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LEGAL, INSTITUTIONAL, AND POLITICAL ISSUES IN TRANSPORTATION OF NUCLEAR MATERIALS AT THE BACK END OF THE LWR NUCLEAR FUEL CYCLE

BY

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PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
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Human Affairs Research Centers
Seattle, Washington 98105

Foreword

Work on this document was completed in September 1977. Since that time numerous court decisions and administrative rulings have occurred which have made parts of this document out of date.

PREFACE

Sixty-six nuclear power plants provide almost 10 percent of the electrical generating capacity in the United States. It is expected that by 1985 an additional 75 nuclear plants will be in operation. In a normal year, each of these plants discharges about 30 metric tons of spent fuel, which is placed in an on-site, temporary storage pool. Eventually, these storage pools are filled to capacity. Then the spent fuel must be transported to reprocessing plants, centralized storage facilities, or waste-disposal facilities. If transportation services are not available to move spent fuel from a reactor with filled storage pools, then the reactor must be shut down. Similar transportation needs confront the commercial contractors that would operate nuclear fuel reprocessing plants or storage facilities.

In late 1977, it is not clear whether an adequate transportation system will be available when needed to move spent fuel and other nuclear materials. This report identifies major legal and institutional problems that could frustrate the establishment of a transportation system for spent fuel and other radioactive materials at the back end of the fuel cycle; it then evaluates possible solutions to these problems.

The transportation of radioactive materials is part of the continuing public controversy over commercial development of nuclear power in the United States. There is a general public fear of the effects of silent and invisible radiation, which can harm not only those unfortunate enough to be overexposed but their descendents as well. Furthermore, where transportation involves the shipment of plutonium or highly enriched uranium, there is the additional perceived danger that such materials could be stolen and fabricated into a nuclear weapon. Virtually all of the regulation, insurance, handling, and safeguards measures are designed to mitigate the above-mentioned concerns.

ACKNOWLEDGMENTS

The authors are indebted to the many people who provided input for this report. They include individuals in the nuclear transportation industry, in state and federal government agencies that deal with nuclear transportation, members of environmental and public interest groups, individuals involved in research on nuclear transport, and private citizens.

Many of these individuals reviewed an earlier draft of this report and offered valuable criticisms and suggestions. Of particular assistance in this regard was Mr. Joel Haggard, a Seattle attorney who is widely recognized as a leading nuclear expert. William A. Holt of Marsh, McLennan, and Mercer greatly assisted with the chapter on insurance; and David Wiley, a University of Puget Sound law student, provided research assistance. None of these individuals, however, reviewed the final revision; the authors, therefore, take full responsibility for any errors of omission or commission that appear in this report.

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CHAPTER ONE

SUMMARY

1.1 Introduction

Today, 66 nuclear power plants provide some 47,000 megawatts of electrical generating capacity for the United States--about 10 percent of the national generating capacity.[1] The President's National Energy Plan anticipates that, by 1985, an additional 75 nuclear plants already planned or under construction could be in operation, and nuclear power could provide as much as 20 percent of the nation's electricity supply.[2] With the exception of a few experimental systems, all of these existing or planned U.S. power plants are light-water reactors (LWRs).[3]

The initial fuel loading of a typical 1,000 MWe LWR power plant contains about 80 metric tons of slightly enriched uranium (about 3 percent U-235). Refueling the reactor occurs annually and requires that the reactor be shut down for a period of five to eight weeks, during which time about 30 metric tons of spent fuel are discharged and replaced with fresh fuel.[4]

Spent fuel is intensely radioactive and generates a great deal of heat. Upon discharge from the reactor, it is stored at the reactor site in water-cooled facilities for a minimum of 150 days before it can be transported. As of January 1, 1977, approximately 1,925 metric tons of spent fuel were held at reactor storage pools. Space for an additional 448 metric tons of fuel was available at locations other than reactor sites.[5]

To date, most fuel discharged from power reactors has been retained in the water-cooled storage basins at reactor sites. Such on-site storage of spent fuel is a temporary measure which cannot be continued indefinitely. To prevent reactor shutdown due to inadequate spent-fuel disposition capability, one or more of the following options need to be exercised:

1. Storage pools at reactor sites could be enlarged to accommodate additional spent fuel. In fact, the President's National Energy Plan indicates that improved methods of storing spent fuel will enable most utilities at least to double their current storage capacity without constructing new facilities.[6] Such increased storage capacity at

the reactor site would defer the need for establishing an industrial-scale transportation system for spent fuel and nuclear waste.

2. Spent fuel could be transported to a reprocessing plant. Spent fuel still contains significant amounts of material suitable for reuse as reactor fuel. This material includes uranium (U-235) which was not fully "burned" during reactor operations, as well as plutonium (Pu-239), an isotope created in the process of reactor operations. Since the beginning of nuclear power development, it has been assumed that these materials would be recovered and used to make fuel for LWRs or breeder reactors. It is generally believed that recovered uranium and plutonium could reduce U.S. uranium needs by 22 percent and enrichment requirements by 14 percent.[7]

3. Spent fuel could be transported to regional or national interim storage pools where it could be recovered later, either for reprocessing or for permanent disposal as wastes in federal repositories.

This report has two purposes:

- To identify major legal and institutional problems and issues in the transportation of spent fuel and associated processing wastes at the back end of the LWR nuclear fuel cycle. (Most of the discussion centers on the transportation of spent fuel, since this activity will involve virtually all of the legal and institutional problems likely to be encountered in moving waste materials, as well.)

- To suggest actions or approaches that might be pursued to resolve the problems identified in the analysis.

Two scenarios for the industrial-scale transportation of spent fuel and radioactive wastes, taken together, highlight most of the major problems and issues of a legal and institutional nature that are likely to arise: (1) utilizing the Allied General Nuclear Services (AGNS) facility at Barnwell, SC, as a temporary storage facility for spent fuel; and (2) utilizing AGNS for full-scale commercial reprocessing of spent LWR fuel.

The AGNS plant at Barnwell is one of three commercial-scale reprocessing plants in the United States. However, it appears that AGNS is the only one of the three that has even a remote potential for operation during the next decade.

Between 1966 and 1972, Nuclear Fuel Services (NFS) operated a reprocessing facility at West Valley, NY. The facility was closed for the announced purpose of major modification and expansion, but is now in receivership and "represents a dead venture."[8] The project has been abandoned by its parent company, Getty Oil, because of uncertainty over whether recycling of plutonium will be allowed and because rebuilding the facility to meet current NRC standards could cost more than $600 million. Before being closed, the facility processed 640 tons of spent fuel and left approximately 600,000 gallons of high-level reprocessing wastes in storage.[9] Some estimates have placed the cost of removal, solidification, and ultimate disposal of these wastes, together with that of decommissioning the reprocessing plant, to be in excess of $600 million.[10] Thus, the NFS venture has become a commercial failure.

A subsequent effort by General Electric to build a regional-scale fuel reprocessing plant at Morris, IL, fared even worse. The plant was to utilize improved technology, but it failed to operate as anticipated. Work was suspended in 1974 after an investment of $64 million.[11]

One other reprocessing proposal bears mentioning. Exxon Nuclear Company, Inc., continues to press its application to build a reprocessing plant near Oak Ridge, TN. However, the timetable for licensing alone appears to be at least 10 years. Thus, if there is to be any commercial reprocessing carried on in the United States within the next decade or so, it appears that the only commercial plant available for this purpose is the AGNS plant in South Carolina.

Some reprocessing plants could be licensed solely as spent-fuel storage facilities. The GE facility at Morris, IL, is now a storage facility, and applications have been filed to expand capacity by 1,100 metric tons uranium (MTU) from the current 700 MTU. Exxon has also applied for the construction of up to a 7,000-MTU storage basin at Oak Ridge, TN.[12] The AGNS plant has a current storage capacity of 370 MTU with a proposed expansion to 700 MTU, but that capacity may be unavailable if reprocessing is not licensed. In addition, other storage facilities can be constructed to serve regional or national needs. The transportation issues for these new facilities are similar to those that may be encountered by transporting spent fuel to the Barnwell plant.

1.2 Transportation Requirements for Fuel Reprocessing

In addition to the transportation requirements for spent fuel, which are discussed further in Chapter Two, there are also transportation requirements for the waste materials generated by reactors. These wastes, which may be classified as trash, failed equipment, and wet wastes, would have to be transported from the reactor to either a commercial burial facility or a federal repository, depending upon their characteristics and radioactivity.

Materials must also be transported from reprocessing facilities. The operation of a reprocessing plant requires transportation of uranium, plutonium, solidified high-level wastes, cladding hulls, transuranic wastes, and nontransuranic wastes out of the facility. Transportation requirements for these materials can be significantly reduced if (1) commercial low-level burial grounds are on the same site as the reprocessing facility (as is the case at Barnwell), and (2) a federal high-level waste repository is also located on or near the site. At this point, however, a federal disposal site for high-level radioactive wastes has not been selected, nor have transportation systems been designed and constructed for such wastes. Thus, numerical estimates of the number of shipments and types of material that would need to be transported from the commercial operation of a reprocessing facility are essentially guesswork.

1.3 Transportation Requirements for Interim Spent-Fuel Storage or Disposal

Currently, there is widespread concern over proliferation of nuclear weapons.[13] Because reprocessing can be a major factor in the proliferation material for nuclear weapons, the assumption that reprocessing should be used with the current generation of power reactors (LWRs) is being critically reevaluated. A number of federal agencies and private groups have reexamined the case for reprocessing and found it remarkably weak.[14] Indeed, President Carter, as part of his proposed National Energy Plan, has called for the indefinite deferral of commercial reprocessing and recycling of plutonium (as well as of the commercial introduction of the plutonium breeder).[15] This decision is highly controversial because of uncertainty over (1) the extent of U.S. uranium reserves and (2) the extent to which U.S. deferral of reprocessing will lead to similar actions by other nuclear nations. Accordingly, whether Congress will finally ratify the President's decision remains to be seen.

The alternative to undertaking reprocessing at an early date is to store spent fuel, either at the reactor site or at some central storage facility, until it becomes evident that either (1) the uranium and plutonium in the spent fuel are needed, or (2) the spent fuel can be disposed of permanently as wastes. However, whether the fuel is stored at the reactor sites or in a central facility will make a significant difference in terms of transportation requirements. For example, if spent-fuel storage capacity is greatly increased at reactor sites, then industrial-scale transportation of spent fuel would be deferred until such storage facilities were filled. It might also be possible greatly to expand the spent-fuel storage facilities at selected reactors, where space and other requirements permit easier expansion of storage. In that event, there would be significant movement of spent fuel from reactors with conventionally sized storage facilities to those reactors with expanded storage facilities.

On the other hand, if commercial or government central storage facilities are constructed, serving either regional or national requirements, spent-fuel transportation would flow from reactors to the central storage sites. At some point in the future, when these storage facilities are filled, the spent fuel would then have to be transported either to a reprocessing plant or to a federal waste repository for disposal as wastes.

1.4 Principal Transportation Issues

This report has identified six major issue areas in which legal and institutional problems need to be addressed before an industrial-scale nuclear transportation system can become operational for the back end of the fuel cycle:

- The interaction among federal, state, and local transportation regulations.
- Rail transportation of nuclear materials.
- The adequacy of emergency-response planning in the event of accidents.
- Safeguards and security to prevent diversion.
- Insurance coverage to provide protection against catastrophic losses that might be incurred.
- Issues concerning labor relations.

Each of these areas is discussed briefly below.

1.4.1 Federal, State, and Local Regulation

At present, the role of state and local regulation--both in terms of prohibiting certain shipments and in terms of imposing requirements in addition to those set by the Nuclear Regulatory Commission (NRC) and the Department of Transportation (DOT)--has not been fully resolved. Chapter Three of this report discusses current federal regulation, and Chapter Four examines state and local requirements.

Because nuclear transportation can arouse strong public sentiments, a number of states and localities have already imposed restrictions on such transportation. These factors, which could result in greatly increased costs, delays, and uncertainty for nuclear transportation, are occurring at a time when there is virtually no movement of spent fuel or high-level radioactive wastes from civilian nuclear reactors. It is possible that, as transportation requirements increase, state and local opposition will also grow. Conversely, however, as additional experience is gained and the safety of such transportation is demonstrated, state and local opposition to transportation could diminish.

Chapter Four discusses four basic approaches for resolving differences between federal regulations and state and local regulations: (1) challenge unlawful state restrictions in the courts to establish clear federal preemption of such requirements; (2) enact federal legislation to clarify precisely the regulatory roles of all levels of government; (3) establish, in whole or in part, a federally owned transportation system that could assert intergovernmental immunity against the imposition of certain state and local requirements; and (4) create cooperative mechanisms among all levels of government, to assure that appropriate weight is given to the concerns of each in establishing a nuclear transportation system.

1.4.2 Railroad Transportation

Proceedings are currently under way before the Interstate Commerce Commission to determine whether spent fuel and radioactive wastes must be shipped on a common-carrier basis and whether special train service will be required. The resolution of these issues could significantly affect the availability and cost of transporting and handling nuclear materials by rail. Since railroads have a much greater carrying capacity than trucks, the nuclear industry contends that rail transportation will be essential for reactor operation. These issues are discussed in Chapter Five of this report.

1.4.3 Emergency Response

Chapter Six discusses and analyzes current requirements for emergency-response planning by licensees, state and local governments, and federal agencies. Although elaborate plans of response to transportation accidents are now being formulated, it appears that the primary responsibility may very well rest with local police and fire departments, who are the ones most likely to be the first on the scene. In the unlikely event of a transportation accident that involves a serious release of radioactive materials, even a few minutes may be critical; thus, greater efforts are needed to assure that local response capabilities are upgraded.

1.4.4 Safeguards and Security

Special attention must be given to the prevention of theft or diversion of nuclear materials that can be used to fabricate nuclear weapons or can be dispersed in such a way as to create radiation hazards. These issues are discussed in Chapter Seven.

Currently, only shipments of strategic quantities of special nuclear materials (plutonium, highly enriched U-235, and U-233) are subject to safeguards requirements. It is generally felt that shipments of spent fuel or high-level radioactive wastes are unlikely candidates for theft because of their extreme radioactivity, the great bulk of their shipping casks (30-100 tons), and their unsuitability for direct fabrication into weapons materials. If a decision is made to reprocess spent fuel, however, much more attention will have to be paid to safeguards. Comparatively less attention would be required if a "throw-away" cycle were used, in which plutonium would not be separated from the rest of the spent-fuel materials and thus would not be readily amenable to theft or diversion.

1.4.5 Insurance Coverage

Industrial-scale transportation at the back end of the nuclear fuel cycle would be facilitated by the routine availability, at reasonable prices, of insurance coverage. Such coverage would assure protection of the public and of nuclear-facility owners and transporters alike. Chapter Eight discusses insurance coverage and raises potential issues concerning gaps or ambiguities that could inhibit the establishment of a routine transportation system.

1.4.6 Labor Relations

At the present time, most trucking firms that carry nuclear materials--both contract and common carriers--are not unionized. The rail transportation industry, however, is highly unionized. Organized labor has been generally supportive of nuclear development; however, as transportation requirements increase, it is possible that collective bargaining agreements will directly or indirectly play a significant role in establishing work rules, improving employee safety, and determining operating procedures. These issues are examined in Chapter Nine of this report.

1.5 Resolution of Potential Transportation Problems

There are many uncertainties concerning the time by which a large-scale transportation system must be in place. Although the operation of reactors results in the discharge of additional spent fuel into reactor storage pools, transportation requirements can be deferred by expanding the storage capacity of the pools at the reactor site. From the standpoint of the reactor operator, expansion of on-site spent fuel storage is currently the preferred option because it entails less uncertainty. Most of the steps needed to implement the expanded storage option are within the control of the utility, and NRC has routinely granted licenses for expanded on-site storage. On the other hand, if the utility elects not to expand on-site storage (or if such expansion is no longer possible), then it is faced with not only the uncertainty of assuring that sufficient transportation capacity will be available, but also with that of relying upon the timely licensing, financing, construction, and operation of the storage, reprocessing, or disposal facilities to which the spent fuel will be shipped. The possibilities for delay in bringing these facilities on-line are legion; thus, reliance upon this option by a utility could jeopardize reactor operation.

In view of the potential difficulties entailed by these other options, it is not surprising that NRC has already granted 18 licenses for expanded on-site storage facilities, with another 18 pending. The difficulty with this approach, however, is that it will greatly increase the already large backlog of spent fuel stored at reactors. The larger this backlog becomes, the more difficult it will be to establish a transportation system with sufficient capacity to handle the pent-up demand.

The time by which a transportation system must be in place is dependent upon several national policy decisions-- for example, decisions concerning how long reprocessing will be deferred, how much on-site spent fuel storage capacity will be allowed, what international fuel cycle agreements may be negotiated, and when off-site storage or waste repositories will be licensed and operational. If the federal government decides to take title to spent fuel, there may be delays pending the promulgation of regulations to establish the terms and conditions under which the transaction will take place. All of these actions must consider the lead times required for implementation. For example, construction lead times for presently licensed spent-fuel casks are about two years, while lead times for design and manufacture of new types of casks are likely to be at least five years. At least two years are generally needed for design, licensing, and installation of additional on-site storage facilities and six years for away-from-reactor storage facilities.

Even if all of these matters were decided, the establishment of an adequate transportation system would still face formidable hurdles. These include ever more stringent regulatory requirements and vulnerability to public pressures.

There are steps that can be taken, however, to resolve many of the present uncertainties. First, the promulgation and implementation of upgraded transportation safety standards should be accelerated. Such acceleration would both improve public confidence in nuclear transportation and reduce risks. Since these standards have been under consideration since 1973, they should not pose any surprises or serious compliance problems for people in the industry. Second, steps should be implemented to improve dramatically the emergency response of local, state, and federal agencies in the event of an accident involving nuclear transportation. Measures to increase funding, improve training, and provide proper equipment to response forces are needed to provide adequate protection in the event of an emergency. Third, potential gaps in insurance coverage should be eliminated. Straightforward regulatory changes and amendments to policies could provide greater public protection with little effort. Fourth, selective safeguards requirements could be extended to spent fuel and high-level waste shipments. Finally, existing administrative proceedings before DOT and ICC should be brought to a conclusion to clarify state-federal relationships and railroad obligations with respect to nuclear transportation.

These and other steps discussed in this report will not be easy to accomplish. In general, establishing an adequate transportation system at the back end of the nuclear fuel cycle will entail numerous changes in existing practices and procedures that will require years to implement--even in the best of circumstances. They will entail controversy, difficult negotiations, protracted administrative and judicial proceedings, and major public policy decisions. It appears that the prospects for successfully establishing an adequate transportation system will be enhanced, however, if the nuclear industry seizes the initiative on safety and puts into practice all reasonable safety measures, whether required by law or not.

CHAPTER ONE NOTES:

SUMMARY

1. See W. Donnelly, "Nuclear Power," An Initial Analysis of the President's National Energy Plan, Congressional Research Service, Library of Congress draft report (May 16, 1977) at 148.

2. Executive Office of the President, The National Energy Plan (April 29, 1977) at 71.

3. Nuclear Energy Policy Study Group, Nuclear Power Issues and Choices, report of a study sponsored by the Ford Foundation and administered by the MITRE Corporation, Ballinger Publishing Co. (1977) at 392, 401.

4. Id. at 246 and 253.

5. ERDA Savannah River Operations Office, 1977-1986 LWR Spent-Fuel Disposition Capabilities, ERDA 77-25 (May 1977) at 4.

6. National Energy Plan, supra note 2 at 72.

7. Nuclear Power Issues and Choices, supra note 3 at 319.

8. L. Carter, "West Valley: The Question Is, Where Does the Buck Stop on Nuclear Wastes," 195 Science 1306 (March 25, 1977).

9. Id.

10. Id.; see also Comptroller General, Issues Related to the Closing of the NFS Reprocessing Plant at West Valley, New York, GAO Report No. EMD 77-27 (Mar. 8, 1977) at 5.

11. Nuclear Power Issues and Choices, supra note 3 at 321-22.

12. Savannah River Operations Office, ERDA, 1977-86 LWR Spent Fuel Storage Disposition Capabilities, 1977 ed., ERDA 77-25 (May 1977) at 2,3.

13. W. Metz, "Reprocessing: How Necessary Is It for the Near Term?" 196 Science 43 (April 1, 1977).

14. Id.

15. National Energy Plan, supra note 2 at 70.

CHAPTER TWO

ANTICIPATED TRANSPORTATION REQUIREMENTS

2.1 Overview

The spent fuel removed annually from a commercial light-water reactor contains about 30 metric tons of uranium (MTU) and 250 kilograms of plutonium.[1] To recover this uranium and plutonium, spent fuel would have to be transported from the reactor storage pool to a reprocessing plant, where the spent fuel would be dissolved and the uranium and plutonium separated by solvent extraction. The plutonium would then be converted to a solid and sent to a plant that makes mixed-oxide fuel; the uranium, which has about the same fuel value as natural uranium, could be transported to an enrichment plant for reuse.[2]

Currently, little commercial transportation and no commercial reprocessing activities are taking place in the United States. This is because the nation's only functioning commercial reprocessing facility, operated by Nuclear Fuel Services, Inc., at West Valley, NY, ceased operations in 1972.[3] The ill-fated G.E. Reprocessing Plant at Morris, IL, is receiving some utility spent-fuel shipments and is now operating only as an off-site storage facility.

As of January 1, 1977, about 1925 metric tons of uranium in spent fuel were being held at reactor sites and in the storage pools of reprocessing plants.[4] Industry's belief that reprocessing was imminent led to provision for storing only limited amounts of spent fuel at reactor sites; thus, reactor storage pools are now filling up.[5] Enlargement of reactor storage pools will defer transportation requirements, but, at some point, the spent fuel must be transported, either to a reprocessing plant or to a regional or national storage or disposal facility.

In the absence of the ability to enlarge reactor storage sites indefinitely, both the number and type of nuclear-material shipments will have to be expanded to a scale currently unprecedented in the nuclear industry. If the 66 power plants in operation today discharge about 30 MTU per year, almost 2,000 MTU per year will accumulate at reactor storage pools. With the 75 additional plants that are expected to be in operation by 1985, the annual discharge rate will increase to over 4,200 MTU. The current inventory of 13 casks (9 truck and 4 rail systems) has an estimated transportation capacity of about 500 MTU of spent fuel per year, and manufacturing capacity is available to deliver 11 more casks by 1979 (two legal weight truck, five overweight truck, and four rail casks). The addition of these new casks could result in a total transportation capability of about 1,000 MTU per year.[6] Consequently, the existing transportation equipment and facilities will have to be greatly expanded from those presently at hand. Furthermore, if the United States, in an effort to prevent other countries from constructing their own reprocessing facilities, decides to provide them with spent-fuel reprocessing or waste-disposal services, then an even greater burden will be placed on U.S. transporting capabilities.

The placement of excessive demands upon existing and future transportation facilities--as would occur, for example, if transportation demands increased more rapidly than the capacity of industry to construct the highly specialized casks and other equipment required for spent-fuel and high-level radioactive waste shipments--could result in transportation's becoming a bottleneck, and could lead to possible reactor shutdowns. Whether these capacity limitations will in fact be exceeded depends upon a large number of variables, which will be discussed in Section 2.5, below.

2.2 Modes of Shipment

There are a number of features that distinguish the feasibility, practicality, and safety of various transportation modes. In general, truck transport is the fastest method for transporting spent fuel; this method of transportation is available at every reactor site except for those proposed to be located offshore. The difficulty is that legal-weight truck casks can carry only about one-ninth of the load that can be handled in larger rail casks. Thus, substitution of truck for rail shipment would result in considerably more shipments and turnarounds, both at the reactor site and at the reprocessing plant or storage facility.[7]

The major advantage of rail shipments over truck shipments is that much greater weights can be accommodated; thus, fewer shipments are required. A typical legal-weight truck cask can transport approximately 0.5 MTU of spent fuel, whereas large rail casks can transport about 4.5 MTU. The use of rail casks improves productivity of employees; it also makes more efficient use of existing storage and reprocessing facilities, which have not been designed to accept many small truck shipments.

On the other hand, rail transportation is notoriously slow, even with continuous expediting. Furthermore, reactor, reprocessing, and storage sites are subject to change or deterioration in rail service because of crumbling roadbeds.[8] Finally, about 40 percent of the nation's currently operating reactors do not have direct access to rail sidings.[9]

For reactor sites without a rail spur, a combination of truck and rail transport modes may work best. However, railroads in the Northeast have refused to carry spent fuel and high-level radioactive wastes on a common-carrier basis and have sought mandatory special train service. As is discussed in Chapter Five, such special train service could increase the mileage costs to the shipper by approximately $20 per mile--an approximate two-fold increase. One nuclear industry source estimates that mandatory use of special trains could add more than one-half billion dollars in annual charges for a transport system serving 200 nuclear power plants.[10] Thus, some of the cost advantages of using rail transportation could be dissipated if special train service is required.

Water transportation enjoys advantages similar to those of rail transport, because of the much greater weight which can be transported. However, transit times are extremely slow, and extra costs would be incurred in cask-rental fees and the construction of docking facilities, both at reactor sites and at reprocessing or storage facilities. Of course, if nuclear power plants are located offshore, or if local restrictions preclude land transportation for certain reactors, then water transportation could be examined as an alternative.

2.3 Spent Fuel and Waste Transportation Requirements of a Typical Large Reactor

Light-water reactors are generally shut down for routine maintenance and refueling about once a year, during which time roughly one-third of the fuel elements in the reactor are replaced. For a typical 1,000 MWe reactor, this would be a discharge of approximately 27-31 tons of fuel per year. The spent-fuel assemblies are initially placed in on-site storage pools for at least 150 days, to permit radioactive decay and thermal cooling prior to shipment. If shipments are by legal-weight truck, 40-60 trips would be required annually to transport this amount of spent fuel; if they are by rail, however, only 6-10 shipments would be required.[11]

In addition to producing spent fuel, a reactor's operation also generates low-level radioactive waste materials. These wastes may be classified as trash (paper, plastic protective clothing, and other materials, some of which may be compactable and combustible); failed equipment (contaminated metal and glass scrap); and wet wastes (filters, incinerated trash ashes, and other materials that are immobilized with cement or some other agent for shipping).

It has been estimated that a typical 1,000 MWe nuclear reactor generates about 420 cubic meters of waste per year.[12] The usual shipping container is a 55-gallon drum which holds about 0.2 cubic meters; thus, about 2,100 drums per year would be filled. Assuming 50 drums per shipment, this would involve about 42 truck shipments of wastes per year. However, the number of shipments is highly sensitive to whether compaction or combustion is employed, as well as to the immobilizing agent used; thus, the number of shipments may vary widely among reactors. These wastes are shipped to commercial burial grounds at the six locations shown in Figure 2.1.

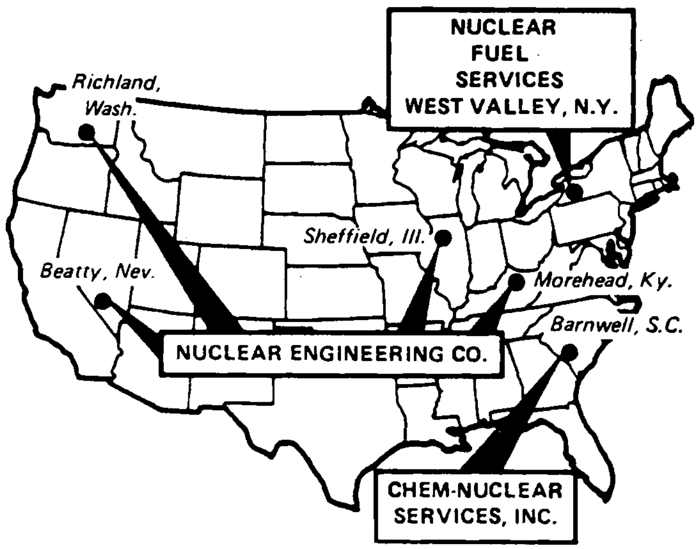
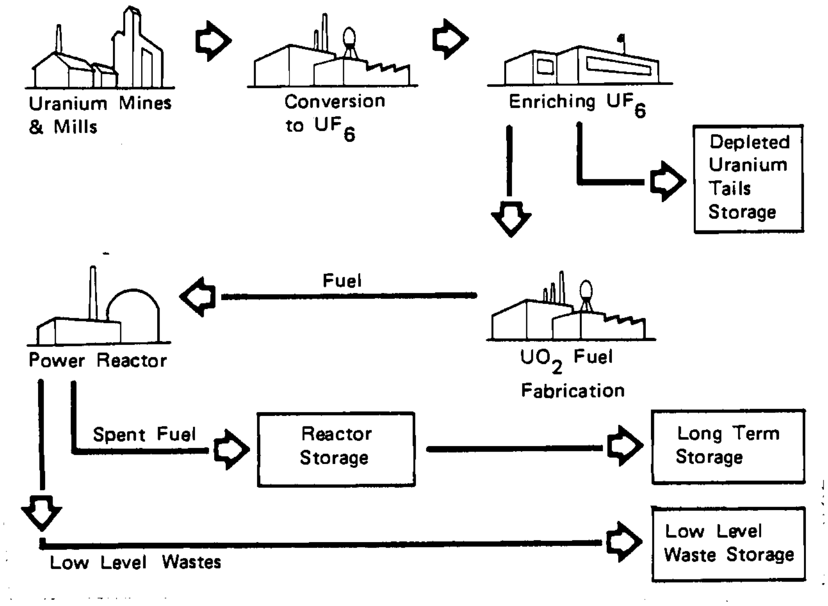


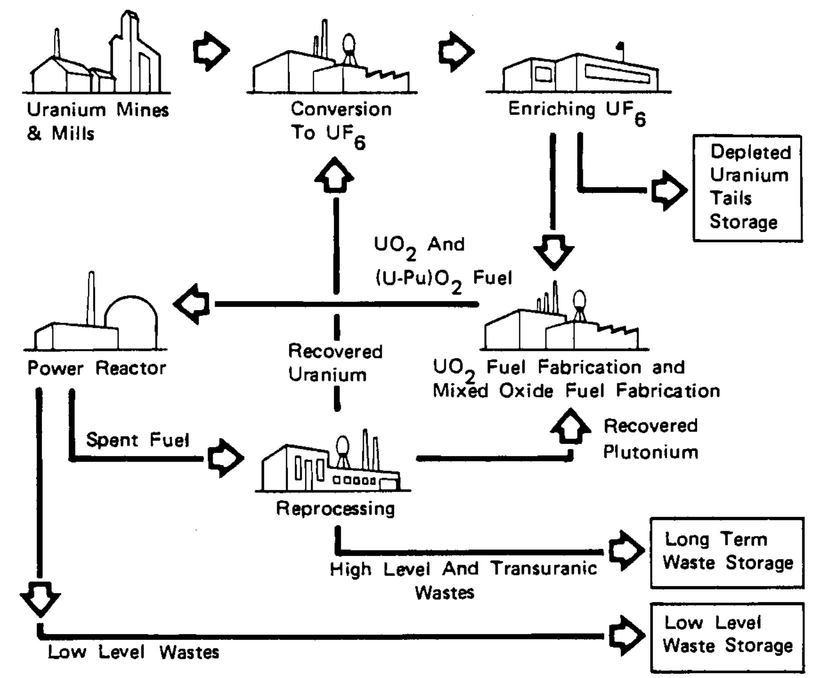
Fig. 2.1. Commercial burial sites for low-level radioactive wastes.

2.4 Shipments to a 1,500-Metric-Ton-per-Year Storage or Reprocessing Facility

Figure 2.2 is a schematic representation of the LWR fuel cycle. Case 1 involves the discharge of spent fuel from a reactor and transportation of the spent fuel to a facility for interim storage. At some future time, the spent fuel would either be shipped to a federal waste repository or reprocessed to extract uranium or plutonium. Case 2 involves the reprocessing of spent fuel, with its subsequent shipments of uranium and plutonium to fuel



Case 1--LWR Fuel Cycle: No Uranium or Plutonium Recycle



Case 2--LWR Fuel Cycle: Uranium and Plutonium Recycle

Fig. 2.2. Light-water reactor fuel cycles. (SOURCE: Nuclear Power Issues and Choices.)

fabrication or enrichment facilities; wastes would be shipped to federal and commercial repositories. For purposes of illustration, this section examines transportation requirements of operating the AGNS facility as either a 1,500 MTU storage or reprocessing facility.

Recent estimates of the Atomic Industrial Forum show 66 nuclear power plants in operation, with 150 more either under construction, holding limited work authorizations, on order, or with letters of intent. Figure 2.3 shows the location of these facilities.

The AGNS facility is designed to serve the reprocessing requirements of approximately 50 reactors; eighteen are now under contract, some as far away as the Trojan plant in Oregon.[13] AGNS officials indicate that the facility currently has storage capacity for 370 MTU and that expansion is under way to increase the storage space to 700 MTU.[14] This storage is intended to be working storage in support of reprocessing operations; apparently, there is no current intention to utilize the Barnwell facility for storage without reprocessing.

It is expected that shipments of spent fuel to the AGNS facility will be moved exclusively by truck or rail. Spent fuel will be contained in specialized casks constructed for this purpose; an example is shown in Figure 2.4. The casks are large: when loaded, a legal-weight truck cask weighs about 50,000 pounds; a large rail cask weighs about 200,000 pounds.[15] Much of their weight and bulk is due to the heavy shielding and strong structure required to withstand hypothetical accident conditions (including a free drop, puncture, thermal, and water-immersion test conditions).[16] The manufacture of these casks is complex and highly specialized; furthermore, in order to be lawfully used, they must be licensed by the NRC. At present, 13 casks are available: 9 legal-weight truck casks and 4 rail casks; the transportation capacity of this cask inventory is about 500 MTU of spent fuel per year.[17]

AGNS has entered into contractual arrangements with NL Industries to provide casks for moving spent fuel from reactors to its reprocessing facility. To reduce the handling time for loading and unloading fuel casks, AGNS would prefer to rely on rail shipments to the greatest practicable extent. Currently, however, about 40 percent of the nation's reactors do not have direct access to rail facilities; this situation could require the use of overweight truck casks at 20 percent of the reactors, with transfers to railroad flatcars at the nearest railhead. Overweight truck shipments generally require special state permits and may be subject to numerous restrictions.

