Critiques of the Siting Process

> Citizen opposition, primarily at the grass-roots level, to siting plans has been extremely strong, regardless of geography.
> (Rheem, 1986)

Key Issues

Screening criteria for DOE's siting decisions for the first repository have emphasized distance from population centers, the availability of federal land, the lack of previous exploratory drilling, and the existence of specific geologic formations. Thus, implicitly the criteria seem to favor sites in the western U.S.--sites far from the generators of spent fuel in the East and Midwest. Finding an acceptable site has therefore gone beyond being a technical problem to being a political one (Jacob and Kirby, 1986). The DOE has not considered any transportation issues beyond the need to link the repository site with the nearest highway and rail systems. Because of the narrow scope of this analysis, there appear to be five key issues fueling opposition to the siting program (Jacob and Kirby, 1986).

Three of the issues deal specifically with corridor states. First, the involvement of corridor jurisdictions in the site selection process is ambiguous. DOE has refused funding to the corridor states to monitor and critique the repository program; states must use their own funds for these studies.

The second issue involves the lack of legal recognition by DOE of the interests of corridor states and of the public living and working along the possible transport routes. These jurisdictions and citizens are a potentially powerful constituency that could influence Congress, but for the present, they are using the courts in an effort to have their interests recognized in the siting process. Because of the antagonism fostered by DOE's actions (or lack thereof), DOE may find it difficult to achieve the workable system of cooperation and consultation with local governments called for in the Mission Plan

(Jacob and Kirby, 1986).

The third issue concerns DOE's failure to recognize (much less to provide mitigation for) the potential problems that repository siting will impose upon corridor states. Since funds for mitigation will be provided for communities near repository sites, similar compensation may become an issue for corridor states. As previously mentioned, DOE expects local jurisdictions to provide emergency response capabilities, but most programs that exist are designed to deal only with problems at permanent nuclear facilities. In fact, most local emergency responders currently lack the equipment and training to deal with a transport accident involving high-level nuclear waste. For example, 80% of the country's fire departments are composed of volunteers, and most of those departments do not have members trained to handle radiological emergencies.

In addition to not addressing the problem of local emergency response, DOE appears to have not adequately addressed other elements of the risk posed by transport. For example, the relative risks associated with different potential routes were not considered (e.g., moving waste to Yucca Mountain over mountainous I-70 versus routing it to a regional repository closer to the source(s) of the waste). Yet, specific transport routes need to be evaluated when selecting a repository site, particularly since it has been found that the accident estimates in DOE's generic models may underestimate true accident rates by a factor of forty or more (Jacob and Kirby, 1986).

Local jurisdictions along proposed transport routes have other concerns as well---concerns regarding health, public safety, and the maintenance of property values. In a more fundamental sense, they are wary of the possible erosion of their authority to impose regulations to protect such local concerns.

The remaining two issues apply to both corridor states and states that have potential repository sites. First, for the transport program to be effective, a high level of coordination is needed--particularly with respect to emergency response--between local, state, and federal agencies. Yet future cooperation and coordination between the federal government and local jurisdictions is threatened by conflicts over the rights of local jurisdictions to regulate waste shipments. This conflict and mistrust is reinforced by the federal prerogative to preempt local requirements if they will impede transport. This right of preemption makes it difficult for states to get DOE to recognize their interests.

The final issue involves the need for a large increase in government agency resources and personnel to oversee the shipment of waste by private carriers. For government and industry, relative responsibility will have to be determined concerning driver training, shipment scheduling, specific route selection, leakage monitoring, and general reporting. DOE estimates the cost of such a radioactive waste management program to be $21 to $35 billion, whereas the General Accounting Office estimates the costs could run to $114 billion.

The major responsibility for monitoring shipments will fall to the states, because transport problems will most likely be discovered at state ports of entry and weigh stations (Jacob and Kirby, 1986). Transport schedules will be monitored and, if needed, shipments will be stopped and rerouted at such state inspection facilities. States will thus need more personnel trained to deal with radioactive cargo, and residents living along transport routes may demand that radiation levels be monitored as well. The question remains: Who will pay for this increased local activity?

