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BY THE COMPTROLLER GENERAL



# Report To The Congress OF THE UNITED STATES

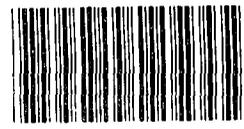
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## Federal Actions Are Needed To Improve Safety And Security Of Nuclear Materials Transportation

Over 2 million packages of radioactive materials are shipped within the United States each year. The Nuclear Regulatory Commission estimates that shipments will more than double to about 5.5 million annually by 1985.

GAO evaluated the policies and practices of the Commission and the Departments of Energy and Transportation to see if improvements were needed to assure safe, secure nuclear shipments.

GAO recommends several changes to existing procedures and regulations that would improve safety and strengthen the security of nuclear shipments.



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COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

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To the President of the Senate and the  
Speaker of the House of Representatives

This report discusses Federal policies and programs aimed at assuring the safety and security of radioactive materials during transportation.

We made this review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53) and the Legislative Reorganization Act of 1970 as amended by Public Law 93-344, (88 Stat. 297), and as part of our evaluation of the effectiveness of the Nuclear Regulatory Commission's regulatory activities as required by the Energy Reorganization Act of 1974 (42 U.S.C. 5876).

We are sending copies of this report to the Director, Office of Management and Budget; the Chairman, Nuclear Regulatory Commission; the Secretaries of Energy and Transportation; and the Acting Administrators of Federal Emergency Management Agency and General Services Administration.

A handwritten signature in black ink, reading "Luther B. Starks".

Comptroller General  
of the United States

COMPTROLLER GENERAL'S  
REPORT TO THE CONGRESS

FEDERAL ACTIONS ARE NEEDED  
TO IMPROVE SAFETY AND  
SECURITY OF NUCLEAR  
MATERIALS TRANSPORTATION

D I G E S T

Federal agencies responsible for the safe transportation of nuclear materials have not developed and enforced policies and regulations which adequately protect the public from exposure to radiation from such shipments. Deficiencies in Federal programs coupled with poor Federal-State interaction have caused States to become concerned about the safety of nuclear materials shipments even though the safety record has been good. As a result, State and local governments have begun to pass laws and regulations which could impede, and in some cases stop, the movement of nuclear materials between different State and local jurisdictions.

Transportation of radioactive materials is vital to the Nation's use of nuclear materials for energy, medical, and other purposes. Shipments include radioactive wastes, reactor fuel, and material used for medical and industrial purposes.

The Department of Transportation, the Nuclear Regulatory Commission, and the Department of Energy have responsibilities for the safe and secure transportation of nuclear materials. All of these agencies could strengthen their safety and security procedures.

MORE ASSURANCE NEEDED THAT  
SHIPMENTS ARE SAFE

Safe shipping containers are the first line of defense in protecting the public from radioactive materials shipments, but inspection procedures do not adequately assure that containers meet Federal safety specifications. The Nuclear Regulatory Commission and the Department of Energy rely on container users and manufacturers to assure these containers

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meet Federal safety specifications. Neither agency independently inspects these packages to assure they are constructed properly and continue to meet Federal standards after repeated use. The Department of Transportation, on the other hand, does some testing but does not test packages to see if they meet performance specifications. (See pp. 6 to 8.)

The Department of Transportation and the <sup>NRC</sup> Commission allow levels of radioactive contamination on packages and transport vehicles which are unnecessarily high. This unnecessary radiation creates a potential hazard for transportation workers as well as the general public. (See pp. 8 to 10.)

Commission regulations do not require receivers of Type A packages to monitor radiation levels to make sure they comply with Federal regulations. Type A packages are used to ship materials such as slightly radioactive waste and radiopharmaceuticals. (See p. 10.)

Neither the Department of Transportation nor the Commission adequately inspect shippers and carriers for compliance with Federal transportation regulations. A recent Department of Transportation/Commission study confirmed the need for better surveillance, and at the same time illustrated the practicality of using State inspectors. (See pp. 10 to 12.)

The Department of Transportation and the Commission have conflicting regulations for packaging nuclear materials with a low specific activity--the measure of radioactivity in each gram of nuclear material. As a result, shippers following Transportation Department regulations are sometimes cited by the Commission for violating Commission regulations. (See p. 12.)

#### SECURITY NEEDS TO BE UPGRADED

The Department of Energy and the Commission require special security measures for shipments of weapons-grade plutonium and highly

enriched uranium when the amount being transported reaches a specified quantity, called the "strategic level." (However, current Federal regulations for protecting less than strategic quantities are inadequate and should be upgraded.)

- No special security measures are required for shipments of weapons-grade materials which are only one or two grams below the strategic quantity level. The theft of multiple shipments below the strategic level could provide enough material to build a bomb. Also, plutonium of less than strategic quantities could be dispersed into the air to seriously endanger public health and safety in populated areas.
- Separate shipments of less than strategic quantities of nuclear materials can be brought together into one unprotected transportation terminal. Thus, two or more shipments of weapons-grade material, which together exceed the strategic quantity level, may be at one terminal at the same time--unprotected.
- The current safeguards criteria do not adequately consider the effect enrichment levels have on the quantity of material needed to make a bomb. As a result, shipments that would be less useful for making a bomb may be protected while more useful shipments are not. (See pp. 15 to 19.)

#### Spent fuel

Spent fuel is a highly radioactive material which is transported in massive, durable containers. Based on test results, its release from these containers in accidents appears unlikely. However, Federal agencies have not adequately considered the possibility of sabotage. The effects of sabotaging a spent-fuel container using high explosives cannot be accurately predicted because tests have not been done to determine the amount of spent fuel that would be released.

A recent Sandia Laboratories report estimated that the escape of 1 percent of the spent fuel in a container could have serious public health and economic impacts. (See pp. 19 to 22.)

### EMERGENCY PLANNING NEEDS IMPROVEMENT

Much more needs to be done to improve emergency response planning at the State and local levels for incidents involving the transportation of nuclear materials. <sup>1/</sup> Substantial Federal resources are available to assist in transportation emergencies. However, Federal agencies may not be able to respond for several hours after an accident.

State and local agencies that would have an important role in protecting the public from the effects of radiological emergencies may not be fully prepared for such emergencies. The majority of States have some type of plans for dealing with transportation accidents involving nuclear materials; only a few have fully tested their plans to see if they would work. Many of these agencies are not prepared to effectively cope with major transportation accidents. In fact, half the States responding to a GAO questionnaire were unable to estimate how much nuclear material is transported through their jurisdictions each year.

The Commission and the Department of Transportation are responsible for providing State and local agencies guidelines in preparing plans for nuclear transportation emergencies. However, neither agency has the authority to require States to develop emergency plans.

*Transportation accidents involving nuclear materials*

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<sup>1/</sup>GAO recently completed a study of emergency planning and preparedness around nuclear facilities entitled, "Areas Around Nuclear Facilities Should Be Better Prepared For Radiological Emergencies," EMD-78-110, March 30, 1979.

GAO believes the new Federal Emergency Management Agency, which is being established to serve as the focal point for Federal emergency preparedness activities, could more effectively encourage State and local governments to develop and maintain emergency response plans for nuclear transportation accidents. (See pp. 25 to 29.)

STATE AND LOCAL REGULATION  
IS INCREASING

Over 20 percent of the States have passed legislation or regulations governing the transportation of radioactive materials. In 1977 alone, 24 bills to regulate the transportation of nuclear materials were introduced in 19 States. Nine of these bills eventually became laws.

To encourage the adoption of uniform regulations nationwide, the Department of Transportation should develop a program of coordination with the States, taking an aggressive approach in addressing State concerns. Inaction in this area could lead to higher costs, greater risk to the public safety, confusion for shippers and carriers, and unnecessary delays in shipping nuclear materials. (See pp. 30 to 44.)

RECOMMENDATIONS TO THE  
CHAIRMAN OF THE NUCLEAR  
REGULATORY COMMISSION AND  
THE SECRETARY OF ENERGY

The Chairman of the Commission and the Secretary of Energy should:

- Perform periodic, independent physical inspection and testing of nuclear materials packages on a random basis during fabrication and after repeated use. Such inspection and testing should either be done by independent contractors or by the agencies themselves.
- Jointly develop a graduated scale of security measures for the transportation of special nuclear materials, rather than the present all-or-nothing strategic

cut-off level. In establishing these levels, the dispersal hazard of plutonium should be considered. In addition, the criteria should take into account the enrichment level of uranium since smaller amounts of highly enriched uranium are needed to make a weapon.

- Take immediate action to preclude enroute consolidation of two or more special nuclear materials shipments that together exceed the strategic levels.
- Determine if there is a need to safeguard spent fuel shipments from sabotage by developing experimental data on the amount of radioactive material that could be released in a sabotage attack on spent fuel casks using high explosives.
- If experimental data shows safeguards are warranted, develop a security system considering communication requirements, armed escort personnel, the least vulnerable transportation mode, and vehicle disabling features.

RECOMMENDATION TO THE CHAIRMAN,  
NUCLEAR REGULATORY COMMISSION

The Chairman, Nuclear Regulatory Commission, should amend its regulations to require receivers of radioactive materials to also monitor Type A packages for radiation levels to make sure they comply with Federal regulations and to report any violations to the Commission.

RECOMMENDATIONS TO THE  
CHAIRMAN OF THE NUCLEAR  
REGULATORY COMMISSION AND THE  
SECRETARY OF TRANSPORTATION

The Commission and the Secretary of Transportation should:

- Reduce permissible contamination levels for packages and vehicles to levels compatible with what industry can reasonably achieve.

- Expand their use of existing State resources to assure that shippers and carriers comply with Federal radioactive materials transportation regulations.
- Continue their efforts to develop consistent regulations for packaging low specific activity radioactive materials.

RECOMMENDATIONS TO THE  
SECRETARY OF TRANSPORTATION

The Secretary of Transportation should:

- Randomly inspect and test packages that are required to meet performance specifications. The Secretary should also inspect and test packages after repeated use. This should be done by independent contractors or the Department.
- Develop a program of coordination with State governments for regulating the transportation of radioactive materials. Particular attention should be given to assuring that State and local concerns are adequately addressed in developing Federal transportation regulations.
- Expedite the Department's efforts to develop a routing regulation for radioactive materials shipments. Because of State and local concerns in this area, the Secretary should make sure that any such Federal regulation is coordinated with State governments and their views are addressed.

RECOMMENDATION TO THE ACTING  
ADMINISTRATOR OF THE FEDERAL  
EMERGENCY MANAGEMENT AGENCY

The Acting Administrator should assume the responsibility for making policy and coordinating radiological emergency response planning for nuclear transportation accidents. The Agency should work with State and local agencies to develop and test plans for responding to accidents involving nuclear materials and should expedite the development of Federal guidelines for State and local planning for nuclear transportation

accidents. These plans should include emergency response actions to be taken by all responsible parties, including shippers and carriers, in the event of an accident.

#### AGENCY COMMENTS

The Departments of Energy and Transportation, the General Services Administration, and the Nuclear Regulatory Commission provided comments on this report.

Appendix I contains GAO's response to those substantitive comments not incorporated into the report. The full texts of the agencies' comments are in appendices II through V.

The Department of Energy generally agreed with the report but took exception to our conclusions concerning the adequacy of current and proposed protection of less than strategic quantities of special nuclear materials. However, the Department agreed to reexamine the area to determine and apply modifications, if necessary.

The Department of Transportation generally agreed with the report's conclusions and recommendations but stated that further coordination with State and local governments is limited under existing authority. GAO does not agree. (See p. 42.)

The General Services Administration did not comment on specific findings and recommendations, but stated that the Director, Federal Emergency Management Agency, will consider assuming responsibility for policy-making and coordination of radiological emergency response planning for nuclear transportation accidents.

The Nuclear Regulatory Commission in most instances agrees with the report's conclusions. However, the Commission believes that current requirements are adequate for assuring packages meet Federal safety specifications and, therefore, does not agree that independent, random physical inspections by the Commission are needed.

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ABBREVIATIONS

DOE	Department of Energy
DOD	Department of Defense
DOT	Department of Transportation
dpm	disintegrations per minute
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
GAO	General Accounting Office
GSA	General Services Administration
LSA	low specific activity
MTB	Materials Transportation Bureau
NRC	Nuclear Regulatory Commission
SNM	special nuclear materials

## CHAPTER 1

### INTRODUCTION

Over 2 million packages of radioactive materials are shipped annually by air, rail, and truck. These shipments include radiopharmaceuticals, power reactor fuels, and radioactive wastes. Transportation of these materials has been safe and secure. To date, no one has died or been seriously injured due to the radioactivity of these shipments. Despite a good record, the safety and security of nuclear shipments have become matters of public concern. Concern for safety relates primarily to the (1) adequacy of procedures and practices used to limit human exposure to radiation during transport, (2) ability of packages to contain and shield the material during both normal and accident conditions, and (3) potential harm from transportation accidents. Security concerns relate to the ability to protect special nuclear material and highly radioactive materials from theft and sabotage during transport.

All radioactive materials, if not adequately protected, present potential hazards. Exposure to radiation can result in cancer or death. Cancers such as leukemia can appear many years after exposure. Of equal concern is the genetic damage that could arise after exposure. This damage may appear in the offspring of exposed individuals or in later generations. Thus, the objective of all radiation protection programs, including those involving the transportation of radioactive materials, is to prevent or minimize exposure to radiation.

### NUCLEAR SHIPMENTS WILL GROW

The volume of radioactive materials shipments will increase substantially with the increased use of nuclear materials. The Nuclear Regulatory Commission (NRC) estimates that nuclear materials shipments will more than double by 1985 to about 5.5 million annually.

One example of the expected increase in the number of nuclear materials shipments is spent fuel. As nuclear fuel is burned in a commercial reactor, the uranium is slowly converted by nuclear fission into highly radioactive contaminants. Thus, this "spent" or used fuel must be periodically replaced with fresh fuel. Because spent fuel is so radioactive it must be shipped in huge shielded containers or casks weighing anywhere from 20 to 100 tons. In 1975 there were about 270 such shipments. NRC expects the number to grow to about 2,200 a year by 1985.

Until the last few years, industry and Government plans called for the routine reprocessing of spent fuel to recover the usable uranium and plutonium. The current administration, however, considers reprocessing unacceptable because it increases the availability of plutonium, which can be used to make nuclear weapons, and has indefinitely deferred commercial reprocessing in this country. Until a final decision is made on reprocessing, the administration has proposed that spent fuel be moved to temporary Government storage facilities. Most spent fuel is now stored at commercial nuclear powerplant sites. Whatever the decision on reprocessing, spent fuel shipments will increase in the future.