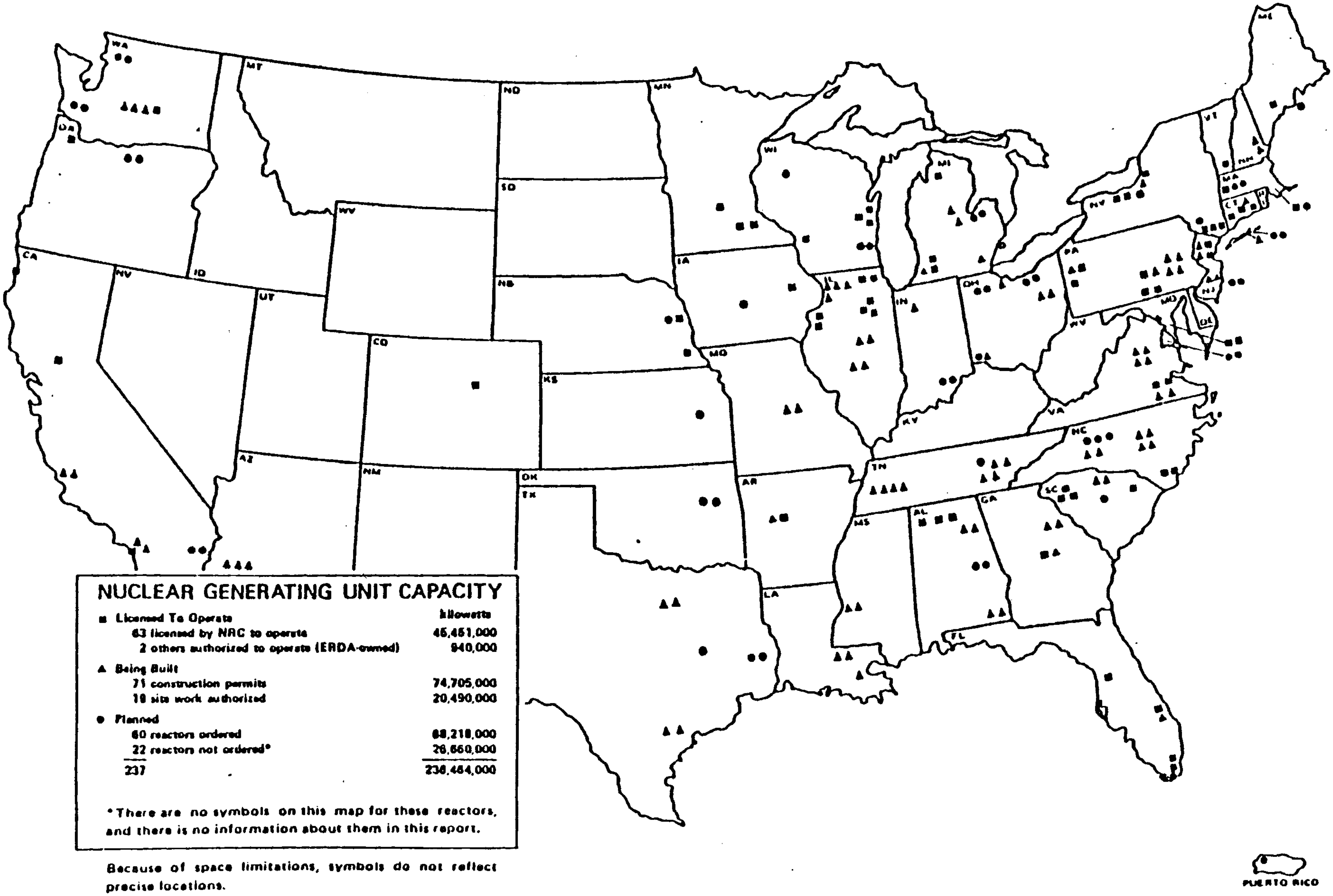
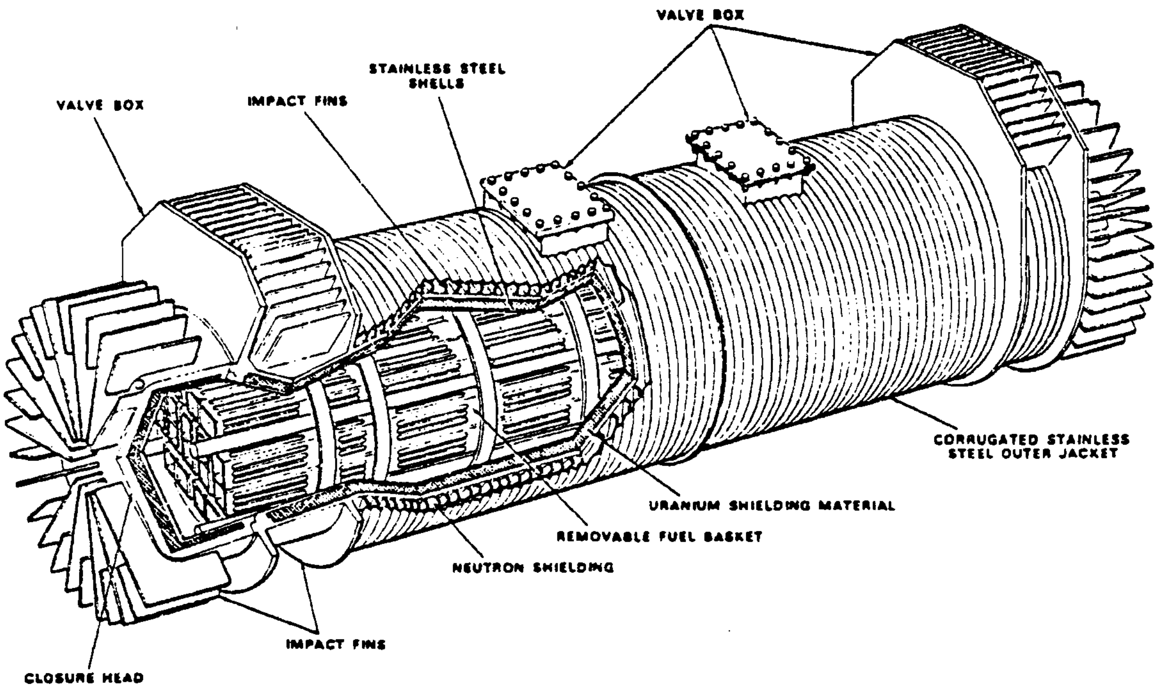
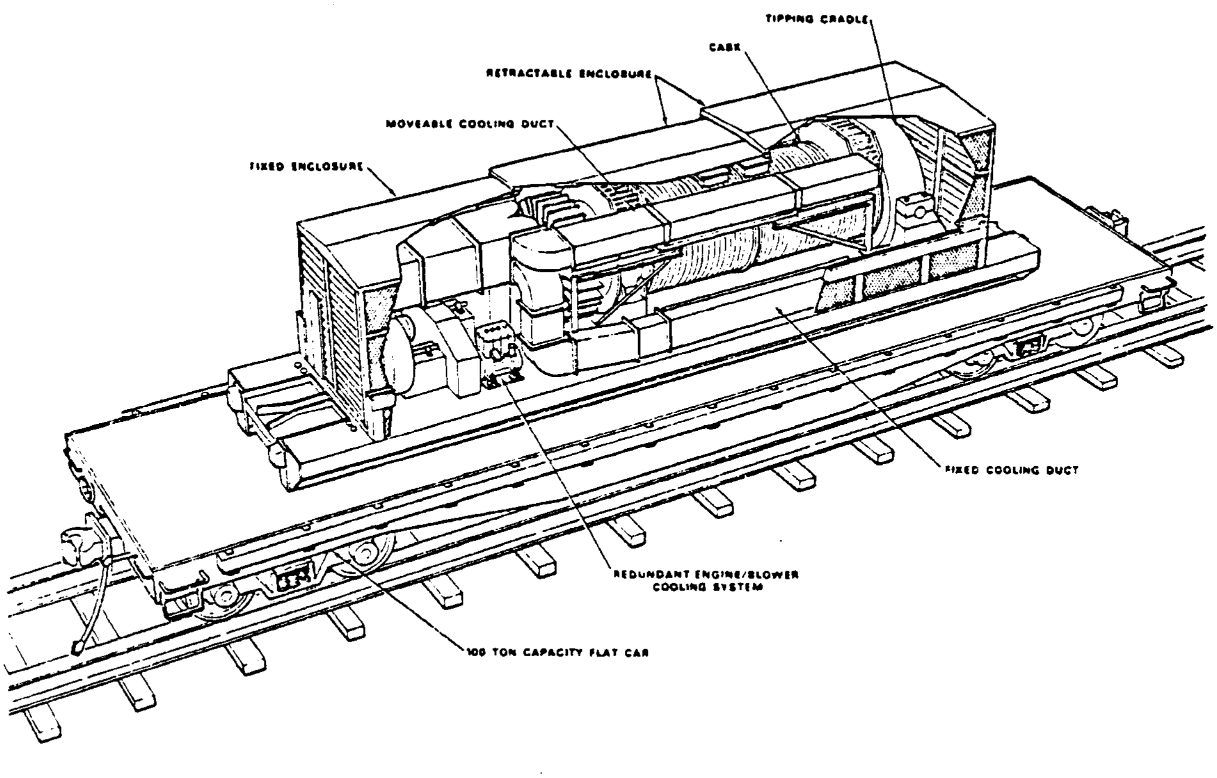


Fig. 2.3. Nuclear power reactors in the United States



IF 300 Spent Fuel Shipping Cask



IF 300 Spent Fuel Shipping Cask in Normal Rail Transport Configuration

Fig. 2.4. Typical Rail Spent Fuel Transportation Cask

If the mix of rail-to-truck shipments desired by AGNS--80 percent rail, 20% truck--is in fact achieved, then roughly 600 shipments per year would be delivered by truck and 275 shipments per year by rail, for an average of two truck shipments and one rail shipment arriving each day. However, if truck shipments alone had to be used, then approximately 3,100 shipments per year would be needed. If, on the other hand, rail shipments alone were employed, then only 325 shipments would be needed. The mix which is actually used will be determined by a combination of economic and regulatory factors, as well as by the requirement for operational efficiency.

The number and type of casks needed to transport 1,500 MTU of spent fuel to a central storage or reprocessing facility depends on a large number of variables. One estimate is that about 11 truck and 19 rail casks are needed for a 1,500 MTU system. This estimate assumes:

- Capacities of 0.5 MTU per truck cask and 4.5 MTU per rail cask.
- Five hundred miles travelled per day by truck and 150 miles per day by rail.
- Average round-trip distances of 1,100 miles for truck and 2,200 miles for rail shipments.
- Loading and unloading times per shipment of three days for truck and five days for rail casks.
- In service periods for both truck and rail casks of about 275 days per year.
- An average of 55 round trips per year for each truck cask and 14 round trips per year for each rail cask.
- Twenty percent of the spent fuel transported by truck and 80 percent by rail.

Each of these assumptions can be varied to obtain different cask requirements. Presumably, firm orders for casks will be placed when specific transportation requirements have been agreed upon by the interested parties.

2.4.1 Reprocessing

Spent-fuel transportation requirements will be the same whether Barnwell is operated as a reprocessing or an interim-storage facility. However, operation as a reprocessing facility will generate additional transportation requirements. Table 2.1 summarizes one estimate of the total number of annual shipments from a typical 1,500 MTU reprocessing plant. Great uncertainty surrounds these estimates, however, because regulations for commercial high-level radioactive waste casks and material configurations have not yet been promulgated. In addition, there will be significant time lags between reprocessing and the transportation of fuel and waste materials. The extent of these lags would depend both upon applicable regulations and upon the availability of storage facilities at the plant site.

TABLE 2.1

ESTIMATED ANNUAL SHIPMENTS FROM A TYPICAL 1,500-METRIC-TON-PER-YEAR REPROCESSING PLANT

1,500 MTU/yr Reprocessing Plant	Estimated Annual Number of Shipments
Plutonium	40
Solidified High-Level Waste (Rail)	20
Cladding Waste (Rail)	100
Noble Gases (Rail)	1
Iodine (Truck)	1
Tritium (Truck)	2
TRU Waste (Rail)	110
Non-TRU Waste (Rail)	30
UF_6 (14-Ton Cylinder by Rail)	30
TOTAL	334

SOURCE: An Overview of Transportation in the Nuclear Fuel Cycle, BNWL-2066.

2.4.2 Spent-Fuel Storage

If the AGNS facility becomes a spent-fuel storage facility only, then future transportation requirements will be determined by the disposition of the spent fuel at the end of the interim storage period. If it is decided that reprocessing should occur, then the spent fuel will be processed through the plant, and transportation requirements will be similar to those discussed above; however, there will be a substantial deferral of transportation needs. If, on the other hand, the decision is made to treat the spent fuel as waste, then, presumably, it will be transported from the storage facility to a federal waste repository for permanent disposal and management. This transportation leg will be similar to the transportation into the plant--except that the distance may vary, depending upon the location of the repository, but it will occur at a later time.

2.5 Total Transportation Requirements and the Availability of Specialized Casks

If 1,500 metric tons per year are shipped for storage or reprocessing to Barnwell, SC, AGNS officials estimate that approximately 20-23 rail casks and 5-10 truck casks will be required--assuming that approximately 80 percent of the shipments will be by rail and 20 percent by truck.[18] If there are transportation mode shifts, then more casks will be required for the mode whose share is increased. For example, if the ratio is 60 percent by rail and 40 percent by truck, only 15-18 rail casks, but about 20 truck casks, will be needed.[19] Lead time for the construction of truck casks is about 12-18 months; for the construction of rail casks, it is about two years. These lead times could increase substantially if demand is high or if regulatory specifications change. It is anticipated that NL Industries, which is under contract with AGNS to handle all transportation of spent fuel into the plant, will be able to produce 4-5 casks per year.

Prior to 1985, there are likely to be transportation requirements in addition to those for shipping spent fuel to a central storage or reprocessing facility. For example, some utilities will require transportation between reactors; also, transportation may be needed both for foreign shipments and for movements to a permanent repository, which may be in operation by 1985. Furthermore, by 1985 there may be more than 140 power reactors operating; together, these will discharge about 4,200 MTU per year. Although enlarged storage pools at reactor sites may defer the timing of transportation requirements, at some point transportation capacity must equal reactor discharges.

Whether a sufficient number of casks can be constructed and made operational in the next few years depends upon a large number of variables, including:

- The date on which central storage or reprocessing activities are commenced, which, in turn, depends on (1) the rate at which reactor storage pools are filled and (2) the timeliness with which the NRC establishes definitive licensing criteria for storage.

- Whether a federal repository is operational by 1985--as is anticipated by the National Energy Plan.

- The number of casks that are currently committed to other uses, which may make them unavailable generally. For example, apparently both Commonwealth Edison of New York and Carolina Power and Light have ordered casks for their own use, in order to transport spent fuel from reactor sites with nearly full storage pools to other reactor sites that have additional storage capacity available.

- The extent to which state and local authorities restrict nuclear transportation through their jurisdictions (see Chapter Four).

- The extent to which the railroads prevail in actions before the Interstate Commerce Commission (ICC) to require special train service for spent-fuel and high-level radioactive waste shipments. At this point, it is not clear whether special train service would increase cask transportation time or not; nevertheless, if reactor owners conclude that special train service charges are excessive, they may seek to divert additional spent-fuel shipments to the truck mode (see Chapter Five).

- The speeds of trains that will be permitted on deteriorating railroad tracks. To the extent that railroad speed limits are reduced, rail shipments may become less desirable to reactor operators. The newly established Conrail Corporation, however, is currently engaged in expensive track improvement and rehabilitation in the Northeast; the success of this program could affect the desirability of rail versus truck shipments.

- The extent to which the United States, as part of its international nonproliferation efforts, repurchases spent fuel from foreign nations for reprocessing, storage, or disposal in the United States.

- The existence of special state or local routing requirements, which could affect both transportation times and the number of casks required.

Because of the uncertainties associated with spent-fuel and high-level waste transportation, companies with the capability of constructing spent-fuel casks may not retain the inventories of material or the personnel necessary for prompt fulfillment of new orders. If these uncertainties are not resolved relatively promptly, then cask start-up and construction times may be considerably lengthened. Delays in this or other aspects of transportation may result in the need for selected utilities to expand on-site reactor storage pools to accommodate additional spent fuel. But all options--reprocessing of spent fuel, central storage or disposal of spent fuel, and expansion of reactor storage pools--require substantial lead times. Thus, unless these transportation issues are resolved in a relatively timely manner, some reactors might have to shut down due to an inability to discharge spent fuel.

In summary, whether there is adequate capacity to construct the needed spent-fuel casks depends on the resolution of a number of outstanding issues. To the extent that these are not resolved, the lack of a sufficient number of spent-fuel casks and other items of equipment could become a bottleneck in completing the fuel cycle.

CHAPTER TWO NOTES:

ANTICIPATED TRANSPORTATION REQUIREMENTS

1. Nuclear Energy Policy Study Group, Nuclear Power Issues and Choices, a study sponsored by the Ford Foundation and administered by the MITRE Corporation, Ballinger Publishing Co. (1977) at 319.

2. Id.

3. Comptroller General of the United States, Issues Related to the Closing of the Nuclear Fuel Services, Inc., Reprocessing Plant at West Valley, NY, report to the Conservation, Energy, and Natural Resources Subcommittee of the House Committee on Government Operations (March 8, 1977) at 1.

4. Savannah River Operations Office, ERDA, 1977-86 LWR Spent Fuel Disposition Capabilities, 1977 ed., ERDA 77-25 (May 1977) at 4.

5. Nuclear Power Issues and Choices, supra note 1 at 320.

6. See AIF, Spent Fuel Storage Study 1976-86 (April 1977) at 19-20.

7. Southern Interstate Nuclear Board, Transportation of Nuclear Spent Fuel (December 1, 1972) at 43.

8. Id. at 45.

9. Telephone conversation with Robert T. Anderson, Transportation Department, Allied General Nuclear Services, Barnwell, SC (April 4, 1977; May 17, 1977).

10. W. England, "Recent Regulatory Developments concerning the Transportation of Nuclear Fuel and Other Radioactive Materials," 7 Environmental Law 203, 216 (1977).

11. See Transportation Branch, AEC, Shipments of Nuclear Fuel and Waste . . . Are They Really Safe? WASH-1339 (Aug. 1974) at 7.

12. See Directorate of Regulatory Standards, AEC, Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, WASH-1238 (December 1972) at 49-50.

13. R. T. Anderson, supra note 9.

14. *Id.*

15. Division of Nuclear Fuel Cycles and Production, ERDA, *Alternatives for Managing Wastes from Reactors and Post-Fission Operations in the LWR Fuel Cycle*, ERDA 76-43 (May 1976) at 22.15.

16. 10 C.F.R. 71.36.

17. AIF, *Spent Fuel Storage Study 1976-86* (April 1977) at 19.

18. R. T. Anderson, *supra* note 9.

19. *Id.*

CHAPTER THREE

PRINCIPAL FEDERAL ACTIVITIES AFFECTING NUCLEAR TRANSPORTATION

3.1 Overview

The Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC) are the two federal agencies that share the major responsibility for regulating the safety of the transportation of nuclear material between reactors and reprocessing plants or storage facilities. The federal standards and regulations governing the packaging and shipping of radioactive materials are intended: (1) to protect plant employees, transport workers, and the general public from external radiation in the transport of radioactive material under normal conditions; and (2) to assure that the packaging is designed and constructed so as to contain radioactive materials, to maintain radioactive emissions within prescribed standards, and to prevent nuclear criticality during both normal and accident conditions.[1]

Another federal activity that may have a dramatic impact on spent-fuel and radioactive-waste transportation requirements is the Carter Administration's review and revision of major nuclear programs. For example, the President's National Energy Plan proposals include improved methods for storing spent fuel at reactor sites, indefinite deferral of commercial reprocessing and recycling of plutonium, and expansion of the Wastes Management Program of the Energy Research and Development Administration (ERDA) to include development of technologies for long-term storage of spent fuel.[2]

In addition, the Clean Air Act Amendments of 1977 could result in expanded Environmental Protection Agency and state jurisdiction over any nuclear activity that results in radiation emissions into the air.

3.2 Existing Federal Nuclear Transportation Controls

Under the Hazardous Materials Transportation Act of 1974 and other statutes, DOT is authorized to regulate transportation "to protect the Nation adequately against the risks to life and property which are inherent in the transportation of hazardous materials in commerce."[3] DOT has promulgated detailed regulations to govern the packaging, shipping, carriage, stowage, storage, and handling of radioactive materials by all transportation modes.[4]

Pursuant to the Energy Reorganization Act of 1974 and the Atomic Energy Act of 1954,[5] NRC is responsible for, among other things, minimizing danger to life and property from the civilian use of nuclear materials. The broad authority accorded to NRC under this legislation covers all persons who possess, use, or transfer by-product, source, or special nuclear materials. However, NRC has exempted common and contract carriers from its licensing and regulatory requirements in view of the regulatory authority exercised over these persons by DOT.[6]

Additional federal authority is provided by the National Environmental Policy Act of 1969, which gives all federal agencies responsibility for protection of the quality of the environment.[7]

Federal safety regulations concerning nuclear materials transportation provide for: (1) containment of the radioactive material to avoid contaminating air, land, or water resources; (2) shielding to control radiation exposure to the environment from individual packages; (3) limitations on the quantity of nuclear material within a given package to prevent radiation hazards, overheating, and the start of a nuclear chain reaction; (4) restrictions on placement and storage of radioactive materials in terms of distance from people; and (5) limitations on the number of packages that are in close proximity to reduce radiation exposure of employees and the public. These regulations are discussed in greater detail in Appendix A of this report.

The existing U.S. safety regulations substantially follow the 1967 edition of Regulations for the Safe Transport of Radioactive Materials (Safety Series No. 6), promulgated by the International Atomic Energy Agency (IAEA). A significant revision of the IAEA standards was issued in 1973. These 1973 standards have been substantially adopted by most nations and international transport organizations--but, so far, not by the United States. DOT and NRC are, however, currently developing proposals to amend 49 C.F.R. 100-199 and 10 C.F.R. 71 so that U.S. regulations will closely conform to the 1973 IAEA revisions.[8] These are now expected to be published in the fall or winter of 1977. The revisions are numerous, but the principal substantive changes are (1) the elimination of the "transport group" system[9] for classifying radionuclides, and (2) the reassessment of Type B package designs. This reassessment will quantify the allowable loss and leakage rates (which are more stringent than practice under existing standards) after both normal and accident damage tests; it will also determine whether Type B packages meet the unilateral or multilateral approval requirements. To qualify as a Type B(U) (unilateral approval) container, a cask must fulfill design criteria over and above those required for a Type B(M) (multilateral approval) container; these additional criteria relate to insuring the integrity of the containment features of such packages without need for any supplemental operational controls.[10]

The statutory jurisdictions of DOT and NRC overlap with respect to responsibilities for the safe transport of nuclear materials. In 1973, DOT and the Atomic Energy Commission (the predecessor to the NRC) updated a memorandum of understanding to allocate regulatory duties over such transportation.[11] According to the memorandum, DOT has primary jurisdiction over shippers and carriers, while NRC has primary jurisdiction over nuclear facilities and containers for spent fuel and high-level wastes. DOT regulations (49 C.F.R. 170-189) pertaining to packaging, marking, and labeling apply to shippers; those dealing with vehicle placarding, loading, storage, monitoring, and accident reporting apply to carriers. All containers for shipment of spent fuel and high-level radioactive waste materials are required to be licensed by NRC. If a transportation accident occurs, or if a suspected leak in a package of radioactive material is discovered while the package is in transit, DOT investigates the occurrence and prepares an investigation report. If an accident occurs or a suspected leak is discovered other than during transit, the occurrence is investigated by NRC. Under the memorandum, DOT (with AEC advice and technical support) is the "National Competent Authority" to carry out the administrative requirements of the International Atomic Energy Agency with respect to the safe transport of radioactive materials. DOT and AEC also agreed to cooperate with exchanges of information in the development and enforcement of regulations. The memorandum of understanding is currently under revision to bring it into conformity with the Energy Reorganization Act, the Hazardous Materials Transportation Act, and the Department of Energy Organization Act[12] (since the memorandum was entered into prior to the enactment of these statutes), but the revisions are not expected to change the substantive provisions of the agreement.[13]

The federal agency that has the principal economic regulatory authority over nuclear transportation is the Interstate Commerce Commission (ICC) which regulates the rates, charges, and conditions of service of truck, rail, and barge lines operating in interstate and foreign commerce. ICC regulations define three types of carriers: private carriers, which transport their own goods and are exempt from ICC regulation; contract carriers, which selectively transport other people's goods and are subject to limited ICC regulation; and common carriers, which transport goods for the general public in accordance with ICC certificates of public convenience and necessity.[14] Even though transportation safety is primarily the domain of DOT and NRC, some ICC activity may also have safety impacts. For example, ICC is currently considering whether or not to permit railroads to require special train service for certain nuclear materials, a decision that turns largely on safety grounds (see Chapter Five for a discussion of this issue).

The Environmental Protection Agency may also be in a position to exercise jurisdiction over certain nuclear activities. Under the President's Reorganization Plan No. 3 of 1970,[15] EPA assumed the duties of the Federal Radiation Council. Under this authority, the EPA Administrator is to advise the President with respect to radiation matters that directly or indirectly affect health; in addition, the Administrator is to provide guidance for all federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with states.[16]

The Clean Air Act Amendments of 1977 (P.L. 95-95) make it clear that radioactive emissions into the air are subject to the full regulatory framework of the Clean Air Act (42 U.S.C. 7401). Under the 1977 Amendments, the EPA Administrator is required (1) to determine within two years whether or not radioactive emissions cause or contribute to air pollution that may be reasonably anticipated to endanger public health, and (2) to establish an appropriate control strategy.

The Conference Report on the Amendments indicates that EPA may choose to promulgate identical standards to those previously established by NRC. However, EPA may do so only to the extent that it finds such standards adequate to fulfill the requirements of the Clean Air Act. The 1977 Amendments also permit NRC to disapprove any EPA, state, or local standard promulgated under the Clean Air Act if the NRC finds that the application of such a standard to a source or facility within its jurisdiction would endanger public health or safety. The President may overturn such an NRC disapproval within 90 days, upon appeal by the agency that promulgated the disapproved standard.

Thus, any state or locality may establish standards more stringent than federal standards--or, where a federal standard has not been established, may establish any standards it deems appropriate. This is an important change in existing law, because it means that states and localities would no longer be preempted by federal law from setting and enforcing air pollution standards for radiation that are stricter than the federal standards. The 1977 Amendments thus reverse the landmark holding of <u>Northern States Power Co. v. State of Minnesota</u>, 447 F.2d 1143 (8th Cir. 1971), aff'd 405 U.S. 1035 (1972), in the context of radioactive air pollution.[17]

It appears that the 1977 Amendments were intended primarily to require EPA or state regulation of radioactive emissions into the air from stationary sources. Whether this authority also extends to emissions from nuclear material in transit is unclear; in any case, substantial time and litigation will be required before the implications of the Clean Air Act Amendments of 1977 on the nuclear industry are fully delineated.

The relationship between federal and state authority over the transportion of nuclear materials is further discussed in the next chapter.

3.3 The Administration's National Energy Plan and Its Potential Effects on Nuclear Transportation

On April 7, 1977, President Carter announced a significant shift in U.S. nuclear policies. He stated:

> The benefits of nuclear power, particularly to some foreign countries that don't have oil and coal of their own, are very practical and critical. But a serious risk is involved in the handling of nuclear fuels--the risk that component parts of this power process will be turned to providing explosives or atomic weapons.
>
> We took an important step in reducing this risk a number of years ago by the implementation of the non-proliferation treaty which has now been signed by approximately 100 nations. But we must go farther.
>
> We have seen recently India evolve an explosive device derived from a peaceful nuclear power plant, and we now feel that several other nations are on the verge of becoming nuclear explosive powers.
>
> * * *
>
> Therefore, we will make a major change in the United States domestic nuclear energy policies and programs which I am announcing today.
>
> * * *
>
> First of all, we will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in U.S. nuclear power programs.
>
> From my own experience, we have concluded that a viable and adequate economic nuclear program can be maintained without such reprocessing and recycling of plutonium. The plant at Barnwell, South Carolina, for instance, will receive neither Federal encouragement nor funding from us for its completion as a reprocessing facility.

> Second, we will restructure our own U.S. breeder program to give greater priority to alternative designs of the breeder other than plutonium, and to defer the date when breeder reactors would be put into commercial use.[18]

Other features of the nuclear power policy statement could also impact nuclear power transportation requirements. For example, to the extent that the United States provides increased uranium enrichment or reprocessing services to foreign nations, significant additional transportation requirements will be created.

The President's National Energy Plan, which includes proposals to implement the nuclear power policy statement, could, if adopted, significantly affect nuclear power transportation requirements. To begin with, the President's plan calls for indefinite deferral of commercial reprocessing and recycling of plutonium, as well as postponement of the commercial introduction of the plutonium breeder. Such action would defer or eliminate the need to transport high-level radioactive waste materials from a reprocessing plant.

Secondly, the President's energy plan also recommends improved methods of storing spent fuel, which would enable most utilities at least to double their current storage capacity without constructing new facilities.[19] To the extent that this goal is achieved, the transportation of spent fuel from the reactor site to a storage or reprocessing facility would be substantially deferred and additional time made available for constructing spent-fuel casks.

Finally, the plan provides for the expansion of ERDA's Waste Management Program to include the development of techniques for long-term storage of spent fuel.[20] Again, if the plan is adopted and the United States moves toward a "throw-away" fuel cycle, then transportation requirements can be considerably affected, depending upon the number and location of storage sites or waste repositories that are developed and the time frame of such development.

At this point, it is not clear how much of the President's National Energy Plan will be finally adopted. The President's proposals are controversial, but preliminary skirmishes indicate that, even though initial reactions were mixed, substantial congressional concurrence is likely. However, a Congressional Research Service study[21] indicated that the President's "last resort" approach to nuclear power implies a lean market for new orders for the U.S. nuclear industry. The prospect is that, by 1985, the industry will be weaker than it is today; it will be less able to service the plants that will then be in operation and will have greater difficulty in responding to any future decision to expand nuclear power. Although the plan anticipates minimum expansion of nuclear power, it includes no contingency recommendations for preserving U.S. nuclear capability if this planning assumption should be wrong.

Others have also concluded that American manufacturers of nuclear reactors are in deep trouble.[22] Their slumping markets show no signs of recovery, and the industry itself is now facing the disintegration of skills and production capability built up since World War II. In the early 1970s, utilities ordered an average of 30 reactors per year; in 1976, there were three orders and in 1977 four--although two are tentative preliminary contracts. The reason for this decline is that utilities have turned almost exclusively to coal. Export sales have virtually stopped, both because of administration export controls and because of foreign anti-nuclear sentiments. This could mean dismantling a generation of advanced technology.[23]

The General Accounting Office (GAO) sharply disagreed with the Carter administration's proposed reduction in breeder development funding, but concurred with the decision to defer nuclear fuel reprocessing--at least temporarily. GAO found that the economic benefits of reprocessing do not now outweigh the proliferation and domestic safeguards concerns.[24]

GAO has also found that the timetables established by ERDA (now the Department of Energy) and NRC for licensing high-level waste repositories are unjustifiably optimistic, while approvals for licensing the enlargement of spent-fuel storage at reactor sites are proceeding too hastily.[25] If GAO is right on both of these assessments, utilities may find themselves in a spent-fuel disposition squeeze.

Part of the energy plan involves a trade-off, deferring fuel reprocessing and postponing the plutonium breeder in return for expedited licensing of conventional light-water reactors. Initial industry reaction has been hostile to current administration proposals for reformed licensing procedures, both because of proposed funding of interveners and because of continued requirements for adjudicatory instead of rule-making hearings for plant licensing.[26]

According to the Congressional Research Service analysis, the energy plan implies that permanent waste repositories should be available by 1985. The plan does not indicate, however, whether the facilities will be for spent fuel or for other radioactive wastes. Considering the emphasis in the plan upon storage rather than reprocessing of spent nuclear fuel, presumably the facilities will be for spent-fuel disposal.

Until the long-term waste facilities are ready, nuclear utilities will have to make their own arrangements to store spent fuel, either by increasing storage capacity of existing reactor pools or by buying temporary storage service from others in the industry at sites away from reactors.[27] An ERDA study concluded that the nuclear industry is taking steps to expand spent-fuel storage capacities, both at reactors and at away-from-reactor storage sites. But if the plans such as those of General Electric for a major storage expansion at Morris, IL, or those of Exxon Nuclear for a large new storage facility at Oak Ridge, TN, do not materialize, there may be a number of reactors that will not have storage capabilities for scheduled discharges.[28]

ERDA is currently conducting an evaluation and crash testing program of spent-fuel casks. These tests are to determine how well containers used to transport nuclear materials can withstand severe accidents. It is possible that the results of such tests or evaluations could lead to amendments of design or licensing criteria for spent-fuel transportation casks. Any regulatory changes would result in additional time required to design and construct new casks--and engineering and licensing lead times for spent-fuel casks have already stretched to almost five years.[29]

In summary, nuclear transportation seemed a relatively settled issue when NRC and DOT regulations covering such transportation were promulgated. It now appears likely that evolutionary changes in regulations will occur in the future, that more agencies may become involved, and that the President's National Energy Plan, if adopted, may significantly affect the timing and extent of transportation requirements in the fuel cycle. Pending the final outcome of congressional policy decisions, the National Energy Plan raises significant uncertainties for the nuclear reactor transportation industry. Decisions regarding reactor spent-fuel storage, away-from-reactor storage sites, a permanent waste repository, international activities, and transportation requirements are closely interrelated. Implementation of such decisions involves different lead times, and delays anywhere in the system can lead to reactor shutdowns.

CHAPTER THREE NOTES:

PRINCIPAL FEDERAL ACTIVITIES AFFECTING NUCLEAR TRANSPORTATION

1. See NRC Office of Standards Development, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, NUREG-0170, Vol. 1, draft report (February 1977), Chap. II.

2. Executive Office of the President, The National Energy Plan (April 29, 1977) at 69-73.

3. 49 U.S.C. 1801.

4. 49 C.F.R. 170-79.

5. 42 U.S.C. 2111 et seq.; 42 U.S.C. 5801 et seq.

6. L. Gossick, "NRC's Role in Regulating Transportation of Radioactive Material," in Summary Report: 1976 AIF Conference on Transportation for the Nuclear Industry (February 1977) at 28.

7. 42 U.S.C. 4321-47.

8. A. Grella, "A Summary of the Basic Regulatory Requirements for the Transport of Radioactive Materials," paper presented at the 22nd Annual Meeting of the American Nuclear Society, Toronto, Canada, (June 16, 1976) at 9.

9. For a brief explanation of the Transport Index, see Appendix A of this report at A-5.

10. See A. Grella, "Recent Revisions to the IAEA Regulations for the Safe Transport of Radioactive Materials: What Are They and What Impact Will They Have on U.S. Regulations?" paper presented at the 18th Annual Meeting of the Health Physics Society, Miami, FL (June 20, 1973) at 6 and 10.

11. Memorandum of Understanding between DOT and AEC for Regulation of Safety in the Transportation of Radioactive Materials under the Jurisdiction of DOT and NRC, 38 F.R. 8466 (March 22, 1973), 1 CCH Nuc. Reg. Rep. 2028.

12. 49 U.S.C. 1801 et seq.; 42 U.S.C. 5801 et seq.; and 42 U.S.C. 7101 et seq., respectively.

13. Telephone conversation with Mr. Barry DeVine, Office of Hazardous Materials Operations, DOT (June 14, 1977).

14. See Office of Standards Development, NRC, Regulatory and Other Responsibilities As Related to Transportation Accidents, NUREG-0179 (June 1977) at 2.

15. 42 U.S.C. 4321.

16. 42 U.S.C. 2021(h).

17. Sections 301 and 120 of the Clear Air Act Amendments of 1977 (42 U.S.C. 7602, 7422) greatly expand EPA and state authority over radioactive emissions into the air. See also Conference Report, Clean Air Act Amendments of 1977, H.R. 95-564, 95th Cong., 1st session (Aug. 3, 1977) at 141-43.

18. Remarks of the President on Nuclear Power Policy, and Question-and-Answer Session, The White House (April 7, 1977) at 2,3.

19. National Energy Plan, supra note 2 at 72.

20. Id.

21. Congressional Research Service, Library of Congress, An Initial Analysis of the President's National Energy Plan (May 16, 1977) at 152-53.

22. N.Y. Times News Service "Reactor Makers Fear Collapse of Industry" Seattle Post-Intelligencer (Sept. 21, 1977) at E-4.

23. Id.

24. Comptroller General, An Evaluation of the National Energy Plan, EMD-77-48 (July 25, 1977) at x.

25. "ERDA is Too Optimistic About Nuclear Waste Disposal, says GAO," Energy Daily (Sept. 13, 1977) at 2; and "Radioactivity: Problems, Prospects for Disposal of Radioactive Wastes Viewed by House," in Current Developments, BNA Environment Reporter 749 (Sept. 16, 1977).

26. "Administration Defends Licensing Bill; Environmentalists Have Doubts," Energy Daily (August 26, 1977) at 2.

27. CRS Energy Plan Analysis, supra note 21 at 157-59.

28. Savannah River Operations Office, ERDA, 1977-86 LWR Spent-Fuel Disposition Capabilities, ERDA 77-25, 1977 ed. (May 1977) at 5 to 6.

29. R. Peterson, "Industry Views on Federal, State, and Local Regulations and Regulatory Processes," Summary Report: 1976 AIF Conference on Transportation for the Nuclear Industry (February 1977) at 36.

CHAPTER FOUR

STATE AND LOCAL ACTIVITIES THAT MAY AFFECT NUCLEAR TRANSPORTATION

4.1 Overview

Attempted state regulation of the transportation of radioactive materials at the back end of the nuclear fuel cycle presents difficult legal issues. Although the Department of Transportation and the Nuclear Regulatory Commission have adopted extensive regulations to govern the packaging and shipping of nuclear materials, a number of states have also enacted controls on such activities.

Examples of state or local controls on radioactive shipments include:

- Special routing.
- Advance notification and/or prior approval.
- State inspections.
- Escort or monitoring requirements.
- Limitations on hours of movement.

In addition, some localities, such as New York City and various towns in Vermont, have virtually prohibited certain nuclear shipments within their jurisdictions. Such actions are generally reflective of local fears--either of nuclear power or of a severe transportation accident.

Currently, the division of regulatory authority between the federal government on the one hand and states and localities on the other is not clearly resolved. Matters are further complicated by the Clean Air Act Amendments of 1977, which provide that radioactive emissions into the air are subject to both Environmental Protection Agency and state standards. A coordinated resolution of the problem appears necessary if the nuclear industry is to avoid significant state and local barriers to efficient transportation of nuclear materials. State and local opposition to nuclear transportation should be dealt with promptly in order to obtain a timely resolution of potential problems. To the extent that the additional state or local requirements are inconsistent along a transportation route, shipping costs could increase and efficiencies could decrease. Thus, depending upon the circumstances, transportation safety could be enhanced or reduced by state action.

The President's Energy Plan calls for licensing of the first nuclear waste repository by 1981.[1] To prevent transportation from becoming a nuclear fuel cycle bottleneck, issues concerning state and local regulation of transportation should be largely resolved by that time, and acceptable routing combinations selected.

The debate on the extent of federal and state powers to regulate nuclear energy is often emotionally charged, with each side taking polar positions. On the one hand, federal officials and the nuclear industry point out that there is a basic national policy to establish uniform regulation of nuclear transportation. To the extent that one state or locality is permitted to establish inconsistent requirements, others will follow. The result could be that the nation's nuclear transportation system would become chaotic and overburdened with differing requirements. Those who take this position hold that, if states are dissatisfied with the adequacy of federal regulation, they should petition appropriate federal agencies for reform. On the other hand, state and local officials point out that they, and not the federal government, are the most knowledgeable about specific local problems, and that they must be in a position to assume primary responsibility for responding to accidents. States have traditionally exercised police powers to protect public health and safety, and some of them are now moving vigorously to assert a leadership role in nuclear transportation.

Because of these strongly held positions, finding the precise demarcation between federal and state roles in this area is difficult. If there is to be a fair a equitable national policy permitting nuclear power, perhaps the federal government and the nuclear industry should accept all reasonable state and local requirements concerning routing, hours of operation, notification, escorts, and special speed limits--so long as a state or locality does not prohibit nuclear shipments unconditionally. Reasonable restrictions can be adapted to, but outright prohibition could permit states or localities to subvert national policies. If one area can ban nuclear transport, then it could happen elsewhere, and the result could be a preclusion of licensed nuclear facility operation.

Cooperation between federal and state authorities in the transportation of nuclear materials is highly desirable. Simply relying upon federal preemption of the field may not resolve the problems: state and local governments have numerous ways at their disposal to affect the transportation of nuclear materials, and some of these methods would require years of litigation before they could be struck down. Thus, it is prudent to examine various methods of intergovernmental cooperation that could resolve these differences.

4.2 Public Concern over Nuclear Power

Significant numbers of people oppose nuclear power. These people have had a direct impact on nuclear projects and have been able to exert sufficient influence to cause elected officials to respond to their concerns, resulting in public debates and confrontations over the U.S. nuclear program.

With the signing of the National Environmental Policy Act on January 1, 1970, the age of the environment was ushered in. With the coming of the environmental movement, threats to the natural environment and a general distrust of high technology have become important issues. For example, it was largely public concern over adverse atmospheric effects, noise, and economics that led to the congressional decision not to fund the development of a U.S. commercial supersonic transport aircraft.

