Regulatory Commission (NRC).³

¹The Nuclear Regulatory Commission defines fissile materials as certain plutonium and uranium radionuclides capable of producing a nuclear chain reaction. Special packaging and shipping procedures are required to prevent an unplanned chain reaction (also referred to as a state of "criticality") from occurring. Some fissile materials can be shipped in Type A packages if they contain lower radioactivity levels. However, except for Type A packages certified for small quantities of fissile materials, Type A fissile packages must be able to withstand the same hypothetical accident conditions as Type B packages.

²The Transportation of Explosives Act (18 U.S.C. 831-835); the Dangerous Cargo Act (R.S. 4472, as amended, 46 U.S.C. 170); Title VI and 902(h) of the Federal Aviation Act of 1958 (49 U.S.C. 1421-1430 and 1472 (h)); and the Department of Transportation Act (49 U.S.C. 1655).

³Under federal law, DOT and NRC have overlapping responsibilities in regulating the transportation of radioactive materials. To coordinate efforts, DOT and NRC adopted a memorandum of understanding in 1979. Under this agreement, DOT is responsible for developing safety standards for quantities of radioactive materials other than fissile materials rated Type A or less. NRC is responsible for developing safety standards covering the design and performance of packages for fissile and other radioactive materials rated Type B. DOT regulations incorporate by reference the NRC-developed standards in 10 CFR 71.

In most of its transportation activities, DOE is a “shipper” subject to DOT regulations and, therefore, to DOT and NRC standards for packages. In the case of Type B shipments, DOT regulations (49 CFR 173.7(d)) authorize DOE to certify its own packages but require DOE to certify that the packages meet standards equivalent to those prescribed by NRC in 10 CFR 71 for commercial shipments. DOT has oversight responsibility for Type B packages that DOE certifies under this provision. According to a DOT headquarters official, NRC has no oversight or monitoring responsibility for DOE-certified packages.

In addition to certifying its own packages, DOE consults with NRC and has received NRC certificates for many of its Type B packages. For example, DOE’s Office of Naval Reactors has had a long-standing policy to submit its package designs to NRC for an independent review; however, Naval Reactors retains the authority to certify these packages. Consequently, many of Naval Reactors’ packages have both DOE and NRC certificates. In addition, a DOE headquarters official told us that DOE sometimes purchases NRC-certified packages from commercial sources. He also noted that, because NRC regulations require licensees to use NRC-certified packages, DOE obtains NRC certificates for DOE-owned packages used by NRC licensees (such as nuclear power plants, radioactive materials producers, and universities).

DOT and NRC radioactive materials transportation and packaging regulations do not apply to DOE shipments made via commercial carriers and which are escorted by DOE-designated or DOE-authorized personnel for national security reasons. This exception to the regulations is contained in 49 C.F.R. 173.7(b), and is referred to in this report as the “national security provision.” According to DOE, it makes about 35 shipments via escorted commercial carriers annually. DOE uses the national security provision to avoid having to identify the classified contents of the shipments on the vehicles, packages, or shipping papers. Regardless of the national security provision, however, DOE has decided that these packages must meet all DOT and NRC safety regulations.

DOT and NRC regulations also do not apply to DOE’s noncommercial radioactive shipments—such as nuclear weapons packages—made in federally owned and operated trucks, railcars, etc. As with escorted commercial shipments, however, DOE policies and procedures require compliance with DOT and NRC safety regulations, except for external placarding of the vehicle. For example, DOE Order 5610.1, dated September 11, 1979, requires that nuclear components, special assemblies, and nuclear explosives be packaged and transported in a manner that

ensures the highest level of safety practicable.⁴ The order requires that packages transporting these materials “provide a level of safety at least comparable to that provided by the packaging and shipment . . . of other radioactive and explosive material.” DOT and NRC transportation and packaging regulations are cited in the DOE order. Also, DOE Order 5480.3, dated July 7, 1985, which applies to all DOE departmental units and contractors involved in packaging and/or transporting hazardous materials or wastes (including radioactive materials), requires each shipment of such materials to comply with DOT safety regulations and NRC packaging standards.

Certification of Type B Packages

NRC has established standards that focus on three basic safety requirements for Type B packages: adequate containment of radioactive material, adequate radiation shielding, and prevention of a nuclear chain-reaction, or criticality. NRC regulations require that Type B packages meet the above requirements not only when subjected to normal transport conditions but also under severe accident conditions.

Under normal transport conditions, a package must be able to withstand hot and cold environments, pressure differentials, vibration, water spray, impact, penetration, and compression. To ensure that they can withstand accident conditions, packages must pass such tests as a free fall, 30-foot drop onto a flat, essentially unyielding surface; a 40-inch fall onto an upright steel rod to test for puncture resistance; high-temperatures (1,475 degrees F. for 30 minutes); and immersion under at least 50 feet of water for 8 hours. The accident test conditions must be performed in the sequence cited in order to determine the cumulative effect of the tests on the package or the array of packages. The tests, performed by or for the package user, may be satisfied by computer analyses, model testing, full-scale tests, or a combination of these methods.

After the Type B packages pass these tests, NRC must certify them before its licensees can use them. Similarly, DOE must certify its Type B packages before its contractors can use them. The certification process begins when the user (licensee or contractor) submits a “safety analysis

⁴DOE defines a nuclear component as a nuclear explosive or device part that contains fissile and/or radioactive and other materials. A special assembly is comprised of nuclear weapons components that do not form a complete nuclear explosive or test device and, therefore, are not capable of producing a nuclear detonation. A nuclear explosive is any assembly or subassembly containing fissile and/or radioactive materials and high explosives, propellants, or other means capable of producing a nuclear detonation.

report for packaging” (SARP) for review and approval. A SARP contains a comprehensive technical description of the proposed package’s design, test results, operational and maintenance procedures, and the contractor’s quality assurance program. The SARP is the key document by which the user demonstrates that a package complies with NRC safety standards and does not pose an unacceptable risk to public health and safety, property, and the environment. If the SARP is found satisfactory, NRC or DOE authorizes use of the package by issuing a “certificate of compliance.” NRC and DOE are actually certifying that the package “design” meets all applicable standards. Users are then free to make as many individual packages as they wish, providing they adhere to the certified design.

To help ensure that the certificates are reviewed periodically, NRC and DOE certificates are valid for designated periods not exceeding 5 years. An NRC official said his agency has always assigned expiration dates to the certificates it issues. DOE has used expiration dates in the past but did not begin requiring them until September 1986.

Three DOE organizations have authority to issue certificates for Type B packages.

- The Office of Naval Reactors (under the Assistant Secretary for Nuclear Energy) certifies Type B and other packages for the naval nuclear propulsion programs. This office also submits its Type B package designs directly to NRC for an independent review. An official from this office said this long-standing policy dates back to when NRC and Naval Reactors were both part of the Atomic Energy Commission and that it helps ensure that packages meet appropriate safety standards. He also said that nearly all SARPs and package contents are classified for national security reasons.
- The Albuquerque Operations Office (under guidance and oversight from the Deputy Assistant Secretary for Military Application) certifies Type B and other packages for transporting nuclear components, special assemblies, and nuclear explosives (hereinafter collectively referred to as “nuclear weapons packages”). According to an Albuquerque nuclear engineer, most SARPs and package contents are classified for national security reasons.
- The Office of Security Evaluations (located in the Office of the Assistant Secretary for Defense Programs) certifies all other DOE packages not covered by the Naval Reactors and Albuquerque offices. The certification authority was transferred to this office in January 1986. Before that time, all DOE operations offices around the country performed the

certification function. These offices were also responsible for managing the packages and meeting defense program goals. According to a DOE official, the SARPs for these packages are usually unclassified; however, any of the approved packages could be used to carry classified contents if needed for that purpose.

DOE's Assistant Secretary for Environment, Safety and Health (ES&H) has safety oversight responsibilities for most unclassified DOE hazardous materials' packaging and transportation. ES&H carries out its responsibilities through its Director of Quality Verification under the Deputy Assistant Secretary for Safety, Health and Quality Assurance. According to ES&H officials, they appraise the efforts of other DOE organizations that carry out their own safety-related responsibilities.

Not all package-certifying offices are subject to ES&H oversight. The new centralized package certification office in the Office of Security Evaluations is, but it has not yet been appraised nor been scheduled for appraisal. The applicable DOE orders specify that the Office of Naval Reactors is exempt from ES&H oversight.⁵ There is no such specific exemption in the orders for the nuclear weapons program, but ES&H officials stated that they also considered this program to be exempt from their oversight. However, the revised DOE Order 5480.3, which governs ES&H's responsibilities in the radioactive materials packaging and transportation areas, will specifically exempt the nuclear weapons program from ES&H oversight.

As of February 25, 1988, DOE had available for use 70 Type B, non-weapons package designs certified by DOE, NRC, or both agencies. Fifteen of the 70 package designs were certified solely by DOE. The 70 designs do not include the 40 non-weapons package designs whose certificates DOE has cancelled since January 1986. According to DOE, most of these cancellations were for older designs with little projected future use or for which upgrading to current regulations would not be cost effective. In addition to the 70, we were able to identify 42 Type B package designs certified by DOE's Albuquerque Operations Office and available for use as nuclear weapons packages.

According to DOE, once a package design is certified, the number of packages fabricated per design can vary from 1 to over 1,000 units.

⁵The Office of Naval Reactors program was not included under the centralized certification program because, according to a Naval Reactors official, it already had an equivalent program in place for headquarters review and approval of contractor-prepared package designs. In addition, Naval Reactors already received an independent review of its Type B packages by NRC.