The increased use of radioactive materials for purposes other than producing energy will also result in large increases in nuclear shipments. For example, in 1975 there were about 910,000 shipments of radioactive materials for medical use and about 215,000 for industrial use. By 1985 NRC estimates these annual shipments will double to 1.7 million and 560,000 shipments, respectively.

#### FEDERAL AGENCIES' RESPONSIBILITIES

Three Federal agencies--the Department of Transportation (DOT), NRC, and the Department of Energy (DOE)--have major responsibilities for assuring that nuclear materials shipments are safe and secure.

DOT regulates the transportation of all hazardous materials, including radioactive materials. DOT regulates both shippers and carriers who are engaged in interstate commerce, and prescribes packaging, marking, labelling, loading, and storage regulations.

NRC regulates commercial users (called licensees), such as nuclear powerplants, hospitals, universities, and radioactive materials producers, through a program of standards, licensing, inspection, and enforcement. Due to overlapping authority and expertise in regulating radioactive materials, NRC and DOT have entered into an agreement to eliminate duplicate and conflicting efforts. Under the agreement, DOT regulates certain shippers, carriers, and packages containing the smaller, less hazardous quantities of radioactive materials, while NRC develops safety standards for licensees and design standards for packages containing the larger, more hazardous quantities of radioactive materials. NRC also has agreements with 25 States to which it has relinquished certain authority. Under these agreements, States regulate manufacturers and users of radioactive materials within their jurisdictions. These States are required to have programs that are compatible with NRC requirements. NRC also develops

security standards and regulates the safeguarding of weapons-grade commercial nuclear shipments.

DOE is responsible for regulating its contractors which include the national laboratories, uranium enrichment plants, and nuclear weapons production plants. DOE safety regulations and packaging design standards are generally the same as NRC's and DOT's; however, shipments for purposes of national security are exempted under certain conditions from DOT regulations.

#### HOW FEDERAL AGENCIES PROTECT THE PUBLIC

Federal agencies consider adequate packaging the first line of defense in protecting the public from radiation exposure. The type of package used depends on the type and quantity of radioactive material being shipped. For small and less hazardous quantities, the package need only prevent loss or dispersal of material under normal transportation conditions. For the more hazardous materials, the package must be able to withstand severe stresses, such as those produced by a major traffic accident, a fire, or immersion.

Despite stringent packaging standards, the Federal agencies involved recognize the possibility that accidents in which the packages fail might happen. Consequently, they look to rapid and effective emergency response as the second line of defense. Such a response requires coordination among Federal, State, and local agencies.

NRC and DOE have also established security requirements to protect against theft and sabotage. The requirements apply to shipments of "strategic" quantities of certain types of nuclear materials that can be used to make bombs.

#### SCOPE OF REVIEW

To evaluate Federal policies and programs that relate to the safe and secure transportation of radioactive materials, we examined pertinent records and interviewed Federal officials at:

- NRC headquarters, Bethesda, Maryland.
- NRC Region III, Glen Ellyn, Illinois.
- DOE headquarters, Germantown, Maryland.
- DOE, Division of Naval Reactor, Arlington, Virginia.
- DOE, Idaho Operations Office, Idaho Falls, Idaho.

- DOE, Sandia Laboratory, Albuquerque, New Mexico.
- DOE, Chicago Operations Office, Argonne, Illinois.
- DOT headquarters, Washington D.C.
- Department of Defense (DOD) headquarters, Washington, D.C.
- Federal Highway Administration (FHWA) Region III, Homewood, Illinois.
- Federal Railroad Administration (FRA) Region III, Chicago, Illinois.
- Federal Aviation Administration (FAA) Great Lakes Region, DesPlaines, Illinois.

We also interviewed health and transportation officials in seven States and one large city. In addition, we visited several commercial carriers and shippers.

We sent a questionnaire to the 50 States requesting information about their involvement in planning and preparing for radiological emergencies. The questionnaire, to which all States responded, included a set of questions on each State's preparedness for nuclear transportation emergencies.

## CHAPTER 2

### STRONGER FEDERAL POLICIES AND REGULATIONS

#### ARE NEEDED TO ASSURE THE SAFE

#### TRANSPORTATION OF RADIOACTIVE MATERIALS

While no serious transportation accidents involving radioactive materials have occurred to date, we identified several areas which need to be improved to better assure that shipments of radioactive materials do not seriously threaten public health and safety. DOE, NRC, and DOT view secure packaging as the primary safeguard for radioactive materials in transit; however, these agencies generally do not independently inspect packages to assure they are constructed properly and continue to meet Federal safety standards after repeated use. In addition, Federal regulations allow levels for radioactive contamination on packages and transport vehicles that are unnecessarily high. As a result, workers and an unsuspecting public could be exposed to unnecessary levels of contamination. We also found that NRC's and DOT's packaging regulations are inconsistent for similar radioactive materials. Finally, we found that the responsible Federal agencies need to do more to better assure compliance with their shipping regulations.

#### PACKAGE TYPES

Packages for shipping radioactive materials vary in size, shape, and weight. They range from fiberboard boxes for certain radiopharmaceuticals to 100-ton steel casks for spent fuel. Federal regulations impose various package design standards depending upon type and size of shipment. Packages are classified by three types: Type A, Type B, and "large quantity."

Type A packages are made of fiberboard, wood, or metal. Although such a package need not be indestructible, it must be strong enough to survive certain puncture, temperature, and vibration tests. Type A packages are typically used to ship slightly radioactive waste and radiopharmaceuticals.

Type B packages are made of wood or metal and are used for larger and more hazardous quantity shipments. Consequently, these packages must survive additional stresses, such as a major traffic accident or fire. A Type B package must be able to maintain its integrity after undergoing the following tests:

- A 30-foot fall onto an unyielding surface with the package landing on its most vulnerable point.
- A 40-inch fall onto a steel pin to test for puncture.
- Exposure for 30 minutes in a furnace at 1,475 degrees Fahrenheit.
- Total submersion in water for 8 hours (for fissile material only).

The most radioactive and largest quantity shipments must be made in "large quantity" packages. These packages are subject to Type B requirements, plus additional provisions to shield against higher levels of radiation and decay heat.

#### AGENCY ACTIONS TO ASSURE PACKAGE SAFETY

DOE, NRC, and DOT view secure packaging as the primary safeguard for radioactive materials in transit. These agencies primarily rely on shippers' quality assurance programs to assure that packages meet safety specifications.

#### Type A packages

DOT has established design specifications for constructing most hazardous materials packages, many of which are used as Type A packages for radioactive materials shipments. In 1975 DOT was given the authority under the Hazardous Materials Transportation Act to inspect package manufacturers to assure packages are actually constructed to specification. As part of its inspection effort, DOT inspectors, periodically on a random basis, select individual packages for testing. These packages are selected either at the plant or bought on the open market and sent to a laboratory for physical testing.

Although given the authority to inspect package manufacturers in 1975, DOT only started doing so in 1977. The program has barely gotten off the ground. DOT's Material Transportation Bureau (MTB) which is responsible for the program:

- Lacks formal written inspection procedures.
- Lacks sufficient resources to inspect manufacturers.
- Lacks a systematic approach to identifying manufacturers for inspection.

In addition to MTB, the modal operating administrations (FRA, FHWA, FAA) do some inspections of package manufacturers. However, DOT acknowledges that inspections of package

manufacturers have not been extensive. For example, in 1977 DOT inspected only 261 of the estimated 10,000 hazardous materials packaging manufacturers. <sup>1/</sup> DOT, however, did not keep records on how many of the 261 inspections covered packages that might be used to ship radioactive materials.

Type A packages must meet established "performance" specifications. In such instances, it is the shipper, not the manufacturer, who is responsible for assuring that these packages meet specifications. Each shipper must maintain, on file for at least 1 year after the latest shipment, a complete certification and supporting analysis demonstrating that the construction methods, package design, and materials used are in compliance with the specification. During shipper inspections, DOT primarily relies on the shipper's records to assure packages meet specifications and does not randomly test these packages.

DOT also requires shippers to reinspect packages after continued use and to retest certain packages before each shipment. However, it is doubtful that all shippers are complying with these requirements. A 1976 DOT study showed that faulty Type A packages were associated with most of the radioactive releases in highway incidents. Packaging problems cited were loose and defective fittings or closures, corrosion, rust, and seam failures.

Despite this, DOT does not actually test packages during shipper inspections. DOT reviews the shipper's quality assurance records but does not verify their accuracy.

#### Type B and large quantity packages

NRC must certify the design of the Type B and large quantity packages before its licensees can use them. DOE is responsible for certifying these types of packages for its contractors. The certification process begins when the user submits a "safety analysis report." The report describes (1) how the packaging design meets Federal standards and (2) the user's quality assurance program to assure they are actually built to design standards. If the report is found satisfactory, NRC or DOE approves the design by

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<sup>1/</sup>DOT had no figures available on the actual number of manufacturers producing packaging for hazardous materials. However, the agency estimates there are about 10,000 manufacturing establishments in the United States with the capability of making materials packages for the transportation of hazardous materials.

issuing a "certificate of compliance." The certificate must also be renewed if a package is modified or new Federal standards are established.

This process helps assure that packaging designs meet Federal standards. It does not assure that packages are actually built to approved designs. DOE requires its contractors to have quality assurance programs to ensure that design standards are met. DOE field offices review contractors' quality assurance records to make sure quality assurance procedures are being followed. However, DOE officials at the three DOE field offices we visited told us they do not do actual physical inspections of Type B packages to verify the accuracy of contractors' quality assurance records.

NRC relies upon its licensees to assure that package manufacturers have adequate quality assurance programs. Like DOE, NRC primarily relies upon records checks of licensee quality assurance programs to ensure that packages are built to safety design specifications. What few physical inspections NRC does are limited to spent fuel casks.

While many packages are reused, neither DOE nor NRC inspects packages after their repeated use. Both agencies rely on the package user's quality assurance program to assure packages continue to meet safety standards.

#### PERMISSIBLE CONTAMINATION LEVELS SHOULD BE REDUCED

Loose radioactive material on the surface of packages and transport vehicles, referred to as contamination, is regulated by NRC and DOT. However, these agencies allow unnecessarily high levels of radioactive contamination on the surface of packages and transport vehicles. These levels are higher than what most industries themselves allow. As a result, transportation workers may be exposed to higher levels of radiation than need be. Also, since DOT regulations require vehicles to be cleaned only to the maximum permissible levels, contamination can spread to materials subsequently shipped in these vehicles.

DOT and NRC regulations permit contamination levels up to the following limits on shipped packages and transport vehicles:

Type of contamination (note a)	Maximum permissible (dpm/100 cm <sup>2</sup> ) (note b)
Alpha	2,200
Beta-gamma	22,000

a/Excluding natural or depleted uranium and natural thorium.

b/Contamination is measured in "disintegrations per minute" (dpm) which is a measure of the rate of radioactive decay. This measurement is taken over a given surface area, frequently 100 square centimeters (about 16 square inches).

Because packages and transport vehicles are in an uncontrolled environment during transit, we compared these limits to those allowed in unrestricted areas 1/ at nuclear facilities and to levels that are permitted on packages shipped by these facilities. We found that, for both alpha and beta-gamma contamination, levels allowed on packages and transport vehicles are about 22 times higher than DOE and NRC licensed facilities generally allow in unrestricted areas. In addition, levels for packages shipped by these facilities are usually "nondetectable," except in some instances involving spent fuel casks.

Industry representatives we talked to criticized the DOT and NRC package contamination levels as being too high. These officials believe that it is unreasonable for NRC and DOT to allow such levels of contamination in uncontrolled areas, such as warehouses and loading docks, when these same levels would require protective measures at nuclear plants. In fact, packages contaminated to such levels would not be allowed in an unrestricted area at a nuclear facility. Even some NRC inspectors agree with the industry's position that levels are too high.

In a presentation given by a DOE prime contractor at a transportation symposium held in May 1978, the contractor representative stated that DOT levels were unreasonable because in most cases current survey and decontamination techniques make it possible to justify much lower levels of permissible contamination. For example, the contractor stated that most of the contractors at the Idaho National Engineering Laboratory survey and decontaminate radioactive shipments to levels of contamination that are nearly nondetectable

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1/Unrestricted areas are those where no protective clothing or other precautions are required.

which is in direct contrast with the allowable limits prescribed in the regulations. This is in accord with our own findings that at facilities we visited facility operators limit contamination to levels well below those allowed by NRC and DOT. Officials of these agencies agreed that this is generally the case.

In most instances, packages that are transported with contamination levels as high as those allowed by NRC and DOT are spent fuel casks. This is primarily due to the fact that casks are submerged into spent fuel pools for loading and become highly contaminated as a result. These casks are then decontaminated, but because some have a number of protrusions and areas which are inaccessible for cleaning, it is not always possible or practical to decontaminate to the lower levels normally used for other packages.

RECEIVERS SHOULD ALSO MONITOR TYPE A  
PACKAGES FOR RADIATION LEVELS

Current NRC regulations require receivers of radioactive materials to monitor the radiation levels of Type B and large quantity shipments with radiation monitoring equipment for compliance with Federal regulations. Even though most shipments are in Type A quantities and can exceed the limits for external radiation levels of packages containing Type B or larger quantities, regulations do not require receivers to monitor them. Although not required, some NRC facilities routinely monitor Type A packages as well. We believe all receivers of radioactive materials should be required to do so. Requiring receivers to monitor Type A packages and report radiation levels in excess of those allowed by Federal regulations to NRC would provide additional assurance that workers and the public are protected from exposure to radiation and would also provide an extra check on whether shippers were complying with DOT packaging regulations.

DOT AND NRC NEED TO BETTER ENSURE  
COMPLIANCE WITH SAFETY REGULATIONS

Although NRC and DOT have compliance inspection programs, neither is adequate to assure compliance with their transportation regulations. NRC and DOT rely mainly on the integrity of shippers and carriers to comply with regulations governing the safety of radioactive materials transportation. We believe that independent assurance of compliance is necessary to assure the public is adequately protected.

Regulations spell out requirements for shipping and receiving radioactive materials, and DOT and NRC periodically review shipping and receiving documents and practices to

determine compliance with the requirements. However, there are many shippers and receivers but few inspectors. For example, one NRC region has 10 inspectors for about 3,800 nuclear material licensees. Depending on the material handled, a licensee may be inspected anywhere from twice a year to once every 10 years. At such times, NRC inspectors examine the licensee's entire operation, from training of employees to disposal of radioactive waste. They only devote about 1 percent of their inspection time to reviewing shipping records. To cite another example, a DOT Federal Highway Administration region has only 25 inspectors for 1,500 shippers and 23,000, carriers many of which handle radioactive materials.