Nuclear power has also become a cause célèbre of environmentalists. The controversy over this form of energy has bewildered nuclear power technologists who, for two decades or more, have worked on the "peaceful atom" with little doubt about the virtue of the task.[2] At first, questions of routine radioactive emissions from power plants were raised; then inadequacies concerning emergency core-cooling systems were pointed out. Environmental activists are now asking questions concerning waste management and the economics of nuclear power.[3] These largely political issues raised by opponents of nuclear power were not initially aired before the Atomic Energy Commission or the congressional Joint Committee on Atomic Energy (JCAE) because:

> These two bodies, convinced that nuclear power is necessary, desirable, and adequately safe, have cooperated over the years in efforts to avoid disclosure of the risks, for fear of unduly alarming the public, and to smother opposition to nuclear power. These efforts have been successful because of the unique nature of the JCAE, its domination of the atomic energy program, and its evolution as a power center functionally independent of the Congress as a whole. The power of the JCAE in controlling the consideration of energy matters in the Congress has made it impossible for opponents of nuclear power to press their contentions effectively at the political level.[4]

As a result of this inability to contest nuclear power in the national legislative arena, critics sought to delay or terminate proposed construction of new nuclear power plants. Both proponents and opponents of nuclear power found, however, that public hearings before the Atomic Energy Commission and court appeals were not a satisfactory forum:

> Public hearing procedures and the availability of intervention in nuclear power licensing appear to be primarily cosmetic devices, providing the illusion but not the reality of public participation in the process. The illusion, moreover, is maintained at substantial and unnecessary economic cost to the applicant, the government, and interveners, resulting in at most minimal contributions to the safety aspects of nuclear power, public confidence in the licensing process, and the credibility of the AEC.[5]

Nevertheless, nuclear power has become a symbol of misplaced priorities to some members of the environmental movement. Vigorous controversies concerning the construction of nuclear power plants continue. For example, in Seabrook, NH, 2,000 protesters recently set up a tent city in a construction site in an attempt to halt permanently the construction of two nuclear power reactors. When ordered to leave the site, most demonstrators stayed and were arrested. Those arrested were taken to a nearby National Guard armory and charged with criminal trespass. However, the Clamshell Alliance, which organized the demonstration, indicated that the protesters planned to return next year and to halt construction of the plant altogether.[6] In response to this demonstration, supporters of nuclear power also turned out: 3,000 utility employees, electricians, and plumbers, together with their families, demonstrated in Manchester, NH, demanding that work promptly be resumed at the Seabrook reactors.[7]

Although President Carter is seeking to speed the licensing of nuclear plants like the one at Seabrook,[8] some have predicted that:

> Our immediate prognosis is for extension rather than diminution of the opposition to nuclear technology. Public opinion, which has consistently supported nuclear power, is nonetheless deeply divided, much as it was during the war in Vietnam. There is some evidence that wider public exposure to rancorous debate on nuclear power may well stiffen the opposition. . . .[9]

This general controversy concerning nuclear power has manifested itself by actions in some states and localities to restrict nuclear development. For example, public initiatives for a moratorium on nuclear development went on the ballot in California, Arizona, Colorado, Montana, Ohio, Oregon, and Washington. All were defeated; nevertheless, similar initiatives are being prepared in another 19 states.[10] It is beyond the scope of this report to examine these general antinuclear activities, but in some instances they have resulted in state or local actions that affect the transportation of spent nuclear fuel or wastes. These actions are discussed in the following section.

4.3 Emerging Patterns of State Regulation of Nuclear Transport

4.3.1 State Regulation Consistent with Federal Law

Many states have adopted hazardous materials control acts that regulate nuclear and radioactive material transportation. Often, the expressed policy of such state legislation is to establish a single system of control that is both consistent with controls in other states and compatible with federal controls concerning nuclear materials transportation.

About one-half of the states have adopted by reference, in whole or in part, the federal hazardous materials transportation regulations of the Department of Transportation (49 C.F.R. 170-79).[11] States have adopted these regulations[12] for two reasons: (1) to apply to that intrastate transportation over which DOT does not exercise its jurisdiction; and (2) to permit the states to enforce these requirements independently, either on their own or under cooperative agreements and joint funding with DOT.[13]

A state transportation surveillence program has also been started under the sponsorship of DOT and NRC. This program, which involves five states, provides modest funding for radiation monitoring equipment. Its purpose is to enable the states to collect data on both the level of compliance with and the adequacy of DOT and NRC regulations. In addition, the program provides participating state police with training in radiation monitoring and enforcement.[14]

The chief of the South Carolina Bureau of Radiological Health recently indicated that enforcement activities in his state would consist primarily of licensee compliance inspections, with the addition of random surveillance inspections of materials shipments to determine compliance with regulations. The inspections are designed both to minimize inconvenience to carriers and to avoid overreaction on the part of the general public. The chief concluded, "Unwarranted travel restrictions, rerouting, prior notifications, special escorts, etc. are not being discussed by governing bodies."[15] This favorable view of nuclear power in general and nuclear transportation in particular, together with confidence in the adequacy of federal transportation regulations, apparently characterizes the regulatory attitude of the majority of states.

This situation is not uniformly the case. Some state and local regulations are either more restrictive than or incompatible with federal regulations; examples of these will be discussed below.

4.3.2 State Regulation in Addition to or Inconsistent with Federal Regulation

General routing restrictions. Because of either structural weight limits, problems with congestion in the event of an accident, or limitations on accident response capabilities, many state or local governments have imposed general restrictions on the transportation of hazardous materials. These restrictions usually apply to the transportation of all hazardous materials, of which nuclear materials are one type. Examples of such restrictions include prohibitions on the use of certain kinds of bridges or tunnels, requirements for advance notification or for escort vehicles, restricted hours of operation, insurance requirements, limitations on parking or standing, and weight limitations.[16] In many states, a transportation regulatory agency has adopted rules requiring special hauling permits for certain types of loads. These requirements apply to loads that exceed specified dimensions, weights, or parameters.[17] In some states, these special permits, in addition to designating routes, may specify certain hours of transport, require communication at certain checkpoints, or establish other safety-related requirements.[18]

Although these requirements may impose both inconveniences and additional costs (particularly if they are not consistent along a transportation route), they appear to be customary in regulating the transportation of hazardous materials. Because states or localities have special knowledge of hazards or problems affecting the transportation of hazardous materials through their boundaries, federal transportation regulations provide for special state restrictions in this regard. For example, Federal Highway Administration regulations require:

> Every motor vehicle containing hazardous materials must be driven and parked in compliance with the laws, ordinances, and regulations of the jurisdiction in which it is being operated, unless they are at variance with specific regulation of the Department of Transportation which are applicable to the operation of that vehicle and which impose a more stringent obligation or restraint.[19]

The attached map shows those states which have reported to DOT regarding the highway facilities for which hazardous materials transportation is restricted (see Figure 4.1). It appears that not all of the states that have restrictions have reported them, however. For example, Connecticut is shown as an unrestricted state although, as discussed below, it places restrictions on the transportation of certain nuclear materials.

In addition, there is some state regulatory activity concerning railroad transportation of hazardous materials. As in the case of highway regulations, most state activity here involves adoption of federal hazardous materials regulations in order to permit state enforcement of these requirements.[20]

Restrictions concerning nuclear shipments. Some states have taken an activist approach toward regulating the transportation of nuclear materials. Recent transportation actions are often a by-product of efforts by states to prevent the siting of nuclear waste repositories within their borders. Federal officials generally take the view that many of the state transportation regulations are preempted by federal activity in this area.[21] Others point out that, although the operational reality of federal-state relations may be framed by legal considerations, these relationships are also influenced decisively by political and economic considerations:

> Whether or not state regulation would be eventually declared federally preempted and hence invalid in a court test, the governor, legislature, or people of a state can in many ways effectively resist an activity within the state's borders that is authorized or directed by the federal government.[22]

As a result, resolution of conflicts between federal authorities and state and local authorities often requires cooperation and accommodation. The state and local activities described below are illustrative of actions that can be taken by states.[23] Some of these actions may ultimately be found to be unlawful, but, in the meantime, shippers or carriers face possible citations, fines, or arrests for failure to comply with these requirements.[24]

Connecticut. The State of Connecticut has authorized its Commissioner of Transportation to initiate a program prohibiting the transportation of large quantities of nuclear material or nuclear waste without first obtaining a permit. A permit is granted if the Commissioner determines that the transportation of such material will be accomplished in the manner necessary to protect the public health and safety.[25] The Commissioner requires all shipments of

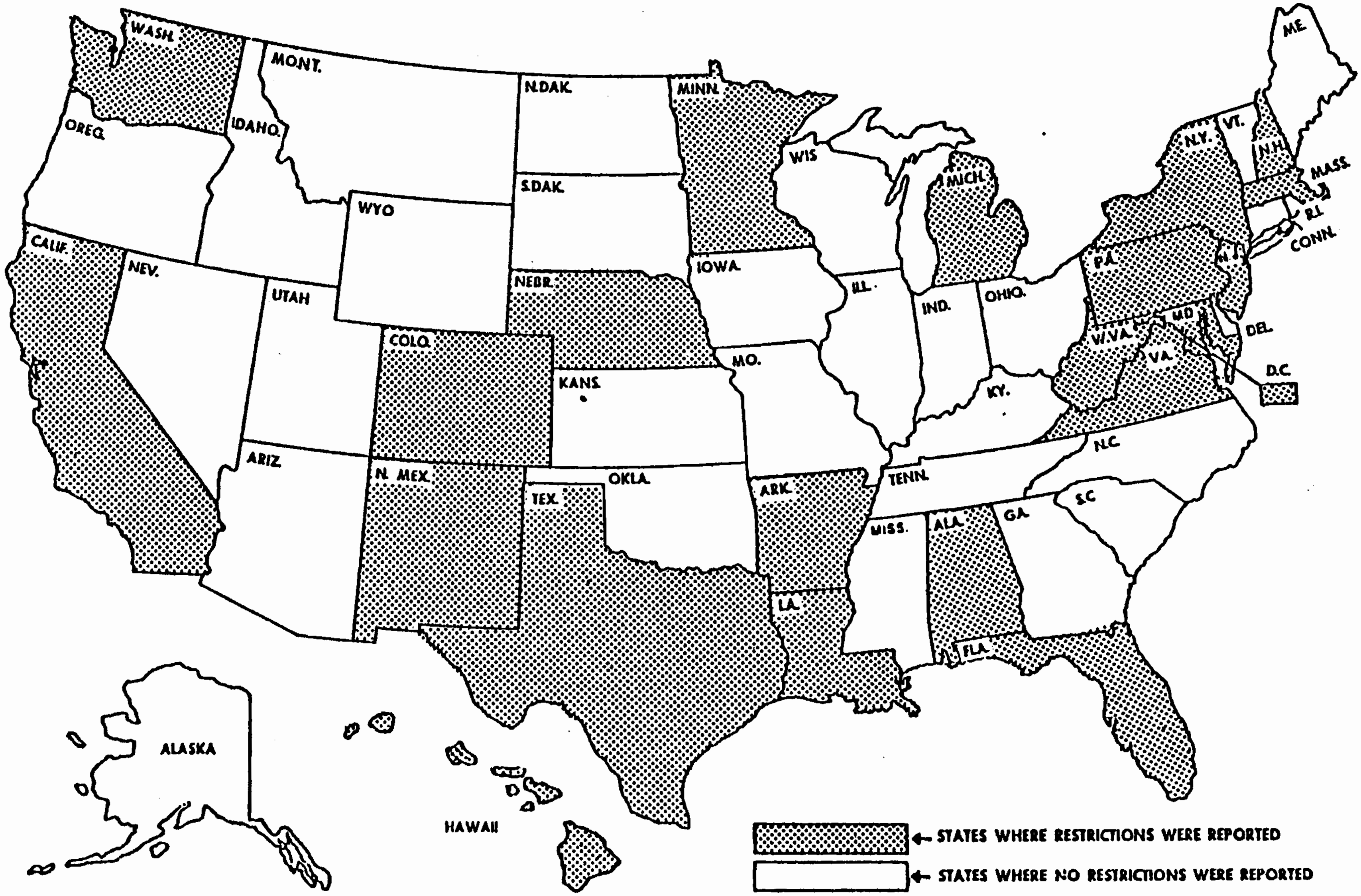


Fig. 4.1. State restrictions of hazardous materials transportation.

radioactive waste materials and spent fuel through the state to be escorted by the police.[26] He may require changes in dates, routes, times, or the use of escorts if he considers such steps necessary for the protection of the public. Violators of the Act are subject to fines of up to $10,000 for each violation.[27]

Minnesota. By statute, Minnesota has prohibited permanent storage of radioactive wastes within the state, as well as the transportation of such wastes into the state. Temporary storage is permitted for up to 12 months. Also, transportation of radioactive wastes into the state is allowed as long as arrangements exist for removal of the materials within 12 months. A violation of the act is considered a gross misdemeanor and is punishable by a fine of up to $10,000 and/or one year's imprisonment.[28]

New Mexico. The Radioactive Materials Disposal Act, which expires on March 31, 1978,[29] establishes a one-year moratorium on transporting radioactive material into New Mexico for purposes of disposal. This legislation was aimed at deferring the plans of Chem-Nuclear of Bellevue, WA, to establish a low-level radioactive waste repository in northeastern New Mexico. The moratorium is intended to provide appropriate state agencies with sufficient time to conduct the necessary environmental and other studies concerning such activities.[30] Violation of the Act is punishable as a felony with a fine of $1,000 per day. This temporary prohibition of nuclear transportation is a compromise that the industry can live with and apparently will not challenge in the courts.[31]

North Carolina. Transportation of spent fuel through North Carolina is prohibited unless the State Highway Patrol is notified in advance. Violations are punishable by a fine of not less than $500 for each unauthorized shipment.[32]

Oregon. The State of Oregon has adopted legislation empowering the Energy Facility Siting Council to regulate the transportation of all radioactive material going to or from any nuclear installation within the state. The legislation requires power plant operators and transporters of radioactive materials to keep the appropriate officials fully informed on the procedures, routes, and schedules for transporting such materials.[33] The Oregon regulations implementing the statute require shipments of spent fuel or high-level radioactive waste (except for those shipments made by or under the direction of ERDA, NRC, or the Department of Defense for national security purposes) to be made only after the carrier has provided the required notification to appropriate officials and has authorized the Energy Facility Siting Council to designate routes, hours of transport, checkpoints on the routes, and other safety precautions.[34] Nuclear shipments to which the Oregon statutes and regulations apply have gone smoothly under the direction of the Energy Facility Siting Council.[35]

The State of Oregon takes a very expansive view of its regulatory authority over the transportation of radioactive materials. An opinion by the Attorney General of the State of Oregon concluded that:

> Statutorially, it appears that the Energy Facility Siting Council (EFSC) is empowered to regulate the in-Oregon transportation process for <u>all</u> radioactive materials derived from or destined for <u>any</u> thermal power plant or nuclear installation, regardless of in- or out-of-state location of such plant or installation.[36]

The difficulty with this interpretation is that it rests on the assumption that most aspects of the transportation of by-product materials, source materials, and special nuclear materials within the state have been delegated to the State of Oregon. This assumption is based on a 1965 agreement between Oregon and the Atomic Energy Commission, the predecessor to the Nuclear Regulatory Commission. However, according to Section 274b of the Atomic Energy Act,[37] the Commission can turn over to a state the regulatory authority concerning special nuclear materials only when the quantities of these materials are not sufficient to form a critical mass. Thus, it appears that, under federal law, the Nuclear Regulatory Commission is barred from relinquishing its regulatory authority concerning the transportation of high-level radioactive waste and spent fuel.[38]

<u>New York State</u>. The Commissioner of the New York State Department of Transportation administers the state's Transportation of Hazardous Materials Act, which was approved July 21, 1976, and became effective April 1, 1977.[39] Under this Act, the Commissioner has the power to promulgate rules governing all modes of transportation in commerce of those hazardous materials whose transportation may pose an unreasonable risk to health, safety, or property. When radioactive materials are transported through a municipality, the State Department of Transportation's regulations may be superseded by local ordinance or federal law if either of the latter is more stringent than the former.[40] This provision becomes particularly relevant in the case of New York City, whose restrictions on the transportation of spent fuel and certain other nuclear materials are discussed in the next section.

Recent litigation concerning the air transport of certain nuclear materials, while not directly affecting the transportation of spent fuel or high-level radioactive waste, may be indicative of the attitude towards nuclear transportation held by some state officials. On May 5, 1975, the State of New York brought suit against seven federal agencies, seeking declaratory and injunctive relief against air transportation of plutonium and other special nuclear materials. The state sought a preliminary injunction on the grounds that an environmental impact statement had not yet been prepared. It also argued that an accidental crash or terrorist activity could result in the release of highly radiotoxic plutonium, causing irreparable harm. The denial of the preliminary injunction was upheld by the Court of Appeals in New York v. Nuclear Regulatory Commission.[41] Although the opinion was not a final decision on the merits of the case, it implied that the relief requested was likely to be denied after a full hearing, as well. The court stated:

> It is clear that appellant has failed to establish that there is any but the most remote of possibilities that an accidental crash of an airplane transporting SNM [Special Nuclear Materials] will occur or that, even if it did occur, the crash would result in the various catastrophic consequences appellant prophesies.[42]

New York City. The City of New York amended its health code on January 15, 1976, to restrict the transportation of radioactive materials in and through the city. As amended, Section 175.111 of the Code requires that a Certificate of Emergency Transport be issued by the Commissioner of Health or his designate for each shipment of certain radioactive materials, including spent fuel and wastes, to be transported into or through the city. Subsection (c) of section 175.111, however, was amended to make shipments by or for the United States in connection with national defense exempt from this requirement.

The explanatory notes to the adoption of the resolution indicate that the movement of such materials "would present a great hazard to public health in this densely and highly populated City."[43] In addition, the explanatory notes indicate that:

> It is intended that such Certificate will be issued for the most compelling reasons involving urgent public policy or national security interests transcending public health and safety concerns and that economic consideration alone will not be acceptable as justification for the issuance of such Certificate.[44]

As a consequence, the practical effect of the New York City regulation is to prohibit the shipment of significant quantities of certain nuclear materials in the city. Primarily affected are the Brookhaven National Laboratory, which is now shipping nuclear materials via a Long Island

Sound ferry, and the Long Island Lighting Co., which has one reactor under construction and two more planned.

New York City Health Commissioner Lowell E. Bellin pointed out that the city regulation does not affect medical shipments or those intended for national security purposes. He called for federal-city cooperation, but said federal officials must recognize "that it is entirely inappropriate to use the largest urban center in the U.S., and one of the most densely populated, as the primary transit route for a rapidly growing traffic in highly dangerous radioactive materials."[45]

In addition, the city takes the position that its nuclear transportation restrictions are consistent with Federal DOT regulations. The City points out that 49 C.F.R. 397.9(a) provides:

> Unless there is no practical alternative, a motor vehicle which contains hazardous materials must be operated over routes which do not go through or near heavily populated areas, places where crowds are assembled, tunnels, narrow streets, or alleys.[46]

On the same day that the New York City regulation was adopted, the U.S. Attorney for the Southern District of New York filed a motion for a preliminary injunction in U.S. District Court to prevent the city from enforcing its new regulation. The requested relief was denied, leaving the regulation in effect while legal proceedings continue.[47]

In addition to the judicial remedies being sought to void the New York City regulation, Associated Universities, Inc. (the operator of the Brookhaven National Laboratory) and ERDA are seeking an administrative ruling by DOT on whether the New York City regulation is inconsistent with, and thus preempted by, the federal Hazardous Materials Transportation Act. The government's challenge of the New York City action will be the first test case under the Act to determine the extent to which local regulation of nuclear transportation will be permitted. The government contends that the New York City regulation:

> . . . thwarts the regulatory scheme established by the Department of Transportation by prohibiting within New York City shipments of radioactive materials made in full compliance with the Hazardous Materials Transportation Act and implementing regulations, a result clearly inconsistent with the objectives and purposes of Congress in enacting the Act. Congress intended to regulate commerce by providing strict standards ensuring that the risks associated with

> the transportation of hazardous materials were remote, and further, intended that localities respond only to purely local safety concerns which are not susceptible of uniform federal regulations.[48]

On the other hand, the City of New York argues that the federal government has grossly underestimated the serious public health implications and potentially disastrous consequences of transporting spent fuel and certain other radioactive materials through major urban population centers:

> There is no federal preemption where, as here, a locality enacts regulations which are not only of vital local health concern but are entirely consistent with federal regulation in the area. [The federal regulations] acknowledge the right of localities to impose more stringent regulation and require carriers to avoid densely popluated areas.[49]

On August 15, 1977, DOT invited public comment upon the application for an inconsistency ruling.[50] As is further discussed in Section 4.4, below, once a determination on inconsistency has been made by the Director of the Office of Hazardous Materials Operations (OHMO), an appeal may be taken to the Director of the Materials Transportation Bureau (MTB) and then to the courts. If a final decision on inconsistency has been reached, the state or locality can still apply to the OHMO for a determination that the particular requirement that is inconsistent is not preempted. As in the case of an inconsistency ruling, appeal may also be taken on a preemption determination to the Director of the MTB and the courts.[51] Thus, final resolution of this issue, depending upon the perserverance of the parties, could require years.

Significantly, the nuclear industry has indicated that it can live with the restrictions on nuclear transportation that the City of New York imposed prior to the current regulations discussed above. The old rules permitted shipments only between the hours of 12:00 a.m. and 6:00 a.m., with a police escort, and at a maximum speed of 30 mph.[52] Perhaps this approach, together with other reasonable precautions, can be reinstated as a compromise.

Vermont, Louisiana, Montana, and South Dakota. On March 1, 1977, at a series of town meetings in Vermont, 31 out of 36 towns that considered the issue voted to ban the construction of nuclear power plants and the transportation and storage of nuclear waste within their borders. Reportedly, the Vermont Public Interest Research Group sought these test votes to demonstrate that a broad sampling of public opinion is opposed to further nuclear power development.[53]

Although the regulation of radioactive waste repositories does not directly affect spent fuel or high-level radioactive waste transportation, Vermont, Louisiana, Montana, and South Dakota recently prohibited the construction of such facilities in their respective states without specific legislative approval. Exceptions are generally provided for temporary high-level radioactive waste storage of spent fuel or disposal of small quantities of radioactive material.[54]

The Vermont town meetings and the legislation in other states banning the disposal of radioactive material illustrate that there is strong public opposition to nearby radioactive waste disposal. Similiarly, a significant increase in the transportation of spent fuel or high-level radioactive waste could be met with stiff public political opposition.

Michigan. States disagree over the extent to which they may regulate nuclear transportation. For example, the Director of the Michigan Department of Public Health requested an opinion from the Michigan Attorney General concerning the degree to which the state is preempted by NRC and DOT from controlling the transport of nuclear waste, spent fuel elements, and other radioactive materials. The Attorney General responded as follows:

> It is therefore my opinion that the State is preempted from controlling the transport of nuclear waste, spent fuel elements, and other radioactive materials. This responsibility is under the sole control of the Nuclear Regulatory Commission in the absence of a turnover agreement vesting the State with duties and powers pursuant thereto.[55]

The Michigan Attorney General pointed out, however, that this prohibition applies only to the regulation of transportation for purposes of protection against radiation hazards, and that any state or local agency may have authority to regulate transportation activities for other purposes.[56] For example, in another opinion, the Attorney General has stated that Michigan can prevent the location of a federal nuclear waste disposal facility in the state by the exercise of its control over land use.

Other potential state regulation. The Chief of ERDA's Transportation Branch has exhaustively studied a number of state proposals which were intended to improve public safety in nuclear shipments (although they may not actually result in such improvements). In a recent paper,[58] he discussed some common state regulatory proposals:

- Routing restrictions or prohibitions to avoid highly populated or dangerous areas.

- Advance notification of certain shipments.
- Prior approval of individual shipments.
- Inspection of shipments.
- Escorts in separate vehicles.
- Speed restrictions to reduce the severity of accidents.
- Specific hours of movement to avoid rush hours.
- Special training of drivers.
- Limitations on radiation exposure of both transportation workers and the public.
- State enforcement of federal regulations.
- Accident investigations by state officials.
- Minimum track standards for rail shipments.
- Special train service with no other freight to permit greater control of radioactive shipments.
- Pilot trains or trucks to precede nuclear shipments to insure no roadbed or road hazards exist.
- Accompanying monitoring personnel with radiation detection equipment to measure levels periodically en route, as well as in the event of an accident.

These and other kinds of transportation restrictions can be directly imposed, as was discussed in the summaries of selected state regulations above. In addition, some states may be able to impose such transportation requirements indirectly. Possible mechanisms include (1) the attachment of conditions to the granting of certificates of public convenience and necessity or other permits for nuclear facilities, (2) the imposition of taxes to modify certain behavior, and (3) the use of hearing procedures to focus public attention on certain nuclear problems. These matters are discussed briefly below.

Transportation safety has become a major issue in nuclear facility licensing proceedings.[59] Certificates of public convenience and necessity or other permits are required in many states for the construction of nuclear power plants or other facilities. Depending upon the specific enabling legislation, states and localities may be in a position to attach transportation conditions when granting such certificates or permits. For example, Oregon's

Energy Facility Siting Council is considering the adoption of standards that would deny site certificates unless the Council concluded that any wastes produced at the facility would be accumulated, stored, and transported in a manner that minimizes risks to the public health and safety.[60]

Although there is an explicit congressional mandate in the Atomic Energy Act of 1954 that the regulation of nuclear power plants, in terms of radiation hazards, is to remain the exclusive province of the federal government, Congress has also declared that state and local agencies can regulate nuclear activities (1) for "purposes other than protection against radiation hazards" and (2) for controlling radioactive emissions into the air.[61] It is conceivable, although not very likely, that a state could make the granting of nuclear power plant construction permits conditional on an agreement to utilize a particular transportation approach. To the extent that a state or locality is successful in demonstrating that such restrictions do not rest on a concern about radiological safety and are not an undue burden on commerce, it is possible that these regulations could successfully withstand challenge. Also, under the Clean Air Act as amended in 1977, states or localities could promulgate standards for radioactive emissions into the air; these standards could restrict or prohibit the construction or operation of nuclear facilities within their jurisdictions.

The granting of some state permits, certificates, or land use planning approvals requires public hearings. At these hearings, intervention by certain parties can be utilized as a delaying device; such intervention can also provide a catalyst for marshalling local opposition to nuclear facilities or their associated transportation requirements. If public opposition to nuclear fuel cycle transportation becomes widespread, securing appropriate permits or authorizations for nuclear transportation could become even more difficult than is the case with fixed reactors, since nuclear transportation is a recurring and visible activity that may involve dozens of jurisdictions.

Another power that may be utilized by certain state governments to influence nuclear transportation is the power to tax. Of course, the state objective is likely to be something other than restricting nuclear transportation, but taxation can have an effect on other nuclear activities that in turn would impact upon transportation requirements. Direct state taxes on interstate transportation activities would be unlikely to be upheld in the face of a commerce clause challenge. However, an indirect tax could also affect transportation activities. For example, Kentucky recently imposed a 10¢ per pound excise tax on the disposal of all commercial low-level radioactive waste materials entering the state. The tax imposed what amounted to a

5,000 percent increase in burial costs, which caused the Nuclear Engineering Corporation virtually to close its Maxey Flats site and to use alternative sites available at other locations.[62] In this case, a state government, by imposing a tax of sufficient magnitude to change commercial conduct, nearly ended the transportation and disposal of commercial low-level radioactive wastes in its jurisdiction.

In addition, local concerns occasionally attract sufficient attention to result in action on the national level. After the State of New York unsuccessfully sought to enjoin federally licensed air shipments of plutonium and enriched uranium over the state, Congress imposed strict limitations on the air shipment of plutonium. In Section 201 of the 1975 Nuclear Regulatory Appropriations Act, NRC is prohibited from licensing the air transportation of plutonium until it can certify to a congressional committee that "a safe container has been developed and tested which will not rupture under crash and blast testing equivalent to the crash and explosion of a high-flying aircraft."[63] Even though state nuclear moratorium legislation has been rejected by voters in several states, Congress is now considering legislation to provide either that (1) NRC cannot act on any application for construction licenses unless the proposed facility has been approved by the affected state, or (2) construction licenses under the Atomic Energy Act will be subject to state disapproval during a 90-day period following license issuance.[64] Of course, it is not clear whether this or other legislation opposed by the nuclear industry is likely to be enacted. However, the abolition of the Joint Committee on Atomic Energy--which largely decided nuclear policy in the United States for over a quarter of a century, and, in the process, developed a decidedly pronuclear bias[65]--may weaken the nuclear industry's position in Congress. The Joint Committee's jurisdiction was assigned to four committees of the House and three committees of the Senate; these committees may be less responsive to the nuclear industry than was the Joint Committee.

4.4 Federal Statutory Provisions for State Regulation of Certain Nuclear Transportation

As was discussed in Chapter Two, DOT and NRC extensively regulate the packaging and shipping of spent fuel and high-level radioactive waste materials. The Clean Air Act Amendments of 1977 also give EPA a strengthened role in controlling radioactive emissions into the air. In light of this dominant federal regulatory role, questions may be raised as to whether the examples of state regulations discussed above are likely to withstand court challenge. No definite answer can be given, pending the outcome of administrative proceedings and judicial actions that are now under way. However, even if state actions based upon state constitutional or statutory authority are not upheld, the existing federal statutory scheme recognizes at least five other ways in which a state can validly regulate the transportation of nuclear materials:

1. Under Section 112 of the Hazardous Materials Transportation Act, a state regulation of the transportation of hazardous materials may be upheld if it is consistent with the federal scheme of regulation. Even if it is inconsistent, a state regulation may still be enforced if the Secretary of Transportation or his delegate determines that it (i) affords an equal or greater level of protection to the public than that provided by federal statutes and regulations, and (ii) does not unreasonably burden commerce.

2. Under Section 274 of the Atomic Energy Act of 1954, the NRC may relinquish to states individually, by agreement, certain aspects of the Commission's responsibility for regulating radiological hazards arising from the use or transportation of radioactive materials.

3. Section 274 of the Atomic Energy Act confirms that federal preemption does not extend to state or local regulations that have purposes other than the control of radiation hazards, even if such requirements may have an incidental impact upon the use of nuclear materials licensed by NRC.

4. In some cases, a state may be free to regulate the intrastate aspects of certain nuclear shipments.

5. Under Sections 112 and 301 of the Clean Air Act Amendments of 1977, states may regulate radioactive emissions into the air.

These possibilities for state regulation are discussed further below.

4.4.1 The State Role under the Hazardous Materials Transportation Act

Section 112 of the Hazardous Materials Transportation Act[66] provides that any state or local requirement that is inconsistent with either the Act or any regulations issued under it is preempted, unless the Secretary determines that the state or local requirement:

1. Affords an equal or greater level of protection to the public than that provided by federal requirements; and

2. Does not unreasonably burden commerce.

DOT has adopted regulations to establish administrative procedures for implementing Section 112.[67] These procedures are intended to provide states, localities, and affected persons with the opportunity to seek administrative rulings on the consistency or inconsistency of any state or local requirement. The regulations also establish procedures by which states or localities can obtain a formal determination that their inconsistent requirements are not preempted. Thus, the regulations would allow two types of state or local requirements to remain in force: (1) those that are consistent with federal regulations; and (2) those that are inconsistent with federal regulations but that receive a determination of nonpreemption by the Secretary because they (i) afford an equal or greater level of protection and (ii) do not unreasonably burden commerce.

What does "inconsistent" mean in this context? Presumably, the clearest case is one in which it is impossible to comply with both state and federal law--for example, where a state law mandates action which is prohibited by federal law. On the other hand, no conflict is generally found where the regulations of the state and federal governments have different purposes and where there is little additional cost or difficulty in complying with both. Between these two extremes lies a gray area where it is difficult to forecast administrative or court decisions.[68]

DOT's regulations also indicate the factors to be considered by the Department in determining whether a state or local regulation is an undue burden on commerce:

- The extent to which the state or local requirements result in increased costs and impairment of efficiency.

- The rationality of the basis for a state or local requirement.

- The extent to which the state or local requirement achieves its stated purpose.

- The need for uniformity with regard to the subject concerned, and, if there is such a need, the extent to which the state or local requirement complements or conflicts with those of other states and localities.[69]

These regulations are intended to incorporate the Supreme Court's test for an unreasonable burden in commerce. This standard, which has caused confusion and delighted law review commentators, does not lend itself to reliable prediction in a given case. Thus, under the Hazardous

Materials Transportation Act, the Secretary of Transportation or his delegate has broad discretion in dividing regulatory responsibilities between the federal government and the states. The Secretary may choose to value uniformity of regulation very highly, or he may permit substantial regulation by the states.

DOT regulations specify that the inconsistency and preemption rulings are determinations that compare the Hazardous Materials Transportation Act and the regulations issued under it to the state or local requirement in question.[71] There is no requirement that any other law, such as the Atomic Energy Act, be considered. A potential ambiguity could occur if, for example, DOT determined that a state requirement was not preempted and yet that state requirement violated the Atomic Energy Act. This ambiguity could be readily resolved, however, by (1) DOT-NRC cooperation; or (2) a separate challenge, by either NRC or an interested party, of the state requirement under the Atomic Energy Act or other applicable law.

There are other opportunities, as well, for state action in the regulation of transportation. Most states have entered into agreements with DOT for cooperation and state enforcement with regard to federal hazardous materials regulations.[72] Although DOT's statutory jurisdiction extends to the regulation of intrastate carriers, DOT generally exercises its authority to regulate hazardous material transportation only with respect to the intra- and interstate activities of interstate carriers, and leaves to the states the regulation of intrastate carriers.

Thus, in both law and practice, the division of transportation regulatory responsibilities between federal and state governments is not always clear.

4.4.2 State Regulation under the Atomic Energy Act

Section 274 of the Atomic Energy Act permits NRC to share some of its regulatory authority with the states upon the execution of an agreement between the Commission and the governor of a state.[74] Currently, 25 states have entered into such agreements, which provide them with regulatory authority over by-product material, source material, and less-than-critical quantities of special nuclear material.[75] The state role has generally been interpreted as being a rather minor one, covering the regulation of research, medical, or industrial activities that only use minimal quantities of radioisotopes, natural uranium, or special nuclear materials. It has generally been assumed that the regulation of more hazardous activities, such as the construction and operation of nuclear reactors, would be reserved for federal responsibility.[76]

Industry experts[77] and federal regulators[78] are of the view that NRC was banned from relinquishing its regulatory authority with respect to the packaging, shipment, or carriage of spent fuel or high-level radioactive wastes. However, some state officials believe that agreement-state status permits a state to regulate spent-fuel shipments. For example, the Attorney General of the State of Oregon has taken the position that Oregon's agreement-state status, together with the legislation that the state has enacted, gives the Energy Facility Siting Council jurisdiction to regulate, within Oregon, all transportation of spent fuel and high-level radioactive waste being transported from or to any nuclear reactor.[79] Because Section 274 of the Atomic Energy Act precludes the NRC from turning over jurisdiction concerning critical amounts of special nuclear materials, it would appear that the Oregon interpretation of state authority is too broad. However, a lawsuit may be required to settle the issue. In the meantime, a shipper who ignores Oregon's regulations may be doing so at his peril.

4.4.3 State or Local Regulations for Purposes Other than the Control of Radiation Hazards

Section 274k of the Atomic Energy Act provides that "nothing in this Section shall be construed to affect the authority of any state or local agency to regulate activities for purposes other than protection against radiation hazards."[80] Thus, for state requirements that (1) establish weight, height, or length limitations for shipments of hazardous materials, and/or (2) require special permits for overweight loads that confine movements to certain hours, there appears to be no preemption under the Atomic Energy Act.

In addition, of course, there is a gray area with respect to the permissible scope of incidental effects of state regulations imposed for purposes other than protection against radiation hazards. Furthermore, state regulation of utilities (including those that operate nuclear plants) is expressly contemplated under Section 271 of the Atomic Energy Act.[81] The difficulty is that there is no clear line between state regulation of a utility's rates and services and some consideration of the radiation-safety aspects of the operation of nuclear power plants and associated transportation.[82] As a result, state transportation conditions issued in conjunction with siting or rate proceedings, if found not to unduly burden interstate commerce, could be determined to be a permissible area of state regulation.

4.4.4 State Regulation of Intrastate Nuclear Transportation

The jurisdiction of DOT under the Hazardous Materials Transportation Act is limited to transportation affecting interstate commerce. Under this test, shipments do not have to cross state lines in order to be subject to DOT jurisdiction. Nevertheless, it is possible that, at some point, as shipments become shorter and more localized, a court could find that they no longer affect interstate commerce and hence are not subject to DOT control.

NRC jurisdiction, however, is not so constrained. For shipments that are not in interstate or foreign commerce, NRC regulations at 10 C.F.R. 71.5 require licensees to conform to DOT's standards and requirements to the same extent as if the shipment or transportation were in interstate or foreign commerce. Because of these regulations, it appears that there is not a significant regulatory gap in federal authority over the transportation of spent fuel and high-level radioactive wastes.

Another type of regulatory gap, however, might be of concern. Although NRC has expressly exempted common and contract carriers from licensing requirements, it does require licensees to assure compliance.[84] In the case of agreement-states, this poses no problem, since all agreement-states require that packing and transportation comply with DOT standards.[85] In addition, many states--both agreement-states and nonagreement-states--have adopted the DOT regulations by reference. However, in those states that are neither agreement-states nor among those that have adopted DOT regulations, there may be a regulatory gap concerning transportation of nuclear materials that (1) does not affect commerce and (2) does not involve NRC licensees. It is not clear, however, whether such a regulatory gap in fact exists, or whether, if it does exist, it would prove to be troublesome.

4.4.5 State Jurisdiction under the Clean Air Act

As was discussed in Chapter Two, the Clean Air Act Amendments of 1977 (P.L. 95-95) may sharply change pre-existing regulatory authority concerning radioactive emissions into the air. The Atomic Energy Act reserved for the federal government the regulation of radioactive emissions of major facilities such as power plants. In Train v. Colorado Public Interest Research Group, 96 S. Ct. 1938 (1976), the U.S. Supreme Court held that radioactive materials that are discharged into navigable waterways cannot be regulated by EPA as "pollutants" under the Federal Water Pollution Control Act (FWPCA) if the discharges of such materials are subject to the jurisdiction of NRC under the Atomic Energy Act. Although the statutory language of FWPCA appears to provide EPA with jurisdiction over emissions of all radioactive materials, the court examined the legislative history of FWPCA and found a congressional intent to maintain, under the Atomic Energy Act, exclusive NRC jurisdiction over radioactive emissions. The legislative history and the statutory language of the Clean Air Act, as amended in 1977, are in sharp contrast to those of the FWPCA. Section 122 of the Clean Air Act explicitly provides for EPA jurisdiction over radioactive emissions into the air, even in instances where the NRC also has jurisdiction. In addition, such radioactive emissions are subject to the full regulatory framework of the Clean Air Act, including the possibility of the establishment by states or localities of standards that are more stringent than those of the federal government. Thus, the strict federal preemption of state or local control of radiation emissions under the Atomic Energy Act is directly undercut by the Clean Air Act Amendments of 1977. The full implications of this change may require litigation and possible legislative clarification, but it is clear that the amendments enlarge state authority over nuclear activities.

4.5 Approaches towards Resolution of Potential Conflicts between Federal and State Regulation of Nuclear Transportation

With the extensive federal regulation of shipments at the back end of the nuclear fuel cycle, and with an expanding body of state regulations that also apply to these shipments, there is likely to be growing confusion and added expense in the transportation of nuclear materials. It has been suggested that there is a widespread feeling among those who are regulated that there are too many rules already and that the rules are too complicated. If the various regulatory systems are made even more complex by a multiplicity of different state rules, a possible result will be more rules but less compliance.[86]

Additional problems are caused by the fact that some regulations may have the appearance of greater safety but may actually increase risks. For example, circuitous routing on side roads to avoid heavily populated areas may produce more accidents than the use of safer, interstate highways.[87] At the same time, however, states and localities may be acting in response to specific, legitimate concerns that could require attention.