Objectives, Scope, and Methodology

In December 1986, the Chairman of the Senate Committee on Governmental Affairs requested that we determine whether DOE is effectively self-regulating its transportation of radioactive and other hazardous materials. In subsequent meetings with the committee staff, we agreed to focus our attention on high-level (Type B) radioactive materials packages certified solely by DOE because (1) these materials can present a serious hazard to people, property, and the environment if the packages fail, (2) DOE has certified its own packages for many years, and (3) a DOE-sponsored study made by the Westinghouse Hanford Company (discussed in ch. 2) showed that the documentation supporting many DOE-certified Type B packages did not meet current regulatory requirements. Our work centered on two main tasks:

- Determining the adequacy of actions taken or planned by DOE to resolve the potential safety concerns identified in the DOE-sponsored study of non-weapons, Type B packages.
- Determining whether problems exist in DOE's certification of Type B packages used in the nuclear weapons program.

Part of our work was conducted at DOE, NRC, and DOT headquarters in the Washington, D.C., area. At each agency, we interviewed officials to determine their policies and procedures applicable to DOE's transportation of radioactive materials. At DOE headquarters, we interviewed officials under the Assistant Secretary for Defense Programs and the Assistant Secretary for ES&H to determine their roles in ensuring the safe use of radioactive material transportation packages. In addition, we reviewed NRC and DOT transportation and packaging regulations, various technical reports, DOE policies and procedures, DOE correspondence and memorandums, and other related documentation. We also interviewed Office of Naval Reactors officials and reviewed applicable documentation to obtain information on their packages. However, because of the large size of DOE's transportation program, the decentralization of the data we needed to obtain, and the fact that Naval Reactors already received an independent review of its packages by NRC, we decided not to assess the Naval Reactors program as part of this review.

We also performed work at three DOE operations offices: the Richland Operations Office in Richland, Washington; the Albuquerque Operations Office in Albuquerque, New Mexico; and the Oak Ridge Operations Office in Oak Ridge, Tennessee. At Richland, we interviewed Westinghouse staff and reviewed documents related to the DOE-contracted study of packages. Westinghouse conducted the study in fiscal years 1985 and 1986 and published the results in 1987.

At Albuquerque, we examined the official certification files for 59 nuclear weapons packages identified by Albuquerque officials as being available for use. We were able to identify 42 of the 59 as Type B packages with valid certificates of compliance. On the basis of indications of possible documentation or testing deficiencies, we judgmentally selected 14 of the 42 to determine if the SARP or other documentation supporting the certificate appeared to address NRC testing standards in effect at the time the packages were certified.

We visited Oak Ridge to review documents and to interview DOE and contractor personnel about packages identified in the Westinghouse study as having potential safety concerns. We also obtained additional information at Oak Ridge on three uncertified nuclear weapons packages used by that office.

As requested by the Chairman's office, we did not obtain DOE's formal written comments on our draft report. We did, however, provide a statement of the facts discussed in this report to DOE, NRC, and DOT officials for their review. DOE generally agreed with our statements but recommended that we clarify certain points. NRC recommended a few wording changes to clarify certain points, but neither it nor DOT took exception to any of our statements. We incorporated these comments where appropriate.

Our work was conducted between February 1987 and April 1988, and updated through July 1988, in accordance with generally accepted government auditing standards. Because of the narrow focus of this review, we did not specifically address DOE's internal controls; however, as discussed in the following chapters, DOE has taken actions and we are recommending further actions that will strengthen DOE's management of its radioactive materials transportation programs.

Guidance Needed to Resolve Problems With DOE Non-Weapons Radioactive Materials Packages

Two recent studies showed problems with the adequacy of DOE's procedures for certifying that its Type B packages for transporting non-weapons high-level radioactive materials are safe to use. The first study, by NRC, dealt with a DOE Type B package used to ship radioactive materials from Brookhaven, New York, to Idaho. The second study, completed in 1987 by a DOE contractor, evaluated more than 40 different DOE-certified Type B packages used to transport radioactive materials across the nation. Both studies, which did not include nuclear weapons or Naval Reactors' packages, identified safety-related concerns, some of which were considered significant. These assessments led DOE to revamp some of its certification procedures, consolidate part of its certification authority, and stop using many of its Type B packages. While these DOE actions did help resolve some of the concerns, we do not believe DOE acted as promptly as it could have and it needs to develop written guidance to ensure that such concerns are promptly and fully resolved in the future.

The Brookhaven Incident

In May 1985, NRC raised a series of questions with DOE and DOT about the structural integrity of a particular Type B package. DOE had certified and used the package to ship spent fuel elements from its Brookhaven National Laboratory on Long Island, New York, to the Idaho National Engineering Laboratory in eastern Idaho. The package, called the MH-1A Spent-Fuel Shipping Cask, is about 8 feet high, about 4.8 feet wide, and weighs 14 tons. DOE acquired the MH-1A from the U.S. Army in 1978. It had an NRC certificate (issued to the Army) that subsequently expired in August 1979.

In October 1979, DOE applied for NRC recertification of the MH-1A. In April 1980, NRC requested additional information (primarily on structural matters) that led DOE to make changes in the MH-1A because the original design did not meet NRC regulations in effect at that time.

In September 1982, DOE resubmitted the revised SARP for the MH-1A to NRC. In February 1983, NRC requested additional information on the package's structural, containment, criticality, thermal, and other characteristics. DOE provided this information to NRC in January 1985 and followed it with a revised SARP in February 1985. However, on January 7, 1985, while the application was still under NRC review, DOE's Albuquerque Operations Office issued a certificate of compliance for the MH-1A under DOE's self-certification package approval authority. Two weeks later, DOE began to make shipments to Idaho from Brookhaven with the package. According to a DOE headquarters official, 13 shipments were

made with the MH-1A between January and May 1985. He also told us no shipments were made from Brookhaven in the MH-1A before 1985; however, it was used prior to that time for an unknown number of other DOE shipments.

On May 21, 1985, NRC informed DOT and DOE of its preliminary findings that DOE's structural analysis of the MH-1A did not adequately demonstrate that the package would retain its contents in the event of an accident. As a result, by letter dated May 23, 1985, DOT questioned whether DOE was evaluating its packages against standards equivalent to those prescribed by NRC, as DOT regulations require. DOT directed DOE to respond to the NRC concerns and withdraw the MH-1A from service until NRC had formally agreed with the resolution of the concerns. After making revisions to the MH-1A SARP, DOE resubmitted it to NRC for certification on October 22, 1987. On June 29, 1988, NRC again wrote to DOE to discuss the concerns it still had with the MH-1A and to request additional information. In July 1988, NRC and DOE officials met to discuss DOE's plans for responding to the NRC concerns. DOE indicated that it still wanted to pursue recertification and would provide the information requested.

According to DOE and DOE contractor officials, this incident prompted DOE to strengthen its package certification process by consolidating much of the activity at DOE headquarters and changing some of its certification procedures.

The Westinghouse Study

In 1983, NRC revised its regulations governing packaging of radioactive materials. Subsequently, in March 1985, DOE headquarters contracted with the Westinghouse Hanford Company to conduct an independent review of the SARPs for selected DOE-certified radioactive materials packages to help DOE field operation offices and its contractors decide what actions were necessary to bring the packages up to the 1983 revised federal standards. The review, conducted in fiscal years 1985 and 1986, covered 41 Type B and 5 Type A fissile package designs (see app. I) certified by six of DOE's eight operations offices. According to Westinghouse officials, the study did not include nuclear weapons packages, Naval Reactors packages, or NRC-certified packages.

The review's main purpose was to evaluate whether the packages conformed with NRC regulations then in effect. During May through August 1986, Westinghouse held meetings with representatives of each field office to discuss the issues it had raised. After these meetings, the field

offices had to respond in writing to DOE headquarters on their planned actions to resolve the Westinghouse findings. The final report, published in January 1987, pointed out many potential safety-related concerns and concluded that most of the SARPs did not provide adequate documentation to meet existing regulatory requirements because the regulations had been revised since many SARPs were prepared. NRC had revised its transportation and packaging regulations in 1983, while 32 of the 46 SARPs reviewed by Westinghouse had been prepared before 1983. Twenty of the SARPs were more than 8 years old, and one was nearly 20 years old.

Our review of the Westinghouse study showed that SARPs for 29 of the 46 packages lacked information Westinghouse considered important in determining whether they met NRC packaging standards. Some SARPs lacked technical documentation, while others required additional testing or analysis to demonstrate that the packages met appropriate standards. According to DOE officials, some of this information was available but did not get incorporated into the SARPs that Westinghouse reviewed. A Westinghouse official, however, said that the company had requested and, as far as he knew, received the SARP and all pertinent backup material for each package.