In order to determine actual package handling practices, and radiation exposure conditions, DOT and NRC contracted with nine States to do a compliance study on a cost-sharing basis. The study involved inspections over 3-month periods and cost the Federal Government \$3,000 per State. The inspectors discovered

- measured radiation levels on some packages that were higher than the level indicated on the label,
- instances where transportation workers were exposed to levels of radiation exceeding limits established for the general public,
- excessive radiation readings at terminals and in trucks, and
- vehicles that lacked proper placards (signs that show radioactive material is being carried in the vehicle).

The study not only confirmed the need for better surveillance, but also illustrated the practicality of using State inspectors to enforce Federal regulations.

As a follow-on to the study, agreements for 1 to 3 year expanded inspection programs were entered into with radiological health bureaus of Pennsylvania, South Carolina, Illinois, Georgia, Michigan, and Kentucky. Pennsylvania and South Carolina completed the first year of their programs in fiscal year 1978. Illinois and Georgia also completed their first year surveillance studies and the results will be published in fiscal year 1979. Negotiations are underway with Connecticut, Wisconsin, and the State of Washington. These contracts cost the Federal Government about \$15,000 per State per year.

We believe the use of State inspectors has several advantages. It should prove less expensive than massive increases in Federal inspection staffs; would help State officials keep abreast of radioactive shipments, thus improving emergency response (see ch. 4); and could improve Federal-State relations (see ch. 5). Also, State officials can stop vehicles on the road for inspection whereas Federal inspectors do not have this authority.

#### NEED FOR UNIFORM REGULATIONS ON LOW SPECIFIC ACTIVITY PACKAGING

DOT and NRC regulations on packaging of low specific activity (LSA) radioactive materials are inconsistent. Specific activity is the measure of radioactivity in each gram of nuclear material. The specific activity of some radioactive materials, e.g., natural uranium and thorium, is relatively low, and hence categorized as LSA.

NRC's regulations require that packaging for LSA material be determined based on total activity shipped, while DOT's regulations do not. As a result, licensee shippers complying with DOT regulations are sometimes cited by NRC when their LSA shipments exceed Type A or B limits.

DOT's position has been that regardless of how much LSA material would be released in an accident, it would be highly unlikely that an individual could breathe in or ingest enough to cause harm. NRC has taken the more conservative position that even when activity per gram of material is low, the total radioactivity of all the grams together must be considered in determining packaging requirements.

NRC recognizes that its requirements have created confusion. A proposed DOT rule change which would require that LSA material be shipped essentially in Type A packages is expected to be adopted by NRC. In addition, under a proposed revision to the memorandum of understanding between NRC and DOT, NRC would no longer regulate LSA packages. Such actions would eliminate the source of the confusion.

#### CONCLUSIONS AND RECOMMENDATIONS

DOT, DOE, and NRC rely on adequate packaging as the first line of defense in protecting the public from radioactive materials in transit. These agencies have developed packaging design standards which appear safe. However, NRC and DOE generally do not independently inspect packages to assure they are constructed properly and continue to meet Federal safety standards after repeated use. These agencies rely on the shippers' and manufacturers' quality assurance

programs to assure packages are properly fabricated. DOT, on the other hand, has just started inspecting package manufacturers, but its inspection program has barely gotten off the ground. However, for packages that are required to meet performance specifications, DOT relies primarily on shippers' records to assure packages meet specifications. All of the agencies rely on shipper quality assurance programs to assure packages continue to meet Federal standards after repeated use.

We believe Federal agencies need more conclusive and independent assurance that radioactive materials packages meet Federal standards. This can be achieved by independent inspectors periodically inspecting and testing packages on a random basis during fabrication and after use to verify licensee and contractor quality assurance records.

We recommend that the Secretary of Energy and the Chairman, NRC, perform periodic, independent physical inspection and testing of nuclear material packages on a random basis during fabrication and after repeated use. Such inspection and testing should either be done by independent contractors or by the agencies themselves.

We also recommend that the Secretary of Transportation randomly inspect and test packages that are required to meet performance specifications. The Secretary should also inspect and test packages after repeated use. This, again, should be done by independent contractors or the agency itself.

NRC's and DOT's permissible levels of radioactive contamination are unnecessarily high. Thus, transportation workers, as well as the general public, could be exposed to unnecessary levels of radiation.

We recommend that the Chairman, NRC, and the Secretary, DOT, reduce the permissible contamination levels for packages and vehicles to levels that are compatible with what industry can reasonably achieve. The agencies should allow the use of a higher value only when cask design or other valid considerations make further decontamination impractical or impossible.

NRC should also require receivers of radioactive materials to monitor Type A packages. This should help to assure that workers and the general public who could come into contact with radioactive materials packages are not exposed to radiation.

To assure worker and public safety and as an added check on compliance, we recommend that NRC amend its regulations to

require receivers of radioactive materials to also monitor Type A packages for radiation levels to make sure they comply with Federal regulations and to report any violations to the Commission.

A recent DOT and NRC study using State inspectors showed noncompliance with Federal nuclear materials transportation regulations. DOT and NRC should strengthen their capabilities to inspect shippers and carriers for compliance with Federal transportation regulations. The use of existing State resources may be the best option. It should prove less expensive than massive increases in Federal inspection staffs; would help State officials keep abreast of radioactive shipments, thus improving emergency response (see ch. 4); and could improve Federal-State relations (see ch. 5). Also, State officials can stop vehicles on the road for inspections whereas Federal inspectors do not have this authority.

We recommend that the Chairman, NRC, and the Secretary, DOT, expand their use of existing State resources to assure that shippers and carriers comply with Federal radioactive materials transportation regulations.

We see no reason for NRC and DOT to use different regulations for packaging low specific activity materials. We believe shippers should not be subjected to two different regulations for the same type shipments.

Therefore, we recommend that the Chairman, NRC, and the Secretary, DOT, continue their efforts to develop consistent regulations for packaging low specific activity radioactive materials.

## CHAPTER 3

### IMPROVEMENTS NEEDED IN PROTECTING RADIOACTIVE

#### MATERIAL SHIPMENTS FROM TERRORISTS

Plutonium and highly enriched uranium are routinely shipped throughout the country. In sufficient quantities, these materials can be used to make nuclear explosive devices. Further, only a few ounces of plutonium placed in a dispersal device can cause death and widespread radioactive contamination. The design and manufacture of a crude nuclear bomb is technically feasible. A plutonium dispersal device is much simpler to make. Effective security measures are necessary to ensure that these materials are not diverted for use in nuclear threats or violence.

Also, commercial nuclear power reactors are producing large quantities of radioactive spent fuel which eventually must be shipped to a storage area or fuel reprocessing facility. Although these shipments are made in massive, durable containers, they could be a target for terrorists. These shipments are not protected against sabotage attempts.

#### NEED TO SAFEGUARD NUCLEAR MATERIALS

Under conceivable circumstances a clandestine group given enough material could build a nuclear weapon. A June 1977 report by the Office of Technology Assessment states

"a small group of people (possible terrorists or criminals), none of which have ever had access to classified literature, could possibly design and build a crude nuclear explosive device."

Nuclear weapons are made from plutonium and uranium highly enriched in uranium-235 and uranium-233. These are called special nuclear materials (SNM). Plutonium and uranium-233 are produced in reactors, while uranium-235 occurs naturally (although not in sufficient concentration for use in nuclear weapons). A crude nuclear bomb might yield as much explosive power as 20,000 tons of conventional explosives. But, even smaller bombs with yields of 10 and 100 tons could cause widespread destruction. For example, a nuclear explosion with a 100-ton yield in a typical suburban area might kill as many as 2,000 people.

Plutonium poses an additional threat. When finely powdered, it can be dispersed by a relatively simple device to cause death and cancer or to contaminate property.

DOE and NRC have established safeguards for certain weapons-grade plutonium and uranium shipments to reduce the risk of diversion. Safeguards are used when shipments equal or exceed the following quantities.

<u>Material</u>	<u>Grams</u>
Plutonium	2,000
Uranium-233	2,000
Uranium-235 (contained in 20 percent or greater-enriched uranium)	5,000
Mixed shipments of the above materials	<u>a/5,000</u>

a/Any combination of strategic SNM in a quantity of 5,000 grams or more computed by the formula: grams = grams U-235 + 2.5 (grams U-233 + grams plutonium).

No security protection is currently required for quantities below the cutoffs, although there were many such shipments made through the United States in fiscal year 1977.

Both NRC and DOE are proposing changes to current regulations that would require physical security for less than strategic quantities of SNM. To maintain a policy of comparably effective safeguards, DOE and NRC have a safeguards working agreement which provides for consultation and coordination. However, NRC officials informed us they have had little interaction with DOE in formulating their proposed rule. DOE officials refused to discuss their proposed rule with us, stating that it was in draft and subject to change.

#### SECURITY FOR WEAPONS-GRADE MATERIAL

Both DOE contractors and NRC licensees ship weapons-grade plutonium and uranium. DOE uses highly sophisticated transport vehicles; an elaborate communication system; and well-trained, armed, federally employed guard forces for enroute protection. For example, the DOE transport vehicles can be quickly immobilized and have a host of anti-intrusion devices; the communication system is high frequency, computer operated, and may under certain conditions, reach every designated communication control center in the United States. DOE contractors use these resources for shipping strategic SNM and nuclear weapons. Contractors also can, and do, ship less than strategic quantities on a space available basis.

By contrast, a private trucking company provides transportation and protection for commercial strategic SNM shipped by NRC licensees. Its vehicles also have anti-intrusion and immobilization features and are accompanied by a force of well-trained, armed guards. However, company officials state that their trailers are easier to penetrate and have fewer communication systems than DOE vehicles.

In a June 1977 report, the Office of Technology Assessment concluded that the DOE system was superior to NRC's system. The report suggested that NRC upgrade security by adopting some DOE procedures. On August 9, 1978, NRC announced a proposed rule in the Federal Register that would upgrade protection of strategic SNM shipments. Also, NRC plans to participate with DOE in a study of the use of the DOE communications system in a commercial carrier's truck.

#### SMALLER SPECIAL NUCLEAR MATERIALS SHIPMENTS SHOULD BE PROTECTED

During fiscal year 1977 numerous highly enriched uranium shipments, some approaching the 5,000-gram cutoff for uranium-235, went unguarded. There were also many unprotected shipments of plutonium below the 2,000 gram cutoff. While this is permitted under existing regulations, we believe that such shipments may present an easy target for diversion by terrorists.

#### Some highly enriched uranium shipments are vulnerable to diversion

Most of the unprotected SNM shipments in fiscal year 1977 were highly enriched uranium. That is, the uranium consisted of more than 90 percent uranium-235. Many of these were just below the strategic cutoff in the 4,900 to 4,999 gram weight range and were made between the same two points. On several occasions two or more shipments were made on the same day.

Current NRC regulations do not prohibit consolidating two or more shipments of less than strategic quantities at carriers' terminals. Thus, two or more shipments which together exceed the strategic quantity level may be at one terminal at the same time--unprotected. Conceivably, by capturing just a few individual highly enriched shipments, or just one or two unguarded consolidated shipments, terrorists could obtain enough material to make a bomb.

On May 24, 1978, NRC proposed a rule to address such a situation. Under this rule, licensees who contemplate making a shipment of 1,000 grams or more of special nuclear

materials would be required to provide advance notification to NRC. With the aid of a written operating procedure, NRC would then use this information to determine and control the risk of colocation of two or more of the shipments during transport. This rule, however, has not been issued in final form.

The current safeguards criteria also do not adequately consider the effect enrichment levels have on the quantity of material needed to make a bomb. This can result in protecting shipments that are less useful for making a bomb while more useful shipments are not protected.

Protection is required only for uranium shipments that are enriched to 20 percent or more and contain at least 5,000 grams (5 kilograms) of uranium-235. <sup>1/</sup> However, the amount of uranium-235 needed to make a bomb decreases rapidly as the enrichment level of the uranium increases. Under the current criteria, 4.999 kilograms of uranium-235 contained in uranium enriched to 93 percent could be shipped unprotected. Yet terrorists would have to capture fewer of these shipments to make a weapon than the guarded 5 kilograms of uranium-235 contained in uranium enriched to 20 percent.

#### Need to protect plutonium shipments

Many small but potentially dangerous plutonium shipments were also unprotected in fiscal year 1977. While they contained quantities less than needed to make a bomb, they were large enough for use in a dispersal device.

Plutonium is highly toxic and small amounts of it can be very dangerous. A person inhaling only 9 milligrams of plutonium (the weight of about half of a postage stamp) has a 50-percent chance of dying within 60 days. <sup>2/</sup> Smaller quantities can also cause latent cancer and genetic damage.

The ease of rigging a dispersal device suggests that this type of weapon would make a more likely tool for terrorists than a fission bomb. In 1976 the Energy Research and Development Administration (one of DOE's predecessor agencies), in

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<sup>1/</sup>The minimum shipment weight of 20 percent enriched uranium requiring safeguarding is 25,000 grams, i.e., 25,000 grams of uranium X 20 percent enrichment (uranium-235) = 5,000 grams uranium-235.

<sup>2/</sup>B. L. Cohen, "Hazards from Plutonium Toxicity," Health Physics, U.C. 32, No. 5, May 1977.

coordination with NRC, compared potential plutonium dispersal to other biological and chemical agents. The study concluded that no additional protective measures were needed to protect against dispersal because other, more hazardous materials were also more easily obtainable. The study also recognized, however, that irrational persons or nuclear adversaries might still prefer nuclear materials to other, more accessible, contaminants. A more recent Government-sponsored study suggests that plutonium could be dispersed by the following methods:

- Scattering it in an area of heavy foot traffic, such as a transportation terminal.
- Placing it in the ventilation system of a major public facility.
- Using a small explosive to spread it in a heavily populated area. 1/

We believe NRC and DOE have not adequately addressed the threat of dispersal in considering the need to provide security for less than strategic quantities of SNM. NRC and DOE believe the risks associated with plutonium dispersal do not warrant special protection for shipments of less than 400 grams. As a result, their current proposals would provide no strong security protection, such as guards, for such shipments. At least 100 shipments during fiscal year 1977 were in the 10-400 gram range. While these shipments were too small to be used in an explosive weapon, they could have been used in a dispersal device.