Top Candidates for the First Site

Deaf Smith County Texas is wheat and cattle country--the most productive agricultural county in Texas, and the third most productive in the nation. Not surprisingly, the strongest criticism of the choice of Deaf Smith County for a repository has come from its farming community. Local merchants have been somewhat more uncertain, but large businesses have not. Frito Lay and Holly Sugar have said they might leave the county if it is the chosen site, and Arrowhead Mills, a health food company, says its operation is incompatible with a high-level nuclear waste repository (Salisbury, 1985b). A survey has shown that 73% of the people residing in the region are opposed to locating the repository in Deaf Smith County. Less is known about the geology of this site than the Yucca Mountain and Hanford sites. What is known is the location of the Ogallala aquifer--the nation's largest aquifer. It supplies water to the nation's eight most productive agricultural states and is critical to the farm economy of northern Texas. The repository shaft would pass right through it. The state is investigating the repository shaft technology because it believes problems of leakage exist which could, over time, introduce radioactivity into the aquifer (KCTS-TV, 1986).

The area around Hanford, Washington--a dry, remote, "unpopulated" region --is generally pro-nuclear country. Hanford is a federal reservation (owned by DOE), created as part of the Manhattan Project, that has "played a key role in the early history of nuclear power" (Salisbury, 1985c, p.3). Its workforce is trained to handle and protect radioactive materials. The nearby Tri-Cities --Richland, Kennewick, and Pasco--have been characterized as seeking the repository, but this is not entirely the case. Rather, according to Richland's city manager, the local people want to be sure that repository technology is proven safe before they give the site their support. Once safety has been proven, then "you will see us boosting it [the Hanford site],and boosting it heavily" (Salisbury, 1985c, p.6). This local guarded support notwithstanding, citizen opposition to the Hanford site does exist throughout the rest of the state. A proposition on the November, 1986 ballot calling for the endorsement of the state of Washington's challenge to DOE's plans to locate the first repository at Hanford was overwhelmingly endorsed by the state's voters (Boulder Daily Camera, 1986d).

A geologist for the state government has investigated the problem of groundwater contamination from the repository causing contamination of surface water after long periods of time (hundreds of years). The Columbia River--a major recreation resource, transportation corridor, and water source for the large eastern Oregon wheat crop--is within four miles of the Hanford site. Even the public perception of contamination could make the wheat unsaleable, curtail recreation, and have serious impacts on the Pacific Northwest (KCTS-TV, 1986).

The Yucca Mountain, Nevada site is located on federal land adjacent to the Nevada Test Site, home of the nation's underground nuclear weapons testing program, near Las Vegas. Nevada's governor, Richard Bryan, and other state Democrats oppose locating the repository in Nevada. State Republican leaders are neither for nor against the site, claiming that taking a stand is premature (Salisbury, 1985d). Public concern about the location of the repository in southern Nevada and transportation to the site, appears to be growing. There was a low turn-out at the February, 1985 public hearings on the site, with the principal critics being those persons already in opposition to the test site and the nation's nuclear weapons program. However, within the next year, the Las Vegas Sun (Nevada's largest newspaper) ran coupons for readers to send to local government officials protesting the location of the repository in Nevada. Following the receipt of 30,000 coupons, the Clark County commissioners became unified in their opposition to siting the repository in adjacent Nye county. One hundred miles away from the site, Las Vegas is dependent upon tourism for its survival, and nuclear waste and tourism are felt by many local citizens to be incompatible. An accident, with or without injuries, would certainly make national headlines and harm the local tourist industry (Salisbury, 1985d). Thus, Las Vegas has adopted a resolution opposing the location of a repository in southern Nevada and transport of waste through the city and Clark County. Reno, also heavily dependent upon tourism, has adopted a similar resolution concerning transport through Reno and Washoe County (Knox ert al., 1986).