To assure that a safe and practical means of nuclear transportation is achieved, differences between state and local regulations need to be worked out and inconsistencies resolved. Possible approaches include:

1. Seek administrative and/or judicial remedies to obtain rulings concerning inconsistency and preemption of state and local regulations.

2. Attempt a legislative clarification, setting out the specific roles for the federal government, on the one hand, and those of states and localities, on the other.

3. Consider the advantages and disadvantages of the federal government's handling transportation at the back end of the nuclear fuel cycle, either directly or through a contractor.

4. Resolve differences by mutual agreement between state and federal agencies.

Although all these approaches can be used for resolving differences between the various levels of government, it appears that the fourth, intergovernmental cooperation, is likely to meet with the greatest probability of success. If cooperation fails, judicial or administrative approaches may also work. Each of the four possibilities is discussed further below.

4.5.1 Preemption Determinations under Existing Law

Under this alternative, federal agencies, nuclear facility owners, and other interested parties could challenge various state and local regulations concerning nuclear transportation. This course is now being pursued in the case of New York City's virtual prohibition against the shipment of certain nuclear materials through the city. In this case, a determination is being sought under Section 112 of the Hazardous Materials Transportation Act of 1974. The aim of the action is to obtain an administrative ruling by the Department of Transportation that the city's regulation of the transportation of nuclear material is inconsistent with the comprehensive federal statutory scheme, and hence preempted.

A decision on whether to pursue preemption of state or local controls should take several matters into consideration.

First, the outcomes of such actions are difficult to predict because DOT has not yet issued any rulings under Section 112 of the Hazardous Materials Transportation Act. A series of decisions with possible appeals to the courts may be required before a pattern develops that will provide guidance as to the appropriate allocation of responsibilities between federal and state governments. At present, inconsistent results may obtain in different judicial circuits and during the terms of different Secretaries of Transportation. If determinations are required in numerous jurisdictions, the costs may be high in terms of delay, uncertainty, and litigation expenses.

Second, even if a given state regulation is struck down, the state may be able to persist in its efforts to control transportation by different means--for example, by utilizing routing restrictions; closing specific highways; imposing a new tax; placing conditions on the granting of needed licenses or permits; or, under the Clean Air Act, establishing more stringent radiation emission standards than those established by DOT or NRC.

Third, if state or local officials feel that they have no ability to influence matters that they regard as legitimate concerns, or if there is strong sentiment among public interest groups, then the publicity and arousal of public interest that might attend a confrontation between federal and local governments could be counterproductive. In some situations, states may regard federal efforts to preempt their regulations as a means of steamrolling over their legitimate concerns. This reaction could cause states to establish other political or economic barriers in the path of the nuclear industry.

Sometimes, adversary proceedings can polarize views on each side, making resolution of the problem more difficult. For example, in February 1976, former Secretary of Transportation William T. Coleman authorized British Airways and Air France to conduct limited operations of the Concorde Supersonic Transport to and from John F. Kennedy International Airport in New York and Dulles International Airport in Virginia. In March 1976, the Port Authority of New York and New Jersey denied permission to operate the Concorde into or out of JFK, pending the Authority's independent evaluation of noise data and community reaction. More than a year later, in May 1977, the U.S. District Court for the Southern District of New York held that the Port Authority's denial of landing rights was invalid because it was preempted by federal law.[88] On June 1, 1977, the U.S. Court of Appeals for the Second Circuit stayed the earlier District Court decision that the Port Authority's ban was illegal. On June 6, the Justice Department filed a brief stating that federal law does not give the federal government the power to preempt an airport owner from excluding aircraft on the basis of noise. The brief, however, termed the local ban on SSTs "unfortunate and ill-advised."[89]

The Concorde case illustrates that, in spite of the serious international ramifications of the New York ban on SSTs, resolution of the issue is requiring substantial time and complex legal maneuvering, and is no doubt costing a great deal of money. It is not suggested here that controversies regarding nuclear transportation would necessarily be as protracted or as vigorously pursued as the SST battle, but rather that seeking a preemption determination by an administrative or judicial agency is not necessarily a speedy, simple, or inexpensive approach.

4.5.2 Clarifying Legislation

Another approach that could be taken, either concurrently with court and administrative actions or following such actions, would be to seek legislative clarification of the preemption issue. Such legislation could amend both the Hazardous Materials Transportation Act and the Atomic Energy Act, resolving actual or potential ambiguities in state and local rules concerning the transportation of nuclear material at the back end of the fuel cycle.

However, if the nuclear industry were to seek complete preemption of all state or local nuclear transportation regulatory authority, opponents of nuclear power would no doubt press for legislation providing an effective state veto of federal licenses. Bills have already been introduced to increase state roles in certain nuclear areas, such as waste management.[90] Thus, the outcome of a legislative battle between the proponents and opponents of nuclear power is not clear.

In some respects, there is sentiment for according additional authority to states and localities to deal with their own problems. For example, the Clean Air Act Amendments of 1977 illustrate a congressional intent to increase state and local jurisdiction over radioactive emissions. The nuclear industry itself does not universally agree that federal regulation is always preferable to state regulation. With respect to the regulation of commercial, low-level, radioactive waste burial grounds, one company representative has indicated:

> I have been personally involved in the commercial disposal of radioactive wastes since 1958 and have been responsible for licensing activities at both the State and the Federal level. On the basis of this experience, I can state categorically that the licensing and ensuing regulatory programs at the State level are (1) more thorough (2) less time consuming (3) more responsible to conditions at hand and (4) conducive to an intimate and cooperative relationship between the regulatory staff and the licensee. *** We are never confronted with inordinate delays which I have experienced in the licensing function at the Federal level.[91]

The extent of state and local control and the degree of federal preemption are often controversial issues. For example, in the case of recombinant DNA legislation, a House subcommittee has already approved in outline form a bill that places a great deal of the authority for the regulation of recombinant DNA experiments in the hands of local biohazards committees, while a bill under consideration in a Senate subcommittee would establish a new federal regulatory commission to control research. At issue here is the extent to which the federal government should be able to preempt state and local controls. The House subcommittee apparently is endorsing a preemption clause that permits more stringent federal regulations only if the Secretary of the Department of Health, Education, and Welfare agrees that extra controls are necessary to provide reasonable protection of human health and the environment, whereas the Senate subcommittee is considering several different versions of the preemption clause.[92]

Although there are many notable exceptions, the legislative process generally operates in a manner that does not result in polar positions being taken on either side of an issue. Instead, the process is usually characterized by compromise and conciliation, as the government attempts to work out a solution that is at least not totally unacceptable to those concerned. This has frequently been the case with energy and consumer legislation. Therefore, if an issue is in controversy, precise clarification of state and federal roles is unlikely to happen in the legislative arena. On the contrary, controversial provisions are often characterized by language that tends to defer significant conflict resolution to administrative agencies or the courts. Thus, an attempt at legislative clarification of a highly controversial and complex issue is unlikely to be fully satisfactory to all or any parties.

4.5.3 Creation of a Federal Transportation System

It is generally assumed that transportation functions within the civilian nuclear reactor fuel cycle will be performed by the private sector. As discussed in Chapter Three, extensive regulations have been adopted to regulate the packaging and shipment of nuclear materials by the private sector, and a number of privately owned casks have been licensed by NRC.

It is also possible, however, to establish a transportation system at the back end of the nuclear fuel cycle that is, in whole or in part, operated by the federal government. The federal government is already involved in nuclear transportation to a limited extent. ERDA has established a government-owned transportation system and is now operating a fleet of specially designed armored vehicles to transport strategic quantities of special nuclear materials. ERDA also employs its own transportation guard force to provide security for its shipments. Formerly, the government transportation network was used only in connection with military programs and among government-owned facilities, but ERDA has announced its plans to take over transportation of strategic quantities of special nuclear materials from the government's civilian nuclear program, as well.[93] Apparently, the initial rationale for this government takeover was increased security, but cost-effectiveness has now become an important factor.[94] In view of this fact, consideration should be given to the possibility that transportation practicality or safety at the back end of the civilian nuclear fuel cycle would be enhanced if other transportation responsibilities, such as the movement of spent fuel or high-level radioactive wastes, were also performed by the federal government.

At first glance, it does not appear that transfer of such transportation responsibilities from the private sector to the federal government alone would necessarily affect nuclear transportation safety or practicality. It could be argued that the profit motive might conflict with the public interest in ensuring maximum safety and care in the transportation of radioactive materials--that is, that increased increments of safety generally increase costs, which a private entity seeks to minimize. However, any such tendency in the private sector could be restrained by the appropriate promulgation and enforcement of government standards to assure safety. It appears, then, that the practicality and effectiveness of a transportation system depends upon factors such as the training and quality of personnel, the operational procedures, the size of the organization, and the resources made available to it, and not on whether the operation is privately or publicly owned.

A similar conclusion was recently reached by an NRC study, which found that a federal security agency is not needed to protect commercial nuclear facilities and materials. The study concluded that a federal guard system would be neither more nor less effective than existing systems of private guards that are properly trained and certified and are operating within stringent federal regulation.[95]

Nevertheless, it is possible that federalization of additional nuclear transportation responsibilities could have significant impact in a number of ways. First, some have suggested that there are differences between private and public entities in their responsiveness to federal safety regulations. For example, James Q. Wilson recently concluded, "An agency will have great difficulty in attaining its goal if, to do so, it must change the behavior of another agency. . . . In general, it is easier for a public agency to change the behavior of a private organization than of another public agency."[96] Second, legal responsibilities in the event of an accident can turn on whether the transporter is a private or federal entity. Third, there are likely to be significant differences between federal and private transportation operators in labor relations and the right to strike. Fourth, there may be differences in public opposition to nuclear transportation. According to a report of an ERDA task force on the nuclear fuel cycle, government handling of all nuclear transportation would mitigate public concern on nuclear safety and security.[97]

Of greatest interest here, however, is that a federal transportation entity could invoke the doctrine of intergovernmental immunity to avoid the application of state and local restrictions on the transportation of nuclear materials.

For example, in a leading case involving state drivers' licenses and postal workers, the U.S. Supreme Court has indicated that a state may not regulate any activity undertaken by the federal government if such regulation interferes with the achievement of federal objectives.[98] Subsequent cases have extended this immunity to federal contractors who are undertaking federal activities.[99] Similarly, a few years ago, the Atomic Energy Commission notified the states of Oregon and Florida that their newly imposed state regulations "would be an unwarranted restriction on Constitutional immunity inasmuch as such State requirements for notification, routing, and approval of shipments of radioactive materials in interstate commerce constitute an impediment to the free flow of such commerce."[100] ERDA has also served notice that it cannot guarantee any state that it will comply with state rules on transportation.[101] Federal immunity may not be complete, but:

> Regulation by the states of activities undertaken by or for the United States faces serious obstacles under the doctrine of "intergovernmental immunities." These obstacles may not be insurmountable, but the chances of invalidation are great enough that only the strongest showing of policy necessity should persuade a state to attempt to regulate such government or federal contractor transportation of radioactive materials.[102]

Thus, if states or localities persist in establishing barriers that make private transportation of nuclear materials impractical, and if the issue cannot be resolved satisfactorily and in a timely manner by litigation or cooperative agreements, then perhaps the possibility of a federal transportation system should be considered. Implementation of this alternative would probably require enabling legislation. It would also be important to design such a system to meet specific requirements as they arose. For example, a completely nationwide system might not be required; rather, the benefits of intergovernmental immunity might be achieved through the establishment of systems only in those areas where local governments have made private transportation infeasible.

In summary, greater federal responsibility for the transportation of spent fuel and high-level radioactive wastes would provide the federal government with substantial immunity from state and local regulations. The implementation of such federalization should give careful consideration, however, to such factors as accountability, appropriate user charges, liabilities in the event of accidents, and the scope of federal activities. However, this step should be undertaken only if other avenues of resolving conflict between federal and state and local regulations have been exhausted.

4.5.4 Intergovernmental Cooperation

Intergovernmental cooperation may be the best means to resolve differences between state and federal governments. A 1974 assessment by the Western Interstate Nuclear Board appears still to apply today:

> Cooperation between levels of government is certainly to be preferred to competition, jealousy, and contest. Genuine cooperation on matters of mutual concern to the states and the nation, however, must be based upon recognition and mutual respect for the peculiar interests and constitutional powers of each of the governments concerned. Unfortunately, in the field of transportation of radioactive materials there has been a notable reluctance on the part of federal officials to recognize the legitimate interest of states in a significant transportation safety policy-making role. As a result, the full potential of cooperative partnership in this field has been slow to be realized.[103] (emphasis added)

The federal government, by actively soliciting state participation in transportation decision making, may be able to avoid both a confrontation among the various levels of government and the ensuing confusion that would result within the industry.

This approach, however, is unlikely to result in complete uniformity of transportation regulation throughout the country. Furthermore, it might require that additional costs be incurred by the nuclear industry to satisfy certain state and local demands. These costs could include: (1) delays in transportation while agreements are worked out; (2) the consideration of alternative routing, which may not always be the best or least costly; and (3) additional expenses incurred because of notification, security, or other requirements that might be agreed upon.

Nonetheless, this method may very well be more fruitful in some cases than attempting federal preemption of state activity, seeking legislative clarification, or federalizing nuclear transportation. The appropriate approach toward resolving differences may have to be taken on a case-by-case basis, but it appears that, to the extent that intergovernmental cooperation is facilitated, state and local acceptance of nuclear transportation may increase.

Intergovernmental cooperation can occur in several ways and in a number of forums, without requiring new legislative authority.

First, the states could assist in implementing federal standards. For example, states could adopt DOT hazardous materials regulations by reference to apply to all intrastate transportation activities. Almost half of the states have done this already. Then cooperative working relationships could be developed among the states, NRC, and DOT to improve inspection, enforcement, and educational efforts aimed at upgrading safety in nuclear transportation. To the extent that there are deficiencies in the federal regulations, a state, under this approach, would take an active role in helping to amend or develop federal standards. Often, a problem develops in one state that may very well occur in other states; thus, amending the federal standards as experience demonstrates a need could prove to be highly practical. If the federal government is reluctant to amend its regulations, however, then states could adopt their own regulations; this may serve to encourage the federal government to examine the problem.

Second, the Clean Air Act, as amended in 1977, permits states to establish, as part of their air pollution control plans, radioactive emission standards that are more stringent than those of the federal government. If states interpret their authority as applying to radiation emissions from containers in transit, questions will undoubtedly be raised over whether Congress intended the Clean Air Act to apply to mobile as well as stationary radiation sources. Litigation may be required to clarify this particular point. Nevertheless, it may be possible to resolve cooperatively some nuclear transportation issues in the framework of the Clean Air Act.

A third approach for resolving federal and state differences involves an examination of transportation issues in the context of NRC licensing or state siting proceedings for reactors or other facilities. Care would have to be exercised, however, to assure that transportation conditions attached to a license or certificate are not overly inflexible, so that they permit response by shippers to changed conditions.

This approach has the advantage of permitting the resolution of transportation issues in a public forum--one in which most interveners who are going to express an interest are already participating. Furthermore, if there is widespread participation of all interested parties in the licensing or certification proceedings, then transportation issues would be among those which could be resolved at an early planning stage, before irrevocable hardware commitments have been made. Mechanisms would have to be developed, however, to assure the participation in these proceedings of all state agencies that are concerned with transportation issues, since licensing and siting proceedings are now the primary concern only of state siting or public utility commission agencies. For example, it would be necessary to alert state transportation, health, or emergency response agencies to these proceedings, to assure that they focus on issues of concern during the licensing or certification process.

A possible disadvantage of this approach would be that, in the absence of coordination agreements transportation issues would be addressed only in the state in which a particular nuclear facility is sited. Also, different transportation agreements could be reached with respect to different nuclear power facilities in the same state, depending upon which parties participate actively in the proceedings.

Further improvements in federal-state relations can occur through joint hearings. This approach is being utilized by the NRC and the Siting Board of New York.[104]

Yet another approach for resolving federal-state differences on nuclear transportation is through the use of ad hoc agreements. This approach differs from state implementation of federal standards in that it could involve requirements beyond those imposed by the federal government. For example, recently federal and State of Washington officials have agreed on a plan to insure safe rail transportation of missile components destined for the Trident submarine support base at Bangor, WA. In this case, the State Utilities and Transportation Commission recommended that certain repairs be made to railroad tracks between Centralia, WA, and Bangor, WA. These recommendations were then reviewed by the National Transportation Safety Board. Both of these agencies worked together with the railroad and the Navy to develop a plan to upgrade the railroad tracks before any Trident components were shipped over them. The key elements of the plan included the following provisions:[105]

- Existing tracks in the state will be repaired and maintained to meet applicable federal standards.

- All trains carrying Trident missiles or components will be limited to a speed of 35 miles per hour.

- Tracks to be traveled by trains carrying missile components will be physically inspected not more than 36 hours before each trip.
- The entire line of tracks will be inspected at least twice a year with sophisticated automatic flaw detection equipment.
- Certain high-ranking railroad officials will accompany trains carrying missiles or components.
- The Navy will notify the State Transportation Commission of each train movement of missiles or components.
- Certain highway crossings will be upgraded.

This is an example of federal-state cooperation that may be applicable to nuclear transportation at the back end of the fuel cycle. Here, the Navy Department, which probably could have preempted state action entirely, chose instead to agree to make improvements in an effort both to upgrade transportation safety and to improve public confidence.

The cooperative approach could require substantial time to work out and might result in extra costs to nuclear transportation--costs which ultimately must be borne by electricity rate payers. But it would seem that, on a case-by-case basis, this approach can result in a workable nuclear transportation system.

CHAPTER FOUR NOTES:

STATE AND LOCAL ACTIVITIES THAT MAY AFFECT NUCLEAR TRANSPORTATION

1. Executive Office of the President, Energy Policy and Planning, The National Energy Plan (April 29, 1977) at 72-73.

2. C. Hohenemser, R. Kasperson, and R. Kates, "The Distrust of Nuclear Power," 196 Science 25,27 (April 1, 1977).

3. Id.

4. H. Green, "Public Participation in Nuclear Power Plant Licensing: The Great Delusion," 15 Wm & Mary L. Rev. 502,507 (1974).

5. Id. at 517.

6. "The Siege of Seabrook," Time (May 16, 1977) at 59.

7. "Counterattack for Seabrook," Time (July 11, 1977) at 80. The Atomic Safety and Licensing Appeal Board, in a divided opinion, has affirmed the decision authorizing the issuance of construction permits for the Seabrook Station. In re Public Service Co. of N.H., et al. (Seabrook Station, Units 1 & 2), 2 CCH Nuc. Reg. Rep. ¶30,216 (1977).

8. Executive Office of the President, Energy Policy and Planning, The National Energy Plan (April 29, 1977) at 72. However, there are indications that sharp opposition has developed to speeding reactor licensing, both from officials in the Carter Administration and from environmental organizations. See "Nuclear Power Plant Speedup Generates Static," Washington Post (August 24, 1977) at A3.

9. C. Hohenemser, supra note 2 at 33.

10. Id. at 25.

11. J. J. Keller & Associates, Hazardous Materials Guide, Neenah, WI; cited in Battelle, Pacific Northwest Laboratories, Evaluation of Hazardous Material Transportation by Rail in Illinois (March 1977) at 14 and 38.

12. Examples of states that have essentially adopted DOT hazardous materials regulations are Arizona (30-653 to 30-655, Arizona Laws Anno.); Texas (Texas Rev. Civ. Stat., Art. 4590F [1976]); Kansas (Kansas Statutes 48-1601-19; Nuclear Energy Development and Radiation Control Act [1972]); Louisiana (Louisiana Rev. Statutes 1051-70, Louisiana Bd. of Nuclear Energy [1966]); and California (California Admin. Code, Title 17, Chap. 5, Subchap. 4, Group 4 ["Transportation of Radioactive Materials"]; phone conversation with Joseph Ward, California Department of Health [June 15, 1977]).

13. L. Trosten, "Authority of Government Agencies and Carriers to Set Conditions for Transportation of Radioactive Materials," AIF Summary Report: 1976 Conference on Transportation for the Nuclear Industry (February 1977) at 87.

14. Participating states are Georgia, Illinois, Michigan, Pennsylvania, and South Carolina, according to Andrew W. Robart, Office of State Programs, NRC. See also "Radiation Control: Illinois Cracks Down," The Energy Daily (Friday, July 8, 1977) at 4.

15. H. Shealy, "State Involvement in the Transportation of Radioactive Material," AIF Summary Report: 1976 Conference on Transportation for the Nuclear Industry, (February 1977) at 35.

16. See Federal Highway Administration, U.S. Dept. of Transportation, A Summary of Highway Facilities Where Hazardous Materials are Restricted (January 1977).

17. See Western Interstate Nuclear Board, Transportation of Radioactive Materials in the Western States (March 1974) at 87.

18. Phone conversation with J. Stewart Cobett, Manager, Nuclear Safety, Chem-Nuclear Systems, Inc., Bellevue, WA (May 24, 1977).

19. 49 C.F.R. 397.3. Interestingly, the previous General Counsel of the Department of Transportation, in a letter dated May 12, 1976, to the General Counsel of the Nuclear Regulatory Commission, interpreted this provision as requiring compliance only with state and local laws relating to the mechanics of driving and handling vehicles. He stated that local restrictions that are tantamount to a ban on the transportation of radioactive materials through or in a local jurisdiction are not required to be complied with under this provision.

20. Battelle, Pacific Northwest Laboratories, *Evaluation of Hazardous Material Transportation by Rail in Illinois* (March 1977).

21. *See*, e.g., W. Brobst, Chief, Transportation Branch, Division of Environmental Control Technology, ERDA, "Nuclear Transportation: Problems and Proposed State Regulations," paper presented at Nuclear Dialogue for State Regulators, Atomic Industrial Forum, Detroit, MI (October 19, 1976).

22. M. Willrich et al., *Radioactive Waste Management and Regulation*, Report to ERDA by the MIT Energy Laboratory, Report No. MIT-EL 76-011 (December 1976) at 4-19.

23. This section is not intended to be a comprehensive listing of state nuclear transportation requirements, but it does provide selected examples of such action.

24. Brobst, *supra* note 21 at 10.

25. *Connecticut Public Act No. 76-321*, June 1, 1976, 2 *CCH Nuc. Reg. Rep*. 16,201.

26. L. Gossick, Executive Director for Operations, NRC, "Regulation of Nuclear Material Transportation: The Role of the NRC," paper presented at the AIF Conference on Transportation for the Nuclear Industry (May 26, 1976) at 6.

27. Conn. Public Act, *supra* note 25.

28. "Repository: Michigan Says No; Ditto for Minnesota," *Nuclear News* (August 1977); H.F. 1215, Chap. 416, 1977 Laws of Minnesota (1977).

29. *CCH Nuc. Reg. Rep*., Letter No. 96 (May 24, 1977) at 2.

30. *Supra* note 18.

31. *See* "New Mexico Votes One-Year Moratorium," *Nuclear News*, May 1977 at 86.

32. General Assembly of North Carolina, House Bill No. 43, Chap. 839, ratified June 30, 1977.

33. *Oregon Revised Statutes* 469.530 (1975).

34. Oregon Administrative Rules 60-001 *et seq*.

35. Conversation with Harlan Haynie, staff member, Oregon Department of Energy (May 24, 1977).

36. Opinion of the Attorney General of the State of Oregon, Lee Johnson, Attorney General, No. 7308 (June 25, 1976) in 2 CCH Nuc. Reg. Rep. 16,256.

37. Sec. 274b(3) of the Atomic Energy Act of 1954 (42 U.S.C. 2021b[3]).

38. W. England, "Recent Regulatory Developments concerning the Transportation of Nuclear Fuel and Other Radioactive Materials," 7 Environmental Law 203, 210 (1977).

39. Chap. 641 of the 1976 Laws of New York State, Sec. 14f, to amend the transportation law.

40. Battelle, Pacific Northwest Laboratories, supra note 20 at A-27.

41. 9 ERC 1825 (2nd Cir., Feb. 14, 1977).

42. Id. at 1834.

43. "The City Record," (Tuesday, January 20, 1976).

44. Id.

45. "Judge Denies Injunction against Shipping Ban," Nuclear News (March 1976) at 76.

46. John Hart Ely, General Counsel of DOT, in a letter dated May 12, 1976, to Peter L. Strauss, General Counsel of NRC, has opined that the "no practicable alternative" proviso of 49 C.F.R. 397.9 is not intended to require consideration of the practicability of transportation modes other than the motor vehicle. This opinion is relevant because Brookhaven National Laboratory must transport certain radioactive shipments by ferry across Long Island Sound if shipment through New York City is prohibited.

47. Nuclear News, supra note 45.

48. Letter from N. Peter Rathvon, Secretary and General Counsel, Associated Universities, Inc. (operator of Brookhaven National Laboratory) to Office of Hazardous Materials Operations, DOT (February 25, 1977) at 3-4.

49. City's Memorandum of Law in Opposition to Motion for Preliminary Injunction, U.S. v. New York City, 76 Civ. 273 at 4.

50. Associated Universities, Inc., Receipt of Application for Inconsistency Ruling, 42 F.R. 41204 (August 15, 1977).

51. Subpart C--Preemption, 49 C.F.R. 107.201 et seq.

52. See D. Binder, "Problems in Planning for the Transportation of Spent Fuel and Radwaste from Nuclear Power Plants," AIF Summary Report: 1976 Conference on Transportation for the Nuclear Industry (February 1977) at 14.

53. "Vermont Towns Say 'No' to Nuclear Power, Wastes," 20 Nuclear News 38 (April 1977).

54. No. 77, an Act to add 10 Vt. Statutes Anno., Chap. 157, relating to storage of radioactive material, April 26, 1977; Chap. 283 (H.B. 822), an Act requiring legislative approval for disposal of high-level nuclear wastes and radioactive materials, and for processing of high-level nuclear wastes in South Dakota, enacted by South Dakota Legislature on April 16, 1977; Chap. 68, Montana Session Laws, an Act to prohibit the disposal in Montana of large quantities of radioactive materials produced in other states, approved March 21, 1977; and Act No. 193, (H.B. 14) to amend Chap. 5 of Title 51 of the Louisiana Revised Statutes of 1950 to prohibit the disposal of radioactive material or waste in salt domes, approved July 7, 1977.

55. Opinion of the Attorney General of the State of Michigan, Frank J. Kelley, No. 4979 (April 23, 1976) in 2 CCH Nuc. Reg. Rep. 16,190, 16,192.

56. Id.

57. W. A. Brobst, Chief Transportation Branch, ERDA, "Nuclear Transportation: Problems and Proposed State Regulations," AIF Nuclear Dialogue for State Regulators, Detroit, MI (October 19, 1976) at 4-5.

58. R. Peterson, "Industry Views on Federal, State, and Local Regulations and Regulatory Processes," AIF Summary Report, 1976 Conference on Transportation for the Nuclear Industry (February 1977) at 36.

59. See "Proposed Standards for the Issuance of Site Certificates before the Energy Facility Siting Council" (April 18, 1977) at 3.

60. 42 U.S.C. 2021k; A. Murphy and B. LaPierre, "Nuclear 'Moratorium' Legislation in the States and the Supremacy Clause: A Case of Express Preemption," Col. L. Rev. 392, 450 (1976); and Clean Air Act Amendments of 1977, 42 U.S.C. 7401, 7422, and 7602.

61. W. O. Doub, "Problems of Organizational Structure in the Federal-State System," Proceedings of the Conference on Public Policy Issues in Nuclear Waste Management, Chicago, IL (October 27-29, 1976) at 186.

62. Sec. 201 of the NRC Appropriations Act (1975), cited in New York v. NRC, 9 ERC 1825, 1829 (2d Cir., February 14, 1977).

63. See H.R. 4866 and H.R. 4866, introduced by Chairman Morris Udall of the House Interior and Insular Affairs Committee, 95th Cong., 1st Sess. (March 10, 1977).

64. C. Norman, "Congress Reshuffles Its Science Committees," 79 Technology Review 6, 7 (March-April 1977).

65. 49 U.S.C. 1811.

66. 49 C.F.R 107 subpart C.

67. See "The Preemption Doctrine: Shifting Perspectives on Federalism and the Burger Court," 75 Columbia L. Rev. 623 (1975).

68. 49 C.F.R 107.221.

69. See 49 C.F.R. 107.3, 107.203 et seq, and 107.215 et seq.

70. L. Trosten, "Authority of Government Agencies and Carriers to Set Conditions for Transportation of Radioactive Materials," AIF Summary Report: 1976 Conference on Transportation for the Nuclear Industry (February 1977) at 87.

71. 42 U.S.C. 2021.

72. The so-called "agreement-states" are Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oregon, South Carolina, Tennessee, Texas, and Washington.

73. A. Murphy and D. LaPierre, "Nuclear 'Moratorium' Legislation in the States and the Supremacy Clause: A Case of Express Preemption", 76 Columbia L. Rev. 392, 402 (1976).

74. See, e.g., W. England, supra note 38 at 210.

75. Brobst, supra note 58 at 10.

76. Oregon Attorney General, supra note 36.

77. 42 U.S.C. 2021(k).

78. 42 U.S.C. 2018.

79. Murphy and LaPierre, supra note 76 at 453.

80. 10 C.F.R. 30.13, 40.12, 70.12. See Comment, "Pre-emption under the Atomic Energy Act of 1954," 11 Tulsa L. J. 397, 413 (1976).

81. Willrich, supra note 22 at 4-15.

82. Brobst, supra note 58 at 6.

83. Id.

84. "Current Developments," 8 BNA Environment Reporter 85 (May 20, 1977).

85. "Current Developments," 8 BNA Environment Reporter 229 (June 10, 1977). On June 14, the Court of Appeals ruled that the temporary ban on the SST is permissible unless unreasonable; 8 BNA Environment Reporter 320 (June 24, 1977). On August 17, the District Court found the ban unreasonable, discriminatory, and unfair Seattle Post-Intelligencer (August 18, 1977). That decision is now being appealed.

86. See, e.g., S. 1008, H.R. 4867, and H.R. 5369, 95th Cong., 1st Sess., all of which would provide for a greater state role in the siting of nuclear facilities.

87. S. Corbett, "Commercial Radioactive Waste Disposal: Marriage or Divorce," paper presented at the U.S. Environmental Protection Agency's Second Workshop on Policy and Technical Issues pertinent to the Development of EPA Criteria for Radioactive Wastes, Albuquerque, NM (April 12-14, 1977) at 4.

88. "Committees Win Delay for Recombinant Bills," Science and Government Report (May 5, 1977) at 4.

89. "OMB Supports ERDA in Shipping Switch," Nuclear News (October 1976) at 85.

90. _Id_.

91. "NRC Finds Federal Security Agency Unnecessary," NRC Release No. 76-205, September 7, 1976, 2 _CCH Nuc. Reg. Rep._, ¶20,039.

92. J. Wilson and P. Rachal, "Can the Government Regulate Itself?" _Public Interest_ No. 46 (Winter 1977) at 4.

93. W. Brobst, "Recent Developments in Government Policy Toward Transportation of Nuclear Materials," _Nuclear Materials Management_ (Fall 1975) at 204.

94. _Johnson v. Maryland_, 254 U.S. 51 (1920).

95. _See_, e.g., _Penn Dairies v. Milk Control Comm'n._, 318 U.S. 261 (1943).

96. Brobst, _supra_ note 58 at 9.

97. _Id_.

98. Western Interstate Nuclear Board, _Transportation of Radioactive Materials in the Western States_ (March 1974) at 51.

99. _Id_. at 85.

100. Protocol for the Conduct of Joint Hearings Before the NRC and the N.Y. State Board on Electric Generation Siting and the Environment, 41 F.R. 49,900 (Nov. 11, 1976) in 2 _CCH Nuc. Reg. Rep_. 16,267.

101. Senator Warren G. Magnuson, news release (April 19, 1977).

CHAPTER FIVE

TRANSPORTATION OF NUCLEAR MATERIALS BY RAIL

5.1 Overview

Rail transportation is intended by the nuclear industry to play a key role in the movement of spent fuel and high-level radioactive wastes. The principal advantage of rail transportation over truck transport is load factors. To illustrate:

> . . . the casks used in rail transportation weigh up to approximately 220,000 pounds. This weight precludes their transportation by highway. There are casks available for truck transportation, but these casks are limited to 45,000 and 50,000 pounds because of highway limitations. Put in another way, the maximum size legal weight truck container will hold less than 0.5 metric tons of spent nuclear fuel, whereas a rail container can hold 3 to 5 metric tons of spent fuel. Hence, one would need 6 to 10 times as many shipments by truck as by rail. At the AGNS facility . . . exclusive use of truck shipments would require over 3,000 shipments per year whereas exclusive use of rail transportation would require about 300-500 shipments per year for operation at full capacity. Were AGNS to try to rely on truck shipments as its primary method of shipping spent nuclear fuel, the AGNS facility at Barnwell could not be operated at more than one third capacity.[1]

Despite rail's apparent advantage in nuclear transportation, some of the nation's railroads are reluctant to transport nuclear materials routinely. Railroads regard nuclear shipments as low-volume, low-revenue traffic that poses large risks.[2] Therefore, railroads are seeking to transport spent fuel and high-level radioactive wastes on a contract rather than a common-carrier basis and only under special train service conditions. Nuclear shippers and ERDA, on the other hand, maintain that the shipping casks are extraordinarily rugged and designed to withstand any credible accident, and that nuclear materials should therefore be transported by railroads as ordinary hazardous freight. These issues are currently in litigation before the Interstate Commerce Commission.

Railroads have transported spent fuel on a limited scale for both the government and private industry since

1956. Most shipments have been for the government, without the imposition of any special conditions in addition to those imposed on other hazardous cargo. However, the treatment of nongovernment shipments has varied by territory.[3] Railroads in the East assert that they have neither published nor joined any tariff provisions governing nuclear shipments and will accept these shipments only in private carriage. Western and Southern territory carriers, on the other hand, have published tariffs and transported nuclear materials in common carriage.[4]

In common carriage, the railroads are required, upon an appropriate tender by a shipper, to transport shipments according to published tariffs which are regulated by the Interstate Commerce Commission. With private carriage, on the other hand, the shipper must negotiate all terms and conditions of transport with each of the railroads involved in the shipment, and the railroads are under no obligation to provide service.

In three related proceedings before the Interstate Commerce Commission, the Eastern railroads are seeking to establish or maintain their status as private carriers for nuclear transportation; one Western railroad, the Missouri-Kansas-Texas Railroad Company (M-K-T), is seeking to withdraw from the common carriage of radioactive materials and empty containers; and the Southern and Western railroads are seeking a nationwide requirement that spent fuel and high-level radioactive wastes be transported only in special train service. With special train service, the train is required to contain no other freight, to travel no faster than 35 miles per hour, and to stop when it meets, passes, or is passed by any other train.[5] These conditions, however, are subject to modification at the discretion of the railroads.

In the M-K-T case, the Administrative Law Judge has ruled against the railroad and has directed it to publish reasonable and otherwise lawful tariff provisions covering the transportation of radioactive materials and associated containers.[6] Similarly, with respect to the efforts of Western and Southern railroads to require special train service for certain nuclear shipments, the Administrative Law Judge has issued an initial decision against the railroads, after finding that "the record fails to demonstrate that the transportation of radioactive materials in regular train service involves any greater risk than the transportation of other hazardous materials for which no special train service is required."[7] The remaining case, relating to whether or not the Eastern railroads will be required to publish common-carrier tariffs for radioactive material shipments, is expected to be announced shortly. All three decisions may be appealed to the Interstate Commerce Commission and the courts.

The resolution of the common carrier and special train service issues, which appears to be in progress within the context of existing institutional arrangements, will have a significant impact on the desirability and cost of rail transportation at the back end of the nuclear fuel cycle. If the common carrier issue is ultimately resolved in favor of the nuclear shippers, as seems likely based upon the initial decision of the Administrative Law Judge, then the nuclear industry would not be faced with a potential embargo of nuclear shipment by rail. The special train service issue does not appear to be as serious a problem because, if it is mandatory, its principal impact will be on the cost of shipment, not on its availability.

5.2 Common Carrier Status

On February 17, 1976, the Interstate Commerce Commission commenced an investigation into the withdrawal by M-K-T from participation on a common-carrier basis in the carriage of certain materials: nonirradiated and irradiated nuclear fuel, radioactive waste, and empty fuel casks that had contained irradiated material. The ICC did not act to suspend the M-K-T action, and the matter was assigned to an Administrative Law Judge for hearing under Docket No. 36307.

The major premises of M-K-T's action appeared to be the claims that: (1) a severe accident involving nuclear material could be disastrous to the railroad, (2) there might not be sufficient insurance protection, and (3) railroad property could be rendered unusable for long periods. In addition, the railroad contended that there was no demand for commercial nuclear transportation and thus no adverse impact to shippers. For these reasons, the railroad sought to withdraw certain nuclear shipments from common carrier service.

In related cases, complaints have been filed by ERDA and many shippers against Eastern railroads to require the publication of common carrier tariffs for nuclear materials.[8] The burden of proof in these cases is different from that of the M-K-T case because here the shippers, rather than the railroad, are seeking a change in existing tariffs. Eastern railroads have refused to participate in the uniform tariff schedule for nongovernment shipments of radioactive materials since such tariffs were first published in 1962.[9] Instead, most Eastern rail lines have required nongovernment shippers to sign individually negotiated contracts as a condition of carriage. Some Eastern railroads have sought, among other things, to assign all liabilities for accidents, regardless of fault, to shippers; to require shippers to make all arrangements for connecting and interchange service; and to permit the railroad to refuse shipments at any time. The railroads have maintained that nuclear transportation is unique and dangerous and that these precautions are needed. ERDA and the other complainants, however, argued that these practices are unlawful under the Interstate Commerce Act and that common-carrier service should be required.[10]

ERDA, the NRC, private parties, utility companies, two state utility agencies, and the various other parties who joined in the hearing against M-K-T and the Eastern railroads also argued generally that the railroads' overreaction to perceived nuclear dangers could impede and retard the development of nuclear energy as a power source for the nation as a whole, especially in that critical portion of the fuel cycle in which transportation is an integral component--the carrying of spent fuel from the reactor site to the reprocessing plant or storage facility.[11]

One of the primary concerns of the protesting parties was that permitting the M-K-T to withdraw as a common carrier would establish:

> a dangerous and ill-advised precedent . . . [which] would encourage other railroads to follow suit. Thus, they argue, instead of an efficiently functioning network of common carrier railroads, protestants would be confronted with a veritable hodgepodge of individual carriers with whom individual contracts must be made and with no genuine assurance that it will ever be possible to transport spent nuclear fuel, radioactive waste materials, or empty containers from given origins to given destinations.[12]

The protestants also countered M-K-T's contention that it did not have adequate protection available in the event of an accident involving nuclear cargo. They argued that the Price-Anderson Act establishes "a comprehensive insurance and indemnity program to protect the public, including carriers, against the risk of loss due to civilian uses of controlled nuclear power, including transportation incident to those activities."[13] (See Chapter Eight for additional discussion of insurance issues.) Moreover, ERDA argued in its brief that:

> MKT is simply in error when its witness states that its 'present insurance excludes radioactive materials from coverage.' Indeed, the classification shows on its face that no carrier is required to accept an irradiated fuel element for shipment unless the shipper certifies that there is a Price-Anderson agreement outstanding at the time of shipment indemnifying . . . the carrier or carriers handling this shipment against public liability as defined in such Act. . . .[14]

Subsequent to the filing of the ERDA brief, the Price-Anderson Act liability limits were declared unconstitutional by a U.S. District Court.[15] Even if upheld on appeal, this decision would appear to affect railroads adversely only in the event that they incurred liability in excess of the $560 million coverage provided for under the Act.