#### NEED TO EVALUATE SECURITY REQUIREMENTS FOR SPENT FUEL SHIPMENTS

The largest single source of radioactivity shipped is spent fuel from light-water reactors. Because of its high radioactivity, spent fuel requires considerable shielding for safe handling. Although the massive shipping "casks" must meet stringent Government safety rules to prevent radioactive release during transportation accidents, most shipments move without any security measures over public thoroughfares. A recent Government-sponsored study concludes that spent fuel casks can be penetrated using high explosives in

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1/"Transport of Radionuclides in Urban Environs: Working Draft Assessment," Sandia Laboratories, SAND 77-1927, May 1978.

quantities obtainable by terrorists, and it projects that some devastating effects could result. 1/

### Dangers of spent fuel

Spent fuel is highly radioactive. A spent fuel assembly may contain up to 1,100 pounds of highly radioactive material. The radiation can be so intense that standing near it for just a few minutes could cause death. Spent fuel remains radioactive for hundreds of years.

### Spent fuel shipping casks

Because irradiated fuel elements are highly radioactive, their shipping containers are very heavily shielded. A typical cask weighs between 20 and 100 tons. It is constructed of thick steel walls lined with a dense shielding material such as lead, tungsten, or depleted uranium. The cask is generally cylindrical, about 5 feet in diameter, and 15 to 18 feet long. The cask not only provides radiation protection, but also dissipates the heat produced by radioactive decay and provides considerable protection against sabotage.

Recently, DOE subjected empty casks to the following tests simulating severe highway and rail accident conditions:

- A truck-mounted cask was crashed into a concrete embankment at 60 mph, and again at 84 mph.
- A locomotive was crashed into a truck-mounted cask at 81.5 mph.
- A rail-mounted cask was crashed into a concrete embankment at 81.4 mph.

The casks survived each of these crashes with only minor damage. These accidents would have presented little or no risk to the public, even if there had been spent fuel in the casks.

### Regulations exempting spent fuel from security requirements

DOT has regulatory responsibility for the safe transportation of radioactive materials, including spent fuel, by all modes of transport. Both DOE and NRC act as technical advisors to assist and advise DOT in establishing safety standards and reviewing package designs. These regulations

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1/Ibid.

are safety oriented, and neither NRC nor DOE requires security measures for spent fuel shipments during transport because they believe the successful sabotage of a spent fuel cask is unlikely.

The safety aspects of the casks enable them to withstand many sabotage methods. For example, casks are quite invulnerable to small arms fire or small explosive charges. Mechanical entry would require heavy duty handling equipment and special tools, in some instances. Government publications and discussions with Government officials revealed that these considerations, coupled with the intense radioactivity of spent fuel, make it an unattractive and impractical target for these types of sabotage attempts.

We believe, however, that there is ample opportunity for a terrorist to hijack a spent fuel shipment. During fiscal year 1977, the Nation's only operating commercial spent fuel storage facility received nearly 100 truck shipments of spent fuel from power reactors around the country. NRC did not require, and the carrier did not take, security precautions beyond requiring drivers to call in every 6 hours.

Spent fuel is also transported by rail. These shipments also have no special security requirements. Although now relatively limited in number, the industry projects 652 rail shipments annually by the mid-1980s. One exception to the general lack of security measures for rail shipments of spent fuel involves DOE's Division of Naval Reactors. These are accompanied by armed escorts and are monitored using DOE's communication system for nuclear weapons shipments.

#### Vulnerability of spent fuel shipments

In May 1976 work was initiated for NRC by Sandia Laboratories to assess the environmental impacts of transporting radioactive materials through urban areas. The results were published in a May 1978 report "Transport of Radionuclides in Urban Environs: Working Draft Assessment." The section dealing with spent fuel states:

"Access to shipments of spent fuel would be possible for an adversary intent upon sabotage or theft. Truck shipments move on the normal road system and could easily be reached at rest and/or refueling stops by following the truck. Traffic tie-ups could be caused which might stop the shipment and permit access \* \* \* If the shipment travels on urban thoroughfares, normal traffic control could cause stops and give an adversary an opportunity to approach the truck \* \* \* Rail

shipments could be reached enroute if the adversary had knowledge of the route and used vehicles or sabotage to block rail crossings. Railcars could be reached in the yards during train make-up \* \* \*."

The report concluded that truck shipments were readily accessible and rail shipments were also accessible, though with greater difficulty. The report also concluded that spent fuel casks can be penetrated by using quantities of explosives obtainable by terrorists. It did not, however, predict probabilities for such an occurrence but did say the possibility was unlikely.

For discussion purposes, the report assumed that a successful sabotage occurred in the heart of New York City at rush hour. The report projected that the radiological effects of such a sabotage would include tens of early fatalities, hundreds to approximately a thousand early morbidities, hundreds of latent cancer fatalities, and more than \$2 billion in cleanup costs. 1/ This estimate does not include the many early fatalities that would likely occur from the blast and debris from the explosive charge itself.

These predictions are based on a postulated release of 1 percent of the spent fuel from a truck-mounted cask. According to the report, this is at least a factor of two greater than expected. However, the report emphasizes that this spent fuel release estimate has not been verified experimentally and that postulated effects are based on engineering judgment and the extrapolation of available data. A Sandia official said that the figures are very gross and he believes they are upper limits that would probably not occur. However, there is no experimental data available on how much spent fuel would actually be released in a successful sabotage attempt.

In May 1978 NRC began to formulate requirements for testing spent fuel cask vulnerability to high explosives to determine if safeguards are necessary. This work is now complete and NRC is ready to begin contractor negotiations.

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1/Early fatalities are those occurring within 1 year after exposure. Early morbidities are illnesses appearing within weeks after exposure. Latent cancer fatalities are those occurring anytime after exposure.

## CONCLUSIONS AND RECOMMENDATIONS

Changes are needed to provide a consistent and adequate level of protection for shipments of nuclear materials.

DOE and NRC require that special security measures be followed for shipments of weapons-grade plutonium and highly enriched uranium when the amount being transported reaches a specified quantity called the strategic quantity. Protection should be extended to shipments of less than strategic quantities of SNM and measures should be taken to prevent consolidation in one unprotected terminal of SNM shipments that together exceed the strategic level.

Although NRC and DOE are currently studying the need to protect smaller quantities of special nuclear materials, their efforts are independent and they are proposing different security levels. Further, their proposals do not adequately consider the dispersal hazard associated with plutonium and the effect of higher enrichment levels on the amount of material needed to make a bomb.

We recommend that the Chairman, NRC, and Secretary of Energy:

- Jointly develop, on a priority basis, a graduated scale of security measures for transportation of special nuclear material, rather than the present all-or-nothing strategic cutoff level. In establishing these levels, the dispersal hazard of plutonium should be considered. In addition, the criteria should take into account the enrichment level of uranium since smaller amounts of highly enriched uranium are needed to make a weapon.
  
- Take immediate action to preclude enroute consolidation of two or more special nuclear material shipments that together exceed the strategic level.

Federal regulations governing the transport of spent fuel, a highly radioactive material, are primarily safety oriented. Spent-fuel shipping containers have been subjected to several severe accident tests that resulted only in minor damage; the release of radioactive material in accidents involving spent-fuel transportation appears unlikely. We should have the same assurance for sabotage attempts.

Spent fuel could be used to cause large numbers of casualties if widely dispersed in a successful sabotage attempt. Mechanical entry into a cask is probably not a

feasible means of accomplishing dispersal, but explosive entry is more likely. Commercial shipments are not safeguarded, and are accessible to such attack. Presently, the number of spent fuel shipments is relatively small, but they are projected to increase significantly by the mid-1980s.

The effects of an explosive attack on a spent-fuel cask cannot be accurately predicted because no tests have been done to determine the amount of spent fuel that would actually be released if high explosives were used. Tests of spent fuel cask vulnerability to high explosives are needed to determine what, if any, safeguards are required.

Any future spent fuel security system should consider communication requirements, vehicle disabling features, and armed escort personnel. The system should use the safest and least vulnerable transportation mode.

We recommend that the Chairman, NRC, and Secretary, DOE:

- Determine if there is a need to safeguard spent fuel shipments from sabotage by developing experimental data on the amount of radioactive material that could be released in a sabotage attack on spent fuel casks using high explosives.
  
- If experimental data shows safeguards are warranted, develop a security system considering communication requirements, armed escort personnel, the least vulnerable transportation mode, and vehicle disabling features.

## CHAPTER 4

### BETTER RESPONSE NEEDED FOR TRANSPORTATION ACCIDENTS

Major transportation accidents involving radioactive material require a fast, effective, and coordinated emergency response to protect the public from radiation exposure. Emergency planning and preparedness should provide adequate assurance that the public will be protected from the effects of such accidents. 1/

State and local agencies have the initial responsibility for responding to nuclear transportation accidents. Yet, many of these agencies are not prepared to effectively cope with major accidents involving radioactive material. In fact, States are generally unaware of the number and types of nuclear shipments moving through their jurisdiction. This lack of planning and preparedness for nuclear transportation accidents could jeopardize public health and safety.

#### IMPROVEMENTS NEEDED IN STATE AND LOCAL PREPAREDNESS

State and local authorities are responsible for implementing emergency measures because they (1) are usually the first on the scene at a transportation accident and (2) have the authority to take required protective measures, such as evacuation.

To obtain a comprehensive picture of emergency planning at the State level we sent a questionnaire to each State. All States responded. Thirty-six said they had plans for dealing with transportation accidents involving nuclear materials, but only eight had fully tested their plans through full-scale drills involving emergency personnel. Many States, however, have responded to actual transportation accidents involving radioactive materials. Although this has given them some opportunity to test their plans, most of the accidents were minor and did not require full-scale implementation of the plans.

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1/We also recently completed a study of emergency planning and preparedness around nuclear facilities entitled, "Areas Around Nuclear Facilities Should Be Better Prepared For Radiological Emergencies," EMD-78-110, Mar. 30, 1979.

The need for adequate planning was demonstrated by the events following an accident involving an overturned truck which had spilled more than 10,000 pounds of uranium concentrate (the raw material used to make nuclear fuel). Although the potential radiation exposure from the material was relatively minor, the concentrate can cause kidney damage if enough is ingested. Not all of the parties involved--State and local officials, the shipper, and the carrier--had an emergency response plan. State officials and the shipper's representatives were not sure who was responsible for the cleanup and related costs. Further delays were encountered because inadequate equipment and untrained personnel were initially dispatched to the scene by the shipper. Actual cleanup began 3 days after the accident. The State still has no emergency response plan, but officials said they were developing one.

Once developed, plans need to be tested to make sure they can be implemented effectively and in a timely manner. The need for testing was highlighted by the problems experienced by another State during its response to an accident involving the derailment of a train carrying four 4,000-gallon steel cylinders of radioactive uranium hexafluoride. In the same train, a carload of ammonium nitrate, a potentially explosive chemical, caught fire. At least 17 Federal, State, local, and private agencies responded to the accident. However, no one assumed control until a State radiological team arrived. Even then, a lack of coordination and serious communication problems existed. According to the head of the State's radiological response team, the lack of coordination was due to the fact that some of the agencies had not worked together before the accident. He said that this indicated the need for preplanned coordination and testing of emergency plans. Since the accident, there has been no testing due to a lack of funds, but the State has evaluated deficiencies identified during the accident and has initiated corrective actions.

#### FEDERAL ROLE

Federal agencies generally recognize their role in nuclear transportation accidents as a backup to State and local efforts. Federal response is often slow. DOE provides the main Federal assistance to States in responding to nuclear transportation accidents. DOE administers a nationwide emergency assistance program from eight widely dispersed regional offices. Each office has trained and equipped response teams available to assist State and local governments. DOE can also draw upon resources from other Federal agencies, such as the Department of Defense and the Environmental Protection Agency. Despite substantial Federal resources available, in most cases

DOE emergency response teams take several hours to arrive at the scene of a radiological accident.

In addition to actual assistance in responding to accidents, the Federal Government has a role in providing guidance to State and local governments in preparing for nuclear accidents. NRC and DOT have the major responsibility in this area. NRC offers three courses to State and local emergency response officials in radiation assessment, and DOT is developing a training course and a guidebook on how to respond to nuclear transportation accidents. In our opinion, this training must be reinforced by periodic emergency drills to maintain the skills needed to cope with an emergency.

Although the Federal Government does not have the authority to require States to develop emergency plans, NRC and DOT are responsible for providing guidelines to States and local agencies to assist them in preparing their plans. In April 1975 a guidance document entitled "Guide and Example Plan for Development of State Emergency Response Plans and Systems for Transportation-Related Radiation Incidents" was published by the Western Interstate Nuclear Board and the Conference of Radiation Control Program Directors Region VIII Regional Training Committee. This was to be an interim guidance document and was done under contract to NRC. It is being used as the basis for a revised guidance document for States being prepared by DOT.

#### Federal reorganization of emergency services

The Federal Emergency Management Agency (FEMA), established by the President's Reorganization Plan Number Three came into being on April 1, 1979. The new Agency will bring together Federal agencies that currently have the major responsibilities for both peacetime and wartime emergency planning. 1/ This new Agency is to serve as a single point of contact for State and local governments concerning all Federal emergency preparedness, mitigating, and response activities.

At the present time, NRC and DOT remain responsible for assisting State and local governments to develop plans for responding to nuclear transportation accidents. Under authority delegated to it by the President, the General Services Administration (GSA) assigned NRC and DOT their responsibilities in a Federal Register Notice dated December 24,

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1/The Federal Preparedness Agency (FPA), the Defense Civil Preparedness Agency (DCPA), and the Federal Disaster Assistance Administration (FDAA).

1975. According to GSA, FEMA may rescind this Federal Register Notice and assume the responsibility for leadership and coordination of emergency response planning for nuclear accidents.

#### NOT ALL SHIPPERS AND CARRIERS HAVE EMERGENCY PLANS

There are no Federal regulations requiring shippers of nuclear materials to have emergency response plans. However, three of the six shippers we visited had developed plans. Two who had not developed plans were DOE contractors who said DOE would send Federal emergency response teams in the event of a serious accident. The other four said they were willing to respond to a transportation accident if it occurred within a reasonable distance from their facility. Two said they would arrange for private local response to accidents in other States. We feel none of these response actions adequately assures that the public will be protected from a transportation accident.

DOT regulations require carriers to instruct their drivers on the proper measures to take in case of an accident. The four carriers we visited provided instructions on what to do if an accident involving radioactive materials occurred. Only two, however, have developed written instructions and procedures. One carrier gives its drivers a 1-week course on how to handle emergencies. The drivers are instructed on how to obtain a radiation reading, rope off the area, and obtain assistance.