The Yucca Mountain site is attractive, according to the EA, because of its geology and arid climate. Perhaps the key attribute necessary for a national high-level nuclear waste repository is its location in a stable geologic formation, where, theoretically, the waste can only escape from the repository via groundwater. Since the repository must be able to contain waste for 10,000 years, the amount of time it will take water to "pass through" the repository to the water table must be greater than 10,000 years. DOE estimates the Yucca Mountain site's annual rainfall to be six inches, with evaporation and plants using up most of this water. The water table, at 500 feet, is extremely deep, and DOE claims that water in the area moves downward at only a few inches per year through rock pores. However, consultants to the Nevada Nuclear Waste Project Office believe that the water moves through fractures in the rocks at a much faster speed. If this faster movement existed, it would probably disqualify the Yucca Mountain site from consideration (Salisbury, 1985d).

An additional serious drawback of the site is the area's susceptibility to earthquakes. The USGS has determined that significant earthquakes affect the area about every 90 years. Analysis indicates that an earthquake would damage the repository's surface structures but not the tunnels, and might alter the water table (Salisbury, 1985d). The evidence shows that Yucca Mountain, with faults that appear to be 4000-6000 years old, does not meet the siting guidelines which generally require a site to be disqualified if earthquake activity has occurred more recently than 10,000 years.

Nevada, Washington, and Texas have all objected to DOE's site plans, the site selection criteria, and virtually every aspect of the siting process. Washington, via its Nuclear Waste Board, joined Nevada in a suit against DOE claiming DOE "must provide federal funds to affected states so that they can independently study proposals for waste dumps within their borders" (Baker, 1985). The U.S. Ninth Circuit Court of Appeals (in a December 3, 1985 ruling) granted $2.1 million to Nevada from DOE for underground hydrologic and geologic testing. The court found that states can conduct their own studies of the repository sites with the federal government bearing the costs (Los Angeles Times, 1985). Currently, all three states are conducting their own site assessment programs.

Nevada has also challenged whether DOE actually used its own guidelines in the site selection process, while Texas has filed suit against DOE, claiming that the agency selected the final sites based on political rather than geological criteria. Part of Texas' case rests on the fact that DOE published the site selection guidelines five months after choosing the Deaf Smith site (Salisbury, 1985b).

The Nevada governor (who was re-elected in November, 1986) has stated he will veto the Yucca Mountain site if it is chosen as the location for the first repository (Not Man Apart, 1985). As mentioned earlier, the NWPA allows the governor of the state chosen for the repository the right to veto DOE's decision, but Congress can override the governor's veto. The governor of

Texas (who was defeated in the 1986 election) stated in 1985 that he too would use this veto power. The governor of Washington has not stated his position (Salisbury, 1985c); however, the governors have joined to take their case to Congress. They want the repository siting process immediately halted and the site selection process restructured, so that a significant decision making role for independent technical groups is included (KCTS-TV, 1986).

By 1986, a group of Deaf Smith County landowners had formed a Nuclear Waste Task Force and filed suit to prevent further site studies in their area. The suit is based on the facts that there are extensive food processing and agricultural activities near the proposed site and that possible contamination of the water table could occur if there were an accident during site characterization. Additionally, Utah (location of one of the top five sites) has considered joining the various law suits brought by the first site states. Utah's intent would be to prevent reconsideration of its Davis Canyon site should any of the sites in Washington, Nevada, or Texas be dropped from consideration.

Selecting a Second Site

Altering the Process. When DOE formally announced that the first national high-level nuclear waste repository would be located in either Nevada, Washington, or Texas, the announcement was accompanied by the unexpected news that the process of selecting the site for the second repository was being postponed indefinitely because of questions concerning cost and need, though the commitment to a two repository system was upheld (Rheem, 1986, p.3). DOE had determined that the amount of nuclear waste requiring underground storage was growing at a slower rate than had been assumed. Initial projections showed that by 2020, storage would be needed for 140,000 metric tons of waste; current projections indicated 110,000 metric tons. In the words of the Secretary of Energy, "It is clear that to go ahead and spend millions of dollars on site identification now would be both premature and unsound fiscal management" (Rheem, 1986, p.4). Yet, the first repository would be limited to storing 70,000 metric tons of waste--an amount that would be reached by 2025.