In 1959, the Interstate Commerce Commission's Bureau of Operating Rights considered actions by certain motor carriers to deny transportation of radioactive materials. The carriers based their refusals on the exclusion of radioactive materials from liability coverage under their insurance policies. The ICC Bureau stated in part that such exclusion was not a valid reason for a carrier's refusing to transport shipments covered by its certificate of public convenience and necessity, in which it holds itself out to transport goods through its published tariffs. ERDA officials strongly contend that the present railroad situation is analogous to the motor carrier refusals that were found unlawful years ago.[16]

On April 19, 1977, the ICC Administrative Law Judge issued his initial decision on the M-K-T common-carrier withdrawal case, finding that the railroad had failed to meet its burden of proof and had not established its major contention that carriage of nuclear materials is so unusual and highly dangerous as to justify a negation of the common carrier obligation. The railroad was thus ordered to assume its common-carrier obligation and to publish tariffs for the lawful transportation of nuclear materials.[17] M-K-T has filed exceptions to the ruling with the Commission, and a decision on the motions is expected by the end of the year.

An initial decision as to the lawfulness of the Eastern railroads' refusal to publish tariffs for the common carriage of nuclear materials is expected in the near future. It is anticipated that this decision will similarly require Eastern railroads to provide common carrier service. These initial decisions may be appealed to the appropriate division of ICC, to the full Commission, and to the courts.

However, a decision that railroads have a common carrier obligation to transport spent fuel and nuclear wastes does not settle the question of whether these commodities should move in special or regular train service.[20] This issue is discussed below.

5.3 Special Train Service

The other major controversy currently surrounding rail transportation is the publication by Western and Southern rail companies of new tariff rules on movements of spent fuel and radioactive waste. These new rules, which became effective February 18, 1976, barred all shipments of such materials from regular rail service and required that they move only in special trains.[21] The rail companies' actions were based on a report prepared by the Association of American Railroads. The Association, fearing adverse publicity, questioned the safety of the casks should an in-transit accident occur. It recommended that regular train service should not be used in the movement of spent fuel and radioactive wastes.[22]

Nuclear shippers strongly oppose this action for several reasons. First, they contend that special train service would greatly increase costs:

> Mandatory special train service increases the mileage cost to the shipper by approximately $20 per mile, about a two-fold cost increase. To put this in a different perspective, the mandatory use of special trains would add more than half a billion dollars in annual transportation charges for the two hundred nuclear power plants expected to be operating in the 1980's.[23]

A study funded by ERDA concludes that shipping spent fuel by special train would increase costs by an average of 50 percent; this could amount to an additional $19 million per year in 1985.[24]

Second, shippers assert that spent fuel casks are perhaps the strongest containers in rail service, that they are extraordinarily carefully designed and built, that the probability of a cask rupture is miniscule, and that the casks can withstand the hazards of regular train service.[25]

In addition, shippers contend that there has been no demonstration by the railroads that special trains are significantly safer than regular trains. In fact, in some situations, such as head-on or rear-end collisions, safety may be reduced in special trains because not as many cars can act as buffers to absorb accident impacts.

Finally, shippers assert that special trains will result in serious loss of transportation efficiency.[26] Although nuclear fuel shippers acknowledge that in some limited circumstances special train service can be cost-effective or offer other advantages over regular freight, they oppose any attempt to make such service mandatory.[27]

The railroads base their argument for mandatory special train service on the claim that the various ERDA and AEC studies that test the strength of casks and other packing requirements have not adequately simulated severe railroad accident conditions. The railroads maintain that the enormous forces that arise in a severe railroad accident can exceed cask design criteria; that the shipping casks have not been tested in a realistic environment; and that assumptions concerning fire risks and the exclusion of grade-crossing accidents in NRC studies underestimate potential damages resulting from a rail transportation accident.[28] These contentions are discussed further in Chapter Six.

In the absence of conclusive data justifying the safety of transporting nuclear cargo in regular train service, the railroad companies argue that special train service will considerably reduce the risks involved in carrying radioactive materials, particularly in view of the lower speeds required by such service. In addition, railroads claim that even a minor derailment of a train carrying nuclear cargo could produce devastating economic results. In such a case, before the lack of danger from radioactive leakage could be ascertained to the satisfaction of local, state, and federal authorities, the rail company might be faced with population evacuation, total cessation of operations in the area, and overall disruption of its operations.[29] Separating such potentially hazardous cargo into independent shipments could allow the rail companies to take precautionary measures which would guard against disruption of their operations in the event of an accident. As Southern Railway summarizes its argument:

> For the future, if spent fuel shipments become as common by the year 2020 as protestants predict, there will undoubtedly be an accident of some kind sooner or later. However, because of the slow speed and constant surveillance of the special train, there will be no danger to anyone even if there is an accident.[30]

As to the additional costs of special train service, the railroads argue that these will be substantially offset by other cost reductions. For example, special train service will reduce decontamination costs in the event of an accident; furthermore, through careful scheduling, it may shorten actual transit time, thereby improving cask utilization.[31]

In an initial decision, the ICC Administrative Law Judge ordered the railroads to rescind their special train service requirements, stating:

> I believe the record will support a finding that special trains for the carriage of spent nuclear fuel is unnecessary and wasteful transportation, and, therefore, an uneconomic burden on shippers and the energy using public.[32]

Whether the arguments of the rail companies or the shippers ultimately prevail, the special train service issue is one involving such divergent perspectives by the two sides that court appeals may be pursued. Protracted litigation could require years. In the meantime, pending the outcome of ICC's decision, nuclear shippers may be required to pay what they regard as excessive costs for special train service that they do not want.

CHAPTER FIVE NOTES:

TRANSPORTATION OF NUCLEAR MATERIALS BY RAIL

1. "Radioactive Materials, Missouri-Kansas-Texas Railroad Company," Initial Decision of Administration Law Judge, Interstate Commerce Commission, Docket No. 36307 at 12.

2. Telephone conversation with C. W. Smith, Counsel, Allied-General Nuclear Services (July 5, 1977).

3. Ad Hoc Committee of Legal Affairs Committee of the Association of American Railroads, "Analysis of Legal Problems Associated with the Rail Transport of Spent Irradiated Fuel Cores in Special Train Service" (February 13, 1975) at 3-4.

4. Id.

5. W. England, "Recent Regulatory Developments Concerning the Transportation of Nuclear Fuel and Other Radioactive Materials," 7 Environmental Law 203, 216 (1977).

6. M-K-T Initial Decision, supra note 1 at 21.

7. "Radioactive Materials, Special Train Service, Nationwide," Initial Decision of Administrative Law Judge, Interstate Commerce Commission, Docket No. 36325 (August 24, 1977) at 18.

8. ICC Docket No.'s 36,312, 36,313, 36,330, and 36,335.

9. W. England, supra note 5 at 213.

10. "Radioactive Materials, Missouri-Kansas-Texas Railroad Company." Brief of the United States Energy Research and Development Administration before the Interstate Commerce Commission. Docket No. 36307 at 16.

11. M-K-T Initial Decision, supra note 1 at 10, 11.

12. Id. at 13.

13. Id.

14. ERDA brief, supra note 10 at 44.

15. Carolina Environmental Study Group v. AEC, 2 CCH Nuc. Reg. Rep. 16,309 (U.S. Dist. Ct. for the Western Dist. of N.C., Docket No. C-C-73-139, March 31, 1977).

16. M. Chais, "Rail Carriage of Spent Fuel and Waste--Where We're At," AIF Summary Report: 1976 Conference on Transportation for the Nuclear Industry (February 1977) at 4.

17. M-K-T Initial Decision at 21.

18. M-K-T Initial Decision, *supra* note 1 at 21.

19. "Radioactive Materials, Special Train Service, Nationwide," Brief of the United States Energy Research and Development Administration before the Interstate Commerce Commission, Docket No. 36325 at 1.

20. *Id.* at 5.

21. W. England, *supra* note 5 at 216.

22. W. V. Loscutoff et al., A Safety and Economic Study of Special Trains for Shipment of Spent Fuel, Battelle, Pacific Northwest Laboratories, BNWL 2263 (May 1977 draft) at 52; Office of Standards Development, NRC, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes (NUREG-0170, Vol. 1, February 1977 draft) at VI-28.

23. Nationwide Special Train Service, *supra* note 21 at 42-64.

24. *Id.* at 79-88.

25. W. England, *supra* note 5 at 217.

26. *See* "Radioactive Materials, Special Train Service, Nationwide," brief of the Southern Railway Company before the Interstate Commerce Commission, Docket No. 36325 at 17, 18.

27. W. England, *supra* note 5 at 217.

28. Southern brief, *supra* note 28 at 45.

29. *Id.* at 46, 47.

30. Nationwide Special Train Service Initial Decision, *supra* note 7 at 19.

CHAPTER SIX

EMERGENCY RESPONSE PLANNING AND IMPLEMENTATION

6.1 Overview

Most NRC studies indicate that the chances of occurrence of a serious accident--one that will involve breach of containment in spent fuel or high-level radioactive wastes--are extremely small. Nevertheless, it is the practice of nuclear regulatory agencies to promote preparedness in the event that a serious accident does occur. This chapter will discuss emergency response to eliminate or mitigate hazards regardless of cause; the next chapter will examine safeguards which are intended to prevent threats, theft, or sabotage of nuclear materials.

Responsibilities for safety and emergency response are divided among federal, state, and local governmental units. On the local level, police and fire departments are generally the agencies that are most closely involved, both because of their responsibility for public health and safety and because they are generally the first to arrive at the scene of an emergency. In addition, in the case of nuclear production and utilization facilities, the Nuclear Regulatory Commission requires that emergency plans be filed as part of licensing applications. These plans provide an on-site emergency response capability until governmental units can respond.[1]

Local units are backed in their response by state agencies with additional expertise. These are generally units of the state health department or the emergency services or civil defense agency. If the incident occurs outside of lands controlled by the federal government, the state agency given responsibility under state law usually has the primary responsibility, both for accident response and for any decontamination and clean-up operations required.[2] State units can, however, request assistance from NRC, the Energy Research and Development Administration, or Department of Defense radiological assistance teams.

At the federal level, responsibility for emergency-response planning is divided among a number of agencies. The Federal Preparedness Agency of the General Services Administration has issued a notice delineating federal responsibilities covering both fixed nuclear facilities and transportation incidents involving nuclear materials.[3] The notice gives NRC the responsibility for providing other federal agencies with guidance concerning their responsibilities and authorities in this regard, as well as for providing state and local governments with planning assistance.

The federal government has also established a capability for actual response to emergency incidents. Under the Interagency Radiological Assistance Plan (IRAP), ERDA has the lead role in coordinating federal radiological assistance response with that of state government, both for fixed-site incidents and for those involving nuclear transportation.[4]

6.2 Emergency Response in Practice

An important issue in emergency response is the extent to which improved response capabilities may be required, either as a matter of prudence or to enhance public acceptance of nuclear transportation. One way in which significant improvements could be made is by providing increased federal funding for preparing and implementing state and local emergency response plans.

The need for such plans is illustrated by the recent example of a train wreck in Rockingham, NC. The following account is based upon reports by the ERDA response team leader and emergency coordinator (see Appendix B).

Twenty-nine cars of a 102-car train on the Seaboard Coastline were derailed near Rockingham, NC, on March 31, 1977. Included in the derailment were four 14-ton cylinders of uranium hexaflouride. Fortunately, all of the cylinders remained intact, with no release of radioactive material.

The wreck occurred at 7:21 a.m. The first to arrive on the scene was the Rockingham Fire Department, at approximately 8:00 a.m. The firemen took a radiation survey and, because it appeared that there was a radiation hazard, ordered that no one enter the area. The two-man radiological response team of the North Carolina Highway Patrol arrived shortly thereafter. This team also surveyed the cylinders; its conclusion was that no radiation hazard existed. By 11:00 a.m., the North Carolina Radiation Protection Emergency Team had arrived by highway patrol helicoptor. Within the next few hours, 26 additional radiological experts arrived on the scene; these included representatives from the railroad, the North Carolina Department of Human Resources, the North Carolina Highway Patrol, the North Carolina Department of Natural and Economic Resources, the South Carolina Department of Health and Environmental Control, the shipper, the U.S. Army, the Nuclear Regulatory Commission, the Environmental Protection Agency, and the

National Traffic Safety Board, as well as radiological assistance teams from Oak Ridge and Savannah River.

Many of these radiological experts, however, arrived far later than would have been desirable had there actually been a radiation hazard. The North Carolina radiation protection team arrived more than three hours after the accident. The Oak Ridge radiological response team did not arrive at the scene until nearly seven hours after the accident, and the Savannah River radiological response team (the wreck was in the Savannah River radiological assistance region) arrived shortly thereafter.

Furthermore, there was a substantial amount of confusion as to the nature and severity of the situation. Four hours after the accident, there were still conflicting reports as to the condition of the uranium hexafluoride cylinders; by five hours after the accident, it still had not been determined whether there were four or six cylinders on this particular train shipment.

Later, when the ERDA response team arrived at the scene of the accident, there was still a great deal of confusion. No one was sure who was in command, although it appeared that the Army was in charge of the area. There was still confusion as to whether there was radiation leakage. Meanwhile, cargoes of peanuts and ammonium nitrate had caught fire, and the fire department was occupied in battling the blaze. A reporter's serious hand burns caused concern; it was seven hours after the train wreck before it was determined that these burns resulted from fertilizer leakage and not from radioactive materials.

By eight hours after the accident, the ERDA radiological response team was being looked upon as the dominant authority. At the same time, the ERDA team was informing the representative of the North Carolina Radiation Protection Team that ERDA had no authority to assume responsibility for amelioration activities. The ERDA team did offer, however, to provide back-up support to the Department of Human Resources, which it considered to be the responsible state agency.

Meanwhile, the EPA representative requested that the local civil defense unit be called out. He felt that serious consideration should be given to evacuating people living downwind from the fertilizer fire, which was emitting a nitrous plume. However, since no homes were visible and the cloud was small, no EPA actions were taken to follow up.

The next day, all four cylinders were surveyed, loaded into gondola cars, and taken to a nearby railroad yard. The cylinders arrived at their destination four days later without incident.

In a critique of the accident held by the responsible North Carolina agencies, it was noted that the accident presented difficulties for two reasons: (1) it occurred in an area remote from highway access and telephone service; and (2) it happened within hours of a second serious derailment, only 75 miles away. It was also observed that, despite the presence of a large number of experts at all levels of government, as well as numerous reporters and camera crews to provide on-the-scene news media coverage, communications between persons at the scene and those in other locations were hampered by a shortage of equipment. As a result, operations were not efficient and confusion arose.[5]

Another problem was the failure to keep people out of the area until it was determined that a radiation hazard did not exist. News media representatives, for instance, were not restricted from entering the area where the cylinders were located.

Inability to locate needed information quickly also caused difficulties. It required over five hours to confirm the number of cylinders on the shipment. It took three hours for the state radiological response team to arrive at the scene, and by then it still had not been determined whether or not a radioactive hazard existed.

Finally, although large numbers of interested officials, experts, and media personnel were present, authorities and responsibilities were not fixed until eight hours after the accident.

This case, then, illustrates the practical difficulty of (1) defining who is in charge, (2) obtaining accurate information, (3) providing adequate communications, and (4) marshalling expertise to the scene of the accident in a timely manner.

On the positive side, the accident indicated that federal, state, and local agencies will respond and work together. The question that was not definitively answered, however, was what if, against all reasonable odds, the Rockingham train derailment had involved rupture of a spent-fuel cask or a cask containing plutonium or high-level radioactive waste? Would the response have been adequate to prevent injury and severe property damage? The case suggests that damages might have been quite severe had there been a significant radiological release or exposure to the fire for a long period of time. It also indicates the importance of cask design and construction as a significant component of the line of defense against potential radiological releases caused by transportation accidents.

6.3 Probability of Accidents and Severity of Consequences

The nuclear industry and its regulators believe that, in the case of spent fuel and high-level radioactive waste shipments, the chance of occurrence of an accident that involves a significant rupture of containment and a consequent release of excessive amounts of radioactivity is extremely remote. Others disagree with this assessment, however.

Those who take the first view point out that spent fuel must be shipped in large, rugged casks that are designed to survive all but the most extremely severe accident. Shipments of solidified, high-level radioactive waste will presumably be made in similarly designed casks, although no such casks are yet commercially available.

Spent-fuel casks are subject to free-drop, puncture, thermal, and water immersion tests, as follows:[6]

- Free-drop: a free drop of a distance of 30 feet onto an essentially unyielding surface, striking in a position for which maximum damage is expected.

- Puncture: a free drop of 40 inches, striking in a position for which maximum damage is expected, atop a vertical, fixed, 6-inch diameter steel pin not less than 8 inches long.

- Thermal: exposure to the equivalent of a 1,475°F fire for 30 minutes, with no artificial cooling for three hours after the exposure.

- Water immersion: immersion under at least three feet of water for a period of not less than eight hours.

To pass this test sequence, the package must not suffer a reduction in shielding that would increase the external radiation dose rate above 1,000 millirems per hour at three feet. In addition, no radioactive material may be released from the package, except for gases and contaminated coolant, which may be released to certain specified levels.[7] Actual performance of the tests is not necessary, however, "if it can be clearly shown, through engineering evaluations or comparative data, that the material or item would be capable of performing satisfactorily under the prescribed test conditions."[8]

Some have suggested that this test sequence is not sufficiently representative of the forces that may occur during an accident. For instance, the Southern Railway Company, in an Interstate Commerce Commission proceeding involving a request by Southern and other railroads to ship spent fuel and radioactive waste material only in special trains, argued that the principal studies by the Atomic Energy Commission and NRC understate the collision impacts and fire risks associated with rail transportation. The studies in question indicate that only 1.5 percent of railroad accidents involve fire and only 1 percent of those fires last more than one hour,[9] but the railroads argued that no empirical fire-duration studies have been made for railroad accidents.[10] In addition, the studies had statistical errors which doubled the actual number of car miles during the relevant years[11] and eliminated railroad grade-crossing accidents from their calculations--yet more than one-third of the accidents involving railroads occur at grade crossings.[12] The railroads concluded that "these and other errors and unfounded assumptions . . . make any conclusions . . . regarding the probability of serious rail accidents completely meaningless."[13]

These railroad contentions were not considered to be persuasive in an initial decision by an ICC Administrative Law Judge, who held that the railroads did not sustain their burden of proof to justify transporting spent fuel and high-level radioactive waste only by special train service.[14]

In another study, the Public Interest Research Group in Michigan (PIRGIM) recently concluded that:

> Shipping radioactive wastes upon highways and railroads is an endeavor filled with difficulties for the industries involved and perilous for the nearby population. The casks are complex mechanisms which may fail either due to improper design, manufacture, or maintenance, or through involvement in accidents causing them to open.[15]

This study contended that large amounts of radioactive material would escape from casks if pressure built to a level sufficient to cause leakage of coolant. When the coolant was gone, the spent fuel would further increase in temperature, causing a greater percentage of fuel to be released as a gas. Radioactive cesium was pinpointed as a special problem.

In response, NRC released a study indicating that a crucial assumption of the PIRGIM study--that cesium would be present in spent fuel in its most volatile form, a free metal--was erroneous. The NRC study concluded that cesium releases would be minor in a serious transportation accident because cesium is chemically combined with other elements; in this form, it would not vaporize at accident temperatures.[16]

The latest NRC effort at estimating nuclear material transportation risks indicates that normal transportation activities only slightly increase background radiation. The analysis shows that, barring additional releases caused by accidents, radiation exposure from transportation of such materials, averaged over the persons exposed, amounts to 0.5 millirems per year. This figure may be compared with the average natural background exposure of about 100 millirems per year.[17]

In an accident scenario, risks are also considered to be very low. However, in spite of the low annual risk of accidents, a specific accidents occurring in very high-density urban population zones could produce as many as one early fatality and 150 latent cancer fatalities, as well as decontamination costs in excess of $200 million.[18]

To help verify computer simulations, ERDA is now sponsoring crash research involving spent fuel casks. According to an ERDA press release dated March 16, 1977:

> A nuclear fuel shipping cask mounted on a tractor-trailer rig was crashed into a concrete wall at 84 miles per hour (mph), in the second of a series of tests to determine how well containers used to transport nuclear material can withstand severe accidents.
>
> The Energy Research and Development Administration (ERDA) reported that one end of the twenty-two ton cask was slightly deformed by the impact. No part of the cask cracked open, and there was no leakage.
>
> A shock absorbing impact limitor on the end of the cask which struck the wall was crushed, as test engineers had predicted. The rocket-powered tractor-trailer rig was totally demolished.
>
> In a similar test which ERDA conducted at 60 mph, in late January, the cask also received only surface damage. The 80 mph crash subjected the cask tractor-trailer to twice as much energy as the 60 mph test.
>
> Both tests were carried out at the rocket sled track of ERDA's Sandia Laboratories, near Albequerque, New Mexico, and were witnessed by members of the news media, industry, and general public. Additional tests, including a cask-train collision at a railroad crossing, are planned later this year.[19]

In addition, to help improve the performance of packaging for radioactive materials, NRC recently promulgated regulations to upgrade requirements for quality assurance in the design, construction, and use of such containers.[20] This action formalized requirements that were previously imposed as container licensing conditions.

Thus, although there is disagreement over the extent of hazards from nuclear transportation, it is likely that both safety standards and enforcement will be upgraded.

6.4 Emergency Planning by NRC Licensees

As indicated above, NRC requires elaborate planning for accidents at stationary nuclear facilities.[21] With respect to transportation of nuclear materials, most shipments are likely to be made using common carriers--either trucks or railroads. Since such carriers are exempt from licensing under present NRC regulations,[22] they are not covered by NRC's emergency planning requirements. However, in the event of an accident, there are several types of requirements that apply. First, state or local law generally requires immediate notice to appropriate fire or police agencies. In addition, DOT requires that carriers notify them at the earliest practical moment of suspected radioactive contamination, with a detailed report completed and submitted within 15 days.[23] A carrier of radioactive materials must also notify the shipper at the earliest practical moment following any incident involving radioactive materials shipments in which there has been breakage, spillage, or suspected radioactive contamination. The shipper must then provide details that are necessary and helpful to mitigate adverse impacts. Vehicles, buildings, areas, and equipment in which radioactive materials have been spilled may not again be placed in service or routinely occupied until the radiation dose rate at any accessible surface is less than 0.5 millirems per hour and no significant removable radioactive surface contamination remains.[24]

DOT regulations also indicate that ERDA is to be notified if radiological advice or assistance is needed. In the case of obvious leakage, or if it appears likely that an inside container has been damaged, loose radioactive material is to be left in a segregated area and held pending disposal instructions from qualified persons. Additional information involving the handling of radioactive materials in the event of an accident is found in the Bureau of Explosives' Pamphlets Nos. 1 and 2.[25]

6.5 Radiological Emergency Response Planning

Some states have taken the initiative in the area of emergency response planning for radiological incidents. For example:

> In Oregon, a full-scale practice evacuation was conducted at the Trojan plant in the summer of 1975. The exercise was based upon a hypothetical rupture of a tank containing radioactive gases. A control center was set up outside the plant. "Victims contaminated with radioactive material" were sent by ambulance to a hospital in Portland forty miles away, and the ability of the hospital to receive them was demonstrated. Highway traffic was interrupted and flyers were handed out explaining that in a real emergency the car would have to turn around. Those residents of a nearby town who were willing were evacuated to a high school gymnasium in another community. The principal thing learned in the test was that the state had inadequate communication equipment; it is not feasible for radiation monitoring people to communicate their information by using pay phones at gas stations! Oregon now has a fresh supply of portable radio-telephones.[26]

The Federal Preparedness Agency of the General Services Administration has set out guidelines to provide states with federal assistance in such planning.

In its notice of Interagency Responsibilities of December 24, 1975,[27] the Federal Preparedness Agency outlined the responsibilities of eight federal agencies in providing state and local governments with assistance in emergency response planning for radiological incidents. Unlike the NRC regulations, which require emergency response plans from nuclear facilities licensees, emergency response planning under the Federal Preparedness Agency is based on voluntary guidelines and depends upon the willingness to cooperate of appropriate local, state, and national agencies.

Acting under Executive Orders 11051 and 11490, the Federal Preparedness Agency is seeking to stimulate vigorous state and local participation in emergency preparedness measures. It is also attempting to develop a coordinated working relationship among the various elements of state governments and the federal agencies to which specific emergency preparedness functions are assigned. The Federal Preparedness Agency points out that, while there is assurance of a low probability of incidents involving radioactive materials, both in fixed nuclear facilities and in the transportation of those materials, the anticipated proliferation of nuclear power plants and materials in the future requires early consideration of this problem, together with adequate emergency planning for such contingencies.

The Federal Preparedness Agency has given NRC the responsibility of issuing guidance to other federal agencies concerning their responsibilities and authorities in emergency response planning for radiological incidents. It has also made NRC responsible for developing and promulgating guidelines, in coordination with other federal agencies, for use by state and local governments in the preparation of their radiological emergency response plans. These NRC guidelines have been published.[28] NRC is to review state and local plans and to concur with them upon a proper showing that they meet NRC guidelines. It also is to determine the accident potential at each fixed nuclear facility and to issue guidelines for the establishment of effective systems of emergency radiation detection and measurement.

In addition to specifying NRC's responsibilities, the Federal Preparedness Agency's notice establishes the responsibilities of the Environmental Protection Agency (EPA); ERDA; the Department of Health, Education and Welfare (HEW); DOT; the Defense Civil Preparedness Agency; and the Federal Disaster Assistance Administration. The responsibilities of these agencies include providing appropriate state and local officials with training in emergency response planning. Other agency responsibilities are outlined below.

EPA is responsible for establishing guidelines for radiation doses that might result from radiological incidents, as well as for recommending appropriate protective actions that can be taken by governmental authorities to ameliorate the consequences of such incidents. EPA also is to assist NRC in developing the state plan. Finally, EPA is to cooperate with NRC in establishing guidelines for emergency radiation detection and measurement systems.

ERDA is responsible for the preparation of plans at ERDA-owned and -operated facilities. It is also to determine the accident potential of the various ERDA facilities.

HEW is to assure that the appropriate guidance is provided to hospital and ambulance services, so that they can function properly in an emergency. It is also responsible for providing states and localities with guidance on appropriate planning actions to prevent the radiological contamination of food.

DOT has responsibility for developing guidelines for assisting states in the preparation of response plans for transportation incidents.

The Defense Civil Preparedness Agency is to assist state and local authorities in planning the emergency preparedness actions required to coordinate emergency operations in response to radiological incidents. It also is to issue guidelines on the use of civil defense resources, including warning, communications, training, and radiological defense emergency response systems.

Finally, the Federal Disaster Assistance Administration of the Department of Housing and Urban Development is to provide guidance to state and local authorities on the disaster-preparedness aspects of state emergency planning. It is also to provide NRC with recommendations concerning the evaluation and review of state and local planning activities.

As indicated above, NRC has no statutory authority to make changes in state or local plans for emergency response planning--or to require that any such plans be prepared at all. Nevertheless, as part of its lead role in radiological incident emergency response planning, NRC has issued a guide to assist state and local governments in planning for accidents at fixed nuclear facilities (NUREG 75-111). The document is both a guide and a checklist for developing and evaluating state and local government radiological emergency response plans for fixed nuclear facilities. NRC is also providing free training courses to appropriate state and local officials to assist them in preparing suitable plans.

In addition, NRC, through established federal interagency regional advisory committees (RACs), carefully reviews proposed state plans. If, in the opinion of the RAC and NRC, a state plan meets minimum guidelines for dealing with fixed nuclear facility accidents, NRC issues a letter of concurrence. In order to maintain this concurrence status, a state must conduct an annual exercise, evaluated by a federal team, to test the adequacy of the plan under simulated accident conditions. The Washington State emergency plan for fixed nuclear facility incidents, prepared by the Washington State Department of Emergency Services in May 1976, is the only state emergency response plan that has received concurrence from NRC.

The Assistant Director for Emergency Preparedness of NRC's Office of State Programs has indicated that the slow response of states in preparing their radiological emergency response plans may be partially accounted for by the fact that, currently, there is no direct federal mechanism to provide financial assistance to states for preparing such plans.[29] NRC's Office of State Programs has, from time to time, received suggestions from various state and local governments that financial assistance be provided by the federal government for the preparation of such plans. Currently, about one-half of the states designate the civil defense or emergency services agency as the lead agency in preparing the state's radiological emergency response plans. In most cases, approximately one-half of the personnel and administrative expenses of civil defense or emergency services offices are paid by the federal government; therefore, these states do receive some federal assistance. For the other states, which generally designate health departments, no direct federal funding is available at present.[30]

NRC's current emphasis with respect to state and local planning is on response to radiological releases from fixed facilities. NRC has, however, provided limited training and an interim planning guidance for transportation accidents involving radioactive materials.[31] Together with DOT, NRC intends to publish more definitive guidance in this area near the end of 1978, upon completion of research work by Sandia Laboratories.[32]

The Sandia study is also anticipated to respond to a common state complaint: lack of information as to the kind of circumstances that are likely to be encountered in a transportation accident involving radioactive materials. The states argue that the present situation leaves them in the position of being told that packages are practically accident-proof, but that, on the other hand, they have the primary responsibility for responding to accidents where packages may not perform as designed, or where design standards are exceeded.[33]

The states are seeking guidelines that will (1) outline a spectrum of accident scenarios that might be encountered and (2) provide recommendations for equipment that should be on hand in police and fire vehicles and through state radiation control organizations.[34] The Sandia study is intended to meet this criticism by providing a scenario book of both fixed nuclear facility and transportation incidents involving radioactive materials. This document will (1) provide a much better means for testing and evaluating state response plans, (2) establish greater consistency of approach, and (3) assure that plans are directed towards realistic kinds of possibilities.

It appears that, until the Sandia work is completed and confirmed, state radiological response plans related to transportation incidents cannot be evaluated as to adequacy. Thus, although some states have developed transportation accident emergency plans, NRC is deferring the evaluation of these plans until the Sandia studies have been completed and new guidelines have been developed in cooperation with DOT. Hopefully, this process will be completed before significant quantities of spent fuel are transported.

6.6 Responding to Radiological Incidents

The discussion in this chapter so far has involved radiological incident planning, and not actual response to accidents. The output of a planning program is a written report; incident response involves actions taken in the event of a nuclear transportation accident. Hopefully, if plans are properly prepared, with full participation of the affected local, state, and national agencies, an actual incident will cause a swift, coordinated, and appropriate response to the emergency plan. Since, so far, there have been no reported nuclear transportation incidents that were so serious as to cause a known loss of life or massive property damage due to radiological contamination, the civilian emergency response capability has not yet been tested under severe emergency conditions.

In addition to the radiological incident emergency response planning that is occurring under the leadership of the Federal Preparedness Agency and NRC, an older program has been and is now in effect. The Interagency Radiological Assistance Plan (IRAP) was developed in 1961 by a committee of representatives from a number of federal agencies as a means of providing rapid and effective radiological assistance in the event of a peacetime radiological incident. IRAP's preamble states that it provides a means for the participating federal agencies to coordinate their radiological emergency-related activities with those of health, police, fire, and civil defense agencies at the state and local level. The plan also provides operating guidelines for interagency radiological emergency operations and training.[35] IRAP has three specific purposes: (1) to provide for prompt and effective radiological assistance as may be required to protect public health, safety, and welfare from radiological hazards resulting from radiological incidents; (2) to coordinate federal, state, and local radiological assistance operations; and (3) to encourage the development of state and local plans and capabilities to cope with radiological incidents.[36]

IRAP designates ERDA as the agency responsible for directing the plan's administration, implementation, and application, with the cooperation of other participating federal agencies. For radiological incidents that occur in fixed-site facilities, if the site is ERDA-controlled, then ERDA has primary responsibility. If the site is not ERDA-controlled, however, ERDA's radiological assistance personnel are to cooperate with appropriate federal, state, and local government authorities in carrying out radiological monitoring, decontamination, material protection and recovery, and other emergency operations.[37] In such cases, however, ERDA's responsibilities do not abridge state or local government authority or the authority of other federal agencies, nor do they take precedence over legitimate private jurisdiction.

ERDA has developed a Radiological Assistance Plan to implement its responsibilities under IRAP. This plan specifies response actions and provides for both on-scene radiological assistance and postemergency assistance. In addition to this central plan, regional radiological assistance plans are formulated at ERDA's principal regional offices.

The costs of ERDA's radiological assistance activities are included as part of the costs of health and safety operations at ERDA installations. Even when ERDA contractor assistance is required off site, the expenses are still treated as an on-site operation. However, if an ERDA contractor incurs unusual costs while performing radiological assistance services, he may request budgetary adjustments. The costs of federal radiological assistance are not normally intended to be recovered from the individual or organization that requests such assistance, but if there is a doubt as to the justifiability of the aid, reimbursement for expenses may be sought.[38]

Thirteen federal agencies are signatories to IRAP. Each has functions and capabilities that can contribute to an ERDA-coordinated federal response to a radiological incident. In addition, interagency coordinating staffs at field offices can be activated by ERDA if their legal authorities, responsibilities, and jurisdictions are needed to cope with the consequences of a particular radiological incident.

The 13 federal agencies that are IRAP signatories and their principal responsibilities under the program are:[39]

- Defense Civil Preparedness Agency: Performs civil defense and disaster warning functions; provides state and local governments with assistance in natural disaster preparedness planning.

- Department of Agriculture: Maintains a radiological-monitoring capability for food and livestock feed.

- Department of Commerce: Provides, through its National Oceanic and Atmospheric Administration, information concerning weather conditions and forecasts that would affect radiation dispersal.

- Department of Defense: Is primarily responsible for individual accident response on military and ERDA facilities involving nuclear weapons, under the joint agreement of the Department of Defense and the Atomic Energy Commission. In addition, each of the armed services has its own capabilities for dealing with nuclear accidents involving nuclear weapons or other nuclear materials controlled by that service.

- Department of Health, Education, and Welfare: Provides radiation expertise through its Bureau of Radiological Health and its Food and Drug Administration.

- Department of Labor: Provides, through its Occupational Safety and Health Administration, radiological monitoring expertise gained from its establishment and enforcement of federal occupational safety and health standards in most of the nation's workplaces.

- Department of Transportation: Notifies federal and local agencies; arranges special transportation activities; and assists in contacting consignors and consignees of shipments involved in the incident. In addition, the Federal Aviation Administration, Federal Highway Administration, and Federal Railroad Administration all have regional hazardous materials specialists and coordinators.

- Energy Research and Development Administration: Is responsible for (1) assistance in the preparation of regional radiological assistance plans, both through its headquarters division and through field offices, and (2) overall management and administration to implement IRAP. The latter includes coordination of the applicable resources of other federal agencies; in addition, ERDA is to utilize its manpower and physical resources for radiological monitoring, decontamination, medical advice and emergency treatment, radiological hazard assessment, and emergency response to radiological occurrences--including those involving nuclear explosives.

- Environmental Protection Agency: Provides, through its Office of Radiation Programs, assistance for (1) measuring environmental radiation, (2) evaluating the extent of contamination, and (3) advising on actions that should be taken to protect public health and safety.

- Interstate Commerce Commission: Is responsible for assisting in arrangements for, or expediting, emergency transportation to or from distressed areas by domestic surface transportation.

- National Aeronautics and Space Administration: Can provide radiological, environmental, health, and medical support personnel; radiation sampling, detection, and monitoring instruments; and fire-fighting and other emergency heavy equipment.

- Nuclear Regulatory Commission: Is responsible for collecting and evaluating the circumstances attending any abnormal release of radioactive material from licensed nuclear facilities or containers.

NRC also can provide significant manpower through its managerial, technical, and professional personnel; unlike ERDA, however, it has no emergency equipment or hardware resources directly available.

The federal government, then, is promoting emergency preparedness for nuclear incidents via three separate avenues:

1. Nuclear facilities licensees and common carriers of nuclear shipments are subject to direct federal regulation. Licensees are required to prepare emergency response plans; common carriers are required to notify DOT, the shipper, and ERDA in the event of a transportation incident involving radiological materials.

2. As established by the Federal Preparedness Agency, various federal agencies are responsible for providing assistance in radiological emergency response planning, with respect to both fixed nuclear facilities and transportation incidents. Under this planning program, NRC has the lead role in encouraging states and local governments to prepare plans for responding to nuclear incidents. Currently, the emphasis is on urging states to prepare response plans for fixed facilities. Upon the completion of additional studies, NRC will turn its attention to transportation emergency response planning, as well.

3. Under IRAP, plans and resources have been developed for responding to radioactive incidents as required; the plan designates ERDA as the lead agency.

Despite these elaborate preparations, it may often be hours before experienced state or federal radiological assistance teams can arrive on the scene, although telephone instructions can often be given to local officials in the meantime. Therefore, the effectiveness of emergency response activities in actual radiological incidents may primarily depend on the training and resources of the local police or fire departments that respond initially.

6.7 Approaches towards Improving Emergency Response

As indicated above, states are now starting to formulate elaborate plans for responding to accidents at fixed nuclear sites. As yet, however, little attention has been paid to accident response in the case of transportation incidents. However, the completion of NRC studies to develop an improved manual, which will include both a description of appropriate activities for responding to transportation accidents and a range of possible accident scenarios, should assist in improving response capabilities.

With respect to the design and construction of shipping containers, additional crash tests and additional quality-control requirements for spent nuclear fuel casks may further improve the accident resistance of these containers.

Training and planning for accident response at the state and local level could be greatly imprved if more funding were available for such activities. One method would be to provide additional federal funding. As an alternative, a mechanism could be developed to permit states or localities to assess utilities in their jurisdiction--or the specific utility that is transporting spent fuel or high-level radioactive waste--for the cost of emergency planning and implementation activities.