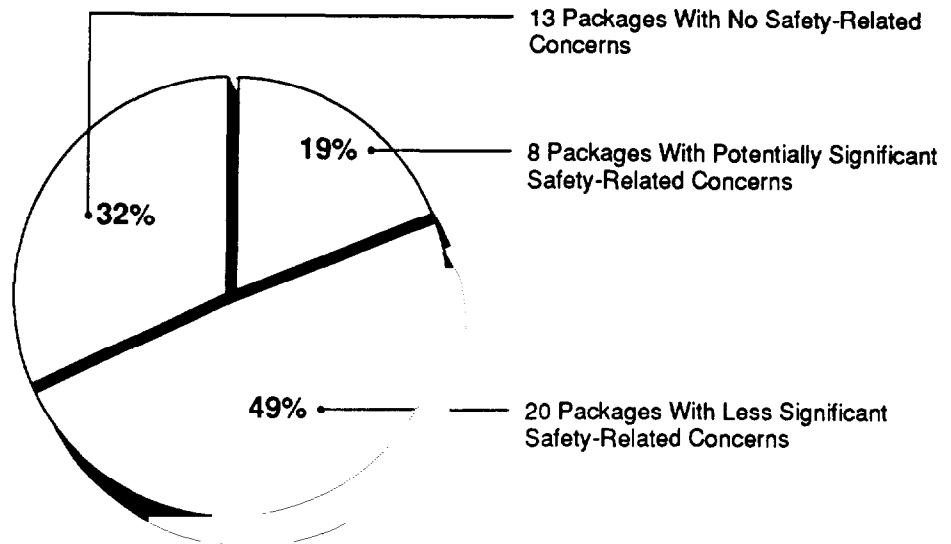
Safety-Related Concerns Identified

About 63 percent of the 348 issues identified in the Westinghouse study involved structural concerns; the remaining 37 percent addressed containment, shielding, thermal, criticality, and acceptance testing and maintenance conditions. At the meetings Westinghouse held with DOE to discuss the concerns, a consensus was reached that some of the concerns had potential safety-related implications. This was reflected in the final report, published in 1987, and in other documents prepared at the meetings. Thus, Westinghouse findings presented DOE with an indication that package documentation did not comply with current NRC packaging performance standards and that some concerns might affect packaging safety. We focused our review on the packages that contained these safety-related concerns.

Figure 2.1 shows the study's findings on potential safety-related concerns. For this discussion, we eliminated the five Type A fissile packages since they are not considered high-level radioactive material transportation packages. For 28 of the remaining 41 Type B packages, Westinghouse identified some type of potential safety-related concern. For example, for 8 of the 28 packages, Westinghouse judged the potential

safety-related concerns to be significant; and, for the remaining 20 packages, they were judged to be less significant.¹

Figure 2.1: DOE-Certified Type B
Packages Reviewed by Westinghouse



Appendix II lists the 28 packages Westinghouse identified as having potential safety-related concerns, the general areas of concern, and their availability for use as of July 31, 1988. Westinghouse identified these issues through a documentation review rather than a physical inspection of the packages. As such, it raised questions about packaging safety that required DOE to do a more detailed examination to determine their validity. According to Westinghouse officials, "significant" safety-related concerns involved questions about a package's ability to contain its payload (contents), prevent nuclear criticality, or provide adequate radiation shielding in the event of an accident. These are the three basic safety requirements that are the focus of NRC standards.

After being informed about the Westinghouse findings, DOE made a shipment in two different packages that had potentially significant concerns. Both of these packages remained available for use for more than 3

¹The Westinghouse study noted that 8 packages may have "critical safety-related problems," and documents supporting the study identified 20 other packages with lesser safety-related concerns. We have characterized these packages in this report as having "significant" and "less significant" safety-related concerns, respectively, to distinguish between the degree of importance Westinghouse attached to them.

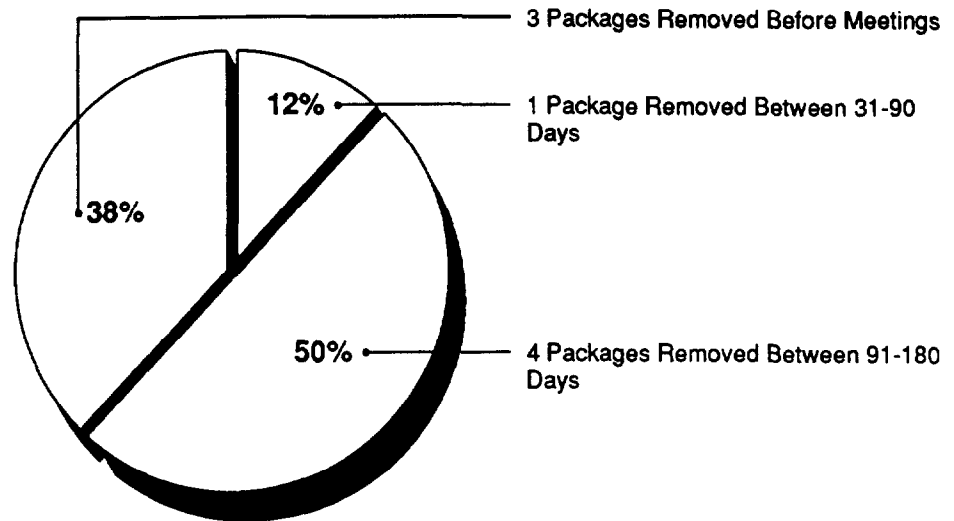
months after the issues were raised. The packages with potentially significant safety-related concerns are discussed in the following section. DOE also made shipments in 8 of the 20 packages that had less significant safety-related concerns. As of July 31, 1988, seven of the eight remained available for use of which 5 were undergoing certificate renewal. DOE decertified the eighth package in September 1987, after it had been used for 11 additional shipments, when a significant safety problem arose during a reevaluation of the package. These packages with less significant safety-related concerns are discussed in appendix III.

For the packages kept available for use, DOE officials told us that they had evaluated the Westinghouse concerns and determined that, in their view, the issues did not present a safety threat. However, our review showed that DOE did not promptly address all concerns. Further, we found that DOE does not have guidelines for what actions are to be taken when safety-related concerns are raised in studies such as Westinghouse's. DOE Order 5480.3, dated July 1985, authorizes such guidelines to be developed.

Packages Kept in Service With Potentially Significant Safety-Related Concerns

Although DOE eventually withdrew from use all eight of the packages that Westinghouse identified as having potentially significant safety-related concerns, it kept four of them available 3 months or more after Westinghouse had notified them about these concerns and used two of the packages for actual shipments. Figure 2.2 shows the length of time DOE took to remove these packages from service. As shown, DOE withdrew three of the eight packages prior to the meetings held with Westinghouse to discuss the issues. This was done by issuing stop-use orders. DOE documents indicated that one of the three packages was no longer needed. Concerning the second package, a DOE official said that it would be more cost effective to acquire another package. Although the third package was needed, DOE documents indicated that its use would be curtailed until several issues had been investigated. DOE subsequently cancelled the certificate of compliance on this package. The other five of the eight packages remained available for use for a longer time before being removed from service: one for a month and a half, two for more than 3 months, and two for more than 5 months. Two of these five packages were used during this period, as described below.

Figure 2.2: Length of Time DOE Took to Remove From Service Eight Packages With Potentially Significant Safety-Related Concerns



Examples of Packages Kept in Service

The Garden Carrier and Loop Transport Casks. The Garden Carrier #2 Cask (DOE certificate number 6088) and the Loop Transport Cask (DOE certificate number 5753) remained available for use for about 3-1/2 months after Westinghouse notified DOE of potentially significant safety-related concerns. Both packages were managed by Oak Ridge and were used once each to ship Type B radioactive materials.

The Garden Carrier #2 Cask was used to transport spent nuclear fuel elements and other radioactive material; with its fire shield, it is about 4.75 feet high and about 3.6 feet in diameter and has about 8.2 inches of lead shielding. Westinghouse noted several potentially significant safety-related concerns with this package. For example, in an accident, the bending stresses on the cask body could exceed the ultimate strength capabilities of the cask. Also, Westinghouse noted that the bolts holding the material in the cask and parts of the cask that would absorb some of the accident shock impact were made of carbon steel that could fracture and fail in cold temperatures.

Westinghouse noted similar problems with the Loop Transport Cask. This package was also used to transport spent nuclear fuel elements; it is 7.5 feet long and 2 feet in diameter, and weighs 8 tons. Westinghouse noted that, in an accident, the bending stresses applied to the cask could exceed the ultimate strength of the material, causing it to fail. It also

noted that the entire outer shell of the cask was fabricated from carbon steel that could fracture and fail in cold weather.²

The Westinghouse study was not the first to raise concerns about these two packages. For example, DOE submitted an application to NRC in July 1978 requesting review and certification of the Loop Transport Cask. In January 1979, NRC requested additional information from DOE and in January 1980 indicated that DOE must specifically identify the package's containment system and evaluate its effectiveness in order for NRC to approve the package. In March 1982, NRC indicated that the data provided by DOE did not describe the tests performed nor demonstrate that the package provided adequate containment.

We found three memorandums in the Oak Ridge files that addressed the containment system of these two packages. The first was a draft letter, dated June 30, 1983, in which the Oak Ridge National Laboratory, operated by a DOE contractor, advised Oak Ridge that the Loop Transport cask might need a new containment system design. In the next memorandum, dated June 27, 1984, the Laboratory noted that this cask's inner container had not passed NRC's drop test to demonstrate containment under accident conditions. In the third memorandum, dated June 18, 1985, the Laboratory stated that the inner container for both the Loop Transport and the Garden Carrier #2 casks could not meet NRC's design review and performance test standards. The Laboratory also noted that a different inner container design for the two casks had been selected for further testing.

In April and June 1986, prior to the withdrawal, Westinghouse informed Oak Ridge about safety-related concerns it had identified with these two packages. An Oak Ridge official said the office and its contractor had evaluated the Westinghouse issues and considered them to be technical concerns that did not affect package safety. About 2 weeks after Oak Ridge and contractor officials met with Westinghouse officials to discuss Westinghouse's concerns, an Oak Ridge contractor made a shipment in a Loop Transport Cask. About a month later, the same contractor made a shipment in a Garden Carrier #2 Cask. When these shipments were made, Oak Ridge had not yet responded to DOE headquarters on how the Westinghouse issues would be resolved. Although Oak Ridge officials told us that they considered these casks safe to use, they did not document the rationale supporting this position.

²Westinghouse officials explained to us that certain types of carbon steel may lack sufficient toughness and impact resistance at low temperatures and could fracture under stress.