#### CONCLUSIONS AND RECOMMENDATIONS

Emergency preparedness for responding to transportation accidents needs improvement. Emergency response plans should indicate the responsibilities of

- Federal, State, and local governments;
- shippers; and
- carriers.

Required actions should also be indicated in the plan. For example, the carrier may be required to rope off the accident area and get help; the shipper, to give details of the material involved; the State and local governments, to respond quickly with appropriate personnel and equipment; and the Federal Government, to serve as a backup with technical assistance and resources as needed.

The plans should periodically test emergency resources to reinforce training and to maintain the skills needed to respond to a serious accident. We believe FEMA, as the focal point for all Federal emergency preparedness activities, could more effectively encourage State and local governments to develop and maintain emergency response plans for nuclear transportation accidents.

We recommend that the Acting Administrator, FEMA, assume the responsibility for making policy and coordinating radiological emergency response planning for nuclear transportation accidents. The Agency should work with State and local agencies to develop and test plans for responding to accidents involving the transportation of nuclear materials and expedite the development of Federal guidelines for State and local planning for nuclear transportation accidents. These plans should include emergency response actions to be taken by all responsible parties, including shippers and carriers, in the event of an accident.

## CHAPTER 5

### STATE REGULATION OF THE TRANSPORTATION

#### OF RADIOACTIVE MATERIAL

Growing concern among the States, municipalities, and the general public about the safety of transporting radioactive material has induced many States and municipalities to pass laws and regulations to control the movement of radioactive materials through their jurisdictions. Many of these laws and regulations are more stringent and restrictive than those of the Federal Government.

Over 20 percent of the States have passed such legislation or regulations. In 1977 alone, 24 bills to regulate the transportation of nuclear materials were introduced in 19 States. Nine of these bills eventually became law. These regulations, coupled with regulations at the Federal level, impose a maze of restrictions on shippers and carriers of radioactive material. Should this trend among the States continue, the movement of radioactive material between different State and local jurisdictions could be seriously impeded, and in some cases may be virtually stopped.

#### STATE AUTHORITY--A COMPLEX QUESTION

The constitutional question of State authority over the transportation of radioactive material while in interstate commerce is exceedingly complex and difficult to answer. States may, as a general rule, regulate interstate shipments which pass through their jurisdictions in the absence of superseding Federal policy or regulation. Yet, there are some circumstances in which the Commerce clause of the Constitution may preclude State regulation even though the Federal Government has not exercised its authority. For example, State regulations may not unduly burden interstate commerce.

The fact that the Congress has regulated an area of transportation does not necessarily preclude States from regulating matters within the same area, as long as the Congress has not specifically excluded them by law and there is no conflict between State regulations and Federal law or overall Federal policy. When a State law and a Federal law or regulation directly conflict, the Constitution's Supremacy Clause provides that the State law must always yield. But, the issues are not so clear-cut with regard to State regulations that

--correspond to or duplicate Federal requirements,

- fill gaps in the Federal regulatory scheme, or
- enforce Federal standards as a minimum but add more stringent requirements.

Such regulations are not immune from Federal preemption; but whether or not they are preempted depends upon the particular Federal statutes and subject matter involved. In short, the question of when the Federal Government can preempt State laws and regulations is often difficult to answer and ultimately must be decided by the courts.

STATE REGULATIONS--WHAT AND WHY?

Although there are many Federal regulations governing the transportation of radioactive material, State regulation in this area is on the upswing. Actions taken to date by States and municipalities range from the total adoption of DOT regulations into State law to an absolute ban on moving certain types of radioactive material through State and local jurisdictions. Some of the regulations only require notification before a shipment is made. However, the time specified for advance notice varies from State to State. Others are more restrictive. One State even passed a regulation so restrictive that it would have resulted in a ban of shipments to or from a nuclear powerplant in the State, forcing the plant to shut down. However, the State later revised the regulation to make it less stringent and thus allow the powerplant to operate. Table I shows examples of legislation/regulations that have been passed by State and local governments as of mid-1978.

Table 1

Examples of State/Local Laws Regulating Transportation of Radioactive Materials

<u>State</u>	<u>Regulation</u>
Arkansas	Requires notifying public authorities before transport and immediately after escape of hazardous materials (includes radioactive material).
Connecticut	Requires a permit for transporting certain radioactive material; permit must be applied for at least 3 days in advance. Shipments limited to hours of 9:00 a.m. to 4:00 p.m., void on Saturdays, Sundays, and holidays.

<u>State</u>	<u>Regulation</u>
New London, Connecticut	Requires a permit which essentially bans the transport of certain radioactive materials through the city; the fee of which is \$500.
Chicago, Illinois	Moratorium is in effect which prevents transportation of certain radioactive materials through O'Hare Airport.
Nebraska	Requires transporters of hazardous materials to carry liability insurance, and specifies the amount of coverage.
New Jersey	Prohibits transport of certain radioactive material into or through the State without first obtaining a certificate of handling from the State.
New York	State thruway authority requires a permit for transporting radioactive material on State thruways. An insurance policy averaging \$2 million must also be taken out. At least 1 month is usually necessary for processing the permit.
New York City, New York	Requires a Certificate of Emergency which essentially bans the transport of certain radioactive materials through the city.
North Carolina	Requires notification of State highway patrol before transporting spent nuclear fuel into or through the State.
Rhode Island	Requires a permit for transporting certain radioactive materials through the State. Must be applied for between 2 weeks to 2 days prior to travel. Travel hours prohibited are: 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. Monday through Friday.
Vermont	Requires notifying State authorities prior to transporting certain radioactive materials. Details about shipment must be provided 2 days prior to transport.

We contacted 10 State and local governments that have passed or proposed legislation and/or regulations governing nuclear materials transportation. All States contacted were aware of the Federal Government's preemptive authority but still plan to enforce their regulations. One State even

submitted its proposed regulation to DOT and was informed by the agency that the restrictions were illegal and conflict with Federal laws and regulations. Yet, though the State passed the regulation, the Department has taken no action against this State.

State officials gave a variety of reasons for needing their own regulations. Among these were the belief that while the Federal transportation regulations were adequate to assure the safe transport of nuclear materials, they were not being adequately enforced by DOT. Several States viewed the lack of Federal enforcement as a serious problem requiring State action. Also, some States were concerned about not knowing what nuclear shipments were moving through their jurisdictions. These States felt that State regulations, such as permit requirements, would provide the information needed to be prepared for transportation emergencies.

Other States and localities attributed their regulations to political concerns, emotional reasons, and anti-nuclear sentiment. For example, one State official told us that although he was not sure there was any justification for restrictive regulations, such regulations reflected a sincere concern on the part of his State about the safety of nuclear shipments. He said he felt the regulation of radioactive materials transportation by State and local governments was "a trend that is going to continue until the State and local governments either shut down nuclear powerplants or the Federal Government preempts them."

#### EFFECT OF STATE AND LOCAL ACTIONS

Even though over 20 percent of the States have already imposed transportation regulations, for the most part, these actions have only resulted in inconvenience and concern on the part of shippers and carriers. Should this trend continue unchecked by the Federal Government, the safe, efficient, and timely movement of nuclear materials through the United States may be impeded. The adoption of a multitude of State regulations, coupled with those at the Federal level, could impose so many restrictions on shippers and carriers that planning nuclear shipments could be extremely complicated and difficult to do in an orderly manner. In addition, regulations imposed for political and emotional reasons may not result in the safest and most expeditious means of transporting radioactive material.

One of the most restrictive and controversial regulations to date has been passed by New York City. This regulation, referred to as section 175.111 of the New York City Health Code, was passed on January 15, 1976. It specifies

that large quantities of plutonium, enriched uranium, and other actinides (a specific family of radioactive material) and spent fuel elements cannot be transported through the City without a certificate of emergency transport from the City Commissioner of Health. Military or national security shipments are exempt. Essentially, the code bans shipments of radioactive material because of the potential hazard associated with transporting such material through such a dense and highly populated area.

Since 1947 Brookhaven National Laboratory located at Upton, Long Island, has operated two research reactors and transported spent fuel by truck through New York City to DOE's reprocessing facility at Savannah River, South Carolina. A hazardous materials highway carrier must cross one of the City bridges to reach the mainland from Long Island. Before the ban, the City allowed radioactive material carriers to cross the lower level of the 59th Street Bridge. Police escorts were usually required while the carrier moved through the City on one of several alternate truck routes. As a result of the City's ban, Brookhaven can no longer take the most direct route to Savannah River. Shortly after the New York City ban, Brookhaven started shipping its radioactive materials by passenger ferry from Long Island to New London, Connecticut, to bypass New York City. Subsequently, the State of Connecticut and the City of New London established permit requirements for nuclear shipments. At the present time, Brookhaven has been denied permits to ship spent fuel through both New York City and New London.

On the same the day the City code became effective, the Department of Justice, prompted by DOE, asked the Federal District Court for declaratory and injunctive relief. The Government argued that section 175.111 was preempted under the Supremacy and Commerce Clauses of the Constitution and by the Atomic Energy Act of 1954. The court denied a preliminary injunction on two grounds:

--No irreparable harm was demonstrated.

--No state of emergency existed.

In addition, because DOT, which is responsible for all aspects of transportation, had not yet made an administrative ruling on the legality of the City's code, the case was adjourned. The case has not yet been argued on its merit.

On March 1, 1977, Associated Universities, Inc., the prime contractor operating Brookhaven, filed an application with DOT for an administrative determination as to whether New York City's ban on nuclear shipments was inconsistent

with the Hazardous Materials Transportation Act. On April 4, 1978, more than a year later, DOT ruled that section 175.111 was not inconsistent with requirements of the act or with requirements in regulations issued to date.

The DOT ruling was based on its interpretation that section 175.111 constituted a routing restriction. It was DOT's view that although the Hazardous Materials Transportation Act authorizes DOT to issue routing regulations, the Department had not yet imposed such regulations. Thus, DOT ruled that the New York City restriction could not be deemed inconsistent with a Federal regulation which did not exist. Concurrently, DOT announced its intent to begin rulemaking to develop routing regulations for nuclear materials shipments.

Although DOT has held public hearings on the need for a routing regulation, DOT officials have informed us that it could take almost 2 years before a regulation is issued in final form and another 5 to 6 months before it becomes effective. Added to the year it took DOT to issue its inconsistency ruling, almost 4 years will have passed since the New York City ban.

Even when a regulation goes into effect, however, State laws are not automatically preempted. Should a State decide to continue to enforce its own regulations, the Federal Government's preemptive authority would have to be decided by the courts. DOE and DOT lawyers informed us that a court battle could last several years.

In the meantime, many States believe the DOT ruling supports their authority to regulate the transportation of radioactive material. One State official informed us that as a result of the DOT ruling he thinks "it will become very fashionable for States to pass regulations." Another State official said that he thought "quite a number of States are going to jump on the band wagon." Even those States in favor of the Government's preemptive authority believe that routing would now be determined based on political considerations rather than safety. "It will not be the best route, but the second best, and then the third best, if chosen based on political considerations," commented one State official.

#### COORDINATION NEEDED BETWEEN DOT AND STATE/LOCAL GOVERNMENTS

Protection of public health and safety is a matter of mutual concern to the States and the Federal Government. Unfortunately, in the field of transportation of radioactive material, DOT has been reluctant to recognize the legitimate

interests of the States and municipalities in a significant transportation safety policymaking role. As a result, State and local governments have felt compelled to act independently in an area that affects the Nation as a whole.

In our review, we found that not only was DOT unaware of all the regulations and legislation the State and local governments were passing, but also was not always responsive to States' concerns about radioactive materials transportation. For example, one State invited NRC, DOT, industry groups, and public interest groups to a public meeting to discuss the transportation problem. DOT officials did not attend because of prior commitments. In another example, although DOT was aware that New London's ordinance was forthcoming, DOT made no attempt to meet and discuss New London's concerns. It was not until after the ordinance was passed and only at the request of the mayor, that DOT officials met with New London officials.

In addition, we were also unable to find any attempt by DOT to solicit input from the States when proposing regulations governing radioactive materials transportation. DOT only publishes proposed regulations in the Federal Register and has no plans for changing their method of notifying the States. However, because States are taking an active role in regulating radioactive materials transportation, we believe that DOT should coordinate proposed Federal regulations with the States. By doing so, and by addressing States' concerns, we believe this would result in more uniform regulations nationwide.

In contrast to DOT's apparent lack of concern for State interests, NRC coordinates proposed regulations with States where it has relinquished its exclusive authority to control certain types of radioactive materials. There are currently 25 such "agreement" States. NRC, in an attempt to have compatible regulations with its agreement States, solicits their comments on draft regulations before publishing them in the Federal Register. We found this coordinated effort is well received by all the agreement States we contacted and appears to have enhanced cooperation among NRC and its agreement States.

In addition, NRC has a contract with the University of Denver to develop a methodology to identify and evaluate public policy issues associated with the transport of radioactive materials in the Rocky Mountain region. Through the results of this effort, NRC intends to work more closely with States in other regions of the country in order to develop regulations that will satisfy State needs and interests while not impeding the transportation of radioactive materials.

## CONCLUSIONS AND RECOMMENDATIONS

The role of the State and local governments in regulating nuclear materials transportation is growing. Whether such State and local ordinances will be preempted by the Federal Government is yet unanswered. State reactions to the DOT-New York City ruling indicate that the States may become even more active in regulating nuclear materials transportation than they have been in the past.

The proliferation of State and local regulations could turn a routine shipment into a major task. Lack of uniformity among regulatory entities could not only create economic hardships for shippers but also result in situations in which carriers are forced to take longer, more hazardous routes. Without additional Federal action, transportation problems could very well limit commercial nuclear power or, at a minimum, increase its costs--a cost that will in all likelihood be passed on to the consumer.

Inaction on the part of DOT has only served to magnify the problem. While the Hazardous Materials Transportation Act has been in effect since January 1975, DOT has been slow in issuing regulations governing the routing of radioactive material and does not expect to do so for at least another 2 years. DOT has also been reluctant to coordinate its regulatory activities for nuclear materials shipments with State and local governments. We believe DOT should take an aggressive and forthright approach in addressing State concerns when formulating regulations governing the transportation of radioactive materials.

We believe DOT could profit from the Nuclear Regulatory Commission's experience in coordinating regulations with its agreement States. Such an approach would enable DOT to identify potential problem areas and would promote uniformity among State and Federal regulations.