There is precedent for assessing charges against private entities for governmental accident-response activities. For example, under both the Deepwater Port Act of 1974 and the Trans-Alaska Pipeline Authorization Act, a fee is assessed on oil movements to establish a fund for clean-up costs and damages in the case of marine oil spills.[40] Also, NRC has indicated that, although a federal repository will assume permanent custody of high-level radioactive waste materials, industry will be required to pay the federal government a charge which, together with interest on unexpended balances, will defray costs of disposal and perpetual surveillance.[41]

Of course, in the case of nuclear transportation, where nuclear facilities may be located in a distant state and transportation routes may not be fully preplanned, there may be some difficulty in equitably assessing utilities or shippers for such local preparedness activities. In addition, it may be desirable to increase greatly the level of response capabilities in populated areas, where an accident could result in more severe damage. Thus, consideration might be given the establishment of a national fund that would be assessed against utilities in proportion to the number of nuclear facilities that they operate. This fund would then be made available to federal, state, and local agencies that might be called upon to respond to a nuclear transportation accident.

Finally, emergency response planning could be improved by establishing designated transportation routes for spent fuel or high-level radioactive waste. If such routes were identified, assistance and training could be provided to the affected state or local jurisdictions. Advance notice to the appropriate state or local jurisdictions of such shipments could further enhance preparedness.

CHAPTER SIX NOTES:

EMERGENCY RESPONSE PLANNING AND IMPLEMENTATION

1. See 10 C.F.R. 50.34(a)(10), 10 C.F.R. 50.34(b)(6)(v), and 10 C.F.R. 50, Appendix E, which require applications for a production or utilization facility license to contain plans for coping with emergencies.

2. Western Interstate Nuclear Board, Transportation of Radioactive Materials in the Western States (March 1974) at 34. Depending upon state or local law, carriers and shippers will also have responsibility for emergency response. See Office of Standards Development, NRC Regulatory and Other Responsibilities As Related to Transportation Accidents, NUREG-0179 (June 1977).

3. Statement of the Federal Preparedness Agency, General Services Administration (December 24, 1975) (40 F.R. 59494). Also in 1 CCH Nuc. Reg. Rep. 2040 (1976).

4. ERDA, Radiological Assistance Plan, ERDA-10 (July 1975).

5. Critique of Seaboard Coastline Derailment South of Rockingham, NC on March 31, 1977, held by Radiation Protection Branch, North Carolina Department of Human Resources and Division of Civil Preparedness, North Carolina Department of Crime Control and Public Safety (May 6, 1977) at 15.

6. See 10 C.F.R. 71, Appendix B, "Hypothetical Accident Conditions."

7. 10 C.F.R. 71.36.

8. 49 C.F.R. 73.398(d).

9. Brief of the Southern Railway Co., ICC Docket No. 36325, "Radioactive Materials, Special Train Service, Nationwide," (Jan. 25, 1977) at 18.

10. Id.

11. Id. at 19.

12. Id.

13. Id. at 18.

14. "Radioactive Materials, Special Train Service, Nationwide," ICC Administrative Law Judge Initial Decision, Docket No. 36325 (Aug. 24, 1977) at 20-21. For a more detailed discussion of rail transportation issues, *see* Chapter Five.

15. Oversight Hearing on Nuclear Waste Disposal in Michigan Before the Subcommittee on Energy and the Environment of the House Committee on Interior and Insular Affairs, 94th Cong., 2d Sess., Ser. 94-68 at 83 (1976). Radioactive emissions into the air are now subject to the full regulatory framework of the Clean Air Act. *See* Clean Air Act Amendments of 1977 (P.L. 95-95).

16. Office of Standards Development, NRC, *Potential Releases of Cesium From Irradiated Fuel in a Transportation Accident*, NUREG-0069 (July 1976).

17. Office of Standards Development, NRC, *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170, Vol. 1 (draft, February 1977) at xx-xxi.

18. *Id*.

19. ERDA Press Release No. 77-52 (March 16, 1977).

20. *See* 10 C.F.R. 71, Appendix E.

21. *See* note 1, *supra*.

22. 10 C.F.R. 30.13, 40.12, and 70.12.

23. 49 C.F.R. 171.15-171.16.

24. 49 C.F.R. 174.750(a).

25. 49 C.F.R. 174.750(b)

26. W. Kelly Woods, "State Regulation of Sited Nuclear Power Plants," paper presented at AIF's Nuclear Dialogue for State Regulators, Detroit, MI (October 20, 1976) at 6.

27. 40 F.R. 59494 (Dec. 24, 1975) in 1 *CCH Nuc. Reg. Rep*. 2040.

28. Office of International and State Programs, NRC, *Radiological Emergency Response Planning: A Handbook for Federal Assistance to State and Local Governments*, NUREG-0093/1 (June 1, 1976); Office of International and State Programs, NRC, *Guide and Checklist for Development and Evaluation of State and Local Government Radiological Emergency Response Plans In Support of Fixed Nuclear Facilities*, NUREG-75/111 (Dec. 1, 1974).

29. Conversation with Mr. Harold Collins, Assistant Director for Emergency Preparedness, Office of State Programs, Nuclear Regulatory Commission, Washington, DC (May 12, 1977). There is no direct federal mechanism for funding such state activities other than general emergency planning grants administered by the Federal Disaster Assistance Administration. These grants may or may not be partially used for radiological emergency response planning.

30. *Id.*

31. Western Interstate Nuclear Board, in cooperation with the Regional Training Committee, Region VIII, *Development of an Example Plan and Guide For Emergency Response Planning for Coping with Transportation-Related Radiation Incidents* (May 15, 1975).

32. *Supra*, note 29.

33. Western Interstate Nuclear Board, *Transportation of Radioactive Materials in Western States* (March 1974) at 29.

34. *Id.*

35. *Interagency Radiological Assistance Plan*, ERDA-10 (revised April 1975) at iii.

36. *Id.* at 1.

37. ERDA, *Radiological Assistance Plan*, ERDA-60 at 14.

38. *Id.* at 8-9.

39. ERDA, *Interagency Radiological Assistance Plan*, ERDA-10 Annex V (April 1975) at 8 to 27.

40. *See* Section 18(f), *Deepwater Port Act of 1974*, 33 U.S.C. 1517(f); and Section 204, *Trans-Alaska Pipeline Authorization Act*, 43 U.S.C. 1653.

41. 10 C.F.R. 50, Appendix F, "Policy Relating to the Siting of Fuel Reprocessing Plants and Related Waste Management Facilities."

CHAPTER SEVEN

TRANSPORTATION SAFEGUARDS AND SECURITY

7.1 Overview

With the growth of the nuclear power industry, there has been increased concern over diversion or theft of nuclear materials, sabotage of nuclear facilities, or other acts involving nuclear threats or violence.[1] This sentiment was reflected in the Energy Reorganization Act of 1974,[2] which established the Office of Nuclear Materials Safety and Safeguards as one of three statutory program components in the newly created Nuclear Regulatory Commission. That Office has responsibility for the establishment and maintenance of safeguards against threats, theft, and sabotage of licensed nuclear facilities and materials. At present, its principal safeguards programs are directed at (1) preventing theft or diversion, both from fixed sites and in transit, of nuclear materials that could be used for nuclear explosives or contaminants, and (2) assuring physical security from sabotage of nuclear facilities.

Currently, there are only three types of radioactive materials that, when present in strategically significant quantities, require physical protection against theft and sabotage during transit: highly enriched uranium (enriched to 20 percent or more in the U-235 isotope), U-233, and plutonium.[3] Spent fuel and high-level waste shipments are generally considered neither an attractive nor a practical target for theft or sabotage.[4]

A recent study sponsored by the Ford Foundation concluded that technologies that introduce weapons-grade materials into commerce are clearly undesirable from a security viewpoint.[5] Accordingly, nuclear fuel cycle decisions have an important bearing on safeguards requirements. If plutonium is not recycled, the opportunities for plutonium theft in civilian industry are largely eliminated. Similarly, if the high-temperature, gas-cooled reactor is not commercialized, the amount of highly enriched uranium in civilian commerce will be very small.

On the other hand, if plutonium reprocessing is commenced, or if highly enriched uranium is used in the nuclear fuel cycle, it has been contended that the weakest link in security would be transportation.[6] Particularly if reprocessing is not commenced, however, it has been suggested that some level of safeguards requirements should be incorporated to apply to spent-fuel transportation.

The difficulty in addressing safeguards issues is that, in spite of sophisticated threat-assessment programs, it is virtually impossible to predict the precise nature of the threat; thus, safeguard requirements are based on a large component of subjective judgment. At the same time, such requirements need to be carefully considered, as they may have significant effects on civil liberties, as well as economic and environmental impacts.

7.2 Current Safeguards Requirements

Although there are extensive federal regulations regarding the shipment, carriage, and handling of both spent fuel and high-level radioactive waste, there are no special safeguards and security requirements concerning the transportation of these materials. The absence of safeguards for such shipments may be due to the belief that the theft of spent fuel is considered highly unlikely, since it is extremely radioactive and can be handled only with special shielding and equipment. The heavy casks (30 to 100 tons) in which it is shipped further complicate theft.[7] Furthermore, the safety requirements that are intended to enable a spent-fuel cask to withstand severe transportation accidents also serve a safeguards function by protecting the cask from small arms fire and explosives. The safety requirements do not completely preclude the possibility that a minor rupture could occur, resulting in dispersal of a cask's gaseous inventory and a small portion of the solids. However, a massive rupture of the cask, resulting in the radioactive contents' being ejected or removed--whether by mechanical means or by high explosives--is considered to be essentially impossible.[8]

Even if the LWR fuel cycle is not closed and the nuclear power program proceeds without commercial reprocessing, it has been suggested by some that spent fuel would be the most vulnerable point in the cycle, and that safeguards precautions should therefore be taken. Others have pointed out, however, that such materials would only be useful to a diverter that had access to a small reprocessing plant.[9]

In contrast to shipments of spent fuel and radioactive wastes, shipments of strategic quantities of plutonium and highly enriched uranium are subject to stringent safeguards requirements. Requirements are also being upgraded for fixed-site facilities, in conjunction with the increasing attention being paid to safeguards at these facilities. NRC's Office of Nuclear Material Safety and Safeguards now has a staff of over 200 that is translating policy into new regulatory requirements. An intense program of on-site evaluations, field tests of vulnerability, and computer simulations is under way to identify problems and areas for improvement. Based on early results of this program, in

February 1977, NRC adopted new requirements to protect nuclear power reactors against sabotage. Both existing and proposed safeguards at fuel cycle facilities include material control and accounting, strengthened physical security, and access control over materials.[10]

Current transportation safeguard requirements include: (1) preplanning to reduce risks in transit; (2) provision of highly trained, armed escorts; (3) restriction of travel primarily to daylight hours on major highways; (4) arrangements for continual communication with a control point; and (5) automatic response in the event that scheduled reports are not received. In addition, NRC regulations require advance notice of such shipments, so that unannounced inspections can be made to check on compliance with applicable requirements.[11]

NRC does not, however, directly regulate carriers and transporters of commercial nuclear materials.[12] Rather, NRC requirements are aimed at licensees who, in turn, "shall make arrangements to assure"[13] that common or contract carriers meet NRC standards. Licensees must also submit transportation plans for shipping strategic quantities of highly enriched uranium and plutonium. Companies currently holding approved plans are Tri-State Motor Transit of Joplin, MD; Transnuclear, Inc., of White Plains, NY; and Edlow International Co. of Washington, DC.[14]

One reason for NRC's indirect approach to regulating carriers is that "the general consensus has been that shipments of nuclear materials represent such a small part of the business of most carriers that they would prefer not to handle nuclear material if it were to mean more regulation or a change in normal, day-to-day services."[15] This indirect regulatory approach, however, has been subject to criticism. Some industrial organizations have suggested that the government provide protective services for strategic quantities of special nuclear materials; others have stated that the shipper or receiver of the material does not have adequate controls over carriers, and have recommended that carriers be licensed by NRC.[16]

The industry's willingness to accept additional stringent safeguards regulation will soon be tested. NRC has proposed new performance-oriented safeguards requirements to strengthen physical protection for highly enriched uranium and plutonium, both at certain fuel-cycle facilities and in transportation.[17] Upgraded guard qualification training and equipment requirements have also been proposed.[18] For fixed-site facilities, these regulations would establish general performance requirements to protect against: (1) assault by a small, well-trained group; (2) attack by stealth; or (3) deceptive action, either by an insider or by a conspiracy of employees. For transportation, elaborate specific performance capabilities are detailed to restrict access, to prevent unauthorized removal, and to provide a response capability. The proposed regulations require licensees to establish a detailed security program that includes: (1) nine highly trained and qualified armed escorts per land shipment, (2) sophisticated redundant communication capabilities, (3) penetration-resistant or armored vehicles, (4) preplanned routes with a severely limited number of intermediate stops, and (5) testing and maintenance programs to assure continued reliability of security systems.

7.3 Current Issues Affecting Transportation Safeguards

7.3.1 Reprocessing

President Carter's National Energy Plan proposed to "defer indefinitely commercial reprocessing and recycling of plutonium. . . ."[19] This position was, at least initially, concurred with by the Senate. In ERDA's 1978 fiscal year, funds were authorized for various studies concerning the Barnwell Nuclear Fuels plant (the only U.S. facility that would be capable of commercial reprocessing for many years), but it was specified that "none of the authorized funds may be used for operations of the plant to process spent fuel from reactors."[20]

A final decision on this issue will have a major impact on size of the safeguards security force. If plutonium or highly enriched uranium are not produced in the civilian power reactor program, there will be far fewer opportunities for diversion of materials that can be directly fabricated into weapons. Spent fuel will be transported from reactor sites either to interim storage areas or to permanent waste repositories. As pointed out above, spent fuel is transported in massive casks that are regarded as essentially self-protective and that are not an attractive target for theft or sabotage.

7.3.2 Extension of Safeguards

It has been debated whether some or all of the physical protection requirements for the transportation of plutonium or highly enriched uranium should be extended to the transportation of spent fuel, as well as to other transportation segments within the civilian power reactor fuel cycle. One study indicated that:

> The lethal hazard from intentional damage to a spent fuel shipment is comparable in magnitude to that from damage to shipments of industrial

> chemicals. However, the expense and difficulty of cleanup are much greater in the case of a spent fuel shipment.[21]

A decision to extend safeguards requirements to spent fuel and other hazardous nuclear materials should rest on a careful assessment of risks, costs, past experience, and evaluations of future conditions. Determining the optimum level of protection is difficult, however, because the actual threat of theft or diversion is not readily quantifiable. A February 1977 NRC study concluded that:

> Shipments of radioactive materials not now covered by NRC physical protection requirements, such as spent fuel and large source nonfissile radioisotopes, do not constitute a threat to the public health and safety because of either their limited potential for misuse or the protection afforded by safety considerations, e.g., shipping containers.[22]

The same study also found that:

> Existing physical security requirements are adequate to protect, at a minimum, against theft or sabotage of special nuclear materials in transit by a postulated threat consisting of a violent assault by a small group of armed, dedicated individuals, diversion by one employee or by both acting in combination. Since there is no evidence of an identifiable threat to nuclear materials in the U.S., physical security requirements based on this postulated threat level are considered adequate and prudent at this time.[23]

However, in contrast to its February finding that existing safeguards were adequate, in July the NRC proposed significantly more stringent safeguards. The proposed regulations require that transit safeguards plans be measured against a larger adversary force that employs effective team tactics. Thus, the timing and extent of future changes in transportation safeguard requirements are an element of uncertainty facing the nuclear transport industry.

7.3.3 Transportation Modes

A recent NRC draft environmental impact statement indicated that there may be both security and safeguards advantages to certain means of transportation. Specifically, it suggested that rail transport may be less attractive than highway transport from a security standpoint.[24] The final environmental statement took a different view, however, maintaining that, "regardless of the mode of transportation, adequate protection against theft and acts of sabotage that would result in a significant radiological hazard can be provided."[25] Nevertheless, according to the earlier study, highway transportation is presently the preferred system for surface transport of strategic quantities of special nuclear materials.

The principal advantages of highway transportation are: (1) accessibility to all nuclear facilities; (2) flexibility of routing; (3) direct service without need to transfer cargo; and (4) speed. In addition, highway transport makes it easier for a response to be coordinated and for response forces to arrive at the scene of an incident.

With respect to rail transportation, the study indicated that one advantage is the greater weight and carrying capability of this mode. This capability permits greater protective armor and other protective measures to be employed, thereby making it more difficult for an adversary to gain access to the protected material. The principal disadvantages of rail transportation, however, are: (1) lack of flexibility in the positioning of guards with respect to the shipment; (2) greater difficulty on the part of response forces in reaching the site of a rail incident; and (3) a lower level of security, even with added escort vehicles, than that achieved by adding escort trucks to highway transport. With respect to this third point, several problems exist: rail escorts can be readily identified; they have no lateral mobility to gain cover in case of an attack; and they can be cut off more easily from the attack point.

If such security features are determined to be important for specific shipments, it may be desirable to establish mechanisms for selecting the preferred mode of transport. These mechanisms should include significant input from state and local officials who may have knowledge of potential hazards and who would be called on for assistance in the event of an emergency. Another factor to be considered in the selection of transportation mode is that proposed new safeguards regulations (new section 10 C.F.R. 73.26(b),[26] which would require advance planning to avoid both regular patterns of shipment and areas of natural disasters or civil disorders (the latter would include strikes or riots). In addition, arrangements would need to be made with local police along the route so that they could be better prepared to respond if needed. (Programs and issues related to emergency response are further discussed in Chapter Six.)

7.3.4 Collocation of Facilities

Siting combined facilities in a single location would have the advantage of reducing transportation requirements. The location of several nuclear reactors on a common site, together with matched-capacity reprocessing, fuel fabrication, and waste disposal facilities, could virtually eliminate the need for shipping plutonium and mixed-oxide fuels off site.[27] This would reduce both safeguards requirements and safety risks related to transportation. Whether the collocation alternative should be pursued, however, depends upon the relative cost and the environmental impacts of combined facilities, as compared with those of dispersed facilities. The selection of either alternative involves considerations far beyond transportation security issues; however, choice of a collocation alternative could significantly reduce transportation requirements for new facilities.

7.3.5 Communications

ERDA has developed a security communications system to maintain continuous communication with the nuclear convoys and to permit automatic, periodic "check-in" transmission sequences. Private transport representatives have requested access to the ERDA communications system because this is one aspect of the private system which is "admittedly weak."[28] In early 1978, NRC and ERDA will begin a two-year test of road transportation for plutonium and highly enriched uranium. This test will permit privately owned carriers to use the ERDA "SECOM II" communications system. The experience gained will presumably be used in the selection and design of future road transportation systems for the nuclear fuel cycle.[29] If the ERDA system is made available to private shippers, service charges may influence transportation costs, but probably not significantly.

7.3.6 Federal Transportation or Guard Forces

The Nuclear Energy Policy Study Group found that, under existing NRC physical protection regulations (10 C.F.R. 73.30), civilian transport procedures for strategic quantities of plutonium and highly enriched uranium are not vastly different from those employed by armored car companies and other carriers that ship high-value cargo, and that some criminal and terrorist groups have already demonstrated their ability to defeat such precautions.[30]

Nuclear weapons and ERDA-owned materials, on the other hand, are transported under stricter security procedures and on specially designed tractor-trailers. The ERDA trucks have special armor plating, bullet-proof windows, and sophisticated communications, as well as a radiotelephone. The trucks are fitted with special immobilization features and are escorted en route by a separate vehicle with redundant communications. Typically, there are at least four armed driver-guards (two on each vehicle) who are ERDA security personnel.[31] The proposed NRC regulations to upgrade safeguards[32] would, if adopted, require similar procedures to be used for civilian transport of nuclear materials.

Despite the move toward additional precautions in the private sector, some contend that the only way to set aside public concern on nuclear safeguards is for the government to handle all transportation of plutonium and highly enriched uranium.[33] Industry spokesmen have vehemently disagreed with this position, however; in fact, they have serious reservations as to whether or not additional guards and guns will be useful or effective.[34]

Under Section 204(b)(2)(C) of the Energy Reorganization Act of 1974, the Office of Nuclear Materials Safety and Safeguards was directed to review safeguards and to assess "the need for, and the feasibility of, establishing a security agency within the office for performance of the safeguards functions. . . ."[35] That study, as was pointed out in Chapter Four, concluded that a special federal nuclear security force would not result in a higher degree of effectiveness than could be achieved through the use of private guards who have been properly trained and certified. The study maintained that, consequently, there was no need for a federal security force to protect special nuclear materials from theft or diversion at this time.[36]

Presumably, the proposed requirements for upgrading safeguards are intended to assure that the private safeguards capability is equivalent to that which could be furnished by a federal force. However, the NRC Second Annual Report to Congress pointed out that:

> In the case of escorts for special nuclear materials in transit, a problem currently exists concerning the authority of private escorts to carry weapons across state boundaries. In the absence of uniform legislation granting such authority, the use of federal escorts would be more appropriate.[37] (emphasis added)

Until the question of private-guard firearms authority is resolved, there may be reluctance to use firearms because of potentially large liabilities from lawsuits by injured parties; such reluctance could compromise guard-force effectiveness.

Serious questions can also be raised concerning the appropriateness in a free society of creating heavily armed private guard forces that are highly trained in combat tactical procedures. Under proposed NRC regulations, large numbers of private nuclear guards will be required to protect power reactors, fuel-cycle facilities, and the transport of strategic quantities of special nuclear material. Will such guards be hired and trained by each facility, or will one or two major corporations provide such services? If protection services are provided by a few corporations, will this situation create a veritable nuclear army under private control? Careful consideration must be given to the extent to which--and circumstances under which--such guards can use deadly force, and to the procedures that should be created to assure proper control and accountability to the public. Closer examination of these issues may reveal that nuclear guard forces should be governmental police forces, not private guards.

7.4 Alternative Approaches Toward the Safeguards Problem

One alternative is to continue safeguards under present regulations. There have been no known attempts in the United States at theft or diversion of nuclear materials,[38] and perhaps existing safeguards are largely adequate to deter criminal activity. The situation may be like airline hijackings, which have declined markedly in recent years because of modest security measures and increased international cooperation. It does not seem clear that the public interest is best served by continually requiring more guards, more sophisticated equipment, and heavier armor--at some point, economic and social costs will outweigh any benefits. However, if increased security is desired by Congress or the public, then several steps can be taken.

First, deferral both of plutonium reprocessing and of the commercial introduction of plutonium breeder reactors, as recommended by the President, would largely deny unauthorized access to plutonium that can be directly fabricated into a nuclear weapon. Similarly, deferral of the use of reactors that are fueled by highly enriched uranium (such as the high-temperature, gas-cooled type) would also reduce safeguards burdens. Whether this step will encourage other nations to make similar deferrals is in great controversy, however.[39] If it is determined that other nations will not follow the U.S. lead, then the possibility exists that plutonium illicitly obtained abroad could be used for terrorist purposes in the United States. In general, however, it appears that deferral of reprocessing would greatly simplify transportation safeguards. Presumably this issue will be resolved by Congress and the Administration in the relatively near future.

Second, the level of safeguards can be further increased--either to require selective protection of shipments such as spent fuel, which do not now require safeguards, or to upgrade the protections under existing regulations for shipments that are now covered. Safeguards could be upgraded either generally or in response to specific state or local requests to apply to unusual situations that exist within a particular jurisdiction. The latter course of action, however, would both increase costs and complicate enforcement.

Third, if it is determined that truck transport is preferable to rail transport from a safeguards perspective, then incentives for additional truck shipments might be considered. However, a significant shift to the truck mode would require a vast increase in the number of shipments because of the smaller capacity of truck casks.

Fourth, collocation of nuclear fuel-cycle facilities to eliminate off-site transportation of spent fuel, wastes, and plutonium would, of course, nearly eliminate transportation safeguards problems altogether. Safeguards, however, are a relatively small part of the cost of a nuclear facility; consequently, other factors--such as economics, environmental impacts, economies of scale, and practicality--will largely determine whether collocation of facilities will occur.

Fifth, security could be improved both by increasing communications capabilities and by providing federal training and equipment to state and local police forces along principal transportation routes. This method, by reducing law enforcement response times, could provide improved security without the addition of more private guards. (For additional approaches toward improving emergency response capabilities, see Chapter Six.)

Finally, if private guard use is to be significantly expanded, it would appear that legislation is required to clarify the relationship between federal and state gun-control laws and to specify the kinds of actions that private guards can take. In the absence of such legislation, a federal nuclear protective responsibility could be assigned to an appropriate agency. The advantages of a federal force, if properly conceived, include uniform training, access to sophisticated weapons, a clear conception of mission and responsibility, and public accountability.

CHAPTER SEVEN NOTES:

TRANSPORTATION SAFEGUARDS AND SECURITY

1. See M. Willrich and T. Taylor, Nuclear Theft: Risks and Safeguards, Report to the Energy Policy Project of the Ford Foundation, Ballinger Publishing Co., 1974.

2. 42 U.S.C. 5801 et seq.

3. Office of Standards Development, NRC, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, NUREG 0170, Vol. 1 (draft, February 1977) at VII-12. Currently there are no strategic quantities of privately owned U-233 and no shipments are expected in the next several years. Id. at VII-8.

4. Id. at VII-3, VII-5; 10 C.F.R. 73.6(b) exempts spent fuel from safeguards physical protection requirements because special nuclear materials are not readily separable from other radioactive materials in the spent fuel.

5. Report of the Nuclear Energy Policy Study Group, sponsored by the Ford Foundation and administered by the MITRE Corporation, Nuclear Power Issues and Choices, Ballinger Publishing Co. (1977) at 302.

6. Id. at 304.

7. Id. at 303.

8. Transportation Environmental Statement, supra note 3 at VII-2.

9. Office of Technology Assessment, Nuclear Proliferation and Safeguards (prepublication draft, April 1977) at II-47.

10. Remarks by NRC Commissioner Richard T. Kennedy before the Institute of Nuclear Materials Management, Washington, DC (June 29, 1977).

11. See R. G. Page, "Safeguards Regulations," paper presented at the Atomic Industrial Forum Conference on Nuclear Safeguards at Orlando, FL, April 12-14, 1976 at 4; 10 C.F.R. Part 73--Physical Protection of Plants and Materials.

12. 10 C.F.R. 70.12.

13. 10 C.F.R. 73.30(a).

14. "Further Upgrading of Protective Measures for Nuclear Materials and Security Personnel at Licensed Nuclear Facilities and in Transportation Activities Have Been Proposed by NRC," Atomic Energy Clearinghouse (July 11, 1977) at 21.

15. General Accounting Office, "Protecting Special Nuclear Material in Transit: Improvements Made and Existing Problems," in Peaceful Nuclear Exports and Weapons Proliferation, 94th Congress, 1st Sess., Committee on Government Operations, U.S. Senate (April 1975) at 1222.

16. Id.

17. Physical Protection of Plants and Materials: Performance-Oriented Safeguards Requirements, 42 F.R. 34310 (July 5, 1977); 42 F.R. 34890 (July 7, 1977).

18. Physical Protection of Plants and Materials: Upgraded Guard Qualification Training and Equipment Requirements, 42 F.R. 34321 (July 5, 1977).

19. Executive Office of the President, The National Energy Plan, April 29, 1977 at 70.

20. Sec. 101 of S. 1811, ERDA Authorization Act of 1978, 95th Cong., 1st Sess.; passed the Senate on July 12, 1977.

21. C. Chester, "Estimates of Threats to the Public from Terrorist Acts Against Nuclear Facilities," Nuclear Safety (November-December 1976) at 664.

22. Office of Standards Development, NRC, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, NUREG-0170, Vol. 1 (draft, February 1977) at VII-23.

23. Id.

24. Office of Standards Development, NRC, Draft Environmental Statement on Transportation of Radioactive Material by Air and Other Modes, NUREG-0034 (March 1976) at VII-14.

25. Final Environmental Statement, supra note 22 at VII-22.

26. See note 17, supra.

27. S. Smiley, "Nuclear Regulatory Commission Special Studies," paper presented at AIF Conference on Nuclear Safeguards, Orlando, FL (April 12, 1976).

28. J. Edlow, "Physical Protection During Transit," paper presented at the AIF Conference on Nuclear Safeguards, Orlando, FL (April 12, 1976).

29. Kennedy Speech, *supra* note 10 at 6.

30. *Nuclear Power Issues and Choices*, *supra* note 5 at 304.

31. *Id*.

32. *See* text accompanying notes 17 and 18, *supra*.

33. W. Brobst, "Recent Developments in Government Policy Toward Transportation of Nuclear Materials," *Nuclear Materials Management* (Fall 1975) at 204.

34. Edlow, *supra* note 28.

35. 42 U.S.C. 5844.

36. "NRC Finds Federal Security Agency Unnecessary," NRC Release No. 76-205, September 7, 1976, 2 *CCH Nuc. Reg. Rep*. 16,258; Security Agency Study NUREG-0015 (1976).

37. "NRC Safeguards Program," 1 *CCH Nuc. Reg. Rep*. 2049.

38. *Id*. at 2,045.

39. Office of Technology Assessment, *supra* note 9 at II-5.

CHAPTER EIGHT

INSURANCE ISSUES

8.1 Overview

Both the nuclear industry and its regulators agree that the probability of occurrence of a transportation accident involving the rupture of casks and radiation leakage is very low:

> The likelihood of death, injury, or serious property damage from the nuclear aspects of nuclear transportation is thousands of times less than the likelihood of death, injury, or serious property damage from more common hazards, such as automobile accidents, boating accidents, accidental poisoning, gunshot wounds, fires, or even falls--all things which we can control, but apparently have accepted as a way of life without much public support for reduction of risk.[1]

But even if the likelihood of occurrence of a serious transportation accident with severe consequences for the public is small, it cannot be concluded with certainty that such an accident will never occur. To assure the availability of substantial funds for satisfying liability claims in the event of a catastrophic nuclear accident, as well as to remove a potential economic deterrent to private-sector participation in atomic energy, a system of private insurance and government indemnity has evolved over the years.

Nuclear insurance should serve at least three objectives: (1) it should provide compensation to those members of the public who suffer losses as a result of nuclear activities; (2) it should create incentives to encourage the industry to exercise maximum care to prevent accidents; and (3) it should facilitate entry into the nuclear industry by spreading the insurance risk.

Liability insurance for the civilian nuclear industry is largely governed by the Price-Anderson Act.[2] This Act affords the public financial protection against damages that might arise from certain peaceful uses of nuclear materials. It does so through a combination of private insurance available from two major insurance pools and supplemental government indemnity agreements covering licensed production and utilization facilities. The Act has the effect of imposing strict liability on the licensed operator, up to a statutory ceiling of $560 million for a single nuclear incident. If a nuclear incident resulted in damages in excess of the statutory ceiling, however, payments of claims by the government in excess of the ceiling could be authorized by special legislation.[3] In any case, the liability limit is expected to increase after 1980, as government indemnity is phased out and additional reactors are licensed.[4]

Property insurance is also available to the nuclear industry. Two major nuclear property insurance pools offer insurance for property damages stemming from nuclear hazards, as well as from conventional perils such as fire, explosion, and wind damage. In addition, shippers' and carriers' transportation insurance is available to cover damage to nuclear materials during transit.[5]

Despite the availability of several types of coverage, and despite the fact that electricity has been commercially generated from nuclear power plants for more than 20 years, there are still potential gaps or ambiguities in insurance coverage for transportation at the back end of the nuclear fuel cycle. Some of the problem areas include:

- Liability coverage in the event of theft or diversion of spent fuel or radioactive waste.
- The question of whether a spent-fuel storage facility will be an indemnified facility under the Atomic Energy Act.
- The constitutionality of limitations on liability.
- Coverage of decontamination activities.
- Carrier and public understanding of available insurance.

It appears, however, that these problems can generally be worked out as transportation requirements for spent fuel and wastes increase, and that they will not be a significant deterrent to meeting the transportation needs of the industry.

8.2 Description of the Nuclear Transportation Insurance System

8.2.1 Liability Coverage

The Price-Anderson Act[6] and the implementing regulations[7] issued by NRC established the framework of liability insurance coverage for the civilian nuclear industry. One objective of the Atomic Energy Act of 1954 was to secure the participation of private industry and private sources of financing in the development of nuclear power. Private industry, however, was still reluctant to assume a partnership role without financial protection against the risk of liability from a catastrophic nuclear accident, even if the probability of such an accident was remote. To remove that roadblock to private participation, as well as to provide substantial protection for injured persons and damaged property, Congress enacted the Price-Anderson Act of 1957.[8]

The 1957 Act, which amended the Atomic Energy Act, limited the nuclear industry's liability to the public to $560 million per incident. Since private insurance companies could not commit enough resources to provide this level of coverage, the Nuclear Regulatory Commission (then the Atomic Energy Commission) was authorized to indemnify licensees for any liability to the public in excess of the amount of private insurance available, up to a maximum limit of $560 million.[9]

In 1966, Congress extended the Price-Anderson Act, amending it to provide for waivers of defenses by licensees. These changes had the effect of imposing strict liability (up to the limit) on the nuclear industry for damage to the public caused by a nuclear incident.[10]

Finally, in late 1975, Congress extended the Price-Anderson Act again, this time until August 1, 1987. With this extension, Congress authorized NRC to promulgate regulations to phase out the government indemnity portion of the Price-Anderson Act program by about 1980.[11]

The current regulations establish two separate layers of private insurance. First, liability insurance pools will continue to provide the primary layer, which now provides coverage up to $140 million per incident. The second layer will consist of deferred premiums, which will be assessed in the event of a nuclear accident for which damage claims are in excess of the insurance available from the pools. NRC has established a deferred premium level of $5 million per incident for each major power reactor that is licensed to operate.[12] If more than one major incident occurs per year, however, the total deferred premiums per year may not exceed $10 million.

The current regulations further specify that government indemnity protection is to remain in effect until the combination of pool liability insurance and deferred premiums reaches the $560 million total liability limit on nuclear incidents. At that time, the limit will be adjusted upward annually by a combination of increased primary insurance capacity and $5 million for each new plant licensed that year.[13]

Private liability insurance for nuclear energy hazards, currently available to NRC licensees up to a maximum of $140 million, is provided by two insurance pools: the Nuclear Energy Liability Insurance Association-Nuclear Energy Property Insurance Assocation (NEL-PIA), an association of stock insurance companies; and the Mutual Atomic Energy Liability Underwriters (MAELU), an association of mutual companies. A third association, the Mutual Atomic Energy Reinsurance Pool (MAERP), underwrites property risks. More than 200 companies participate in these pools, which pledge assets that together can insure risks of a size that would be beyond the financial capability of a single company. In practice, NEL-PIA, MAELU, and MAERP combine their resources into single liability and property pools through reinsurance agreements with each other.[14]

Although this insurance coverage is for NRC-licensed production and utilization facilities, it is relevant to nuclear transportation, as well. This is because both the insurance coverage and the indemnity agreements required by the Price-Anderson Act extend not only to the licensee itself, which is the "named insured," but also to any other person who may incur liability associated with nuclear energy hazards "arising out of or in connection with the licensed activity."[15] Thus, under the present Price-Anderson system, no separate insurance contracts or indemnity agreements are required to cover liability arising from the transportation of nuclear materials; rather, under the "omnibus" feature of licensee financial protection and indemnity, carriers are covered for liability with respect to any nuclear incident occuring during shipments to or from an existing indemnified facility.[16]

As will be discussed below, this system leaves potential gaps in transportation coverage. For example, coverage may be denied for an incident that occurs during a diversion, or for one that occurs in a shipment between two facilities that are not indemnified.

8.2.2 Property Coverage

Property insurance, both for on-site property and for nuclear materials in transport, is available through the NEL-PIA and MAERP nuclear insurance pools. The coverage is made available on an "all-risks" basis, subject to specified exclusions, so that the protection includes damage to the insured's property due to both nuclear and conventional hazards. Coverage of spent fuel stored at a reactor site is also provided, so long as values are appropriately reported. Shippers' and carriers' transportation policies that insure against damage to nuclear materials in transport are routinely issued. However, property coverage for damage to shipping casks is not yet routine. Nevertheless, such coverage is available as an accommodation to the transportation industry, on either an individual shipment or an annual basis.

8.3 Potential Gaps or Ambiguities in Nuclear Insurance Coverage

Potential gaps in nuclear insurance coverage are troublesome because, in the event of a nuclear incident, insurance objectives such as adequate financial protection for those suffering losses may be denied. Gaps in coverage could also discourage industry from entering the nuclear business. The following discussion will examine the potential gaps. It appears, however, that most of these problems can be worked out as transportation at the back end of the fuel cycle moves to industrial scale.

8.3.1 Theft or Diversion

A recent NRC staff study[18] concluded that, although certain acts of sabotage and theft are covered under the present Price-Anderson Act, there is a gap in this liability coverage. The staff study indicated that, if damages were caused by an illegal act of sabotage or theft that occurred on a preplanned transportation route, payment of compensation was not precluded. However, an unlawful diversion of nuclear material from the planned route, followed by contamination or other damage resulting from its misuse at another location, probably would not be covered. Although this situation appears inconsistent with the goal of protecting the public, it is not clear whether NRC has the authority at present to close this coverage gap by regulatory action.

Similar potential gaps in coverage could arise if a nuclear shipment were removed from its transportation route for any purpose other than the continuation of transportation or associated temporary storage. Thus, an issue of coverage could arise if a driver of a spent-fuel shipment left his preplanned transportation route to engage in an unauthorized activity of his own.

8.3.2 Spent-Fuel Storage Facilities

It has been generally assumed in the past that spent fuel would be reprocessed to recover and reuse uranium and plutonium; for this reason, spent fuel has been allowed to accumulate at reactor sites.[19] However, the President's National Energy Plan calls for indefinite deferral of commercial reprocessing. If there in fact is to be no reprocessing, then, as reactor storage pools are filled, it may be necessary to transport spent fuel either to other reactor sites with excess storage capacity or to away-from-reactor storage facilities.

The transportation of spent fuel from one reactor site to another would be covered under the "omnibus" coverage of the originating reactor's nuclear liability facility form and indemnity agreement. When the spent fuel reached the site of the second reactor and was removed from the transporting conveyance, however, the transportation liability coverage would cease. At this point, if the second reactor was operated by the same utility as the first and continued coverage was desired, the operator would have to report the arrival of the spent fuel to the insurance pools; furthermore, he would have to continue to report it each year thereafter on the annual statement of values. Insurance experts disagree, however, as to whether such coverage would be available if the second reactor was operated by a different utility.