In September 1986, about 3 months after being informed about the Westinghouse issues and after a shipment had been made in each package, Oak Ridge informed DOE headquarters that resolving the technical issues raised by the Westinghouse study on the two packages was not cost effective. Oak Ridge indicated that it would direct its contractor to stop making off-site shipments with these packages and asked DOE headquarters to cancel the DOE certificates of compliance and withdraw the applications for NRC certificates. In January 1987, DOE headquarters withdrew its application for NRC certificates for both of these packages and subsequently cancelled its own certificates.

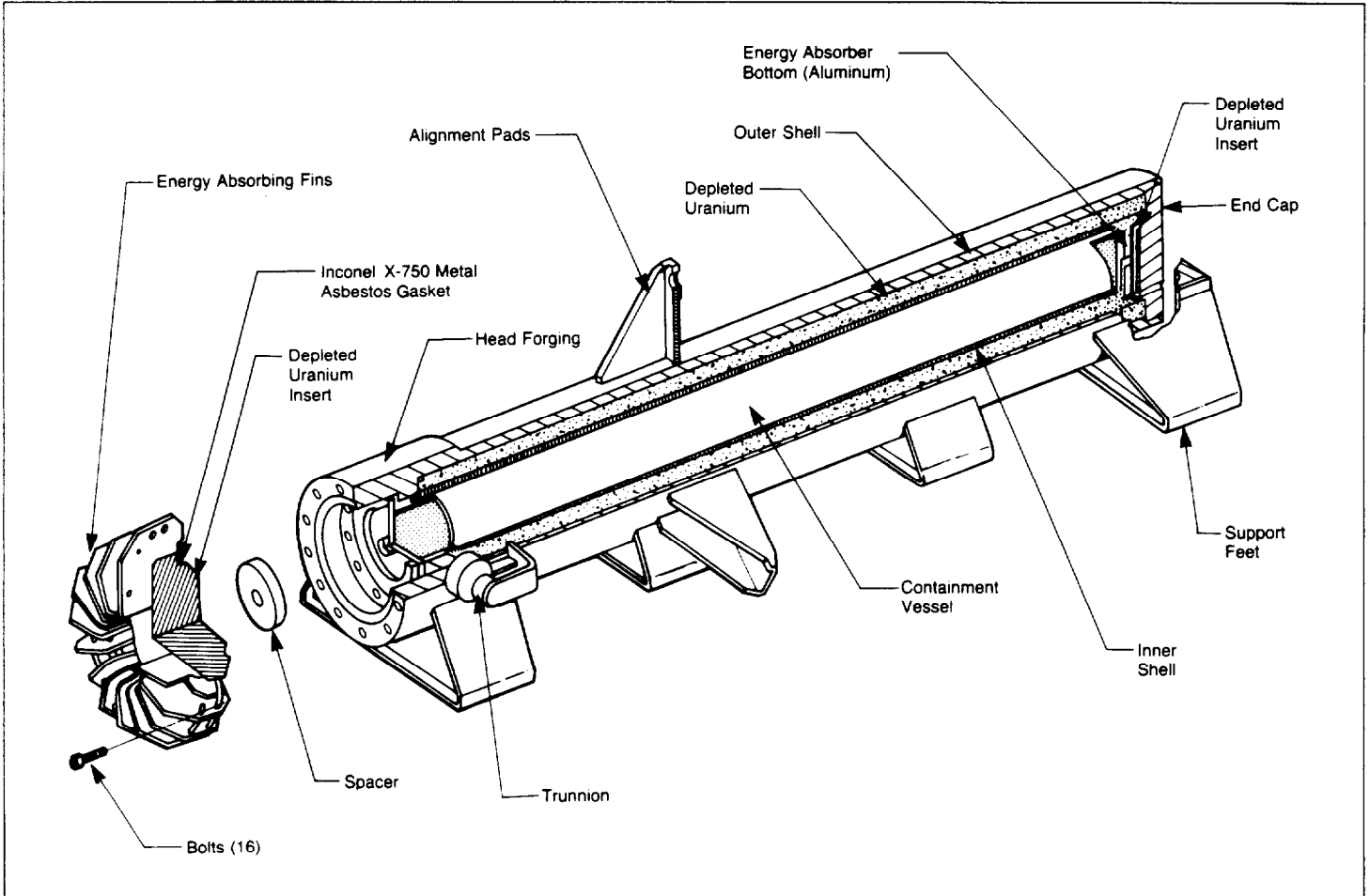
**Examples of Other Packages
With Potentially Significant
Safety-Related Concerns**

The RAS Shipping Container. Westinghouse raised several questions about the structural integrity of the RAS Shipping Container (DOE certificate number 6345), a 21,500-pound, 11.5-foot-long, 22-inch-diameter cylinder-shaped cask used to ship spent nuclear fuel and other radioactive materials. (See fig. 2.3.) The radioactive material is held in special containers within the cask. According to DOE, this package was used about 300 times between 1972 and September 1985, the date of its last use.

The Westinghouse study noted that the cask body and containment vessel were primarily made from carbon steel that could fracture in cold temperatures; and it raised several questions about the SARP, including nonconservative analyses, calculation errors, and the cask's susceptibility to bending or buckling and releasing its contents. Westinghouse officials told us that this package raised the greatest safety concerns of all the packages it reviewed. DOE subsequently decertified the package to preclude its continued use.

The Analytical Shipping Cask. Westinghouse raised questions about the containment and shielding integrity of the Analytical Shipping Cask, model CMB-14 (DOE certificate number 6421). Used to transport large quantities of "special form" radioactive material, including up to 3 kilograms of fissile materials, this heavily shielded package weighs about a ton. Westinghouse questioned whether the package could withstand actual drop test conditions to demonstrate compliance with NRC standards, pointing out that the cask body must directly absorb all impact energies because it does not have crushable material (called "impact limiters") surrounding its extremities. Westinghouse noted that this package's ability to meet drop test conditions was determined by analytical means rather than by actual tests. Westinghouse also stated that the SARP's analysis contained incorrect assumptions and calculations for

Figure 2.3: RAS Shipping Container



determining the effects of the drop test and indicated that the cask's base plate could shear off, allowing the loss of contents or shielding. In addition, Westinghouse noted that the bending capability of the package had been incorrectly calculated and that the package had no resistance to bending. DOE promptly issued a stop-use order on this package and subsequently cancelled its certificate. According to DOE, this package was last used before 1984.

Actions Taken by DOE to Resolve Problems

DOE took several actions to address the problems disclosed by these studies. These actions fell into two basic areas: stopping the use of some packages with potential safety-related concerns and consolidating certification responsibilities for non-weapons packages at headquarters.

Stopping the Use of Packages With Potential Safety-Related Concerns

As of December 31, 1987, DOE had withdrawn from use all eight packages Westinghouse identified as having potentially significant safety-related concerns. It did so by issuing stop-use orders, canceling the certificates of compliance, or letting the certificate of compliance expire. This is illustrated by the actions taken on the RAS Shipping Container and the Analytical Shipping Cask discussed above. Although DOE took prompt action to remove these two packages from service, several other packages with potentially significant concerns were not promptly removed from use.

As of December 31, 1987, DOE also had withdrawn from use 9 of the 20 packages that Westinghouse considered to have less significant safety-related concerns. (See app. III.) Three of the 20 packages had certificates of compliance, but according to a DOE official, no units had been fabricated for use. The remaining eight packages were available for use as of July 31, 1988. Five of the eight have been submitted for certificate renewal.

Consolidating Package Certification Authority

Following the Brookhaven incident, DOE identified several problems with having individual field offices review and certify their own packages. In a June 1986 overview report on packaging certification, DOE headquarters Office of Security Evaluations pointed out a number of problems, including the following, that led DOE to centralize part of its packaging certification function. But the report did not further explain the problems:

- Package certification was driven by program schedule needs rather than the adequacy of the SARP.
- DOE headquarters did not provide sufficient oversight and appraisals of field office package approval activities.
- Package certificates were issued for indefinite periods and were not reviewed when regulations changed.
- Field offices lacked adequate staff.

DOE headquarters officials told us that SARP review and approval was largely a part-time function and field offices often lacked sufficient staff with the right skills to perform adequate reviews.

Because of these and other concerns, in January 1986, DOE headquarters withdrew package approval authority from its eight operations offices and established a unit within the Office of the Assistant Secretary for Defense Programs to carry out package certifications. This consolidation

According to a DOE headquarters official, if a package was judged safe to use, DOE field operations offices were allowed additional time to bring the package and/or its documentation up to current standards. This action was based on (1) DOE's policy to require a complete package review when the certificate is next reviewed and (2) NRC's "grandfathering" regulation, 10 CFR 71.13, which states that packages approved by NRC under earlier regulations and fabricated before September 1986 can be used in the United States without having to meet current NRC requirements. DOE officials said this policy permits them to use packages with valid certificates of compliance while bringing the packages and/or documentation up to current regulations. Packages kept for use in this way are then reviewed when the certificate comes up for renewal.

DOE's policy of allowing additional time to bring the package and/or documentation up to current standards, once the package is judged safe to use, may result in some issues not being fully addressed for several years. For example, as discussed in appendix III, Westinghouse raised concerns with the Plutonium Oxide and Americium Oxide Shipping Cask. While Westinghouse and DOE officials did not consider these to be significant safety-related concerns, and DOE continued to use the package, additional data are needed in the SARP to support this position. We do not believe these issues will be fully addressed until the SARP receives a full, independent review, which may not occur until the package undergoes certificate renewal in March 1990.