The second repository is to be located east of the Mississippi River and in an area geologically different from that of the first repository. The seven eastern states containing twelve possible secondary sites (first announced on January 16, 1986) were Wisconsin, Minnesota, Maine, New Hampshire, North Carolina, Virginia, and Georgia. DOE held community briefings in the areas with potential second repository sites following the announcement, but many citizens were not able to get the information they wanted from DOE at those meetings. For example, DOE could not answer questions concerning "how communities would be protected from transportation accidents, leaking containers, shifting earth, and other potential dangers" (Christian Science Monitor, 1986, p.23). In Maine, the federal government showed an apparent ignorance of local geology when they overlooked a known fault (Christian Science Monitor, 1986), and opposition in all the states to hosting a repository was "tremendous" (Rheem, 1986). Critics subsequently charged that the federal government postponed the second siting decision fearing that "citizen outrage" in the East would threaten the whole program and that the first repository would be scrapped along with the second (Rheem, 1986).

Critics also charge that the decision to postpone the quest for a second site was a political move by the Reagan administration in light of the upcoming 1986 and 1988 elections. The dropping of consideration of a second repository eliminated siting as an election issue in two key Republican races (Gottlieb and Wiley, 1986). North Carolina's Representative Broyhill, a Republican, had been "beaten-up" in the 1986 primary election by an opponent who charged that he had lobbied for the site's location in North Carolina (Rheem, 1986). Similarly, the 1988 presidential primaries begin in New Hampshire, and Vice President Bush would have a difficult time in this important primary if the voters were enraged by the inclusion of their state on the second repository site list.

The West Responds. The Department of Energy's decision to suspend plans for a second repository has left western politicians believing that their region has been shortchanged since the national repository will be located in a western state. In the words of Nevada's governor, "Nevada doesn't generate any high level waste. Why should we be the dumping ground for other people's garbage?" (Gottlieb and Wiley, 1986, p.4). This view coincides with the perception many Westerners have that the region "is often seen by the rest of the country, and particularly by officials in Washington, D.C., as a vast open space where deadly government-sponsored activities can be accommodated" (Gottlieb and Wiley, 1986, p.4).

The original congressional compromise which led to the passage of the Nuclear Waste Policy Act was based in part on the regional, political solution that DOE "shall have a second site" (Gottlieb and Wiley, 1986, p.4). Washington's Representative Swift, a Democrat who worked on the regional compromise, feels it has been violated and may initiate legislation to put a moratorium on site selection and reassess the whole question of nuclear waste disposal.

Western legislators, at an October, 1986 meeting, sent a resolution to Congress urging that work on the siting and development of the first repository be suspended until such time as work begins on siting the second repository. The legislators fear that unless forced to do so, the federal government will never locate a repository in the eastern U.S.. With 85% of the country's spent fuel, destined for long-term storage, coming from east of the

Mississippi River, they fear the West will have to carry "more than its share of the nation's nuclear waste burden" (High Country News, 1986, p.3).

ROUTING

Federal Regulations

The goal of the federal government's routing regulations for high-level nuclear wastes is to reduce risk "by reducing the amount of time the radioactive material is in transit" (DOE, 1986a, pp.5-77). Because interstate highways provide the quickest means for crossing the country (and usually have lower accident rates than other routes), they are the federal government's routing choice.