We recommend that the Secretary of Transportation:

- Develop a program of coordination with State governments for regulating the transportation of radioactive materials. Particular attention should be given to assuring State and local concerns are adequately addressed in developing Federal transportation regulations.
- Expedite the Department's efforts to develop a routing regulation for radioactive materials shipments. Because of State and local concerns in this area, the Secretary should make sure that any such Federal

regulation is coordinated with State governments and their views are addressed.

AGENCY COMMENTS AND OUR EVALUATION

DOE, DOT, NRC, and GSA provided us written comments on this report. Where appropriate, their comments have been incorporated into our report. This appendix contains our responses to those substantive comments not incorporated into our report. The full text of the agencies' comments are in appendices II through V.

NUCLEAR REGULATORY COMMISSIONAgency comment

"GAO Conclusion. Safe shipping containers are the first line of defense for protecting the public from radioactive materials shipments. The Commission and the Department (of Transportation) rely on the container users and manufacturers to do quality assurance inspections to assure these containers meet Federal safety specifications. GAO believes the agencies should, on a random basis, periodically perform physical inspections of new containers and reinspections of used containers.

"NRC Response. The NRC holds the licensee responsible for conducting all activities, including transport activities, in a manner which will not cause undue risk to the public's health and safety. The NRC staff establishes safety standards and requirements which licensees must meet for transport activities to assure these activities are not causing undue risk to the public. The design of each Type B package and the quality assurance program must be reviewed and approved by NRC before the package may be used by a licensee. The staff inspects the licensee to assure that the licensee is meeting his responsibility. The inspection activity is varied, depending on the complexity of the licensees' activities and on the risk associated with that activity. Because spent fuel casks are complicated packagings, the NRC staff does inspect the activities of the cask manufacturer. The staff does not perform engineering tests on the packaging, but may observe engineering tests by the manufacturer during cask fabrication. Packagings for other shipments of radioactive material are not as complicated. These packagings may consist of steel drums with several inserts, a wooden box with inner container, or a cardboard box and inner wrappings. Most of these containers are not complicated in

design and, as a result, can be inspected for design conformance after the fabrication is completed.

"Because of this reduced complexity, the NRC staff inspects licensees as they are using these packagings and can verify that the packagings do not have significant deficiencies. Of course, the licensed users of these less complicated packages are held responsible for the correct fabrication just as for the fabrication of casks. Based on the above considerations, the NRC staff does not agree with the GAO conclusion."

### Our evaluation

Holding the licensee responsible for assuring that the fabricator has an adequate quality assurance program does not in itself assure that packages are fabricated correctly. Only by going beyond the written quality assurance records and performing physical inspections can one be sure such programs are being followed.

### Agency comment

"GAO Conclusion. Neither the Transportation Department nor the Commission have the resources to adequately inspect shippers and carriers for compliance with Federal transportation regulations in the annual shipment of millions of radioactive materials packages. GAO believes the Department of Transportation and the Commission should further develop their use of existing State resources to strengthen the enforcement of Federal regulations.

"NRC Response. GAO apparently included NRC in the first part of this conclusion because NRC sponsored the state transportation surveillance study with DOT. The findings of the study were that the non-compliance items were associated with DOT requirements. Consequently, we do not agree with the conclusion that, based on the study, NRC should strengthen its inspection capability. We agree with the second part in that present efforts of the NRC and the DOT to cooperate with the States in the surveillance program to evaluate compliance with the Federal regulations for safe transportation of radioactive materials should be expanded to include more states as monetary constraints and state interests allow."

Our evaluation

We agree that the majority of the noncompliance items were associated with DOT requirements. However, since NRC requires its licensees to comply with DOT regulations, we believe our conclusions and recommendations also apply to NRC.

Agency comment

"GAO Conclusion. GAO believes that the Commission should require receivers of radioactive materials to monitor Type A packages and to report to the Commission radiation levels in excess of those allowed by Federal regulations.

"NRC Response. We agree that the question of monitoring Type A packages on receipt could be reconsidered for protection of the persons receiving the package. The existing monitoring rule in 10 CFR 20.205 was developed for protecting workers and the general public in the transportation system, and could be expanded to provide protection for the recipient if it is determined that such protection is not already afforded by 10 CFR 20.201, "SURVEYS." However, the additional radiation exposure to the recipient in monitoring all packages on receipt merely for the purpose of assuring regulatory compliance probably cannot be justified."

Our evaluation

We believe that by assuring regulatory compliance, protection will not only be extended to the recipient, but also workers and the general public. However, we recognize that certain types of Type A packages could be exempted from monitoring requirements and have written our recommendation to allow such flexibility.

Agency comment

"Page [17, 1st and 2nd] paragraphs. The conclusion arrived at by GAO in their comparison of the DOE and NRC transportation security systems is invalid since they relied on the results of the Office of Technology Assessments report dated June 1977 which were outdated."

Our evaluation

Our report discusses the Office of Technology Assessment's conclusion that NRC should upgrade security by adopting some DOE procedures. Our report also recognizes subsequent NRC actions to upgrade security.

DEPARTMENT OF TRANSPORTATIONAgency comment

"DOT finds the recommendation for coordination with State and local governments along the line of the Nuclear Regulatory Commission (NRC) Agreement State Program to be appealing, but what can be achieved is limited under existing statutory authorities."

Our evaluation

We are not recommending that DOT adopt an entire program like NRC's Agreement State Program. We recommend only that DOT develop a method of coordinating with State and local agencies along the lines NRC does as part of their overall program. NRC's method of coordinating with States is not complex and would not require additional statutory authority for DOT. NRC solicits comments, informally, from established contacts on draft regulations at an early stage. Such a program appears to have enhanced cooperation between NRC and its agreement States--a cooperation that is lacking between DOT and State and local governments.

Agency comment

"Page [8], para. [4]: "... agencies allow unnecessarily high levels of radioactive contamination on the surfaces of packages and transport vehicles.

"Although the Federal regulations are currently the same as internationally prescribed limits, DOT agrees that contamination levels need to be reevaluated. Such a study is likely to result in regulatory revisions in accord with the concept of "as low as reasonably achievable" with certain upper limits.

"The report's determination that the levels are 'unnecessarily high' is based on a comparison between continuously occupied areas in nuclear facilities and packages with which persons come in contact for short periods of time. Transportation reduces chronic exposure to individuals many times over in

comparison to occupational areas, and it should not be implied that the same restrictions are warranted."

#### Our evaluation

The report's determination that the levels are unnecessarily high is based not only on a comparison with unrestricted areas in nuclear facilities but also with the package limits commonly used by the nuclear industry. Considerations of as low as reasonably achievable also entered into the determination.

#### Agency comment

"Page [10], para. [2]: The suggestion that receivers check all packages would carry a high price tag for the private sector. The economic impact on hospitals, department stores receiving smoke detectors, etc., could not be justified on the basis of the minimal increases in safety that could be expected."

#### Our evaluation

We agree that there are certain types of Type A packages which could be exempted from radiation level monitoring requirements. Accordingly, we have worded our paragraph and recommendation to give NRC the necessary flexibility.

#### Agency comment

"page [14], recommendation: Use existing state resources to assure shippers and carriers comply with Federal radioactive materials transportation regulations."

"It would be more appropriate for this recommendation to suggest using State resources to supplement the Federal enforcement effort. Both the NRC Agreement States program and the NRC/DOT Radioactive Materials Transportation Surveillance program involve state participation in the Federal program. The transportation surveillance program involves certain states who have contracted with NRC and DOT to conduct surveys of physical conditions of radioactive materials packages and compliance with existing packaging and handling regulations, as well as to gather information concerning actual radiation exposures. Some states have participated on a cost-sharing basis for several years in a

program involving monitoring and reporting to the Federal Government on compliance with Federal transport regulations. In its FY '80 budget, RSPA has requested \$75,000 for development and enforcement of uniform state compliance programs. Increased Federal assistance would probably be necessary to achieve GAO's recommendation. In addition, the FHWA is currently funding a demonstration program with a limited number of states to promote the establishment and maintenance of motor carrier safety programs, and the adoption of consistent safety standards for both intrastate and interstate motor carrier commerce. The results of this Demonstration Program will be considered in determining the feasibility of additional Federal/State programs."

#### Our evaluation

We agree. We do not propose that Federal enforcement efforts be eliminated in favor of using only State resources. We believe State participation in the NRC/DOT Radioactive Materials Surveillance Program has worked well and such efforts should be expanded.



Department of Energy  
Washington, D.C. 20585

March 21, 1979

Mr. J. Dexter Peach, Director  
Energy and Minerals Division  
General Accounting Office  
Washington, D.C. 20548

Dear Mr. Peach:

We appreciate the opportunity to review and comment on the GAO draft report entitled "Nuclear Materials Transportation: Federal Actions Are Needed To Improve Safety And Security."

Comments on the draft report were transmitted by my February 21, 1979 letter to your staff for consideration in revising and redrafting the subject report. Certain issues still remain a concern that we feel should be considered for inclusion in the final report to Congress.

First, the report raises once again the issue of the dispersal hazard of certain radioactive materials such as Plutonium-239. In a recommendation to the Secretary of Energy and the Chairman of the Nuclear Regulatory Commission, the report calls for a graduated scale of security measures to be developed for the transportation of special nuclear materials, and that in establishing these levels the dispersal hazard should be taken into account. We believe that the report should include the fact that in 1976 the Energy Research and Development Administration, with the assistance of its national laboratories and in coordination with the Nuclear Regulatory Commission, studied in some detail the dispersal hazard. The study activity included the hazard and threat of the dispersal of Plutonium and other radioisotopes and compared these with both biological and chemical agents. The study revealed that in terms of danger to the public health and safety, biological or chemical materials other than nuclear materials are more hazardous and more easily obtainable by anyone. It was recognized that the totally irrational malevolent as well as particular nuclear adversaries might still prefer nuclear contaminants.

After consideration of all of these facts, together with the lack of intelligence evidence that a Plutonium dispersal threat prevailed in the United States, it was concluded that no additional protective measures were required to address special nuclear material dispersal beyond that protection resultant from related and existing health and safety measures

(protective packaging, health and safety examination of personnel when exiting Plutonium facilities, etc.). No evidence to the contrary is now available. Nevertheless, the Department is willing to undertake, in coordination with the Nuclear Regulatory Commission, a re-examination of this area and to determine and apply modifications, if determined necessary, to the Department's requirements and procedures for the protection of special nuclear material.

Second, the report reflects the GAO opinion that "Current Federal Regulations for protecting nuclear materials are inadequate" and recommends a graded system and a formulation to avoid protecting 20% enriched Uranium at higher levels than slightly smaller quantities of 90% enriched Uranium. We believe that the opinion is apparently based on the fact that present operative Department of Energy requirements and Nuclear Regulatory Commission Regulations do not specify protection measures for other than significant quantities of the element Plutonium or the element Uranium enriched in the isotope U-235 or Uranium-233. A review of the Department of Energy requirements providing for the security of special nuclear materials both at fixed sites and in transport was undertaken over a year ago, and a new draft Department of Energy Order 5632.2 was prepared. The draft Order has been structured to conform closely to the recommendations of Information Circular 225 (Revision 1) entitled "The Physical Protection of Special Nuclear Materials" which was published by the International Atomic Energy Agency. The Order specifies graded physical protection measures for special nuclear materials in terms of three material categories based on the quantity of special nuclear material present. Specific measures are provided down to quantities of material of 1 gram. We believe that the issuance and application of this Order, now awaiting printing, is responsive to the concern expressed in the report about the present "all or nothing" significant quantity cut-off levels.

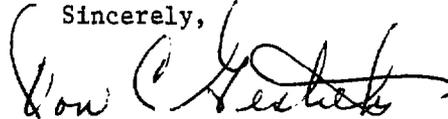
We feel it is important in the context that, in the case of enriched Uranium, the determination of protective measures that will be applied is made based on the total amount of the isotope U-235 present and not on the weight of total Uranium present. In the case of 20% enriched Uranium then, maximum protection would be applied to 25 kilograms of total Uranium containing 5 kilograms of Uranium-235. The definition of and the provision of protection for significant quantities of special nuclear material is based on Uranium enriched in the isotope 235 to 90% or above. As a matter of prudence, protection was extended to Uranium enriched to as low as 20% in the isotope 235 with the result that such shipments (enriched to 20%) may be overprotected. We believe that while this may not be technically precise, it is probably more understandable and, therefore, acceptable to the public than some more complex formula that might result in actually reducing present levels of protection for

some 20% enriched material. Nevertheless, we are willing to undertake in coordination with the Nuclear Regulatory Commission a re-examination of this area and to develop and apply appropriate modifications to Department of Energy requirements if found necessary.

The third point which the draft report raises is the joint determination and development by the Nuclear Regulatory Commission and the Department of Energy of needed safeguards levels and specific security measures. As we have indicated previously, we are prepared to re-examine this subject matter in coordination with the Nuclear Regulatory Commission. We will request our Office of General Counsel to determine whether such joint activities would be in consonance with the sense and intent of Congress and the provisions of the Energy Reorganization Act of 1974. In this regard an approach could be used which would be in effect an extension of the activities of the ERDA/NRC Task Force on Safeguards which functioned to jointly examine certain other aspects of the safeguards problem in 1975 and 1976.

Additional comments of an editorial nature and suggested revisions are being provided to your staff.

Sincerely,



Donald C. Gestiehr  
Director  
GAO Liaison



## OFFICE OF THE SECRETARY OF TRANSPORTATION

WASHINGTON, D.C. 20590

ASSISTANT SECRETARY  
FOR ADMINISTRATION

March 21, 1979

Mr. Henry Eschwege  
 Director, Community and Economic  
 Development Division  
 U.S. General Accounting Office  
 Washington, D.C. 20548

Dear Mr. Eschwege:

We have enclosed two copies of the Department of Transportation (DOT) reply to the General Accounting Office (GAO) draft report, "Nuclear Materials Transportation: Federal Actions Are Needed To Improve Safety and Security."

The majority of the report is factual, concise, and straight-forward in its conclusions. Most of the conclusions have merit, although in some cases the report's development of an issue is based on supposition rather than facts and objectivity.

The report's five recommendations to the Secretary of Transportation address real and important issues:

- DOT agrees with the need to reassess permissible contamination levels on the surfaces of packages and transport vehicles.
- DOT agrees with the need to increase support for use of state resources to strengthen enforcement of regulations.
- DOT finds the recommendation for coordination with State and local governments along the line of the Nuclear Regulatory Commission (NRC) Agreement State Program to be appealing, but what can be achieved is limited under existing statutory authorities.
- DOT's rulemaking on routing of highway shipments of radioactive material is receiving a very high priority and is progressing on schedule.