Lack of Specific Guidance for Resolving Future Safety-Related Concerns

Under DOE Order 5480.3, dated July 9, 1985, DOE headquarters is authorized to provide guidance for the safe packaging of radioactive and fissile materials, including curtailing or suspending the use of specific packages when necessary. However, DOE officials said that no specific guidance exists for curtailing or suspending packages where safety concerns are raised in studies such as Westinghouse's. They said that in such cases, the decision to continue using a specific package rests primarily with the field operations office that is responsible for managing the package and with the contractors that are using it. In essence, these officials said that DOE operations office personnel must use their professional judgment in such matters.

Notwithstanding these DOE assurances, in the absence of any definitive guidance, the pressure to sustain operations could crowd out the full consideration of safety-related concerns. This practice may not be in either DOE's or the public's best interest. As noted earlier in this chapter, a June 1986 report by the DOE Office of Security Evaluations cited this

type of conflict as one reason that DOE had withdrawn certification authority from its operations offices and centralized it at headquarters.

In our view, the examples in this chapter and appendix III illustrate the potential for such conflict. In the cases of the Garden Carrier, Loop Transport, and HFIR (see app. III) casks, DOE operations offices needed all three packages and decided that the Westinghouse issues were “technical” concerns that did not involve package safety and continued to use them. Two of the packages, however, were subsequently withdrawn because of DOE’s judgment that it would not be cost effective to bring them up to current safety standards. The third package, the HIFR cask, was later withdrawn because of significant unresolved concerns. We believe that the lack of adequate guidance to govern such activities presented an opportunity to tip a decision in favor of program expediency over safety.

An effective oversight role for DOE headquarters is also important in these decisions. In at least one case, the oversight provided by DOE headquarters did result in a decision not to keep three packages in use because of potential safety concerns. DOE headquarters officials responsible for this oversight told us, however, that they do not have authority to direct operations offices to take specific actions. Rather, they can only recommend that action be taken. In our view, it is important that decisions about using packages that have potential safety-related concerns be subject to review by an organization that does not directly manage or use the package but does have authority to suspend package use until the concerns can be evaluated and resolved.

Conclusions

Both the Brookhaven incident and the Westinghouse study caused DOE to remove radioactive materials packages from use, many of which had potential safety concerns. They also prompted DOE to change its organization and procedures for certifying packages. These actions indicate that DOE considered many of the concerns raised by the studies to be important.

Many factors must be taken into consideration in determining if a package is adequate to ship high-level radioactive materials. We believe that safety considerations should have the highest priority and that whenever a concern is raised that could affect the safety and reliability of a package, the issue should be immediately addressed. Further, we believe that package use should be promptly suspended until the issues are resolved and documented. Without definitive guidance governing the

suspension or other handling of packages with identified potential safety-related concerns, DOE is not in a position to assure the Congress and the public that these concerns are adequately resolved before the packages are used or made available for use. If a particular package with problems or potential problems is needed for national security or other valid reasons, we believe that high-level consideration and approval within DOE headquarters should be required before continued use.

Recommendation

We recommend that, in accordance with the provisions of DOE Order 5480.3, the Secretary of Energy promptly develop written guidance for addressing and resolving safety-related concerns raised about the packages used to ship non-weapons, high-level radioactive materials. This guidance should include provisions for approving the continued use of these packages by an organization that does not manage their use.

Improvements Needed to Ensure Proper Review of Nuclear Weapons Packages

Our review of the certification process for nuclear weapons packages at the Albuquerque Operations Office showed that a number of problems exist. We found, for example, that some nuclear weapons packages were uncertified, while others had incomplete documentation or had been used for extended periods on the basis of a temporary certificate. Officials at Albuquerque said they regard most of the problems we identified as matters of documentation rather than matters of safety. We believe that the problems could be more significant than that, and we do not think Albuquerque is aggressively ensuring that the problems are not safety-related.

To deal with certification deficiencies, DOE transferred certification authority for most unclassified packages from the operations offices to a headquarters office. DOE did not, however, include Albuquerque's certification authority for nuclear weapons packages in the transfer.

Problems With Certification of Nuclear Weapons Packages

The Westinghouse study, discussed in chapter 2, did not focus on transportation packages for nuclear explosives, components, and special assemblies. Our review of the certification files for these types of packages at Albuquerque showed several problems ranging from the use of uncertified packages to inadequate staff available to conduct reviews.

DOE Order 5610.1 requires Albuquerque to maintain a directory of approved nuclear weapons package designs. At the time of our review, however, Albuquerque did not have an accurate directory. The directory that an Albuquerque official provided us identified 59 package designs as being available for use, but we found that 6 had expired certificates, 2 were double-counted, and 3 had never been certified.¹

Shipments Were Made in Three Uncertified Packages

Although the three nuclear weapons packages had not been certified for use by Albuquerque as required by DOE procedures, the Oak Ridge Operations Office allowed their use. Over 2 years later, Albuquerque received and reviewed draft SARPs for these packages. Albuquerque approved the packages for temporary continued use even though (1) it identified deficiencies in the SARPs and (2) Oak Ridge had not demonstrated an urgent need to justify their continued temporary use. In our view, these actions were contrary to DOE procedures and inadequate to

¹Albuquerque officials subsequently developed an official directory dated January 13, 1988. Our work, however, was based on the earlier listing, which was the only directory available during most of the period of our review at Albuquerque—April 1987 to February 1988.

ensure that the packages met appropriate safety standards before being used to transport radioactive materials.

Initial Authorizations by Oak Ridge

The three packages were developed at Oak Ridge for transporting nuclear weapons components consisting of Type B materials. Although Albuquerque was responsible for certifying these packages, Oak Ridge and Albuquerque officials said the draft SARPs prepared for each package were not sent to Albuquerque for review before the packages were placed in service. Instead, Oak Ridge had independently reviewed the draft SARPs for two of the package designs and authorized their use on April 27, 1983. It had authorized use of the third package design on December 11, 1985. Subsequent to Oak Ridge's authorization of the package designs, hundreds of individual packages had been fabricated for use. These packages have been used for shipments as recently as October 1987. The exact number of shipments is classified information.

Letters at Oak Ridge indicated two reasons for allowing this action: (1) DOE Order 5610.1 provisions authorizing DOE field managers to grant "one-time" approvals and (2) the national security provision exempting DOE shipments via commercial carriers from complying with DOT and NRC packaging regulations if escorted by personnel for national security reasons. In our opinion, however, neither reason given by Oak Ridge appears to justify its approval of the three packages for use. Two of the packages have been used for more than 4 years and are far from one-time approvals. Furthermore, even though the national security provision may apply to these packages, DOE officials told us that their procedures require Albuquerque to issue DOE certificates for them.

Subsequent Review and Interim Approval by Albuquerque

The three uncertified packages appeared on Albuquerque's list of certified packages provided to us in August 1987. When we asked for the certification files for these packages in September 1987, Albuquerque officials could not locate them. An Albuquerque official later explained that it was not uncommon for packages to be assigned identification numbers (as appeared on the list) during package development. In early December 1987, an Albuquerque official told us that Albuquerque had learned from discussions with Oak Ridge staff that the packages had not been certified, which explained why the certification files could not be found.

On November 24, 1987, Oak Ridge sent Albuquerque a draft SARP for each package—the same SARPs Oak Ridge had used years before to

approve the packages for use. Albuquerque officials told us that they did not begin reviewing the SARPs until they received a February 2, 1988, memorandum from Oak Ridge requesting review and certification. In a February 19, 1988, memorandum to Oak Ridge, an Albuquerque official indicated that each SARP was deficient in several areas. For example, an attachment to the memorandum noted that (1) each SARP did not adequately describe the effects of nine normal conditions of transport and four hypothetical accident conditions tests, (2) the SARPs' general statements concluding that these conditions had been met were not sufficient, and (3) the SARPs lacked required quality assurance program plans and drawings with sufficient detail to "identify the package accurately and provide a sufficient basis for evaluation of the package."

On February 19, 1988, pending satisfactory responses to these and other issues and receipt of final SARPs, Albuquerque issued interim certificates authorizing package use for 60 days. Under DOE Order 5610.1, the Albuquerque Manager can issue interim approval for "... undocumented packaging requiring expeditious handling upon receipt of a satisfactory interim safety analysis from another field office manager that the packaging and transportation to be used meet appropriate safety requirements." Within 60 days of the interim approval, the requester must provide Albuquerque complete documentation so that a "final" package certificate can be issued.

The DOE order does not define "undocumented packaging requiring expeditious handling" or "satisfactory interim safety analysis." An Albuquerque official indicated that his office looks for an urgent program need, not necessarily relating to national security, as justification for issuing an interim certificate. An Office of Military Application official told us that these interim approvals can be issued on either the basis of verbal or preliminary written information. We found, however, that there was no written justification of an "urgent need" and Albuquerque's conversations with Oak Ridge took place after the interim certificates were issued. Oak Ridge, in its February 2, 1988, memorandum, requested final certification on the three packages and provided draft SARPs to support its request. The documentation, however, did not show that Oak Ridge had an urgent program need for continued use of the packages, and Albuquerque, in approving interim certification, did not refer to any urgent program need to justify its decision. Further, in our opinion the deficiencies noted by Albuquerque in the draft SARPs—particularly those concerning the lack of data showing the effects of required tests on packages—raise questions about the ability of these packages to meet safety standards.

Albuquerque officials and an Office of Military Application official told us they viewed the draft SARP deficiencies as documentation problems, not safety problems. An Albuquerque official noted that interim certificates were issued to give Oak Ridge time to correct the deficiencies. Albuquerque officials told us that they were confident that Oak Ridge could provide the necessary information to resolve the identified issues on the basis of their discussions with Oak Ridge staff. These discussions, however, took place after Albuquerque issued the interim certificates.