There are three basic concepts, detailed in HM-164 (the DOT final rule governing highway routing of radioactive materials), used to devise a highway routing system. First, uniform and consistent route selection rules, which are also practical and add to safety, must be used. In addition, route selection should be based on a valid measure of reduced public risk; the overall risk of a route is dependent upon various factors including: accident rates, duration of travel, traffic patterns, population density, road conditions, driver training, and time of travel. Thirdly, routing decisions should carefully consider local views "because routing is a site-specific activity unlike other transportation controls, such as marking and packing" (DOE, 1986a, p.A-85). However, routing regulations and final route selection should balance local and national interests. For rail transit, there are no federal routing regulations--fewer alternative routes exist, track conditions limit the number of acceptable routes, and rail lines generally are privately owned and maintained (KCTS-TV, 1986).

DOT rules

As previously mentioned, the Hazardous Materials Transportation Act gives the federal government the power to preempt state requirements which are inconsistent with the HMTA. For a state requirement to be preeminent, it must afford greater protection to the public and not place an unreasonable burden on commerce.

Nevertheless, the federal government recognizes that nuclear waste shipment routing is a key concern of state, local, and tribal officials, and, to address this concern, states can designate alternate highway routes for spent fuel shipments. For a route to become an acceptable alternate, the state must demonstrate that the alternate is as safe as the routes specified by the federal government. Thus, HMTA preferred routes encompass interstate highways (including beltways around major cities) and/or state designated alternate routes. Carriers can leave these preferred routes to pick-up, deliver, or transfer a "large-quantity package of radioactive materials" (DOE, 1986a, p.A-86); to obtain necessary rest, fuel, and vehicle repairs; or to avoid emergency conditions that might make travel on a designated route unsafe.

HM-164 further clarifies routing requirements, stating that trucks generally are to follow the most direct interstate route and are to avoid large cities when an interstate bypass or beltway is available. State governors must also receive timely notification before spent fuel is transported into their state.

Motor Carrier Safety Act

Another federal regulation, the Motor Carrier Safety Act, also deals with the transport of hazardous materials. It states that trucks with hazardous cargoes should not go through cities and that they also must "'not go through or near heavily populated areas, places where crowds are assembled, tunnels, narrow streets, or alleys,' unless there are no 'practicable alternatives' from a safety standpoint" (Millar, 1984b). Convenience of operation cannot be the basis for making the determination of whether it is practicable "to avoid places of high risk where a serious accident could have catastrophic results" (Millar, 1984b, pp.8-9). State and local governments can thus use the act (by enforcing its provisions) to impose routing regulations and curfews governing hazardous material shipments. The courts have upheld such safety rules.

Selecting Alternative Routes

The DOT strongly encourages states to examine their highway networks and designate preferred routes for spent fuel transport either to supplement or provide alternatives to the interstate system; permitting the designation of alternative routes is one method of allowing local input into routing decisions (DOE, 1986a). States are directed to select routes with the lowest risk to the public--i.e., a route or set of routes which minimizes possible radiological impacts from shipments. Selection is made either in accordance with DOT guidelines or by using "an equivalent routing analysis that adequately considers overall risk to the public" (DOE, 1986a, pp.5-78). Substantive consultation with affected localities and states must be included in the analyses so all potential impacts are considered. Because transportation costs are a "tiny proportion" of the cost of nuclear-generated electricity, the use of alternative routes should be feasible (Surrey, 1984).

However, should the federal government accept a state's alternative route or routes, it will be setting a precedent which the residents and landowners along the newly designated route(s) could then apply in order to have those new routes changed again. This situation would create "a virtual veto on the movement of irradiated fuel on all routes" (Surrey, 1984, p.4). In order to avoid this scenario, the federal government has attempted to allay fears by stressing cask safety and the low risk of an accident occurring.