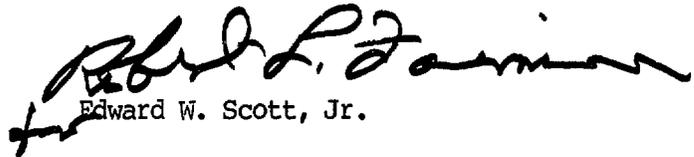
It's a law we  
can live with.

- The recommendation for DOT/NPC jointly developed regulations for Low Specific Activity packages is no longer applicable since NRC will not regulate them under the terms of a new memorandum of understanding.

Our detailed comments are provided in the enclosed statement.

If we can further assist you, please let us know.

Sincerely,

  
Edward W. Scott, Jr.

Enclosures

DEPARTMENT OF TRANSPORTATION REPLYTOGAO DRAFT REPORT OF JANUARY 18, 1979

(Code 30512)

ONNUCLEAR MATERIALS TRANSPORTATION:  
FEDERAL ACTIONS ARE NEEDED TO IMPROVE  
SAFETY AND SECURITYSUMMARY OF GAO FINDINGS AND RECOMMENDATIONS

In its study of radioactive materials transportation, the GAO reviewed regulations, studies and reports, agency policies, and records and interviewed officials of the Department of Transportation (DOT), the Nuclear Regulatory Commission (NRC), the Department of Energy (DOE), and the Department of Defense (DOD). Also interviewed were health and transportation officials in seven states and one metropolitan city, several commercial carriers and shippers. A questionnaire was sent to all 50 states regarding their planning and preparedness for meeting radiological emergencies.

GAO concludes that improvements are needed to assure adequate protection to the public from exposure to radiation from nuclear materials shipments. Recommendations are made to the various Federal agencies having statutory responsibilities for transportation of nuclear materials. The findings and recommendations in the report are separated into four categories, as summarized below:

Stronger Federal Policies and Regulations are Needed to Assure the Safe Transportation of Radioactive Materials

- o Shipping Containers
  - NRC and DOE inspection procedures are inadequate to assure Federal packaging specifications are met
  - DOT inspection program has not "gotten off the ground"
  - periodic inspections during fabrication of new containers and reinspections of used containers are needed
- o Radioactive Contamination Levels
  - DOT and NRC regulations allow unnecessarily high levels of contamination on surfaces of packagings and transport vehicles

- permissible levels should be reduced to as low as reasonably achievable by industry
- o Compliance with Federal Regulations
  - DOT and NRC have inadequate resources to conduct necessary inspections
  - State resources should be used to strengthen enforcement capability
  - consignees of nuclear shipments should inspect all packages to monitor and report excessive radiation levels
- o Uniform Regulation for Low Specific Activity Radioactive Materials
  - DOT and NRC regulations on packaging for low specific activity materials are inconsistent
  - consistent regulations should be jointly developed

Improvements Needed in Protecting Radioactive Materials Shipments from terrorists

- o Strategic Quantities of Special Nuclear Material
  - DOE and NRC require different levels of protection
  - DOE system is more secure and should be used pending further assessment of requirements
  - the needed level of security should be determined and consistent regulations and procedures jointly developed
- o Less than Strategic Quantities of Special Nuclear Materials (SNM)
  - protection should be extended to shipments of smaller quantities of SNM
  - measures should be taken to prevent enroute consolidation of SNM shipments that exceed the strategic level
- o Spent Fuel
  - Federal regulations are safety-oriented and ignore security concerns
  - the primary risk associated with spent fuel shipping cask is vulnerability to terrorist activity
  - the need for a security system should be determined

Better Response Needed for Transportation Accidents

- o State and Local Preparedness
  - State and Local agencies have initial responsibility for responding to accidents
  - 36 states have radiological emergency plans but only 8 have fully tested them
  - states are unable to estimate the volume of nuclear materials transported through their jurisdiction
- o Federal Role
  - DOT and NRC provide guidelines to states and local agencies for preparing emergency plans
  - DOE has emergency response teams but they are often slow in reaching an accident scene
  - DOT and NRC training should be reinforced by periodic emergency drills
  - the new Federal Emergency Management Agency should serve as focal point

State Regulation of the Transportation of Radioactive Material

- Inaction by DOT has resulted in a proliferation of state and local regulations
- prohibitive regulations at state and local levels could impede safe and efficient transportation
- DOT should aggressively address state concerns through coordination of regulations
- DOT should expedite its rulemaking on routing of radioactive materials shipments

DEPARTMENT OF TRANSPORTATION POSITION

The bulk of the report is factual, concise, and straightforward in its conclusions. Most of the conclusions have merit, although in some cases the report's development of an issue is based on supposition rather than facts and objectivity.

The Report's five recommendations to the Secretary of Transportation address real and important issues:

- DOT agrees with the need to reassess permissible contamination levels of the surfaces of packages and transport vehicles.

- DOT agrees with the view that states should be encouraged to strengthen enforcement of regulations.
- DOT finds the recommendation for coordination with state and local governments along the line of the NRC Agreement State Program to be appealing, but what can be achieved is limited under existing statutory authorities.
- DOT's rulemaking on routing of highway shipments of radioactive material is receiving a very high priority and is progressing on schedule.
- The recommendation for DOT/NRC jointly developed regulations for Low Specific Activity packages is no longer applicable since NRC will not regulate them under the terms of a new memorandum of understanding.

The following specific comments are provided as suggestions for strengthening the discussions in the report. The comments are grouped according to chapter and page numbers are cited for identification. Appropriate modifications should also be made to the DIGEST, pages i-x.

#### CHAPTER 1 -- Introduction

page 3, para. 3 and 4:

References to the agreements between DOT and NRC should be changed to agreement since only one memorandum of understanding exists.

page 4, para. 2: "For the larger quantities and more hazardous materials ..."

This sentence is not technically correct. Packaging requirements are based upon quantity limits established for each material, the limits being determined by the degree of hazard involved.

#### CHAPTER 2 -- Stronger Federal Policies and Regulations are Needed to Assure the Safe Transportation of Radioactive Materials

page 8, para. 2:

Construction materials for Type B packages are not limited to metal.

page 8, para. 3: "... higher levels of radiation and heat decay."

GAO note: [See GAO note on p. 68.]

This should read "... decay heat" to correct the causal relationship between decay and heat.

pages 11-13 (DOT's inspection efforts):

The Type A package specification (DOT-7A) is a "performance" specification, which places responsibility on the shipper, not the manufacturer, for ensuring that the package as prepared for transportation can pass the required tests. The report repeatedly refers to the Type A manufacturer when it should refer to the shipper. The conclusions should be modified appropriately.

To clarify the discussion of DOT inspection capability, it should be noted that the five full-time inspectors mentioned are those in the Materials Transportation Bureau. The modal operating administrations have full-time and part-time inspectors who also inspect container manufacturers and packages used to transport hazardous materials. However, DOT recognizes the need to improve inspections and MTB is in the process of hiring a full-time inspector who will be dedicated to radioactive materials concerns.

pages 13-15 (permissible contamination levels):

Although this section addresses a subject of mutual concern, the report questions permissible contamination levels by citing examples that must be considered "sensational." This approach weakens the credibility of the conclusion, one that could have been supported in an objective and clearly thought out manner.

page 13, para. 2: "... agencies allow unnecessarily high levels of radioactive contamination on the surfaces of packages and transport vehicles."

Although the Federal regulations are currently the same as internationally prescribed limits, DOT agrees that contamination levels need to be reevaluated. Such a study is likely to result in regulatory revisions in accord with the concept of "as low as reasonably achievable" with certain upper limits.

The report's determination that the levels are "unnecessarily high" is based on a comparison between continuously occupied areas in nuclear facilities and packages with which persons come in contact for short periods of time. Transportation reduces chronic exposure to individuals many times over in comparison to occupational areas, and it should not be implied that the same restrictions are warranted.

page 14, para. 3 (zero contamination):

Introduction of the procedures and practices of a radiopharmaceutical manufacturer as a model for the entire industry

is unrealistic. The radiopharmaceutical business is unique in its use of brand new cardboard boxes, its high-value product, and its inherent cleanliness. Most packagings for radioactive materials transportation are expensive, a primary example being spent fuel casks, and cannot be discarded after each use. Therefore, some surface contamination is unavoidable.

page 15, para. 1:

The example of contaminated carrier conveyances appears to oversimplify the situation. The report concludes that the vehicle contamination resulted from "liberal permissible contamination levels." It should be pointed out that most incidents of contamination result from material being released from inside the package and not from transfer of surface contamination between package and vehicle.

page 16, para. 1:

Reference is made to a DOT Federal Highway Administration Region having "25 inspectors for 1,500 shippers and 23,000 carriers." This incorrectly implies that all the shippers and carriers in the Region are involved in the transportation of radioactive materials.

page 16, para. 2 (state surveillance program):

This compliance study provided DOT and NRC with valuable information, some of which has led to regulatory action. However, the report's mention of "1,141 discrepancies ... among 2,593 packages ..." is misleading by omission. As might be expected, when one mistake was made, several were made on a single package. Therefore, it should not be implied that 44% of the packages had discrepancies. It also would have been more accurate had the report indicated only a small portion of certain types of transport workers were discovered to be receiving high levels of radiation.

page 17, para. 1:

The suggestion that receivers check all packages would carry a high price tag for the private sector. The economic impact on hospitals, department stores receiving smoke detectors, etc., could not be justified on the basis of the minimal increases in safety that could be expected.

page 17-18 (Low Specific Activity Packaging) and page 21, recommendation: "Jointly develop consistent regulations for packaging low specific activity radioactive materials."

A new memorandum of understanding between NRC and DOT has recently been approved. When it is signed and implemented, NRC will no longer regulate LSA packages. Therefore, the question of inconsistent requirements is moot.

Regarding DOT packaging requirements for LSA materials a recent notice of proposed rulemaking (HM-169) proposes that LSA materials must be shipped in essentially Type A packages. If implemented, this requirement will be more stringent than that of any other member nation of the International Atomic Energy Agency.

page 20, recommendation: "Use existing state resources to assure shippers and carriers comply with Federal radioactive materials transportation regulations.

It would be more appropriate for this recommendation to suggest using State resources to supplement the Federal enforcement effort. Both the NRC Agreement States program and the NRC/DOT Radioactive Materials Transportation Surveillance program involve state participation in the Federal program. The transportation surveillance program involves certain states who have contracted with NRC and DOT to conduct surveys of physical conditions of radioactive materials packages and compliance with existing packaging and handling regulations, as well as to gather information concerning actual radiation exposures. Some states have participated on a cost-sharing basis for several years in a program involving monitoring and reporting to the Federal Government on compliance with Federal transport regulations. In its FY '80 budget, RSPA has requested \$75,000 for development and enforcement of uniform state compliance programs. Increased Federal assistance would probably be necessary to achieve GAO's recommendation. In addition, the FHWA is currently funding a demonstration program with a limited number of states to promote the establishment and maintenance of motor carrier safety programs, and the adoption of consistent safety standards for both intra-state and interstate motor carrier commerce. The results of this Demonstration Program will be considered in determining the feasibility of additional Federal/State programs.

### CHAPTER 3 -- Improvements Needed In Protecting Radioactive Materials Shipment from Terrorists

Although the conclusions and recommendations in this chapter are directed to the Secretary of Energy and the Chairman, NRC, DOT is also interested in the findings of studies now being conducted by these two agencies. If it is determined that additional physical protection measures are necessary for radioactive materials in transportation, DOT is prepared to initiate appropriate rulemaking proceedings.

This question has also been addressed by the Interagency Review Group on Nuclear Waste Management (IRG) in its review of transportation issues. In its report to the President, the IRG will be recommending that physical protection requirements studies be continued and that any necessary rulemakings be handled expeditiously by NRC and DOT.

#### CHAPTER 4 -- Better Response Needed for Transportation Accidents

This chapter accurately defines the roles of Federal and state governments and industry and the importance of planning for emergency response to transportation accidents. DOT endorses the recommendation giving the new Federal Emergency Management Agency (FEMA) responsibility for leadership and coordination of planning for emergency response to nuclear transportation accidents. FEMA should coordinate its actions closely with both NRC and DOT, particularly with respect to identifying responsibilities of shippers and carriers.

DOT has three radioactive materials emergency response projects underway which will be completed in 1979:

- o Radioactive Materials Transportation Incident Responders Guidebook. When completed in May 1979, this guidebook will be made available to emergency service personnel, and local, state, and federal personnel who have related responsibilities.
- o Training Course for First-on-the-Scene Emergency Service Personnel. This course session on radioactive materials is an add-on session to a basic hazardous materials emergency response course developed for the DOT. It is scheduled to be available in June 1979.
- o Guide Checklist and Example Plan for Preparation of State and Local Emergency Response Plans for Transportation Incidents Involving Radioactive Materials. This is a revision to broaden an existing document prepared by the Western Interstate Energy Board. Completion is scheduled for October 1979.

page 37, para. 2 and 3:

As a point of clarification regarding the accident in Colorado involving spillage of uranium concentrate, we believe it is inappropriate for GAO to perpetuate the accounting of "quarreling ... between State officials and the shipper's representatives." This characterization was offered by a bystander and was officially responded to by the Colorado Department of Health. A copy of their response is attached and provides further information on the events which occurred.

CHAPTER 5 -- State Regulation of the Transportation of Radioactive Material

page 46 (examples of State and local laws):

The New York City requirement is for a "Certificate of Emergency Transportation." The New London requirement has been revised to impose a ban identical in effect with that of New York City.

page 47, para. 1:

DOT has established formal procedures for preemptive review of enacted State and local requirements. No formal request for such a review has been made regarding radioactive materials transportation.

page 49, para. 1: "Subsequently, ... the City of New London established permit requirements for nuclear shipments. At the present time, it is uncertain whether Brookhaven will be granted the permits necessary to make its shipments."

As indicated in the comment on the list appearing on page 46 of the draft report, the City of New London has further restricted nuclear shipments with the effective result of a ban similar to New York City's. New London's action was taken after Brookhaven attempted to obtain a permit, and was intended to ensure that no such permit would issue.

page 54, recommendation: "Develop a program of coordination with State and Local governments for regulating the transportation of radioactive materials transportation ..."

To the extent a State has authority to regulate transportation within its borders, the DOT encourages the State to adopt the Federal hazardous materials regulations and apply them to intrastate and interstate commerce. The regulations, like the safety program, include but are not limited to radioactive materials.