On May 26, 1988, an Oak Ridge official told us that all three packages were taken out of service when the interim certificates expired on April 19, 1988. Albuquerque and Oak Ridge officials also told us that two of the three packages were urgently needed for defense program purposes. An Oak Ridge official said that the office was not pursuing certification for the third package because the program for which it was used was discontinued. The official said Oak Ridge was working to resolve the issues raised by Albuquerque on the other two packages so that they could be certified and brought back into service.

Interim Certificates Used for Extended Periods on Four Packages

We also found that several packages had interim certificates for periods well beyond the 60-day provision. In addition to the three interim certificates discussed above, at the time of our review five other packages were authorized for use under interim certificates. Four of the five packages had not received final certificates and had been available for use under interim certificates for the past 9 to 11 years. During fiscal years 1986-87, one of these packages was involved in many classified shipments. Albuquerque assigned an expiration date to the interim approval granted to the fifth package; however, the date assigned exceeded the 60-day limit by over 8 months. The interim approval was granted on April 6, 1987, and set to expire on December 31, 1987.

Seven Packages Lacked Complete Documentation

Working from the list we received, we determined with Albuquerque assistance that 42 packages with valid Albuquerque certificates carried Type B materials and were available for use.² These included 24 packages for transporting nuclear weapons components, 12 for carrying special assemblies, 5 for carrying nuclear explosives, and 1 for weapons-related materials.

²We eliminated from DOE's list of 59 packages 11 which did not have valid certificates and 4 used for Type A non-fissile materials. Also not included were two packages which we could not identify as either Type A or Type B.

Our preliminary examination of the official certification review files raised questions concerning the adequacy of documentation or testing for several packages. We judgmentally selected 14 of these packages for further review. They included seven used to ship nuclear components, five for special assemblies, and two for nuclear explosives. We then examined the official certification files to see if the information presented addressed NRC testing standards in effect when the packages were certified. Finally, we discussed our observations with Albuquerque staff to determine if we had overlooked relevant information.

We found that in 7 of the 14 cases, the information in the certification files did not completely address all NRC standards in effect when the packages were certified. For example, in two of these cases, the documentation did not address five types of required testing. In two other cases, the documentation asserted, but did not demonstrate, compliance with the packaging standards.

**DOE Headquarters
Appraisal Identifies
Deficiencies in
Documentation and
Staffing**

A DOE headquarters appraisal also noted documentation and other problems at Albuquerque. In February 1987, DOE headquarters staff evaluated and reported on Albuquerque's compliance with DOE Order 5610.1, which concerns DOE requirements for nuclear weapons packages. In our opinion, two of the observations were especially important.

One observation was that the documentation supporting many packages for nuclear weapon systems was inadequate to demonstrate achievement of safety levels required by DOE standards. The appraisal noted that packaging for many weapon systems (nuclear explosives or special assemblies) consists of a dolly or handling device while the weapon system itself provides the structural, thermal, and containment protection. The appraisal indicated that although nuclear weapon safety design criteria appear to include safety requirements specified in DOE Order 5480.3, these requirements were neither clearly cited nor always assessed or reflected in the safety appraisals. The report states, "Therefore, the direct supporting justification for some certificates is tenuous." The appraisal recommended, among other items, that DOE Order 5610.1 be revised to clarify the criteria against which safety is judged and, until it is revised, SARPS should explicitly address DOE Order 5480.3 requirements. According to a DOE official, a draft revision to DOE Order 5610.1 was put into effect on a trial basis in June 1988.

A second observation was that Albuquerque lacked sufficient staff to properly conduct SARP reviews. The appraisal found that SARP reviews

were conducted by one Albuquerque packaging engineer (part-time) with some assistance from quality assurance and weapons production personnel. The appraisal contrasted this with DOE headquarters centralized package certification program, which includes specialists to provide independent structural, thermal, quality assurance, and other analyses and an in-depth review. The appraisal reported that Albuquerque's staffing of "0.6 persons" was inadequate to discharge Albuquerque's DOE Order 5610.1 responsibilities. The appraisal did not indicate what an adequate staffing level should be.

Albuquerque Has Been Slow to Take Action on Issues Raised About Packages

Albuquerque officials told us that most of the issues we identified are documentation or administrative problems, not safety problems. They believe that the packages are safe and indicated that the issues we identified are indications not of safety problems but of a lack of file documentation that fully explains why the packages are safe. They also pointed out that all of these packages are transported in specially designed vehicles. Although these vehicles are not considered when evaluating a package for certification, Albuquerque officials said the vehicles provide significant protection in the event of a serious accident.

We think the problems could be greater than Albuquerque officials indicate and believe other reviews support our position. In our view, Albuquerque's pace in recognizing potential problems and dealing with them has been slow. Before our review was conducted, both the Westinghouse study and the internal DOE review provided strong indications of potential problems with Albuquerque's certification process.

Although the Westinghouse study did not focus on Albuquerque's nuclear weapons packages, it did review 17 non-weapons packages approved by Albuquerque. According to an Albuquerque official, the office approved non-weapons and weapons packages using generally the same certification process.³ Westinghouse identified potential safety problems with 9 of the 17 non-weapons packages and discussed these findings with Albuquerque in July 1986. While action has been taken on the nine (four with the most significant problems were removed from service, four with lesser problems are undergoing review at headquarters, and one that was not used was decertified), the findings should have raised questions about the condition of Albuquerque's nuclear weapons packages as well.

³In January 1986, DOE centralized the certification of DOE non-nuclear weapon packages at DOE headquarters.

Chapter 3
Improvements Needed to Ensure Proper
Review of Nuclear Weapons Packages

The February 1987 appraisal by DOE headquarters also indicated that a review of Albuquerque's nuclear weapons packages was in order. DOE noted the lack of expiration dates on many packages and recommended that all packages be assigned dates after which an updated SARP would be required before the package could be recertified.⁴ On July 30, 1987, Albuquerque advised DOE headquarters that it planned to review all previously issued weapons certificates and assign expiration dates. However, it did not establish a timetable for doing so. Albuquerque officials subsequently told us that most package certificates without expiration dates would be valid until December 31, 1989. Expiration dates were assigned in January 1988. In the interim, an Albuquerque official said DOE contractors will decide which packages are still needed and prepare updated SARPs.

Albuquerque officials plan to review the SARPs as they are submitted with assistance from one or two consultants. Albuquerque officials were uncertain of how long it would take to completely review and approve all packages. They said delays in revising DOE Order 5610.1 governing these packages may affect completion of the process. An Albuquerque official also told us that if recertification of a package is not completed by December 31, 1989, Albuquerque may allow continued package use by following NRC's "timely renewal" provision.⁵ This provision essentially allows an expired package certificate to remain in force, provided an application for renewal is submitted 30 days before the expiration date.

⁴Our review also showed problems with expiration dates. Of the 42 package certificates we reviewed at Albuquerque, 35 (83 percent) did not have expiration dates. Sixteen of these had been certified before 1978, meaning that they had not been fully reexamined for compliance with regulations for more than 10 years.

⁵Twenty-nine of the 35 package certificates that did not have expiration dates were later issued December 31, 1989, expiration dates. The other 6 package certificates were assigned earlier dates.

DOE Actions to Centralize Package Certification Process Did Not Extend to Nuclear Weapons Packages

DOT questioned the adequacy of DOE's package certification process after the Brookhaven incident in 1985. Subsequently, DOE took actions to improve the quality of the process. A major step involved moving certification authority from eight of DOE's operations offices to a newly created, centralized package certification office within the Office of Security Evaluations (under the Assistant Secretary for Defense Programs) at DOE headquarters. DOE reorganized to help ensure that it could meet DOT and NRC packaging requirements. According to a DOE official, the agency was concerned in part that under the previous approval system, the program responsibilities of operations offices may have inappropriately influenced the review of SARPs and the issuance of certificates of compliance. By consolidating this activity at headquarters, he said, DOE hoped to provide a greater degree of independence and uniformity in the certification process.

DOE's centralized certification office should improve much of its control over the certification process. DOE has not, however, included the certification of nuclear weapons packages in its centralized effort. Responsibility for certifying these packages remains with Albuquerque, under the oversight of the Deputy Assistant Secretary for Military Application at DOE headquarters.

In the past, we have recommended the need for independent oversight of various aspects of DOE's nuclear activities.⁶ We have pointed out that one basic cause of shortcomings in DOE's safety process was the safety program's organizational placement within DOE. In our view, independence means that, whenever possible, the reviewing group should be removed from funding or staffing pressures to ensure that reporting will not only be impartial but will be viewed as impartial by knowledgeable third parties. In this way, conflicts between DOE's program and safety goals can be minimized.

Albuquerque's program responsibilities for nuclear weapons carry the potential for conflicts with its role as an independent certifier of weapons transportation packages. Under guidance from the Deputy Assistant Secretary for Military Application, Albuquerque's primary mission involves managing the research, development, and production of nuclear weapons. It is also responsible for the safe and secure movement of nuclear weapons and strategic quantities of nuclear materials within the

⁶See *Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities* (EMD-81-108, Aug. 4, 1981) and *Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved* (GAO/RCED-86-175, June 16, 1986).

continental United States. These missions rely heavily on the availability of radioactive materials shipping packages.

According to Albuquerque officials, the nuclear weapons package certification process is located in the Safety Programs Division, which is independent of other Albuquerque operating divisions with program responsibilities. We think this degree of independence is insufficient. As long as the package certification process remains an internal function within Albuquerque, the potential remains for conflicts between program objectives and safety considerations. At a minimum, trade-offs between the two must be made during the budget process. Competition for staff and other resources appears to exist, as evidenced by the DOE headquarters appraisal finding that the certification program lacks adequate staff to discharge its responsibilities properly. In our opinion, even the appearance of potential conflicts should be avoided if alternative arrangements are available.