Selection Methodology

Guidelines have been prepared by DOT for states to use to select their preferred highway routes for nuclear waste shipments. These federal guidelines are not the only route analysis method available, as federal regulations allow states "considerable flexibility in carrying out the routing function" (DOT, 1984a, p.ii). However, the method of analysis a state chooses needs to be equivalent to the federal guidelines in that it "adequately considers overall risk to the public" (DOT, 1984a, p.ii). States must also meet the requirement that they "solicit and consider input from other jurisdictions which are likely to be impacted by a routing decision" (DOT, 1984a, p.iii). Consulting with affected local governments and adjoining states is intended to ensure that all the impacts of an alternate route and the route's continuity are considered; obviously, alternate routes designated by one state must meet those designated by another state at state boundaries. The method of public participation is up to each state, but states are encouraged to provide the public with notice of the proposed alternate routes, hold hearings if they are needed, and provide a period of time for comments.

There are six general steps a state must follow to select an alternative route. First, routes potentially available for shipping wastes between the points being considered in the analysis must be determined. A list of route comparison factors, including primary and secondary factors, must then be developed. The third step involves the evaluation of the route comparison factors for each potential route. This evaluation must include an analysis involving each primary comparison factor and, if deemed necessary, further analysis based on the secondary factors. Next, the route which best minimizes the impacts of waste transport, based on data from the evaluation, is then selected as the preferred route. The whole route selection process must be documented, and finally, the state must obtain public comment and the appropriate reviews or approvals of other agencies and affected local jurisdictions.

A state has several options it can pursue in its evaluation. It may analyze all of the federal preferred interstate routes so that those routes can be compared with available noninterstate routes. It then may want to remove the preferred status from a part of a federally designated interstate route or designate additional preferred routes to supplement those chosen by the federal government. These alternate routes could include noninterstate by-passes around urban areas where interstate by-passes do not exist. Regardless of the course a state chooses, it assumes the burden of proof and must perform a comparative analysis that shows that the alternate route results in lower overall impacts than does the designated route.

Routes must be compared based on what occurs both during normal transport and after an accident. Comparisons of radiological and nonradiological risks must be provided for normal transport, and, under the accident scenario, routes must be compared with respect to the effectiveness of emergency response, evacuation capabilities, and the route's avoidance of certain special facilities. Appendix A contains a more complete listing of the specific data needs for the various route comparison factors.

Primary route comparison factors. Primary route comparison factors are used to choose a route which minimizes radiological risk. Three factors are specifically examined to develop the data needed to analyze this risk: first, radiation exposure due to normal transport along available routes (which could vary significantly); next, the risk to public health from the accidental release of radioactive materials (which could vary because of differences in the frequency of severe transport accidents and in the number of people who would be affected by emitted radioactivity); and finally, economic risk due to an accidental release (which could vary because decontamination costs can change considerably depending on the property involved). Obviously, accident frequency needs to be considered when determining these costs.

Primary comparison factors can either be averaged along the entire route, or the route can be broken down into segments and then analyzed. Segmenting the route provides a more valid and detailed analysis when accident rates or population densities differ greatly for different parts of the route. The specific data needed for a primary comparison include accident frequencies (accidents per vehicle mile), traffic counts, average vehicle speed, population distribution, and land use information.

Secondary route comparison factors. Secondary route comparison factors are used only after a careful primary analysis shows that the alternate routes have virtually the same level of risk or "if unusual conditions exist in the State that increase the importance of one or more of the secondary factors" (DOT, 1984a, p.7). These factors are inherently subjective and therefore more difficult to quantify and estimate than primary factors. Secondary factors fall under four headings related to accidents: emergency response effectiveness, evacuation capabilities, the location of special facilities, and traffic fatality and injury data. States may also identify other important secondary factors, or they can delete some of those listed.

Measuring emergency response effectiveness involves assessing how well the planned response mitigates the potential consequences of an accident. This is dependent in large part on the amount of time needed to reach an accident site, and such response times could vary significantly among available routes. To understand this factor, data would have to be gathered on the location and capabilities of agencies or groups who would be involved in emergency response or evacuation along the various routes. Similarly, the time and effort required for an evacuation; an evacuation's economic impacts; the location, type, and number of special facilities would also need to be assessed as they can vary between routes. Special facilities are those which contain either large populations (such as stadiums), persons sensitive to radiation (such as schools), or people who are hard to evacuate (such as hospitals and nursing homes). The fourth secondary factor includes traffic data concerning fatalities and injuries due solely to the hazards of transportation and independent of the radioactive nature of the waste being transported. States are to use the data to choose routes that minimize accidents. As mentioned earlier, the federal government is well aware that any accident could result in bad publicity or even precautionary evacuations when radiation is not in fact released, and thus could cause the public to take a negative view of nuclear waste transport (DOT, 1984a).