Privately operated away-from-reactor storage facilities, which are licensed under Parts 30 and 70 of 10 CFR, are issued a materials license rather than a production or utilization license. Under section 170d of the Atomic Energy Act, NRC has discretionary authority to require financial protection and to provide indemnity coverage to such materials, but it has not yet done so. Currently, NRC is reviewing the question of whether such an indemnity extension to spent-fuel storage facilities is warranted. If it decides not to extend indemnity to these storage facilities, then transportation to such facilities would represent another possible gap in Price-Anderson protection. For a shipment traveling on a preplanned route from a reactor to a nonindemnified storage facility, there would be no gap in coverage, because Price-Anderson protection applies so long as either the point of origin or the point of destination is an indemnified facility.[20] But there could be a gap for subsequent shipments if, for example, they were made from the nonindemnified storage facility to another nonindemnified site. Similarly, if the United States seeks to defer reprocessing by other nations through purchase or disposal of their spent fuel, the transportation in the United States of such spent fuel to a nonindemnified storage facility may present a gap in Price-Anderson coverage. The resolution to this kind of problem is straightforward: NRC can exercise its descretion to provide indemnity coverage to materials licensees that operate spent-fuel storage facilities.

In the meantime, a shipper can partially protect himself by purchasing suppliers' and transporters' liability coverage up to a current maximum of $140 million. This coverage would protect against liability losses that are excluded under applicable facility policies.

Of course, if reprocessing is commenced, then shipments between the reactor and the reprocessing plant would be covered, since both the points of origin and destination are indemnified facilities. In such a case, the material would be covered during transit by the financial protection and indemnity agreements maintained by the licensee at whose facility the shipment originated.[21] Shipments from a reprocessing plant (an indemnified facility) to a commercial burial ground (a nonindemnified facility) or federal waste repository (which may or may not be an indemnified facility) would also be covered, unless the material was diverted from the preplanned route.

8.3.3 Limitation on Liability

Substantial controversy has surrounded the Price-Anderson Act limitation on liability. This limitation, now $560 million, will gradually increase in the 1980s as additional private insurance capacity is realized and as the licensing of additional reactors provides more deferred premium obligations. Somewhat ironically, although the Price-Anderson Act was designed to compensate the public in the event of a nuclear incident, public interest and environmental groups oppose it. They argue that if nuclear power is safe, the Act is unnecessary; in that case, commercial insurance should be available for full protection. Since such protection is not available, however, these groups question the safety of nuclear power and view Price-Anderson as a subsidy that promotes unsafe nuclear development. Some opponents of nuclear power also feel that the indemnification limit is needed for private industry to be willing to construct nuclear power plants. They base this view on the Reactor Safety Study (WASH-1400, commonly referred to as the Rasmussen report), which indicates that some reactor malfunctions could result in death and property damages in excess of $560 million.[22] Consequently, they feel that removal of the indemnification limit would discourage utilities from constructing nuclear plants.

Whether damages in excess of $560 million are similarly possible in the most serious transportation accident is not clear at this time. But a recent NRC environmental statement on the transportation of radioactive materials suggests that an extremely unlikely and severe accident that results in a major release of radioactive materials from a spent-fuel cask in a densely populated area could result in one early fatality, 10 to 60 cases of potentially fatal cardiopulmonary insufficiency, and 120-150 latent cancer fatalities over a 30-year period, as well as decontamination costs in excess of $200 million.[23]

During consideration of the most recent Price-Anderson Act extension, liability limits were the subject of congressional debate. Two amendments modifying the limit--one that would have removed the limitation altogether, and one that would have permitted any person to bring an action in federal court to test the constitutionality of the limitation--were both defeated.[24] Instead, the Act provides that:

> In the event of a nuclear incident involving damages in excess of that amount of aggregate liability, the Congress will thoroughly review the particular incident and will take whatever action is deemed necessary and appropriate to protect the public from the consequences of a disaster of such a magnitude. . . ."[25]

In addition, after any nuclear incident that requires payment by the United States or that results in public liability claims in excess of the Price-Anderson limit, NRC is to survey the causes and extent of the damage and to make a report to the Congress and the public. These provisions are intended to assure that Congress will focus appropriate attention on any liability claims in excess of the Price-Anderson Act limitation. If claims in excess of the liability limits are filed, then Congress could indemnify the injured parties by enacting special legislation.

Another significant challenge to the Price-Anderson Act was withstood in the summer and fall of 1976, when voters in several states defeated attempts to impose curbs on nuclear power development. Initiatives in Arizona, California, Colorado, Montana, Ohio, Oregon, and Washington were defeated by wide margins, after spirited election campaigns to which utilities and the nuclear industry contributed heavily. Had these measures been enacted, they would have imposed restrictions ranging from a requirement of state legislative approval before a nuclear facility could be built to a prohibition of construction until several conditions were met. These included the demonstration of safety systems, the resolution of waste storage questions, and--of principal concern here--the removal of financial liability limits.[26] Interestingly, it is relatively likely that the liability provisions of the state initiatives (as well as several of their other provisions), if challenged, would have been declared void because of preemption by federal law.[27]

However, just when it appeared that the issue of Price-Anderson liability limits had been resolved, a federal district court in the Western District of North Carolina ruled that these limits were unconstitutional. On March 31, 1977, Judge James B. McMillan concluded that:

> Plaintiffs are threatened with certain injury of relatively minor nature, and with the reasonable likelihood of major and perhaps catastrophic injury, without assurance of adequate compensation if that should occur. But for the limitation of the Price-Anderson Act, the nuclear power plants would not be being built and those threats would not exist. Plaintiffs are actively pursuing the case. They have a live stake in the controversy and are sufficiently aroused that their position has been well and adequately presented. A live case or

> controversy exists; they have standing; the issue is ripe for decision and there is no need to wait until a reactor accident occurs before deciding the case. The time to put on the roof is before it starts raining.
>
> * * *
>
> I therefore hold and declare that the provisions of 42 U.S.C. 2210(e) and any other provisions necessary to implement the $560,000,000 limitation of liability are unconstitutional and unenforceable insofar as they apply to nuclear incidents occurring inside the United States.[28]

The immediate impact of the decision cannot be determined, but construction is continuing on the McGuire Nuclear Generating Station near Charlotte, North Carolina, while direct appeals to the U.S. Supreme Court are being pursued. Other statutory liability limits, in such areas as workmen's compensation and civil aviation, have withstood challenge; however, if the North Carolina decision is upheld on appeal, then another uncertainty would be created for the nuclear industry.

The court did not discuss transportation accidents because the plaintiffs did not contend that any single nuclear transportation accident would produce damages in excess of $560 million.[29] However, since no separate insurance contracts or indemnity agreements are issued to cover liability arising from transportation to or from power reactors and fuel reprocessing plants (the only licensees currently indemnified by the NRC), the decision may apply to such transportation, as well. The decision could also affect nuclear shipments that are not to or from an indemnified facility, for which suppliers' and transporters' liability coverage is currently available to a maximum of $140 million.

Even if the decision is upheld on appeal, however, it is unlikely to affect transportation significantly, since there is a widespread belief that a transportation accident is most unlikely to result in damage claims in excess of the amount of financial protection or indemnity coverage available. Nevertheless, to resolve this potential problem, some in the insurance industry believe that:

> . . . the federal government should assume the statutory obligation to compensate the public in the event that liabilities arising out of a nuclear incident should ever exceed the amount of financial protection required.[30]

In its decision striking down the Price-Anderson liability limitation, the court also observed that "the Act tends to encourage irresponsibility in matters of safety and environmental protection rather than to encourage responsibility on the part of builders and owners."[31] This observation is emphatically disagreed with by the nuclear industry; however, to provide additional incentives to exercise maximum care, consideration should be given to reducing premium levels for those who have consistent accident-free experience.

8.3.4 Railroad Insurance Issues

As was discussed in Chapter Five, several of the nation's railroads are engaged in proceedings before the Interstate Commerce Commission in an effort to require the use of special trains to transport spent fuel and radioactive waste. In part, some railroads are taking this position on insurance grounds. The railroads are concerned about three types of incidents: (1) those in which damages and personal injuries result from acts of terrorism; (2) those in which the incident itself is not of sufficient magnitude to be classified as an extraordinary nuclear occurrence, but railroad property is contaminated; and (3) those in which total claims are in an excess of $560 million.[32] The quantification of these risks, which represent potential gaps in coverage, would depend both on applicable state law and on the fact situation of the railroad involved.

8.3.5 Liability and Coverage for Decontamination

Transportation accidents involving radioactive materials may entail substantial public expenditures, both for population evacuations and for cleaning up the accident site. The latter could include extensive decontamination operations as well as physical repairs or modifications to restore the site to a safe condition. At the present time, it appears that these costs would have to be borne by the affected state or local government, unless the state had imposed upon carriers or nuclear facility operators a definite and enforceable legal liability for such evacuation, cleanup, decontamination, and restoration operations. If such a legal liability had been established, then these expenses might be a covered claim under the Price-Anderson Act; otherwise, the costs would presumably be borne by the state as an expense to be shared by its taxpayers.[33]

8.3.6 Other Potential Problem Areas

Questions could be raised concerning several potential problems with financial protection and indemnity that could occur in the event of a serious nuclear incident. For example, what happens if certain terms and conditions of agreements, such as the requirements for prompt notification, are not precisely followed? Would such failure result in denial of coverage? Given a 20-year statute of limitations, what about the problem of latent injuries that might become apparent years after the incident? Do these circumstances result in large contingent liabilities? Financial protection and indemnity agreements exclude damages due to war or insurrection. Therefore, an issue could arise as to whether more than one incident of sabotage constituted an insurrection. These and other questions cannot be resolved except in specific situations and subsequent judicial interpretation. In the event that, following a serious nuclear incident, insurance companies or the government was unwilling to concede liability, questions concerning the scope of Price-Anderson coverage would ultimately be determined by the federal courts. Many of the questions presented would be of first impression, since the Price-Anderson compensation machinery is unique in many respects and has never been construed by the courts.[34]

8.4 Summary

There appear to be a few situations in which gaps exist in the insurance coverage available for the transportation of nuclear materials. However, it is not likely that these gaps and potential ambiguities would become a serious bottleneck for the commencement of industrial-scale transportation at the back end of the nuclear fuel cycle. Most of these questions will have to be worked out on a case-by-case basis as additional experience is gained.

It is possible to imagine many situations in which potential insurance problems could arise, but it would appear that generally applicable legal doctrines would permit equitable resolution of most problems. In addition, NRC could exercise its discretionary authority to extend Price-Anderson Act coverage to those materials licensees whose activities pose risks of large damage claims.[35]

Even if a catastrophic nuclear transportation incident did occur, and, for some reason, the public was not adequately compensated, there is precedent for the enactment of special legislation by Congress to assure compensation to injured victims. For example, litigation arose as a result of the Texas City disaster involving an explosion of ammonium nitrate fertilizer. The fertilizer, which was being sent to France as part of a federal foreign aid program, caught fire while it was being loaded onto ships. The accident killed 560 persons and injured another 3,000. The claims brought under the Federal Tort Claims Act totalled over $200 million in 300 suits. The court denied all claims against the federal government on the grounds that the decisions by government officials to export the fertilizer, together with their failure to manage adequately the manufacture, handling, and shipment of the fertilizer, all amounted to planning or policy level actions, which are exclusions to recovery under the Federal Tort Claims Act.[36] However, Congress later enacted legislation to provide compensation.

Thus, it appears that insurance problems involving the transportation of nuclear materials could be resolved through administrative, judicial, or legislative channels.

CHAPTER EIGHT NOTES:

INSURANCE ISSUES[a]

(a) The assistance of Mr. William A. Holt of Marsh, McLennan, and Mercer, Seattle, Washington, in providing materials and explaining nuclear insurance concepts is gratefully acknowledged.

1. "Shipments of Nuclear Fuel and Waste . . . Are They Really Safe?" WASH-1339 (April 1974) at 11.

2. 42 U.S.C. 2210.

3. Section 170e of the Atomic Energy Act of 1954, 42 U.S.C. 2210e.

4. "NRC Adopts Amendments to Indemnity Regulations," Press Release No. 77-67 (April 18, 1977).

5. Insurance Information Institute, "NEL-PIA: Insurance for the Nuclear Industry" (March 1976) at 8.

6. 42 U.S.C. 2210.

7. 10 C.F.R. Part 140.

8. A. Murphy and D. LaPierre, "Nuclear Moratorium Legislation in the States and the Supremacy Clause: A Case of Express Preemption," 76 Col. L. Rev. 392, 405 (1976).

9. Insurance Information Institute, supra note 5 at 4.

10. A. Murphy and D. La Pierre, supra note 8 at 406-07.

11. See 41 F.R. 40511 (Monday, September 30, 1976); "NRC Adopts Amendments for Indemnity Phase-Out," Nuclear News (February 1977) at 29.

12. Id. at 30; 10 C.F.R. 140.11 (a) (4).

13. Id.

14. Insurance Information Institute, supra note 5 at 3.

15. Section 170c of the Atomic Energy Act of 1954, 42 U.S.C. 2210c.

16. 41 F.R. 40515 (September 20, 1976).

17. Nuclear Regulatory Commission, Staff Study Concerning Financial Protection Against Potential Harm Caused by Sabotage or Theft of Nuclear Materials (June 1975).

18. Report of the Nuclear Policy Study Group, Nuclear Power Issues and Choices, sponsored by the Ford Foundation and administered by the MITRE Corp. (1977) at 247.

19. NRC Staff Study, supra note 18 at 15.

20. Id.

21. Nuclear Power Choices and Issues, supra note 19 at 241.

22. Office of Standards Development, NRC, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, Vol. 1, NUREG-0170 (draft, February 1977) at ii.

23. C. Behrens, "Nuclear Insurance/Indemnification: The Price-Anderson Act," Issue Brief No. IB75013, Congressional Research Service (April 9, 1976) at 5.

24. Section 170e of the Atomic Energy Act of 1954, 42 U.S.C. 2210e.

25. See C. Hohenemser, R. Kasperson, and R. Kates, "The Distrust of Nuclear Power," 196 Science 25 (April 1, 1977); and CCH Nuc. Reg. Rep. No. 68 (November 9, 1976) at 2.

26. W. C. Reynolds, ed., The California Nuclear Initiative, Institute for Energy Studies, Stanford U. (April 1976) at 32.

27. Carolina Environmental Study Group, Inc. v. AEC, 2 CCH Nuc. Reg. Rep. 16,309, 16,325 (W.D., NC, March 31, 1977).

28. Id. at 16,313.

29. F. Boylan, "Nuclear Insurance Overview: Suggestions for Improving the System," paper presented at the AIF Workshop on Insurance, Atlanta, GA (May 9, 1977) at 3.

30. Carolina Environmental Study Group, Inc. v. AEC, 2 CCH Nuc. Reg. Rep. 16,309, 16,322 (W.D., NC, March 31, 1977).

31. Legal Affairs Committee of the Association of American Railroads, Analysis of Legal Problems Associated with the Rail Transport of Spent Irradiated Fuel Cores in Special Train Service (February 13, 1975) at 29-33.

32. *See* Western Interstate Nuclear Board, *Transportation of Radioactive Materials in Western States* (March 1974) at 34-35.

33. NRC staff report, *supra* note 18 at 12.

34. Boylan, *supra* note 30 at 5.

35. *U.S. v. Dalehite*, 346 U.S. 15 (1953).

CHAPTER NINE

LABOR RELATIONS

9.1 Overview

The nuclear industry has focused little attention on labor relations matters, perhaps because organized labor has generally supported nuclear development in the past. In the nuclear transportation industry, it does not appear that unions (except in the airline industry) have sought to impose particular work practices, rules, or compensation scales. In part, this may be due to the fact that there have been relatively few shipments of spent fuel and radioactive waste. There are only a small number of trucking firms that specialize in nuclear transport, and those lines that do so are generally not unionized. Although railroads are heavily organized, nuclear transportation is such an infinitesimal portion of the total cargo carried by rail that railway unions have yet to focus attention on potential problems they may have with nuclear transportation.*

The Air Line Pilots Association (ALPA), however, has been active in seeking to improve airline safety and has promulgated an embargo on shipments of certain radioactive materials on passenger aircraft. Since February 1, 1975, ALPA policy requires pilots to refuse to carry radioactive cargo with a transport index greater than three.[1] (Under certain circumstances, DOT regulations would permit carriage of radioactive material with a higher transport index.[2]) This embargo by pilots apparently has been effective, even though similar actions by airlines have been successfully challenged.[3] In part because of the ALPA action, DOT is now proposing amendments to its regulations on air shipment of radioactive materials.[4]

There are a number of ways in which organized labor could affect the transportation of nuclear materials in the fuel cycle. For example, it could increase the number of firms that are unionized, seek greater health and safety in transport, or encourage work stoppages that could interrupt shipments. Obviously, the assistance and cooperation of labor is needed for a successful transportation system.

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*As was discussed in Chapter Five, however, railroad management is seeking to impose special train service conditions on spent-fuel and radioactive-waste shipments.

The following material provides an overview of labor legislation and union membership in the transportation industry. Also examined are the current available mechanisms for dealing with perceived threats to health and safety in the work place. Finally, this chapter examines present concerns and legislative goals of organized labor in an attempt to determine whether labor can be expected to address nuclear materials transportation issues in the future.

9.2 Statutory Framework

The role of organized labor in the transportation of nuclear materials is shaped by applicable statutes. The following discussion concerning the National Labor Relations Act and the Occupational Safety and Health Act provides an overview of this statutory framework.

9.2.1 National Labor Relations Act: Right to Collective Bargaining

The legislative foundation of American labor law is the National Labor Relations Act (NRLA), which was enacted in three major stages: the Wagner Act of 1935, the Taft-Hartley Act of 1947, and the Landrum-Griffin Act of 1959.[5] Section 7 of the NLRA grants employees the right to form labor organizations, to deal collectively through such organizations with respect to employment conditions, and to engage in activities in support of these rights.[6] Essentially, the NLRA was adopted in an effort to stabilize labor-management relations by guaranteeing the individual employee basic representation of his interests. This representation is apparent in the transportation industry, which is highly organized.

The Wagner Act promulgated substantive rules of labor law and established an administrative agency, the National Labor Relations Board, with the power to determine "any question of representation affecting commerce" and to "prevent any person from engaging in any unfair labor practice . . . affecting commerce."[7]

The Taft-Hartley Amendments to the NLRA (also known as the Labor-Management Relations Act of 1947), separated the prosecutorial functions, which were placed in the Office of the General Counsel, and the adjudicative responsibilities, which were retained in the Board. In this legislation:

> . . . Congress expressly declared that unfair labor practices were not to be based on any expression of opinion or argument which contained no threat of reprisal (the 'employer free speech'

> section), or on any refusal in bargaining to make a concession or reach an agreement. Reports regarding union finances and internal procedures were to be filed by unions. Section 7 was amended to accord to employees the right to refrain from joining a union or engaging in collective bargaining or concerted activities; and the closed-shop agreement was declared illegal while other union-security agreements were declared subject to outlawry by state right to work laws.[8]

The Taft-Hartley Act also identified specific examples of what were deemed unfair labor practices by both management and labor. A key component of the legislation was Section 208, which authorized the use of the injunction against large-scale work stoppages that posed a threat to the national health and safety.[9]

The Landrum-Griffin Act, also known as the Labor Management Reporting and Disclosure Act, was enacted in 1959 primarily to curb corrupt activities of union leadership. It established reporting requirements relating to internal procedures of union decision making and placed more stringent limitations on certain picketing activities by unions.[10]

These three laws provide a framework within which labor organizational activities in the nuclear transportation industry are governed.

9.2.2 Health and Safety Provisions of NLRA

Recently, there has been growing concern about health and safety in the work place. It has been pointed out that:

> Each day millions of workers in America enter a battlefield, but they fight no foreign enemy and conquer no lands. No borders are in dispute. The war they are fighting is against the poisonous chemicals they work with and the working conditions that place serious mental and physical stress upon them. The battlefield is the American workplace, and the casualties of this war are higher than those of any other in the nation's history.[11]

A U.S. Department of Labor Study indicated that health and safety hazards, unpleasant physical working conditions, and work-related illness or injury ranked far above income and fringe benefits as worker concerns.[12] Similarly, in congressional testimony on the Occupational Safety and Health Act, workers and union representatives stressed the need for protection against unseen industrial hazards that produce insidious long-term health effects.[13] Because of concerns such as these, there is a conviction in a large segment of the labor force that battling complex health problems should be a routine, daily responsibility for organized labor.

The transportation industry, in particular, has experienced high injury-frequency rates. In 1973, for example, transportation injury frequency was 2.5 times the average industry rate. The only industry having a higher accidental-injury frequency rate than transportation was coal mining.[14]

Workers in the nuclear transportation industry are subject to the usual transportation injury risks; they also incur risks from increased exposure to radiation.[15] Thus, the nuclear industry should not be surprised if nuclear transportation employees seek a reduction in their exposure to radiation hazards as well as to conventional risks. Such action could occur either through union activities to obtain more stringent governmental regulation or as part of the collective bargaining process.

Terms and conditions of employment are matters that are subject to collective bargaining between employers and unions. Through collective bargaining, labor-management agreements can provide for safety and health standards in the work place that are more stringent than those required by applicable provisions of state or federal law. This is significant because a company or a state or local government probably could not take such action by reason of common carrier obligations or because the action is found to be preempted by federal law. Thus, in the area of radiation protection, for example, a collective bargaining agreement could contain more stringent requirements than those prescribed by DOT or NRC regulations. It is not clear, however, how far such agreements could go. For example, a labor-management contract may not be upheld if it stipulates a work-place environment that, as a practical matter, operates as an embargo of certain shipments.

Employees also have the power to engage in self-help through work stoppages over health and safety issues during the term of their contracts. Section 7 of the NLRA protects the rights of employees to strike and to take other action required for mutual aid and protection. Although agreements between employers and unions frequently contain no-strike provisions for the term of the contract, Section 502 of the Taft-Hartley Act provides:

> Nothing in this chapter shall be construed to require an individual employee to render labor or service without his consent . . . <u>nor shall the quitting of labor by an employee or employees in good faith because of abnormally dangerous conditions for work at the place of employment of such employee or employees be deemed a strike under this chapter</u>.[16] (Emphasis added)

The significance of this section is that it protects certain work stoppages which would otherwise run afoul of the contractual no-strike clause.[17]

An important question concerning the scope of this protection is whether a good-faith belief that an abnormally dangerous condition exists is sufficient to invoke the protection of Section 502, or whether the test for application of the provision is an objective one and is not controlled by the employee's viewpoint. A recent Supreme Court decision indicates:

> A union seeking to justify a contractually prohibited work stoppage under Section 502 must present 'ascertainable, objective evidence supporting its conclusions that an abnormally dangerous condition for work exists.'[18]

This opinion has been interpreted as indicating:

> If employees want to avoid discipline for a work stoppage on the grounds that their health or safety is endangered, they must meet three criteria: immediate involvement; exhaustion of any applicable contractual provisions; and proof, not that their feelings were bona fide or even reasonable, but that there was an actual danger to health or safety.[19]

Such objective proof of abnormally dangerous working conditions may exist in the nuclear transportation industry. Reports have indicated extensive violations of law with respect to both radiation emissions from ground vehicles that are above levels prescribed by the regulations and a failure to placard vehicles properly with signs indicating that they carry radioactive cargo.[20] If these reports are accurate, then the nuclear transportation industry may be subject to justifiable safety-related work stoppages.

Such employee self-help activities in support of safety goals can become bitter controversies. Labor relations in parts of the U.S. coal industry, for example, have deteriorated to the point where wildcat strikes and violence are common. Similarly, Australia's labor unions are threatening to halt the Australian uranium industry because of divisive views concerning national mining and export policies.[21]

9.2.3 Occupational Safety and Health Act

The Occupational Safety and Health Act of 1970 (OSHA) was a much-heralded legislative enactment, aimed at fortifying the federal government's power to rectify hazardous working conditions. The purpose of the Act is to "assure so far as possible every working man and woman in the Nation safe and healthful working conditions . . ."[22] In practice, the Act has engendered much criticism--both from health and labor groups, which charge that enforcement has been weak, and from business groups, which claim that activities under the Act have been highly intrusive and deleterious in their effect on the national economy.[23]

Recent comments by the Secretary of Labor indicate that OSHA may be assuming a more activist role in the future. In April 1977, the Secretary announced a new emergency standard for exposure of industrial workers to benzene, which has been linked by researchers to leukemia. This standard lowers maximum tolerance levels over an eight-hour period by 90 percent, to one part per million. Secretary Marshall commented during the announcement:

> I believe this signals a new day for an agency which in the past has been criticized for acting too slowly when lives are at stake. Moreover, this action signals that we are going to focus our primary attention in OSHA on major, rather than minor, problems; that we are going to catch whales rather than minnow.[24]

The impact of OSHA, administered by the Department of Labor, on the nuclear industry is not clear at this point. The Departments of Labor and Transportation have been at loggerheads for five years in an effort to develop an effective, yet nonduplicative, pattern of transportation safety regulation and enforcement.[25] Because of this jurisdictional ambiguity, OSHA may exercise jurisdiction over transportation working conditions, even though OSHA does not "apply to working conditions of employees with respect to which other Federal agencies . . . exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health."[26]

9.3 Profile of Organization in the Transportation Industry

9.3.1 Trucks

The trucking industry as a whole is heavily unionized. Drivers who belong to a union are members of the International Brotherhood of Teamsters, Chauffeurs, and Helpers of America, whose membership as of January 1976 was in excess of 1.8 million.[27] The other major union organization in the trucking industry is the International Association of Machinists and Aerospace Workers, an AFL-CIO affiliate with over 750,000 members as of January 1976.[28] Its members perform various tasks related to equipment maintenance.

While the transportation field as a whole is substantially organized, the trucking companies that operate as nuclear materials specialists are generally not unionized. As is true of specialized carriers as a whole--for example, automobile hauling lines and bulk cargo carriers[29]--transport companies that regularly deal in radioactive material shipments rely heavily on independent contractors who own their own rigs for hauling such cargo.

Tri-State Trucking of Joplin, MO, is the largest of the nation's trucking companies specializing in radioactive material.[30] Approximately 8 percent of the company's business is devoted to radioactive shipments. The company owns and operates its own rigs and also employs outside drivers to carry cargo on a lease arrangement with the company. Neither the full-time Tri-State drivers nor the lease operators hired by the company are currently union members. Tri-State drivers had been unionized in the early 1970s, but members voted to decertify the union shortly after the organization of Tri-State into a Teamsters' local. Tri-State does not assign its drivers into separate general and hazardous materials divisions. Since all Tri-State drivers must undergo training in all aspects of the company's operations, all drivers receive training in safety aspects of nuclear material transportation.

Of the trucking companies that specialize in transporting radioactive materials, McCormick's Highway Transportation of Schnectady, NY, is one of the few--if not the only one--that is organized. About 50 percent of the company's business is related to nuclear materials. McCormick's, which operates in the eastern United States, is a relatively small company. It employs nine drivers, all of whom are Teamster members. While the bulk of the firm's nuclear business is in transporting low-level materials, the company is infrequently involved in transporting plutonium. For plutonium shipments, in compliance with federal regulations, the company arranges augmented security, specialized routing, and other precautions; drivers of such shipments receive additional pay. For all other radioactive shipments, however, no special distinction in pay is made. As yet, McCormick's drivers have not acted through union representatives to assert greater control over conditions under which company trucks are operated. Thus far, the major concern seems to be an ongoing interest in equipment safety, in the apparent belief that properly functioning equipment is the best insurance against accidents, no matter what type of cargo is being transported.[31]

9.3.2 Rail Industry Profile

According to the Bureau of Labor Statistics, the transportation industry as a whole is the most heavily organized industry in the United States.[32] The railroad sector is particularly unionized, with over 600,000 railway union employees in 1975.[33] Table 9.1 is a listing of the principal railway unions and their membership.

9.4 Union Policies Involving Nuclear Material Transportation

The various unions involved in the rail and truck industries have yet to single out nuclear cargo as calling for any special organizational impetus or activity to give them increased input over conditions under which such material is transported. Due in part to the good safety record of nuclear materials transportation, unions have apparently felt no compelling necessity to appoint oversight or watchdog committees or to adopt other procedures which allow for increased labor impact on working and handling conditions of such cargo.

Thus far, it does not appear that any of the major unions have published an issue or position paper with respect to the transportation of nuclear materials. The Teamsters' organization has formed an in-house safety committee, but this group has not acted specifically in regard to nuclear materials transport.[34] A general health and safety agreement implemented by the trucking industry and the Teamsters does not differentiate between types of cargo; rather, it deals with safety concerns in terms of general guidelines.[35]

The AFL-CIO issued an energy policy statement in late February 1977, after its executive council meeting in Bal Harbour, FL. This statement endorsed increased nuclear power development in general terms, but avoided any specific recommendations on such development. For example, the statement indicated that "every effort must be made to accelerate the development of coal and nuclear power while protecting the environment and maintaining stringent health and safety standards."[36] This type of statement illustrates the present posture of the AFL-CIO in regard to nuclear issues.

The Oil, Chemical, and Atomic Workers International Union, which represents employees at some nuclear fuel-cycle facilities, has issued a general statement on worker safety. The August 1977 executive council meeting of the union in Los Angeles adopted a resolution urging that employee nuclear safety jurisdiction be transferred from NRC and ERDA to the Occupational Safety and Health Administration in the Department of Labor. Since there is concern that fear of employer reprisals currently inhibits workers from filing safety complaints,[37] the resolution also advocated that workers who file such complaints be provided job protection.

TABLE 9.1

UNION MEMBERSHIP IN 1975 WITH
RAILROAD-RELATED DUTIES

Union	Membership
American Railway Supervisors Association	3,000
American Train Dispatchers Association	3,400
Brotherhood of Locomotive Engineers	56,000
Brotherhood of Maintenance of Way Employees	94,000
Brotherhood of Railroad Signalmen	11,000
Brotherhood Railway Carmen of the United States and Canada	49,000
Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees	139,000
Brotherhood of Sleeping Car Porters	1,200
Hotel and Restaurant Employees and Bartenders International Union	4,200
International Association of Machinists and Aerospace Workers	19,000
International Brotherhood of Boilermakers and Blacksmiths	3,100
International Brotherhood of Electrical Workers	15,000
International Brotherhood of Firemen and Oilers	12,100
International Organization of Masters, Mates and Pilots of America; National Marine Beneficial Association; International Longshoremens' Association	1,200
Railroad Yardmasters of America	6,800
Sheet Metal Workers' International Association	5,400
Transport Workers Union of America	11,000
United Transportation Union	188,000

SOURCE: Compiled largely from Railroad Retirement Board table, Bureau of Research, January 1977, and other sources.

Labor's primary goal at present is to increase the proportion of union members in the national work force. Although union membership is increasing in numbers, it has been declining in percentage for almost two decades. In 1954, about 35 percent of the labor force was unionized; in 1977, that figure is about 26 percent.[38]

With the increasing mechanization of industry in general and manufacturing in particular, blue-collar jobs--historically the most unionized portion of the labor force---have declined in number, while white-collar jobs, which historically have not been substantially organized, have increased in number. George Meany, the AFL-CIO President, has adopted an interventionist stance with respect to increasing the organized labor force in the country, referring to organizing as "a major responsibility and continuing obligation" of the federation and affiliate organizations. To bolster these efforts, the AFL-CIO has established a coordinating committee of the organizing directors of the affiliated unions.[40]

Meany also announced in February at the Bal Harbour meeting that the AFL-CIO was starting an $800,000 lobbying effort to enact changes in labor laws. These changes would facilitate the process of enlisting new workers and winning collective bargaining contracts for them by providing for accelerated representation elections conducted by the NLRB. Other changes sought would allow triple damages for workers illegally discharged for union activities and would mandate the denial of government contracts to companies that have been shown to have repeatedly violated national labor regulations.[41]

The major geographic target for spurred organization activities is the Sunbelt state area. These states, stretching from the Carolinas to Arizona, have been relatively hostile to labor unions and count among their numbers the majority of the right-to-work states. Increasing numbers of companies are relocating in the Sunbelt, recognizing the lower wage scale advantages of doing business in this area.[42]

In summary, organized labor intends to remain a viable and potent social, economic, and political force, and can be expected to assume a more activist role in organizing efforts and promoting worker safety. Since nuclear transportation could become a vulnerable target of its activities, the industry should seize the initiative and take all practicable steps to reduce radioactive emissions and to improve employee safety, so that it can avoid a major confrontation.

CHAPTER NINE NOTES:

LABOR RELATIONS

1. Conversation with Capt. James Eckols, Chairman, ALPA National Hazardous Materials Committee (September 9, 1977). As defined in 49 C.F.R. 173.389(i), the transport index is the highest radiation dose rate, in millirems per hour, at three feet from the external surface of a shipping package. This figure indicates the degree of control a carrier must exercise during transportation.

2. 49 C.F.R. 175.700.

3. _See_ L. Trosten, "Authority of Governmental Agencies and Carriers to Set Conditions for Transportation of Radioactive Materials," _AIF Summary Report: 1976 Conference on Transportation for the Nuclear Industry_ (February 1977) at 91.

4. Proposed Amendments for Air Shipments of Radioactive Materials, 42 F.R. 37427 (July 21, 1977).

5. 29 U.S.C. 141 _et seq._

6. 29 U.S.C. 157.

7. 29 U.S.C. 159,160.

8. R. Gorman, _Basic Text on American Labor Law Unionization and Collective Bargaining_ (hereinafter cited as _Gorman_) (1976) at 5,6.

9. 29 U.S.C. 178.

10. _Gorman_ at 5,6.

11. J. Stellman and S. Daum, _Work Is Dangerous to Your Health_ (New York: Vintage Books, 1973, paper ed.) at 3.

12. N. Wood, "Environmental Law and Occupational Health," _Labor L.J._ (March, 1976) at 153.

13. _Id_. at 154.

14. K. Baker, "The Safety of Workers in the Nuclear Fuel and Reactor Industries," 17 _Nuc. Safety_ 363, 368 (May-June 1976).

15. _See_ Baker, _supra_ note 13 at 370.

16. 29 U.S.C. 143.

17. J. Atleson, "Threats to Health and Safety: Employee Self-Help Under the NLRA," 59 Minn. L. Rev. 647, 659 (1975).

18. Gateway Coal Company v. United Mine Workers of America, 314 U.S. 368, 386-87 (1974).

19. J. Summa, "Criteria for Health and Safety Arbitration," Labor L. J. 368, 374 (June 1975).

20. "Illinois Cracks Down," Energy Daily (July 8, 1977) at 4. See also M. Anderson, "Fallout on the Freeway," Oversight Hearing on Nuclear Waste Disposal in Michigan, Subcommittee on Energy and the Environment, House Committee on Interior and Insular Affairs, 94th Cong., 2d Sess. (July 6, 1976) at 56 to 117.

21. "Australia's Labor Unions Threaten to Halt Uranium Industry," Energy Daily (September 6, 1977) at 2.

22. 29 U.S.C. 651.

23. J. Hyatt, "U.S. Inspection Unit Finds Itself Caught in Critical Cross Fire," Wall Street Journal (August 20, 1974) at 1.

24. "Occupational Health and Safety Letter," Department of Labor (May 8, 1977) at 3.

25. C. Edwards, "Safety and Health Regulation of the Transportation Industry: Can the Industry Serve Two Masters?" ICC Practitioner's Journal (July-August 1976) at 614.

26. 29 U.S.C. 653(b)(1).

27. Directory of National Unions and Employee Associations 1973 (hereinafter cited as National Union Directory), U.S. Department of Labor, Bureau of Labor Statistics, Supplement 3 (January 1976) at 55.

28. Id. at 42.

29. Telephone conversation with Mr. Derdeur, Director of Industrial Relations, American Trucking Association, Washington, DC (May 31, 1977).

30. Telephone conversation with Mr. Earl Rutenkroger, Nuclear Division Chief, Tri-State Trucking Company, Joplin, MO (May 6, 1977).

31. Telephone conversation with Mr. Mastroianni of McCormick Highway Transportation Company, Schenectady, NY (May 6, 1977).

32. <u>National Union Directory</u> at 81.

33. U.S. Railroad Retirement Board--Table, Bureau of Research, (January 1977).

34. Information gathered in telephone conversation with Mr. Michael Markowitz of the Eastern Conference of the International Brotherhood of Teamsters (June 1, 1977).

35. <u>Id.</u>

36. "Labor: Would Accelerate Use of Coal, Nuclear," <u>Nuclear News</u> (April 1977) at 54.

37. Conversation with Dr. Frank Collins of the Oil, Chemical, and Atomic Workers Union (September 9, 1977).

38. J. Singer, "Organized Labor--Speaking in Accents Other Than the One from the Bronx," 9 <u>National Journal</u> 376 (March 12, 1977) at 378.

39. <u>Id</u>.

40. <u>Id</u>.

41. <u>Id</u>.

42. <u>Id</u>.

APPENDIX A

GOVERNMENT REGULATIONS PERTAINING TO THE TRANSPORTATION OF RADIOACTIVE MATERIALS

Source: An Overview of Transportation in the Nuclear Fuel Cycle: BNWL 2066.

FEDERAL REGULATIONS

Regulations governing the transportation of radioactive materials have been established to prevent the loss or dispersal of material during shipment and to insure the safety of the public and transportation workers. There is overlapping responsibility for regulating the safe transport of radioactive materials. Primary responsibility at the federal level for the safety of radioactive shipments lies with the Department of Transportation (DOT) Materials Transportation Bureau and the Nuclear Regulatory Commission (NRC). A "Memorandum of Understanding" between the two agencies was signed in 1966 and revised in 1973.[1] This memorandum calls for cooperation between DOT and NRC and delineates the responsibilities of each agency. DOT is responsible for promulgating and enforcing safety standards governing packaging and shipping containers and for the labeling, classification and marking of all packages. DOT also implements safety standards for the mechanical condition of carrier equipment and qualifications of carrier personnel. NRC develops performance standards for package designs and reviews package designs for Type B, fissile and large quantity packages (defined below). DOT requires NRC approval to use these packages.[2] The Federal Aviation Administration, the Interstate Commerce Commission, the Civil Aeronautics Board, the U.S. Coast Guard and state regulatory agencies also exercise some regulatory authority over the shipment of radioactive materials.

The transportation or packaging for transport of radioactive material is subject to issuance of the appropriate licenses. Applicants for a license to package or to transport radioactive material must show by a combination of analysis and experiment that the proposed package or transport vehicle satisfies all the requirements set forth in the Code of Federal Regulations. The application must describe proposed controls or precautions to be used in the loading, unloading, handling and transport of radioactive material and the procedures to be followed in the event of an accident or delay in shipment. Inspection and accountability procedures must also be described.