In our view, placing Albuquerque's package certification responsibility with DOE headquarters' centralized program not only offers the opportunity for increased independence and uniformity in the certification process, but also brings the nuclear weapons packages under ES&H oversight. DOE headquarters established the centralized package certification program, in part, to remove the package review and approval process from program schedule pressures at the DOE field office level. We believe similar action could be taken concerning the nuclear weapons certification process to avoid possible conflicts between program and safety goals.

DOE Plans to Review Nuclear Weapons Transportation

As our field work on this review was ending, DOE was revising its policy and procedures for reviewing its nuclear weapons packages. The proposed approach, provided in draft DOE Order 5610.1A, indicates that the entire transportation process, including vehicles, communications equipment, type of packaging, proposed routes, personnel and training requirements, and the like will be evaluated.

The proposed approach also calls for a Nuclear Weapons Transportation Safety Review Panel to evaluate SARPs and other information before any shipment or series of shipments involving nuclear explosives, nuclear components, or special assemblies is authorized. Except for the transportation of these items at the Nevada Test Site, the Albuquerque Operations Office Manager will be responsible for convening the panels,

designating the chairperson, and, based on the panels' recommendations, making the final decision concerning whether the movement of materials should be approved. (The Nevada Operations Office Manager has similar responsibilities for on-site shipments at the Nevada Test Site.) Minority opinions expressed by panel members will be presented in the report for the operations office manager's consideration. A DOE official told us that the draft order was put into effect in June 1988 on a trial basis of about 6 months, and internal review of the order is continuing.

Conclusions

DOE's efforts to centralize much of the agency's radioactive material package review and certification process should improve its control over this important safety function. However, this action did not change the package approval process for nuclear explosives, nuclear components, or special assemblies, which remains with the Albuquerque Operations Office and which is not subject to ES&H oversight. We found that some of the same deficiencies that motivated DOE to shift certification responsibility from the field to headquarters also exist in the nuclear weapons program at Albuquerque. This includes packages not periodically reviewed for regulatory compliance and a lack of resources to do proper package reviews.

Albuquerque plans to review its packages for regulatory compliance but intends to wait for its contractors to decide which package designs are still needed. If a package is needed, an updated SARP will have to be submitted for review. In many cases the review may not begin until after December 31, 1989, when the package certificates expire. More timely action is appropriate, given the potential hazards associated with the materials transported, the general public's welfare, and indications that documentation supporting the previous certificates is inadequate. As a result, we believe that a prompt, independent review of all available documentation is needed to ensure the safety of DOE's nuclear weapons packages.

While DOE plans to expand its review and certification of nuclear explosives, components, and special assemblies to include the entire transportation system, the final decision is expected to rest with the Albuquerque Manager. We continue to believe that regardless of the specifics that are adopted, certification at DOE headquarters would enhance DOE's credibility and help avoid potential conflicts between program and safety goals. We also believe that the nuclear weapons packages should be subject to ES&H review and that this would lend further independence

and credibility to the program. Transferring this certification authority to headquarters would bring it under ES&H oversight.

Recommendations

We recommend that the Secretary of Energy (1) promptly conduct an independent review of all available documentation to ensure that package designs approved for transporting nuclear explosives, nuclear components, and special assemblies meet all applicable safety regulations and (2) consolidate certification responsibilities for these packages with the centralized package certification program at DOE headquarters.

Radioactive Materials Shipping Packages Included in the Westinghouse Study

Operations office	Certificate number	Number in inventory (FY 1986)	Total shipments (FY 1986)
Albuquerque	5097	3	0
	5332	485	1,137
	5599 ^a	^a	^a
	5645	6	0
	5790	40	7
	5791	10	0
	5885	2	0
	6286	10	0
	6421	1	0
	9501	0	0
	9502	5	0
	9504	59	29
	9505	14	7
	9506	0	0
	9507	5	0
	9508	0	0
Chicago	5608	2	0
	6345	2	0
	6643	16	0
Oak Ridge	5170 ^b	550	540
	5467 ^b	7,960	2,945
	5507	1	22
	5597	11	30
	5753	1	1
	6088	1	1
	9855	130	8
	9856	5	0
	9857 ^b	500	0
	9858 ^b	100	0
	9859	21	77
Richland	9860	1,890	1,646
	4915	5	0
San Francisco	9903 ^b	235	8
	6166	2	0
San Francisco	6400	1	1
	6478	2	0
	6495	1	0

(continued)

**Appendix I
Radioactive Materials Shipping Packages
Included in the Westinghouse Study**

Operations office	Certificate number	Number in inventory (FY 1986)	Total shipments (FY 1986)
	9931	1	0
	9932	4	7
Savannah River	9965	165	20
	9966	0	0
	9967	0	0
	9968	0	0
	5320-3	14	2
	5320-4	49	0

^aUsage information is classified.

^bThese are Type A fissile packages; all others are Type B.

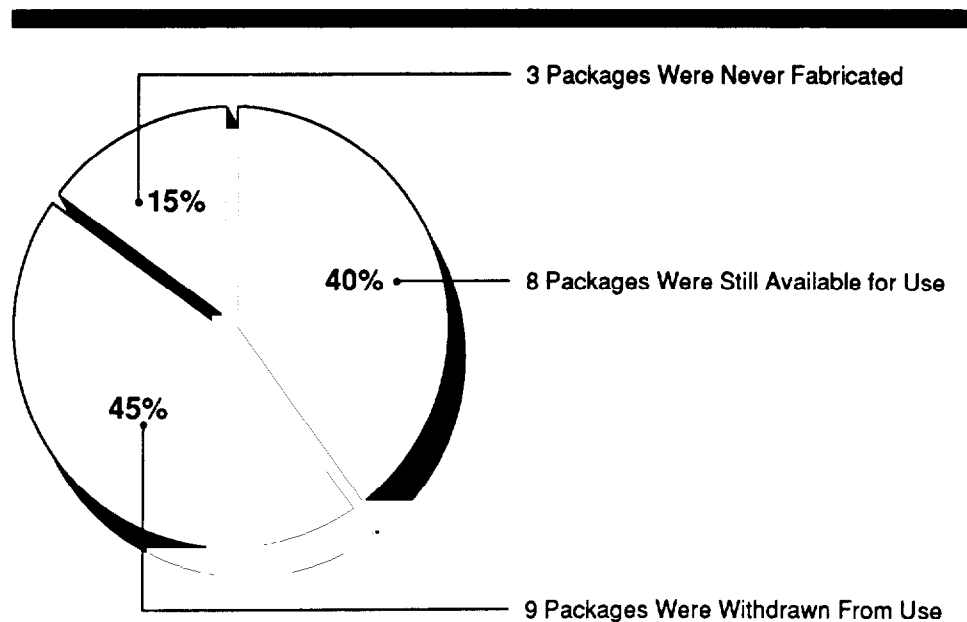
DOE-Certified Packages That Contained Potential Safety-Related Concerns

Certificate number	General area of concern			Available for use as of July 31, 1988	
	Containment	Shielding	Criticality	Yes	No
Significant concerns:					
5645	X	X	X		X
5599	X				X
6421	X	X			X
5885	X				X
6345	X	X			X
5753	X	X			X
6088	X				X
6478	X	X			X
Total	8	5	1	0	8
Less significant concerns:					
5332	X			X	
5790	X	X		X	
5791	X	X		X	
6286	X				X
9507	X			X	
5608	X				X
6643	X				X
5507	X				X
9859	X			X	
4915-1	X				X
6166	X	X			X
6495	X	X			X
9931	X				X
9932	X			X	
5320-3	X			X	
5320-4	X				X
9965	X			X	
9966	X				X
9967	X				X
9968	X				X
Total	20	4	0	8	12

Packages Identified by Westinghouse as Having Less Significant Safety-Related Concerns

Westinghouse's review identified 20 Type B, non-weapons packages as having less significant safety-related concerns. Figure III.1 shows the status of these 20 packages as of July 31, 1988. As shown, three packages had never been fabricated and thus were never available for use. Of the remaining 17 packages, 9 had been withdrawn from service and 8 remained available for use. Eight of the 17 were used after DOE was made aware of the results of the Westinghouse study.

Figure III.1: Status of 20 Packages With Less Significant Safety-Related Concerns as of July 31, 1988



Nine Packages Withdrawn From Use

DOE withdrew nine of the packages from use by December 31, 1987. Even though only one of these packages was actually used, DOE did not promptly reach decisions on whether any of them should continue to be made available for use. These packages remained available for use for periods ranging from 1 to 17 months after Westinghouse informed DOE of the issues.

According to DOE, the issues raised by Westinghouse were resolved for one of the nine packages before it was withdrawn from use. For three other packages, the DOE operations office wanted from 6 to 9 months to analyze the issues, but DOE headquarters did not concur. DOE determined that four other packages were no longer needed, but it took up to 17 months to remove them from service.

**Appendix III
Packages Identified by Westinghouse as
Having Less Significant Safety-
Related Concerns**

The remaining package—called the HFIR Spent Fuel Element Shipping Cask (DOE certificate number 5507)—continued to be available for use for 10 months after DOE was informed about potential safety-related concerns. During this period, DOE used the package 11 times to transport high-level radioactive materials. The package, about 6 feet tall and about 4 feet in diameter, is used to transport a variety of spent fuel elements. The Westinghouse study raised several concerns with this package, including the following:

- The viability of the package as a containment vessel was questioned because the primary containment is provided by the structural integrity of the spent fuel payload that was being shipped. Westinghouse noted that because the package was used to transport a number of different spent fuel payloads, greater analysis of each payload was needed to ensure that the package would meet standards.
- The package has only one seal, a silicone gasket—a type of gasket that may have problems meeting NRC requirements.
- The package's component for absorbing shock is made of carbon steel that, during an accident, could fracture and fail in cold temperatures.