Sample Case. The federal guidelines include an example demonstrating how to take two routes and apply the route comparison factors using "fill-in-the-blank" prepared worksheets. Copies of the worksheets are found in Appendix B. In the example, the evaluation of primary components shows Route B to be clearly preferable to Route A.

When the choice between routes is not as clear-cut, the values for each primary factor can be normalized and then summed for each route. Normalizing the factors in the example involves summing each factor (A + B) and then dividing A and then B by their sum. The total of these normalized values for each route determines a figure of merit that is used for the comparison of the routes (see Appendix B, Worksheet H).

Conclusion

Route comparison implies that each primary factor will be of equal importance in reducing the impacts of exposure to radiation. For this reason the factors are weighted equally. But normal exposure to radiation (from cask penetration during transit and, particularly, when the vehicle is stopped) "often contributes a greater share of the health risks from transportation of radioactive materials than accidents resulting in public health impacts" (DOT, 1984a, p.38). This route assessment method, therefore, cannot be used to determine the actual risks associated with transport, nor can it be used to develop comparative risk figures to assess routing alternatives. More specific information is needed to develop such "true" risk assessments.

EMERGENCY PREPAREDNESS

Background

Although transportation accidents involving high-level nuclear waste are low probability events, the magnitude of the hazard dictates that jurisdictions should be prepared to respond to such an emergency. An emergency response plan should be activated once an accident occurs "if only to verify that there is no hazards [sic] from the accident" (FEMA, 1983, p.8). Emergency response occurs more often because radiation has leaked during normal transport than because containers have been breached during an accident (Mitter et al., 1980). Containers that leak during transit do so because of improper packaging by the shipper. Thus, more work is clearly needed to insure that containers are properly packed and sealed.

As a hazard, radiation has two unique qualities; it is odorless and invisible. Hence, use of proper detection equipment is essential. Such detection requires knowledge of both the form of radiation being looked for and possession of the proper instruments to detect this radiation. Such instruments must be properly calibrated, responders must know how to use them, and those same persons must be protected by proper clothing from possible radiation. If a significant release has occurred, the spread of radioactive material due to wind must be considered, and the responsible agencies must plan for possible decontamination of responders and the public.

The consequences of a transportation accident will depend upon its severity and location, the amount and type of material being moved, packaging, the fraction of material released, meteorological conditions at the site, response time of emergency personnel, and the presence or possibility of a fire. All of these variables will affect the dispersal of the radioactive material and its interaction with other nearby substances.

Obviously, the actual emergency response effort will also strongly affect the consequences of the accident. Emergency response operations are typically plagued by certain recurring problems, the more persistent being:

1) lack of coordination among responding agencies;
2) lack of a predesignated, local on-scene coordinator;
3) lack of involvement by state transportation organizations in local emergency response planning and preparedness programs;
4) poor communication between on-site responders and response agency representatives;
5) public overreaction to an accident.

This final problem can often be attributed to the failure of response organizations to develop timely and accurate communications with the media, and, conversely, to the failure of the media to accurately report the situation.

Accident Response

Overview

State and local government officials have primary responsibility for immediate emergency response to a nuclear waste transport accident. On the federal level, FEMA coordinates the response of federal agencies with support provided by the Department of Energy. This support by DOE includes on-scene radiological monitoring and assessment.

Following an accident, local and state governments are also responsible for the broader protection of public health and safety. States must decide who will be notified in the event of an accident and what services each responding group will handle. Clear delineation is important; the driver of a truck involved in an accident, local police, fire personnel, and other local officials must all know what to do and who to call no matter where an accident occurs along a route.