The following Federal Regulations are applicable to the transportation of radioactive materials:

- Title 49 Code of Federal Regulations Parts 170-199 (49 CFR 170-199) - Department of Transportation regulations governing the transport of hazardous materials.
- 10 CFR 71 - Nuclear Regulatory Commission regulations governing the packaging and shipment of radioactive materials.
- 14 CFR 103 - Federal Aviation Administration regulations for shipment of radioactive materials by air.
- 46 CFR 146 and 149 - U.S. Coast Guard regulations governing the shipment of radioactive materials by water.
- 10 CFR 73 - Nuclear Regulatory Commission regulations for the protection of special nuclear material in transit.

DOT and NRC regulations are the most important for shipments in the Nuclear Fuel Cycle. These regulations will be reviewed here.

Transport Group

Radioactive materials are classified for transportation purposes into one of seven transport groups according to their radiotoxicity and potential hazard if released to the environment.[a] Transport Group I is the most restrictive. Materials such as plutonium are placed in this group. Materials such as tritium gas with a relatively low hazard potential are placed in Transport Group VII.

Quantity Designations

A shipment of radioactive material is classified as Type A, Type B, or Large Quantity of Radioactive Material depending on the amount of radioactivity it contains. The dividing line between the quantity types is dependent on the Transport Group of the material being shipped. (See Table A-1.)

[a] It is anticipated that the U.S. Regulations will be changed in the near future to agree in substance with 1973 IAEA Regulations. The transport group designation has been replaced with a different system in these regulations. (See References 3 and 4.)

If a shipment contains materials from more than one Transport Group, the most restrictive group will generally apply for the determination of quantity type. (See 10 CFR 71.4(p).)

TABLE A-1. Maximum Activities for Normal Form[a] Type A and B Quantities of Radioactive Material by Transport Group

Transport Group	Type A Quantity (Ci)	Type B Quantity (Ci)
I	0.001	20
II	0.05	20
III	3	200
IV	20	200
V	20	5000
VI and VII	1000	50000

NOTE: Any quantity greater than Type B is defined as a "Large Quantity" of radioactive material.

[a] Normal form material is everything that does not meet the "Special Form" criteria outlined below.

Low Specific Activity (LSA) Materials

Some shipments of material with a relatively low hazard potential are exempted from certain of the requirements in the regulations even though they may contain Type A or B quantities of radioactive materials. LSA materials include uranium or thorium ores, unirradiated depleted or natural uranium, unirradiated thorium; aqueous solutions of tritium oxide containing less than 5 mCi/ml; and materials having uniformly distributed activity in which the concentrations per gram does not exceed the following:

- 0.1 μCi of Group I materials
- 5.0 μCi of Group II radionuclides
- 300 μCi of Group III and IV materials.

Externally contaminated non-radioactive materials may be considered LSA provided the contamination is not readily dispersible and the average surface contamination per square centimeter does not exceed the following:

- 0.1 μCi for Group I radionuclides
- 1.0 μCi for other materials.

Special Form Material

Radioactive material in special form may be transported as if it were Transport Group V regardless of the radioactive species present. Special form material meets one of the following criteria:

1. Radioactive material in solid form having no dimension less than 0.5 mm (or one dimension greater than 5 mm). Will not sublime, melt or ignite in air at 538°C. Remains non-dispersible after immersion for one week in water at 20°C or air at 30°C.

2. Radioactive material contained in a capsule that will satisfy the above requirements.

Special form material must remain intact after a test that includes a 9.1-m drop, impact of 1.4-Kg steel rod dropped from a height of 1 m, heating to 800°C for 10 minutes and immersion in water for 24 hours.

Fissile Classification

A shipment containing fissile materials (^{233}U, ^{235}U, ^{238}Pu, ^{239}Pu, ^{241}Pu) is classified according to the amount of control which must be exercised to prevent nuclear criticality in shipment.

- Fissile Class I packages may be shipped in unlimited numbers in any arrangement, requiring no nuclear criticality considerations.
- Fissile Class II packages may be shipped together in any arrangement but their numbers are limited to an aggregate Transport Index (see definition below) of 50. For purposes of nuclear criticality safety, individual packages must have a transport index between 0.1 and 10.

- Fissile Class III packages must be controlled in transport by special arrangements between the shipper and the carrier to provide nuclear criticality safety.

Certain shipments of fissile materials are exempt from the normal requirements for packages containing fissile material. These packages meet one of the following criteria (among others - see 10 CFR 71.9):

1. Contain less than 15 g fissile material
2. Contain Th or U with less than 0.72% fissile material
3. Contain less than 350 g fissile material with a maximum of 5 g in any 0.028 cubic meter (1 ft^3) of the package.

Transport Index

The transport index is a number placed on a package of radioactive material to designate the degree of control to be exercised by the carrier during transportation. The transport index is the larger of the following numbers:

1. The highest radiation dose rate in millirem/hr at 1 m from any accessible external surface of the package; or
2. For Fissile Class II packages the number 50 divided by the maximum number of such packages which may be transported together with criticality safety considerations.

Except in a exclusive use vehicle, the aggregate transport index of all packages in any storage area during transportation must be exceed 50. (Shipments of Fissile Class II packages can never exceed an aggregate transport index of 50. A total transport index of 100 is permitted for fissile Class III shipments.) The transport index also determines the labeling requirements for the package.

Special Nuclear Material (SNM)

A shipment of radioactive material is designated special nuclear material if it contains 5000 grams or more of ^{235}U (contained in uranium enriched to 20 percent or more), ^{233}U or plutonium or any combination of the three computed by the formula

$$\text{grams} = \text{grams } ^{235}U + 2.5 \, (\text{grams } ^{233}U + \text{grams Pu}).$$

10 CFR 73 requires that shipments of special nuclear material be afforded additional physical protection in transit to prevent theft or sabotage. These protective measures include:

- Carrier procedures NRC approved pre-planned
- Hand-to-hand receipts
- Tamper-indicating seals on all containers
- Minimum container weights of 227 kg for shipments in open vehicles
- No cargo transfers enroute
- Periodic radio communication between transport vehicle and carrier dispatcher
- Armed escorts or specially designed transport vehicles with disabling features

Radiation Dose Requirements

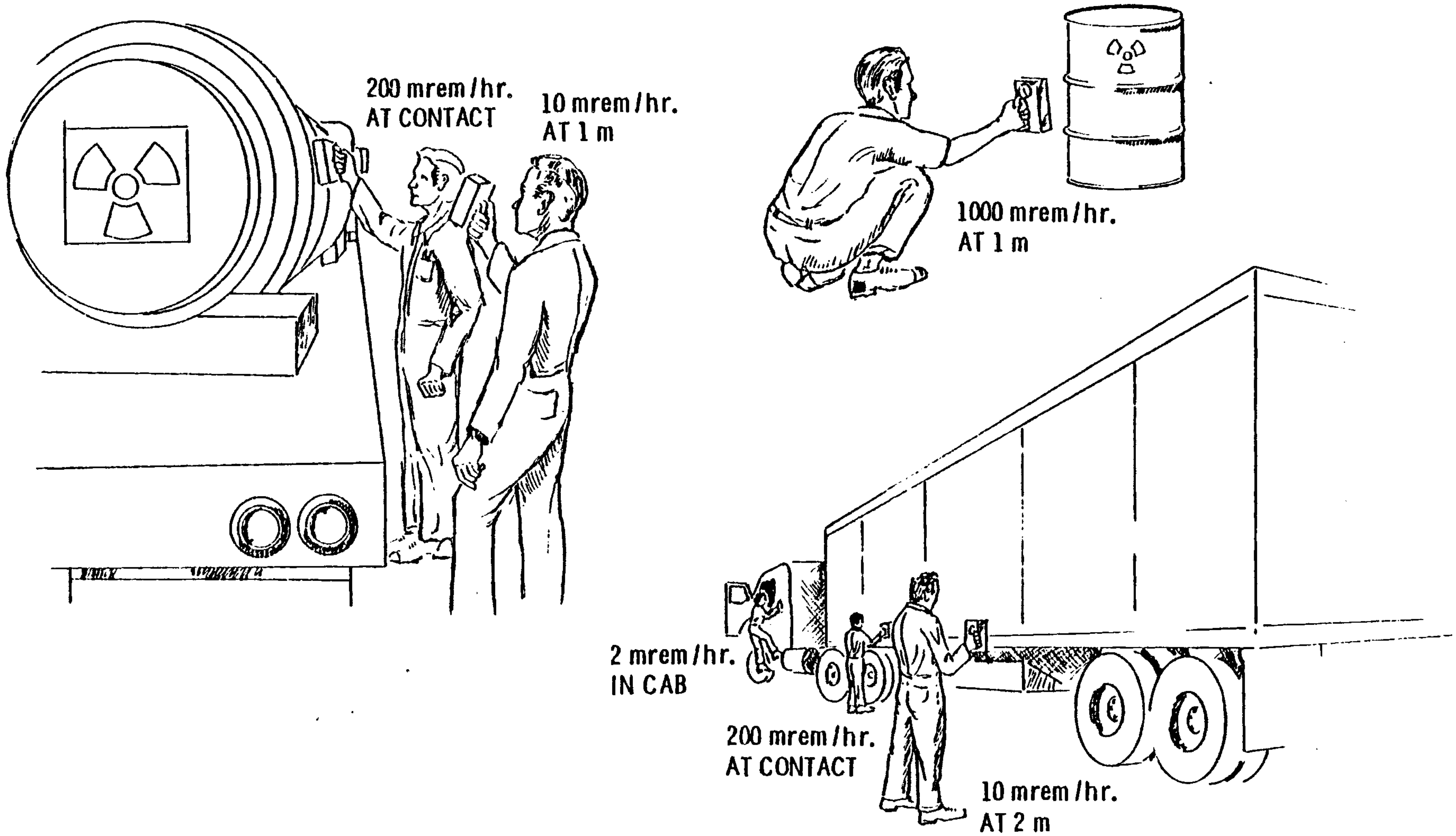
Radiation dose rates from shipments of radioactive materials are also limited by the regulations. Larger maximum radiation dose levels are allowed for vehicles being used exclusively to transport radioactive materials than for non-exclusive use vehicles. For vehicles not in exclusive use the following limits apply

- 200 millirem/hr at any point on the external surface of the package
- 10 millirem/hr at 1 m from the package

For vehicles being used exclusively for the transport of radioactive materials the limits are as follows:

- 1000 millirem/hr at 1 m from the external surface of the package (closed transport vehicle only)
- 200 millirem/hr at any point on the external surface of the vehicle (closed transport vehicle only)
- 10 millirem/hr at 2 m from the external surface of the vehicle
- 2 millirem/hr in any normally occupied position in the vehicle.

These dose limits are illustrated in Figure A-1 for truck transport.



LIMITS FOR NON-EXCLUSIVE USE VEHICLE

LIMITS FOR EXCLUSIVE USE VEHICLE

FIGURE A-1. Radiation Dose Limits (Reference 5)

Packaging

The type of packaging required for a shipment of radioactive material is dependent on the type, quantity, form and fissile classification of the material to be shipped. 49 CFR allows shipment of radioactive materials in DOT specification containers, in containers licensed by NRC or in containers authorized by special permit from DOT.[a] The specification containers are described in the regulations. All radioactive material shipping containers must meet the general package requirements for radioactive material shipping containers 49 CFR 173.393 and the general requirements for all packaging used in interstate commerce contained in 49 CFR 173.24.

Low specific activity material shipped in exclusive use vehicles is exempt from most of the packaging requirements of 49 CFR. Basically only strong, tight packaging is required. The radiation dose limits discussed previously are still applicable, however.

Type A quantities of radioactive material must be shipped in DOT specification 6M packaging, approved Type B packaging or packaging that meets the requirements of DOT specification 7A (See 49 CFR 178.350). In addition to meeting the general packaging requirements of 49 CFR 173.24 and 49 CFR 173.393, specification 7A packaging must be capable of maintaining its shielding integrity and preventing the dispersal of its contents during a test simulating conditions normally incident to transportation. These test conditions are outlined below.

Test Representing Conditions Normally Incident To Transportation

- Heat - direct sunlight at an ambient temperature of 54°C in still air.
- Cold - an ambient temperature of -40°C in still air and shade.
- Pressure - one half standard atmospheric pressure.
- Vibration - normally incident to transport.

[a] Special permits are no longer issued for radioactive material shipping containers. The special permits now in effect will be allowed to expire without renewal. In the future all radioactive material will be shipped in DOT specification or NRC licensed containers.

- Water spray - sufficient to keep the exposed surfaces of the package except the bottom wet for 30 minutes.
- Free drop - 1 1/2 to 2 1/2 hours after the water spray test at a distance of 1.3 to 1.2 m (depending on package weight) onto an unyielding surface.
- Corner drop - onto each corner in succession (each quarter of each rim for cylinders) from a height of 30 cm onto an unyielding surface (applies only to wood or fiberboard containers of less than 45 kg and to all Fissile Class II Packages).
- Penetration - impact of the hemispherical end of 5.9 kg steel cylinder 3.2 cm in diameter dropped from a height of 1 m onto the most vulnerable surface of the package.
- Compression - a compressive load against the top and bottom of the package in its normally transported condition. The load is the greater of 5 times the weight of the package or 1.38 neutrons/cm^2 times the minimum horizontal cross section of the package. (This test applied only to packages weighing less than 4535 kg.)

Type B quantities of radioactive material may be shipped in DOT specification 6M containers, in packaging authorized by NRC or in packaging meeting the 1973 IAEA requirements (provided DOT has validated the approval of the foreign competent authority). Type B packaging submitted to NRC for approval must be able to maintain its integrity through the test conditions outlined below simulating transportation accident environments as well as the test simulating conditions normally incident to transportation outlined above.

Test Conditions Simulating Severe Transportation Accident Environments

(Tests applied sequentially to determine cumulative effect on the package.)

- Free drop - through a distance of 9.1 m onto an unyielding surface striking the surface in the position which would produce maximum damage.

- Puncture - a free drop through a distance of 1 m onto a cylindrical steel bar 15.2 cm in diameter with the edge rounded to a radius of 6.4 mm. The length of the bar is selected for maximum damage (minimum length is 20.3 cm). The bar is mounted on an unyielding horizontal surface and the package is dropped in a position expected to produce maximum damage.
- Thermal - exposure to the equivalent of a 800°C fire for 30 minutes with no artificial cooling for 3 hrs after the exposure.
- Water immersion - (fissile material packages only) at a depth of 91 cm for 8 hours.

Large quantities of radioactive materials are shipped in Type B packaging. The packaging used must provide adequate shielding and heat removal capabilities for the radioactive material to be transported.

Fissile material may be shipped in DOT specification 6L (Type A quantities only) or 6M packaging or in packaging approved by NRC. Packaging approved by NRC for fissile materials must meet some requirements not posed on containers for other radioactive materials (See 10 CFR 71.38 - 71.40). These conditions insure a wide margin of safety on the number of packages which can be shipped at one time. They also insure that a critical mass could not be assembled in the event of a transportation accident.

Special Regulations Applying to Plutonium

Because of its hazardous nature, there are some special regulations in effect for the shipment of plutonium. Plutonium may presently be shipped as a liquid (in nitrate solution) or as a solid (plutonium oxide). After June 1978, plutonium in excess of 20 Ci per package must be shipped as a solid. (10 CFR 71.42). The plutonium must be double packaged and the inner container must maintain its containment integrity as the outer container undergoes the tests for Type B packaging. The separate outer container must meet the requirements for packaging of material in normal form.

Federal regulations prohibit shipments of plutonium in passenger aircraft in quantities exceeding 20 grams or 20 Ci, whichever is less (10 CFR 71.42). However, a recently enacted federal statute has placed an embargo on shipments of plutonium by air until it is shown that the shipping containers will not release their contents in an airplane crash environment.

State Regulations

Although federal agencies dominate the regulatory process for the transportation of radioactive materials, state governments also exercise some control over these shipments. State highway departments regulate gross vehicle weights, vehicular dimensions and other parameters for radioactive shipments just as they do for other kinds of shipments. About one half of the states have adopted the U.S. DOT Hazardous Materials Regulations to cover intra-state shipments. Several states have adopted or proposed additional regulations concerning radioactive materials.[1,6] These include:

- Special routing of radioactive shipments
- Advance notification for shipments of large quantities of materials
- State inspections of some types of radioactive shipments
- Prohibition of certain types of shipments within the states
- Prior approval for radioactive shipments
- Requirement of exclusive use vehicle for radioactive shipments
- Use of pilot vehicles
- Speed restrictions for radioactive shipments
- Specific hours of movement
- Accompaniment of all shipments by radiation monitoring personnel.

The variation of regulations between adjacent states can often require special considerations for interstate shipments.

There is a potential conflict between some of the proposed state laws and the provisions of the National Transportation Act of 1974. (Public Law 93-633 signed in 1975). This law prohibits the states from adopting laws or regulations more stringent than Federal regulations unless the state regulations improve transportation safety. Even in this case, such rules can be adopted only if they do not unreasonably burden commerce.

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(Transportation Regulations)

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2. W. M. Rogers, Jr., "State and Federal Roles in Regulating the Transportation of Radioactive Materials," in Proceedings of the 4th International Symposium on Packaging and Transportation of Radioactive Material (CONF-740901), Miami Beach, FL, September 1974.

3. A. W. Grella, "An Update on the Status of Recent and Proposed Changes to the U.S. Regulations for Transport of Radioactive Material," in Proceedings of the 4th International Symposium on Packaging and Transportation of Radioactive Material, (CONF-740901), Miami Beach, FL, September 1974.

4. Regulation for the Safe Transport of Radioactive Materials 1973 Revised Edition, International Atomic Energy Agency, Vienna, Austria, 1973.

5. Radioactive Materials Transportation Manual, Nuclear Transport Division, Tri-State Motor Transit Co., Joplin, MO, 1974.

6. W. A. Brobst, "The State of State Regulations," in Proceedings of the 4th International Symposium on Packaging and Transportation of Radioactive Material (CONF-740901), Miami Beach, FL, September 1974.

General References

F. B. Conlon and G. L. Pettigrew, Summary of Federal Regulations for Packaging and Transportation of Radioactive Materials, (BRH/DMRE 71-1) U.S. Department of Health Education and Welfare Public Health Service, Bureau of Radiological Health, Rockville, MD, February 1971.

W. A. Brobst, Transportation of Nuclear Fuel and Waste, presented at Waste Management 1974 Symposium, Department of Nuclear Engineering, University of Arizona, Tucson, AZ, April 1974.

APPENDIX B

ROCKINGHAM, N.C. TRAINWRECK

April 13, 1977

William H. Travis, Director
Safety and Environmental Control Division

TRAIN WRECK - ROCKINGHAM, N. C.

Twenty nine cars of a 102 car train on Seaborad Coast Line were derailed at 7:21 a.m. on March 31, 1977. Included in the derailment were two flat cars each loaded with two trailers which in turn each contained a 14 ton cylinder of normal UF_6. The wreck was in the SRO radiological assistance region. However, SRO requested our assistance in responding and we dispatched a 4-man team by charter aircraft to the site. Despite various reports that some of the cylinders were ruptured and were leaking we found all of the cylinders intact with no release of radioactive material. The cylinders were recovered and loaded in gondola cars for transport to the nearest railyard at Hamlet, N. C. (7 miles). From there they were transported by Tri-State trucks to ORGDP. There was involvement at the accident site by a number of local, State and Federal Agencies and there was a lot of interest and activity by the news media. The cylinders of UF_6 belong to the French Company, Comurhex, and the shipper was Transnuclear. Attached are chronological accounts of our activities in response to this accident.

R. D. Smith, Response Team Leader

Wayne Smalley, Emergency Coordinator

Encl.
1. Chronological documents
2. Photos

cc: H. D. Fletcher, Encl. 1
C. A. Keller, Encl. 1
J. H. Lamb, Encl. 1
W. Range, Encl. 1
C. C. Lushbaugh, ORAU, Encl. 1
J. K. Bratton, DMA, HQ, Encl. 1 & 2
H. Hollister, SSC, HQ, Encl. 1 & 2
W. E. Mott, ECT, HQ, Encl. 1
W. R. Voigt, URE, HQ, Encl. 1
N. Stetson, SRO, Encl. 1 & 2

Train Wreck - Rockingham, N. C.
Chronological Account of ORO Activities

3/31/77

9:10 a.m.	Notified by Joe Russell, UEO Division, of a train wreck on the Seaboard Coast Line (SCL) near Rockingham, N. C. involving 4 cylinders of UF_6 feed material that were destined for our Paducah Plant. Twenty-nine cars of the 102 car train were derailed and there was a fire involved. The cylinders belong to the French Company, Comurhex, and the shipper is Transnuclear, Inc. Mr. Gillespie, SCL had notified Bill Kraemer at Paducah and Kraemer had called UEOD.
9:15 a.m.	Notified Don Collins at SRO and told him we would be standing by to assist if needed.
9:25 a.m.	Doran Fletcher, Director, UEOD, relayed additional information he had received through Paducah from Gillespie. The two flat cars which carried the UF_6 cylinders were involved in the fire. One cylinder had ruptured and a brown liquid was flowing from the cylinder and running down the hill. A newsman had been burned by the liquid and had been taken to the Richmond Memorial Hospital. The contact was Dr. Stephenson, 919-997-2561. Bill Pryor also came in with notification of the wreck which had been called to him by Larry Blalock, Supply Division. Paducah had notified Blalock and had given Mr. Wilks, SCL as their contact.
9:30 a.m.	Called Shift Superintendent Webb at ORGDP and requested that a UF_6 safety specialist be made available to go to the accident site.
9:35 a.m.	Called Collins to give him our latest information. He requested that we send a team to the site including people with expertise in handling UF_6 cylinder accidents. He did not have a photographer available for his team and we agreed that I would send our photographer, Frank Hoffman, with the team.
9:40 a.m.	Arranged for Dick Smith, Sr. Health Physicist, to be the leader of our response team.

Encl 1

9:45 a.m. Advised Charlie Keller, Assistant Manager for Operations (AMO) and Vince D'Amico, Deputy AMO, of the situation and got approval to dispatch a team.

9:50 a.m. Called Blalock and requested that he arrange for a charter plane to take our team to Rockingham.

9:55 a.m. Called Dr. Lushbaugh, REAC/TS, and requested that he contact Stephenson at Richmond Memorial Hospital to determine the condition of the burned newsman, and give any needed advice on caring for the patient.

10:00 a.m. Webb informed me that Hank Colbert would be our UF_6 safety specialist.

10:10 a.m. Paul Matthews called from the HQ EOC and I briefed him on the available information.

10:20 a.m. Keller called to say that he had received a request from HQ for more information about the cylinders. He instructed me to report all available information to the HQ EOC.

10:25 a.m. Lushbaugh reported on his information from Stephenson. The newsman had been taking photographs of the wreck. He had lost his footing and fallen sticking his left hand into some black liquid on the ground. He had 3rd degree thermal burns over the whole hand and up above the wrist. There were two small fires in a boxcar and a man with a C. D. meter had gotten a small positive reading on one of the UF_6 cylinders.

10:35 a.m. Smith reported that Jim Alexander, Public Information Officer, had received approval from the Manager to join the response team.

10:40 a.m. Went over the plans for the response with Smith.

11:00 a.m. Hoffman departed in his photography truck for the airport.

11:00 a.m. Called the N. C. State Highway Patrol and requested that they send a car to meet our team at the airport and transport them to the site.

11:10 a.m.	Fletcher gave me a report that Paducah had received from E. L. Cook, SCL Terminal Supt. at Hamlet, N. C. (7 miles from the wreck). Cook had reported that two of the UF_6 cylinders were ruptured, one was in a fire and one in a pond.
11:15 a.m.	Called Cook. He had not been out to the accident site but some of his people had. He had just received another report from one of his people that all 4 of the UF_6 cylinders had been thrown from their trailers, that 3 of them were "cleared" and looked o.k. but that the 4th one was "puckered" and in proximity to a fire.
11:15 a.m.	Culbert arrived to join the team and Smith, Alexander and Culbert departed for the airport.
11:30 a.m.	Called Matthews to report latest information.
11:40 a.m.	Jack Sutherland, NRC-Atlanta, called and I briefed him on the situation.
12:10 p.m.	Peggy McConnell, Public Information, called with a message for Alexander: The SRO PI Office had advised that the N. C. governor had appointed a Mr. Manoock to be the N. C. public information coordinator for the train wreck.
12:15 p.m.	Smith called from the airport and gave me 2:00 o'clock as ETA for the team at Rockingham. He said that before departure Culbert had called Vicki Matson, Transnuclear, and she had said there were 6 UF_6 cylinders on the train. I briefed him on the latest developments. I told Alexander about Manooch and he asked me to have McConnell call Phil Kief, HQ Public Affairs, and suggest that HQ call AP or UP and clarify the fact that UF_6 has a very low level hazard.
12:30 p.m.	Called the N. C. Highway Patrol with our team aircraft identification number and ETA at Rockingham.
12:55 p.m.	Called the Paducah Shift Superintendent to get the telephone number for E. S. Wilks, SCL Division Superintendent at Raleigh.

01:00 Called Wilks. He contacted Mr. Lecke, Trainmaster of the wrecked train by radio and established a conference hookup so that he and I could talk with Lecke. I asked Lecke to verify the number of UF_6 cylinders on the train. He went over his consist and said that there were only the four cylinders that were involved in the derailment. Wilks then set up a conference hookup with his Assistant Supt., Mr. Eaton, who was at the wreck site. Eaton reported: one cylinder, still fastened to its trailer was on top of the road bed. The trailer bed and tires were on fire but the fire had about burned out. Another cylinder was half-way down a 40 ft. fill embankment and was caught against a trailer bed. It had a small indentation in one end. The other two cylinders had rolled to the bottom of the enbankment. Capt. Parker from Fort Bragg had radiation monitoring instrumentation and had taken readings on the cylinders. He had detected slight leakage (very minimal) from the cylinder on the west side at the bottom of the enbankment. He said there were on site 3 people from Fort Bragg and 3 people (Fred Hardy, D. H. Brown and C. D. Brown) from the State of North Carolina.

1:50 Briefed Matthews on latest information. He had heard from Fort Bragg that the readings on the one cylinder were 1.5 mr/hr and 1500 cpm which we decided were probably normal readings. He had also learned that there was a carload of ammonium nitrate spilled near our cylinders and we guessed that this was perhaps what burned the newsman. He said wreck had occurred at 7:21 a.m.

2:00 Briefed Fletcher on latest information. We agreed that the cylinders should be brought in to ORGDP since it is closer to the wreck site than Paducah.

2:10 Kim Hoag, SSC-HQ, called for information and I briefed him on the situation.

2:25 Cook called to discuss moving cylinders. He suggested loading them in gondola cars. Told him it might be o.k. if cylinders were not allowed to move in the cars but to discuss it with our team which should be on site by now.

3:00 McConnell reported a call from Jim Garber, SRO. Garber said that some fertilizer in the wreck had been on fire and had liquified and that it was this material which had burned the newsman.

3:25 Wilks called to say that Culbert had reported to him thru the railroad radio system on the status of the cylinders. He said there was some skirt damage to all 4 cylinders but that the valves were all o.k. and there were no leaks.

3:30 Walt Dietz, SRO, called and I gave him what information I had. He said he had lost radio contact with his team when they were about 50 miles from SRO, that they were having some car trouble at the time and that he had not heard from them since.

3:40 Obtained a Transnuclear (Falls Church, Va.) number from Blalock and called reaching Matson. She said that there were 6 cylinders in the shipment which came by ship from LaHarve, France to Portsmouth, Va. and then by train to Hamlet. Two cars carrying 4 cylinders billed for ORGDP were included in the train that later derailed. The other car with 2 cylinders destined for Paducah was held at Hamlet for another train. We discussed possible arrangements for re-loading the cylinders. She said if the cradles were still intact she could send in more trailers and transport as before. Otherwise she would have to ship by some other means.

3:50 Gave Keller a status report.

4:05 Gave Matthews a status report.

4:30 Smith reported by telephone from a service station near the site: The cylinders are all intact. Two are at the bottom of a 20' bank. One is half way up the bank lying against a flat car. The other one is on top of the roadbed lying next to a car-load of peanuts which is burning. The end of this cylinder has been in the fire and is covered with soot. The cylinders are bent up some but are in good shape. The plug end of the cylinder half way down the bank is pushed in a little bit and the valve cover is gone but the valve is o.k. A carload of ammonium nitrate had spilled near one of the UF_6 cylinders and was on fire. Some of the liquified ammonium nitrate had run down the bank and was evidently the brown liquid that had burned the newsman. Our team arrived at the Rockingham airport at 01:30. TV reporters were waiting there to talk to them. They left the airport about 2:00 and were at the site at 2:15. The crowd at the site included numerous press and TV people, representatives from the states of North Carolina and South Carolina, Army units from Ft. Bragg and Ft. Jackson, and one person from NRC. I advised Smith of Transnuclear's plans for shipping the cylinders.

4:55 Gave Matthews an information update.

April 1

9:30 a.m. Smith reported from Rockingham that during the previous evening the 4 cylinders had been loaded into gondola cars and taken to the railyard at Hamlet. From there they will be transported by Tri-State trucks to ORGDP.

3:00 p.m. The team arrived back at Oak Ridge.

April 4

3:30 p.m. Received report from Transnuclear that 3 of the cylinders were on the road to ORGDP and the 4th was being loaded and would be on the road this afternoon.

April 5

8:30 a.m. Received report from ORGDP that all cylinders had arrived there.

Wayne Smalley
Wayne Smalley

RADIOLOGICAL ASSISTANCE CALL TRAIN WRECK

ROCKINGHAM, N.C. MARCH 31, 1977

The following is a chronological accounting of the undersigned actions regarding the subject train wreck:

0940 I was alerted of the train wreck and that early reports indicated that two cylinders were ruptured and one was near a fire. A total of 4-14 ton cylinders were involved. A reporter apparently burned his hand in the release. I was informed to make plans to proceed to the sight as team leader via a charter-airplane which was being obtained by the Transportation Branch.

1010 With my equipment assembled I received word that Frank Hoffman, ERDA Photographer and Henry Culbert, UCC-ND UF_6 Safety Specialist would accompany me. Jim Alexander, ERDA PIO, was in conference with Mr. Hart regarding the advisability of proceeding to the scene.

1035 Jim Alexander informed me that he would go to Rockingham with us. I further found out that the reporter received 3rd degree thermal burns from a black liquid; not an acid burn.

1100 Frank Hoffman left for the airport in his own truck while Alexander and I waited for Culbert to arrive.

1115 The ORO Radiological Assistance Team left Oak Ridge.

1215 I contacted Wayne Smalley from the airport and was advised that none of the cylinders were leaking; one was puckered and near a small fire. Smalley was advised that we would arrive in Rockingham at 1400. Smalley said he would contact the N.C. Highway patrol and have our plane met.

1230 With the aid of a good tail wind the flight arrived ahead of schedule at the Rockingham airport. I telephoned the Highway Patrol who in turn sent Mr. Bill Newsome, ABC enforcement office, to be our chauffeur while in Rockingham.

1415 After talking with a reporter at the airport the team arrived at the scene. Contact was made with Captain Parker, 18th EOD Fort Bragg, and Mr. Dayne Brown, N.C. State Department of Human

Resources Radiation Protection Branch (At this point in time the army appeared to be in charge of the area.) They located the 4 UF_6 cylinders for us and stated that two were suspected to be leaking. A reading of 1500 c/m alpha was observed by them on one of the cylinders (this is within DOT limits). Henry Culbert and I inspected the cylinders and quickly determined that none were leaking.

The Rockingham Fire Department were fighting a peanut and ammonium nitrate fire with dry chemicals. The Fire Captain was informed that as far as the UF_6 cylinders were concerned water could be used. He was also informed that the fire should be kept away from the cylinders. One cylinder (DV-08-665) was located in the middle of the wreckage on top of the railroad bed approximately 20 feet from the fire. This cylinder was the only one near enough to the fire to be concerned with if the fire drastically changed, but it was presently in no danger. A cylinder would have to be in a fire for 1 1/2 to 2 hours before a hydraulic rupture could occur. This cylinder had soot on one end just barely warm to the touch, had a broken saddle, and the valve protector was missing.

Another cylinder (DV-08-814) was located halfway down the 20 to 30 foot railroad bed bank resting against a flat car. This cylinder received the most damage. The plug end was dented, the skirt was dented on both ends, the saddle was misshapen, and the valve was very slightly bent.

Both cylinders (DV-08-630 and DV-08-514) were at the bottom of the bank and sustained virtually no damage.

1445 Contact was made with Mr. J. H. Eaton, Assistant Superintendent Seaboard Cost line, who was in charge of the railroad repair operations. He was informed of our findings. He requested if he could continue clean up operations and was told to do so by all means. Only one small request was made of Mr. Eaton and that was "please don't drop anything like a boxcar on our cylinders. They are well constructed but--let's not push our luck!" Mr. Eaton stated they wanted to move the cylinders to the bottom of the bank as they were reached and moved the following day. He was informed this was acceptable.

At this point in time ORO was being looked upon as the dominant authority with regard to the cylinders and all operations associated with them. Mr. Dayne Brown was informed that ERDA had no authority to assume responsibility for amelioration activities but would provide him, as the responsible state agency representative, all the backup support required but that final decisions would have to come from him. Mr. Brown was informed of the Railroads Plans to move the cylinders and that we had no problem with the plans; he agreed. Mr. Brown then departed the scene leaving Mr. Cecil Brown, of his office, in charge.

1500 The Savannah River Radiological Assistance Team led by Mr. Don Collins arrived at the scene they were briefed on the situation and shown the cylinders.

1600 Henry Culbert, Don Collins and I drove to a nearby telephone and reported back to ORO and SR.

1700 Mr. George Moein, EPA, Chief Hazardous Materials Section, Federal On-scene Coordination, arrived. The peanut fire was flaming up again and had a golden brown color which concerned him as being a nitrous oxide fume coming from the fertilizer. He requested that the Local Civil Defense Unit be called out with serious consideration being given to evacuating the people living down wind of the cloud. No homes were visible and the cloud was small. No further EPA actions along this line were taken. EPA was not interested in the UF_6 since ERDA was on sight.

2000 to 2200 The peanut fire flared up rather spectacularly. Flames were leaping from the door and one end of the car glowed red hot. Really a bit too hot for a top quality roasted peanut. The firemen fought the fire for some time but it became apparent that it would have to burn itself out. As soon as enough wreckage was cleared from the burning boxcar, bulldozers were used to push it over the bank. In the process of doing so the back end of the boxcar came closer to the cylinder on the track which was making everyone a little nervous. Movement of the boxcar was stopped.

2200 Wreckage has been cleared and enough track layed on the other side of burning boxcar to allow the crane to get to and pick up the cylinder close to the fire and move it out of the way. The burning boxcar was pushed over the bank.

4/1/77

0130 By this time all four cylinders were moved from their post wreck position, surveyed by N.C. State personnel (1 mr/hr at contact no detectable alpha), visually inspected and judged to be safe for shipment, loaded into gondola cars and taken to the railroad yard in Hamlet, N. C. about 7 miles from the wreck. We departed the scene. At this time all the track has been replaced along one line with the addition of ballast and leveling remaining to be done. RR official estimated the line would be open at 0300.

1000 We visited the railroad yard in Hamlet along with Mr. Matt Cacciatore of Transnuclear. The cylinders were further inspected in the day light and found to be in the condition previously reported. A conversation was held with Mr. E. L. Cook, Seaboard Cost line Superintendent, about shipping out the cylinders on Monday, April 4, via Tri-States Motor Freight. Mr. Cacciatore was making the arrangements.

Comment
According to Mr. Cook and Mr. Eaton the wreck was caused by a depression in the track bed which causes a car load of sand to start rocking. At about the same time slack was taken out of the train which caused the sand car to jump the rails. Ties were observed to be broken and gouged down the middle for quite a distance. The derailed sand car then hit a switch which caused the 29 car derailment. There were 102 cars in the train traveling at an estimated speed of 40 mph. The sand car was located at position 38 and the UF_6 cylinders were located in about the middle of the wreck.

According to reports received from a number of personnel, named in enclosure 1, the following scenario of actions occurred preceding ORO's arrival. The Rockingham fire department was the first on the scene and arrived about 0800. They had a radiation survey meter (probably a CDV-700) surveyed the cylinders, believed there was a radiation hazard and instructed no one to enter the area. The Highway Patrol radiological response team (Sargeant Lemmond and Sargeant Ethridge) arrived by helicopter shortly thereafter, surveyed the cylinders and concluded that no radiation hazard existed.

A reporter was reviewing the wreckage lost his balance and fell placing his hand in a hot black substance severely burning his hand (probably molten ammonium nitrate; residue of this was observed where he fell). At 1100 both the Army from Ft. Bragg and the N. C. State Radiation Protection Branch arrived, surveyed the cylinders, could not determine postively they were not leaking and instructed the railroad to stay away from them until ERDA arrived. According to Mr. Eaton this delayed clearing operations about 2 hours.

With exception of the UF_6 either all or most of the cargo involved was destroyed. Mr. Eaton as well as most everyone else was very impressed with the structure of the UF_6 cylinders.

4/4 Cylinders left Hamlet by Tri-State Motor Freight

4/5 Cylinders arrived at ORGDP.

Richard D. Smith
R. D. Smith

LIST OF PERSONNEL INVOLVED AT THE SIGHT

Seaboard Coast Line Railroad Company

J. H. Eaton, Assistant Superintendent, Raleigh, N. C.

N. C. Department of Human Resources

Radiological Protection Branch, Raleigh, N. C.

Dayne H. Brown
Cicil B. Brown

N. C. State Highway Patrol

O. C. Brock, Lt.
F. M. Lemmond, 1st Sgt.
W. F. Ethridge, 1st Sgt.
W. Newsome, ABC enforcement officer, Rockingham

U. S. Army

18th EOD

Ft. Bragg

Capt. Parker
SP5 Bridgeman
Sgt. Tipton

48th EOD

Ft. Jackson

SFC Hentschell
SSG Brewer
SSG Degary
SP5 Walters

N. C. Department of Natural and Economic Resources

Division of Environmental Management, Fayetteville, N. C.

Jim Mulligan

S. C. Department of Health and Environmental Control

Bureau of Radiological Health - Columbia, S. C.

D. G. Ebenhack

Bureau of Water Quality - Columbia, S. C.

Bill Rowell

Transnuclear - Rye, N. Y.

Matt Cacciatore

Enclosure 1

NRC - Atlanta, Ga.

Bill Cline

EPA - Atlanta, Ga.

G. J. Moein

NTSB

Bureau Surface Transportation Safety

Russell F. Gaben, East Point, Ga.
Victor Hess, Washington, D. C.

Savannah River Radiological Assistance Team

Don Collins	ERDA	Team Leader
Dave Peek	ERDA	PIO
John Murdock	Dupont	Health Physicist
Lue Spanu	Dupont	Health Physicist
Jim Croley	Dupont	Industrial Hygienist

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