The NRC-agreement State program, which is expressly sanctioned by the Atomic Energy Act (42 U.S.C. 2021), provides an attractive base on which to build an improved transportation monitoring and inspection capability. In this connection, we have regularly participated in NRC Regional meetings with State liaison officers to encourage their participation in our rulemaking proceedings and to keep them apprised of our program activities. As pointed out earlier in our comments on the material appearing on page 20 of the draft report, expansion of state activities is likely to depend on the availability of Federal assistance

funds. Express Federal statutory recognition of states roles in transportation may also be required.

page 54, recommendation: "Expedite the Department's efforts to develop a routing regulation for radioactive materials shipments ... DOT should make sure that any such Federal regulation is coordinated with state and local governments and that their views are considered."

The Department is now reviewing comments received on an ANPRM covering routing of highway shipments of radioactive materials (Docket HM-164). The ANPRM was published in August 1978 and followed by a public hearing in November. An NPRM is expected to be issued in July 1979 and final rules one year later. It is anticipated that further public hearings will be held after the NPRM is issued. In addition, we intend to approach the NRC liaison officers directly for their comments. In consideration of the complexity of Federal-State relations in the area of regulating highway transportation, as noted in the report, the two-year schedule to be followed is reasonable. That schedule will permit adequate public participation and allow DOT to consider legitimate State and local concerns in its development of any regulations.

This rulemaking is also the subject of a recommendation being made by the IRG which has also expressed concern over the growing number of state and local regulations over highway transportation of nuclear materials.

To complement the Materials Transportation Bureau's rulemaking on routing of radioactive materials, the FHWA is developing guidelines for use by State and local officials in designating highway routes for transporting hazardous materials. The guidelines will consider existing highway design, population, geography, and other factors. Such guidelines will form the basis for FHWA advice, information, and direction to State and local governments for the establishment of a national system of routes for the transport of hazardous materials. Development of the guidelines is scheduled for completion in mid-1980.



General  
Services  
Administration Washington, DC 20405

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FEB 9 1979

Honorable Elmer B. Staats  
Comptroller General of  
the United States  
General Accounting Office  
Washington, D.C. 20548

Dear Mr. Staats:

The General Services Administration (GSA) is pleased to respond to your request for review and comments of the GAO draft report entitled, "Nuclear Materials Transportation: Federal Actions Are Needed To Improve Safety and Security". The Federal Preparedness Agency, GSA, is particularly interested in this report as it addresses responsibilities assigned by the Federal Preparedness Agency to the Nuclear Regulatory Commission and the Department of Transportation.

Thank you for providing the General Services Administration an opportunity to comment on this draft report. Our comments are enclosed.

Sincerely,

A handwritten signature in black ink, appearing to read "Jay Solomon". The signature is written in a cursive, flowing style.

Jay Solomon  
Administrator

Enclosure

General Services Administration  
Comments on GAO Draft Report  
"Nuclear Materials Transportation: Federal  
Actions Are Needed To Improve Safety and Security"

Comments are provided as follows:

General Comments

The report is a thorough analysis of the subject and accurately describes the need for better coordination among Federal agencies and between Federal, State, and local authorities. This report may provide the needed motivation for improved control of nuclear materials transportation and for improved planning for and response to transportation accidents involving such materials.

The Federal Preparedness Agency of the General Services Administration has particular interest in the report's conclusions regarding the Nuclear Regulatory Commission (NRC) and the Department of Transportation's (DOT) activities in assisting State and local Governments in preparing their response plans for such accidents. As the report indicates, the Federal Emergency Management Agency (FEMA) will be organized on or before April 1, 1979. The report's recommendation that FEMA assume responsibility for leadership and coordination of this program will be considered by the new FEMA Director. Recommendations on this issue have been prepared for the President's Reorganization Project and will probably be considered by the new Director at an early date.

Specific Comments

Table of Contents,  
Abbreviations

Change "FEMA - Federal Energy  
Management Agency" to "FEMA -  
Federal Emergency Management  
Agency"



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

March 23, 1979

MEMORANDUM FOR: James Howard  
Assistant Director, GAO

FROM: James J. Cummings, Director *RF for*  
Office of Inspector and Auditor

SUBJECT: GAO DRAFT REPORT, "NUCLEAR MATERIALS TRANSPORTATION:  
FEDERAL ACTIONS ARE NEEDED TO IMPROVE SAFETY AND  
SECURITY"

Attached are NRC's formal comments on the subject report.

Attachment:  
As stated



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

4- 1979

Mr. J. Dexter Peach, Director  
Energy and Minerals Division  
U.S. General Accounting Office  
441 G Street, N.W.  
Washington, D.C. 20548

Dear Mr. Peach:

Thank you for the opportunity to review the draft of the proposed GAO report "Nuclear Materials Transportation: Federal Actions are Needed to Improve Safety and Security."

In many instances NRC agrees with the conclusions expressed in the report and over the past several years has begun actions to remedy the noted problem areas. These actions and our views concerning the conclusions are set forth below. Specific comments are provided in the enclosure.

GAO Conclusion. Safe shipping containers are the first line of defense for protecting the public from radioactive materials shipments. The Commission and the Department (of Transportation) rely on the container users and manufacturers to do quality assurance inspections to assure these containers meet Federal safety specifications. GAO believes the agencies should, on a random basis, periodically perform physical inspections of new containers and reinspections of used containers.

NRC Response. The NRC holds the licensee responsible for conducting all activities, including transport activities, in a manner which will not cause undue risk to the public's health and safety. The NRC staff establishes safety standards and requirements which licensees must meet for transport activities to assure these activities are not causing undue risk to the public. The design of each Type B package and the quality assurance program must be reviewed and approved by NRC before the package may be used by a licensee. The staff inspects the licensee to assure that the licensee is meeting his responsibility. The inspection activity is varied, depending on the complexity of the licensees' activities and on the risk associated with that activity. Because spent fuel casks are complicated packagings, the NRC staff does inspect the activities of the cask manufacturer. The staff does not perform engineering tests on the packaging, but may observe engineering tests by the manufacturer during cask fabrication. Packagings for other shipments of radioactive material are not as complicated. These packagings may consist of steel drums with several inserts, a wooden box with inner container, or a cardboard box and inner wrappings. Most of these containers are not complicated in design and, as a result, can be inspected for design conformance after the fabrication is completed.

Because of this reduced complexity, the NRC staff inspects licensees as they are using these packagings and can verify that the packagings do not have significant deficiencies. Of course, the licensed users of these less complicated packages are held responsible for the correct fabrication just as for the fabrication of casks. Based on the above considerations, the NRC staff does not agree with the GAO conclusion.

GAO Conclusion. Neither the Transportation Department nor the Commission have the resources to adequately inspect shippers and carriers for compliance with Federal transportation regulations in the annual shipment of millions of radioactive materials packages. GAO believes the Department of Transportation and the Commission should further develop their use of existing State resources to strengthen the enforcement of Federal regulations.

NRC Response. GAO apparently included NRC in the first part of this conclusion because NRC sponsored the state transportation surveillance study with DOT. The findings of the study were that the noncompliance items were associated with DOT requirements. Consequently, we do not agree with the conclusion that, based on the study, NRC should strengthen its inspection capability. We agree with the second part in that present efforts of the NRC and the DOT to cooperate with the States in the surveillance program to evaluate compliance with the Federal regulations for safe transportation of radioactive materials should be expanded to include more states as monetary constraints and state interests allow.

GAO Conclusion. GAO believes that the Commission should require receivers of radioactive materials to monitor Type A packages and to report to the Commission radiation levels in excess of those allowed by Federal regulations.

NRC Response. We agree that the question of monitoring Type A packages on receipt could be reconsidered for protection of the persons receiving the package. The existing monitoring rule in 10 CFR 20.205 was developed for protecting workers and the general public in the transportation system, and could be expanded to provide protection for the recipient if it is determined that such protection is not already afforded by 10 CFR 20.201, "SURVEYS." However, the additional radiation exposure to the recipient in monitoring all packages on receipt merely for the purpose of assuring regulatory compliance probably cannot be justified.

GAO Conclusion. The GAO believes the NRC and the DOT should reduce the permissible contamination levels for packages and vehicles to levels that are compatible with what industry can reasonably achieve.

NRC Response. We agree that the question of whether the present standards should be decreased should be studied. We do not now think that such a regulatory change would have significant effect on present practice or public health and safety.

GAO Conclusion. The GAO believes that NRC and DOT should develop consistent regulations for packaging for low specific radioactive materials.

NRC Response. We agree that NRC and DOT regulations should be aligned on this issue. Both the NRC and the DOT are consolidating their requirements in the DOT regulations. The GAO report is inconsistent in that the agencies' present progress on this issue is recognized in one place, but not in all places where the conclusion is expressed. Shortening the report by removing redundancy would solve this problem.

GAO Conclusion. In some instances, shipments of weapons-grade materials are one or two grams below the strategic quantity level but no special security measures are required for them. The theft of multiple shipments below the strategic level could provide enough material to build a bomb. Also, less than strategic quantities of plutonium could be dispersed into the air to seriously endanger public health and safety in populated areas.

NRC Response. We agree that there is a need to provide security measures for shipments of less-than-strategic quantities of licensed, weapons-grade material. A program is in progress to amend NRC regulations to require licensees to provide the needed security measures. On May 24, 1978, we issued for public comment proposed amendments that set forth the needed requirements. These amendments are comparable to the physical protection guidelines in IAEA publication INFCIRC 225. We expect to issue the amendments in final form within a few months.

A study of the risks associated with the deliberate dispersal of plutonium has been carried out, and the results of the study were taken into account when the new proposed amendments were being drafted. On the basis of the information developed in the study, the NRC determined that additional protection measures against plutonium dispersal (beyond those proposed in the regulations issued for public comment) were not needed for licensed shipments. We have no new information to serve as a basis for modifying that position. Nonetheless, we are willing to undertake, in coordination with DOE, a reexamination of this area and to determine and apply modifications, if deemed necessary, to NRC regulations.

GAO Conclusion. Separate shipments of less than strategic quantities of nuclear materials can be brought together into one unprotected transportation terminal. Thus, two or more shipments of weapons-grade material which together exceed the strategic quantity level may be at one terminal at the same time--unprotected.

NRC Response. We agree that the situation described in this conclusion is unacceptable. Although such a situation did exist in the past, we believe that currently there is little risk of its reoccurrence. Since July 15, 1976 license conditions have been in effect that limit the risk of shipment consolidation at transport terminals by the following means: Practically all shipments that would likely be of interest to an adversary -- for example, shipments in the range of 1,000 to 5,000 formula grams -- are made by licensees who are licensed to possess more than 5,000 formula grams. Under current license conditions, each of these licensees is prohibited from having more than one unprotected shipment of 200 formula grams or more en route to any one consignee at any one time. Thus, even under current conditions, the risk of chance consolidation of shipments by two or more licensees is small and unpredictable. The small remaining risk will soon be reduced even further. If issued in its present proposed effective form, the proposed amendments of May 24, 1978 will require all licensees who contemplate making a shipment of 1,000 formula grams or more to provide advance notification to the NRC. The NRC would then use this information to determine and control the risk of collocation of two or more shipments during transport.

GAO Conclusion. The effect higher enrichment levels have on the quantity of nuclear materials needed to make a weapon are not adequately considered in determining strategic quantity levels. As a result, shipments that are less useful for making a bomb may be protected while more useful shipments are not.

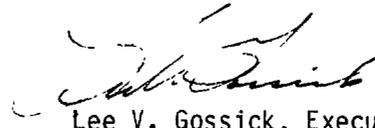
NRC Response. We agree that under current requirements, there is a protection anomaly in that some licensed shipments less useful for making a bomb may be protected while more useful shipments are not. This situation will soon be corrected. The proposed amendments that were issued for public comment on May 24, 1978 take into account the decreasing amounts of uranium needed to make a weapon as enrichment level increases. If amended within the next few months as proposed, the regulations will specify three security levels, three enrichment levels, and five weight (quantity) ranges. A shipment would be assigned one of the three different security levels, depending on both the quantity of materials in the shipments and the enrichment level.

GAO Conclusion. Spent fuel is a highly radioactive material which is transported in massive, durable containers. Based on test results, its release from these containers in accidents appears unlikely. However, Federal Agencies have not adequately considered the possibility of sabotage. GAO believes that the Department of Energy and the Commission should determine whether spent fuel shipments need to be safeguarded

from sabotage by developing experimental data on the amount of radioactive material that could be released in an attack on spent fuel casks using high explosives.

NRC Response. We agree with the conclusion that experimental data needs to be developed. In May 1978 we began to formulate the requirements for the development of the needed experimental data, and contract negotiations are now in progress. We expect the contractor to begin work within a few weeks. This program probably will not yield useful results before FY80. Accordingly, even though the staff believes that the likelihood of a sabotage attack on a spent fuel shipment is low and that the difficulty of breaching a cask is high, the staff is considering the imposition of interim protective measures for spent fuel movements pending the completion of the research activity.

Sincerely,



Lee V. Gossick, Executive Director  
for Operations

Enclosure: Specific Comments

Specific Comments

Page viii, 3rd paragraph and page 39. To more accurately reflect the NRC position on the mission of the new Federal Emergency Management Agency (FEMA) as reflected in correspondence to the Office of Management and Budget and conversations with GAO, change the first two sentences to read: "As a part of the overall Federal emergency preparedness effort, assume a policy coordination role in Federal assistance to State and local governments in the development of their radiological emergency response plans for transportation accidents involving radioactive materials. For example, FEMA should encourage other involved Federal agencies to expedite the development of Federal guidelines for State and local governments in this area."

At the bottom of page 14 delete "\$15,000." The sentence should read, "The study involved ... \$3,000 per State."

Page 22, 2nd and 3rd paragraphs. The conclusion arrived at by GAO in their comparison of the DOE and NRC transportation security systems is invalid since they relied on the results of the Office of Technology Assessments report dated June 1977 which were outdated.

- 6th and 7th lines

"..., and can reach every point in the United States..." should be changed to read, "..., and may under certain conditions, reach every designated communication control center in the U.S."

- 7th line

"DOE contractors use these resources for shipping strategic SNM and nuclear weapons." should be changed to read, "DOE has the responsibility for using its transportation security system for transporting strategic SNM and nuclear weapons."

- 8th line

Change sentence to read "...space available bases, or by other than the DOE transportation security system."

(30512)

GAO note: Page numbers in apps. III and V refer to the draft report and may not correspond to this final report.

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