Some of these concerns were similar to those raised by NRC during its earlier review to independently certify the package. In May 1982, NRC questioned the HFIR package's structural, thermal, and containment capabilities and requested DOE to provide additional information in these areas. Oak Ridge officials told us they considered NRC's concerns to be technical and not related to safety. However, on September 11, 1987, DOE withdrew its application for NRC certification, indicating that the cask had been decertified and would be replaced with a new one. A DOE official said that it would not be cost effective to bring the HFIR package up to current NRC standards.

Oak Ridge officials were informed about the Westinghouse issues in April and June 1986. They told us they evaluated the concerns raised by Westinghouse and, as with the issues raised by NRC, considered most of them to be technical concerns that did not affect package safety. An Oak Ridge official said that none of the issues were significant enough to warrant suspending use of the HFIR and that the cask was needed to support ongoing activities. Between May 1986 and March 1987, an Oak Ridge contractor made 11 shipments with this package.

Because of questions raised by NRC and Westinghouse and the continued need for the HFIR package, DOE's centralized certification office requested that the Argonne National Laboratory review the original and

**Appendix III
Packages Identified by Westinghouse as
Having Less Significant Safety-
Related Concerns**

revised SARPS for compliance with nuclear criticality requirements. The review was prompted by a proposed use of the package that was not covered by the original certificate of compliance. In a letter dated March 26, 1987, Argonne advised DOE headquarters that it had serious questions on whether the package contents would stay subcritical during transport under the proposed use—these questions also applied to some of the “loadings” (contents) for which the HFIR was originally certified. On April 2, 1987, DOE advised its contractor not to use the package, and on April 24, 1987, Oak Ridge formally notified the contractor not to use the package until the issue was resolved.

On September 11, 1987, DOE’s centralized certification office indicated that the HFIR cask should not be used even in a limited fashion unless all significant concerns regarding the package were satisfactorily resolved. It noted that the problems identified by various assessments (NRC, Westinghouse, and headquarters) addressed a variety of issues, including structural, containment, criticality, shielding, and heat-loading characteristics. The office further stated that the cask should not be used for further shipments and it cancelled the package’s certificate of compliance effective immediately. A new HFIR spent fuel shipping cask has been designed and its SARP has been submitted to NRC for review and certification.

**Eight Packages Still
Available for Use**

As of July 31, 1988, eight of the packages with less significant safety-related concerns were still available for use. Seven had continued to be used to ship radioactive materials. Five of the eight were undergoing certificate renewal by DOE. The certificates for the other three do not expire until either 1989 or 1990.

**Examples of Packages
With Less Significant
Safety-Related Concerns**

Westinghouse personnel told us they did not consider the examples below to be significant safety-related concerns but, nevertheless, thought they should be addressed.

**The Rocky Flats Shipping
Container**

Westinghouse questioned the containment system for the Rocky Flats Shipping Container, model 2030-1 (DOE certificate number 5332). This is either a 30- or 50-gallon metal drum with an inner container held within the drum by a packing material and a lid that is secured by a clamping bolt ring. Westinghouse noted that the reliability of the clamping ring is not high when subjected to large deformations and questioned whether

a plutonium-carrying package should be so dependent on such a single load path.

In response to this issue, DOE officials noted that the closure system satisfactorily passed required tests and that additional testing data supporting this position would be included in a revised SARP prepared for certificate renewal. In November 1987, DOE's centralized certification office began reviewing the revised SARP for certificate renewal. On May 26, 1988, a DOE headquarters official told us that the review had raised questions about the closure system issue and many other issues needing to be resolved and that the review was continuing. However, on July 15, 1988, Albuquerque wrote to headquarters stating that it did not anticipate future non-weapons use for this package, so it withdrew the recertification request and said it would seek a weapons package certificate. A headquarters official said that the existing certificate would be cancelled on August 25, 1988. According to DOE records, over 1,000 shipments were made with this package in fiscal year 1986.

Plutonium Oxide and Americium Oxide Shipping Cask

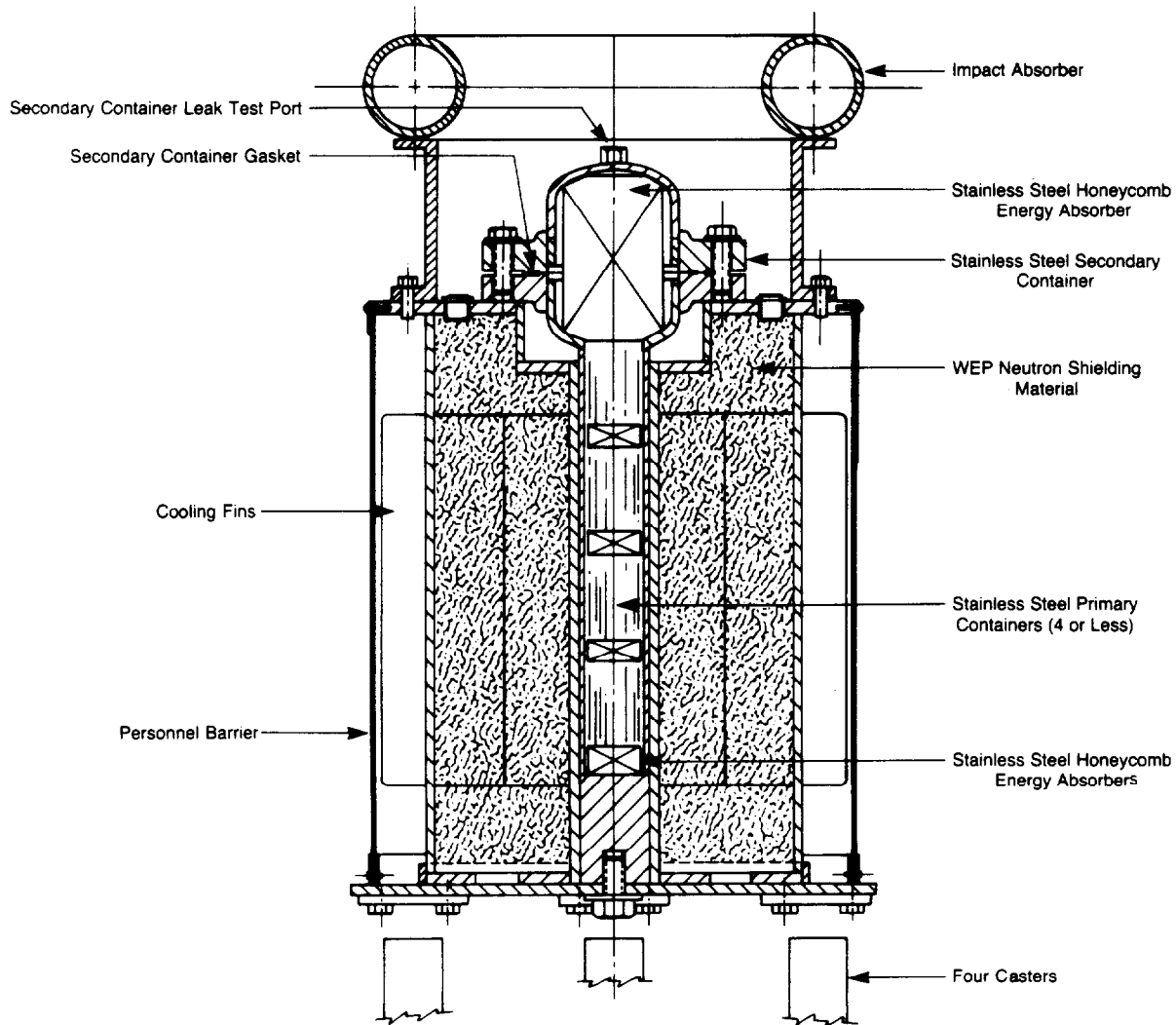
Westinghouse questioned the containment system for the Plutonium Oxide and Americium Oxide Shipping Cask (DOE certificate number 5320-3). This package, as its name implies, is used to transport plutonium and americium oxides in any solid form such as granules, scrap, pellets, or powder. It is 18 inches, by 20 inches, by 36 inches. During fiscal year 1987, DOE made 26 shipments with the package, and it remained available for use as of July 31, 1988.

The primary containment vessel is located within a secondary vessel which is press-fitted into an outer package and secured by a single bolt three-fourths of an inch in diameter. Westinghouse raised a concern about the reliability of the press-fit and the reliance on the single bolt to keep the containment vessels in the package. Westinghouse was concerned that if the bolt failed or pulled through the carbon steel plate to which it was fastened, the cask could lose its shielding and impact-absorbing system.

In response to this issue, the Savannah River Operations Office, the DOE office responsible for managing the package, indicated to DOE headquarters that the secondary containment vessel is pressed into place with 25 tons of force and that the bolt is a redundant system for keeping the containment vessel in the package. It also said that the package had been successfully drop tested with the full impact applied totally to the bolt and carbon steel base plate. A Westinghouse official, however, told

**Appendix III
 Packages Identified by Westinghouse as
 Having Less Significant Safety-
 Related Concerns**

Figure III.2: Plutonium Oxide and Americium Oxide Shipping Cask



us that the SARP neither mentions the force of the press-fit nor contains sufficient information to demonstrate that the press-fit would hold the containment vessel in the package. In addition, according to the SARP, the carbon steel plate was not in place during the drop test.

**Appendix III
Packages Identified by Westinghouse as
Having Less Significant Safety-
Related Concerns**

While DOE officials believe this package is safe to use and Westinghouse did not consider it a significant safety concern, additional data are needed in the SARP to support this position.

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