Police officers should have a minimal level of field training in radioactive hazard response, and fire and ambulance personnel should have training in the identification of radioactive materials, site control, and notification of specialized response teams. A high level of training and expertise among initial responders is more desirable than a rigid hazards analysis procedure (Gunderloy et al., 1984). Similarly, state response systems that rely on informal contacts between state and local agencies appear to work as well as centralized, highly documented response systems (Gunderloy et al., 1984).

An alternative approach to emergency response is offered by Mitter et al. (1980). The authors feel that the Nuclear Regulatory Commission (NRC) should recommend that only specialized response teams be responsible for determining if a hazard to the public really exists. Too often, they say, first responders do not know how to properly use radiation detection equipment, or the equipment has not been properly maintained and calibrated. The actions of first responders could result in an incorrect reading of radioactivity, leading to local panic. For these reasons, they feel that such specialized equipment should only be used by designated radiological emergency response teams.

FEMA Guidelines

FEMA (1983) has spelled out guidelines for an effective response to a high-level waste transportation accident. (Again, it is important to remember that packaging and transport are the responsibility of the shipper and carrier, while response falls to state or local governments.)

Shippers should know and comply with all pertinent regulations and maintain a twenty-four hour phone contact for spent fuel shipments. Carriers have the same responsibilities and should also be able to assist in the management of an accident site. They should see that the accident is cleaned up but are not required to perform the clean-up themselves. This notwithstanding, carriers will have to reimburse emergency responders according to applicable laws and court decisions.

States should have a radiological emergency response plan, an emergency radiological response team, a coordinated communications system, and response agreements with contiguous states. In turn, local jurisdictions should have local plans that are compatible with the state plan. Local law enforcement and/or fire service personnel will most likely be the first responders to an accident and will need to be able to deal with injured persons, determine if radioactive materials are present, and obtain information on the materials involved. They will have to notify the appropriate authorities and determine what steps must be taken to save lives and property. For its part, the federal government will support these leading roles taken by state and local government.

Model Plan

The NRC Division of Risk Analysis has prepared and ideal model detailing the critical elements of a state emergency response system for dealing with radiological materials transportation incidents (Gunderloy et al., 1984). Because there are no constraints in the model on the availability of personnel or funding, as well as no other "real world" restrictions, state and local governments can use it as a standard against which they can check their own response systems.

The critical elements of the model system include a carefully constructed response plan, a well-structured state organization, on-scene coordinators, well-equipped mobile command centers, backup support vehicles and equipment, and a dedicated communication system.

On-scene coordinators are predesignated, well trained, and the focus and information source for all responders. They are responsible for training first-on-scene personnel and conducting advance coordination activities. The response plan to be followed includes a well thought out initial tactical approach. (However, as alluded to earlier, there are numerous problems that can hamper any response plan and render it less effective. Problems in government organization and structure, the actions of the on-scene coordinator, deficiencies in responder training, lack of advance planning, failure to develop a tactical approach, insufficient resources, and failure to establish the plan's basis in law constitute areas where difficulties often arise.)

In the ideal system, emergency responders plan their emergency response and then take part in operational training to acquire and maintain the necessary response skills. This operational training is required of all first responders--police, fire, emergency rescue, emergency medical personnel--and of state response team members. A specific course of basic training (Appendix C) is designed to give responders a reasonable level of expertise in assessing the radiological effects of an accident.

Conclusion/General Comments

As the volume of radiological materials in transit increases, detailed planning for emergency response will increasingly be necessary to insure that first responders know how to control an accident scene and which expert response teams to call in an emergency. In this light, the NRC should develop and distribute a standard list of questions and decision rules to be used by dispatchers and other communication personnel when dealing with a transport accident (Mitter et al., 1980). Ideally, any guidelines for emergency response should address performance--i.e., the ability to identify specific problems, effect a quick response, control and contain the scene until dangerous materials are removed.