THE COMPLEX WORLD OF RADIOACTIVE MATERIALS TRANSPORT: REALITY VS CHALLENGES

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ABSTRACT

The world is indeed complex when it comes to the transportation of radioactive materials. In reality, a very high degree of safety has been achieved, both domestically and worldwide, through rigorous implementation of comprehensive packaging and transportation laws and regulations. There are no reported deaths or serious injuries due to the radioactive nature of the cargo. Few, if any, such large-scale industrial activities around the globe have this enviable safety record. The environmental impacts of radioactive materials transport have been exhaustively analyzed and shown to be intrinsically safe and environmentally benign. So why is something which is done so well such a challenge?

Challenges are myriad. While the international regulatory regime is fairly uniform, member state interpretation and implementation of the International Atomic Energy Agency regulations are subject to wide interpretation. Issues include long approval times for packages, implementation of ST-1, political agendas, and the potential revival of commercial nuclear power in the United States.

This paper will focus on the increasing demand for radioactive materials transport, particularly in the United States. The challenges will be presented in the context of historically safe, secure, and environmentally sound transportation.

THE REALITY

Here is the reality of radioactive materials transport. It is highly regulated, historically safe, environmentally benign, and is a vital link in the nuclear fuel cycle. The regulatory framework is based on worldwide consensus and cooperation, resulting in an unsurpassed safety record compared to any other commercial industrial activity.

Regulations for the safe transport of radioactive materials have their origins in the U.S. Interstate Commerce Commission (ICC) rules in the 1950s. In 1961, the International Atomic Energy Agency (IAEA) adopted regulations based on the ICC rules. These IAEA regulations, and their subsequent revisions, have formed the basis for member state regulations. The degree of harmonization and conformity of this international regulatory framework is extraordinary.

Safety is achieved through strict compliance with packaging and transportation regulations. Packaging, however, is the cornerstone of shipment safety. Packaging is designed to protect people and the environment, even in case of an accident. Radioactive materials have been shipped without a death or serious injury due to the radioactive cargo. Accidents happen, but the packaging assures radioactive materials are safely contained.

The U.S. Department of Energy (DOE) (1) and the Nuclear Regulatory Commission (NRC) (2) have exhaustively analyzed the environmental impacts of transporting radioactive materials. This analysis, has been comprehensive and conclusive, and demonstrates the efficacy of the regulatory framework.

THE VITAL LINK

Transportation of radioactive materials is the vital activity linking all activities in the nuclear fuel cycle. At virtually every step, a packaging and transporter move radioactive materials from one state of refinement to the next. Ore must be moved from mines to processors. Nuclear materials are moved to fuel manufacturers and reactors. Spent fuel and waste are transported safely for storage or disposal. In the United States, there are over three million such shipments yearly with most being radio-pharmaceuticals for medical treatments and diagnostics (3). They rarely make the news.

In the United States, this vital link is becoming more and more important. The DOE is cleaning up the legacy of the Cold War. This cleanup and closure of sites is a $6 billion/year enterprise. Shipment of materials and waste is critical. Mountains of low-level waste will be shipped to the Nevada Test Site or to Envirocare in Utah. Nuclear materials must be moved to secure locations. Spent fuel will eventually move to a repository.

As DOE proceeds with development of a high-level waste repository, transportation issues are used to inflame the debate. DOE has issued a Draft Environmental Impact Statement (EIS) in July 1999 (4). It envisions the need to ship about 300 metric tons of heavy metal per year for about 24 years. In a rail-heavy scenario, about 460 Rail and 110 truck shipment per year would be made. In a highway-heavy scenario, there would be about 2,000 truck and 13 rail shipments per year. This EIS generated over 3,000 comments, concerns, and questions about shipment safety and security. Transportation is indeed the vital repository link.

Vice President Cheney issued his report to the President on a National Energy Policy on May 16, 2001 (5). This report proposed a national energy policy designed to promote dependable, affordable, and environmentally sound energy for the future. A key focus was on new energy supply, including nuclear-generated electricity. Transportation requirements for fresh fuel, spent fuel, and radioactive waste will increase when new plants are built and operated.

One of DOE□s priority efforts is to prevent the proliferation of nuclear weapons by retrieving high-enriched uranium from foreign research reactors where the United States provided this fuel. The reactors are then converted to using low-enriched fuel. This initiative is ongoing and includes returning 19.2 metric tons of enriched uranium and 0.6 metric tons of target material over a 13-year period. An EIS was produced to analyze potential impacts of this project and a Record of Decision was issued on may 17, 1996 (6). Activists continue to protest these shipments in spite of the nuclear weapons non-proliferation objectives.

TYPICAL U.S. EXPERIENCE

Transportation of radioactive material is, again, historically safe and environmentally benign. It takes place routinely and without incident. So, what makes it so difficult with the public? Activism is one reason.

Anti-nuclear activists attack transportation of radioactive materials, particularly spent fuel and waste, to shut down or delay nuclear programs. Their tactic is fear-mongering and mischaracterization of transportation risks. A good example is protest over DOE's proposed shipment of 125 spent fuel assemblies from its West Valley, New York, site to the Idaho National Engineering and Environmental Laboratory (7). These activists cite a discredited study stating a potential $35 billion cleanup from a truck shipping accident and $270 billion cleanup from a train shipping accident (8). They characterize those cask shipments as “Mobile Chernobyls.”

Private sector and government programs involving transportation of radioactive materials seem driven to “extra-regulator” excess to get the job done. Even though meeting the regulations will assure safety, shippers are willing to go well beyond requirements. Some examples include special training for emergency responders, extra security guards, dedicated trains and ships, special routing including time-of-day restrictions, and the list goes on. The efficacy of the regulations in assuring safety is soon lost in the myriad extra “bells and whistles.”

Polarization at the political level is a particular problem. Few politicians take a pro-nuclear position of any issue, particularly transportation. Activists have easy access to elected officials and often urge these officials to adverse action on nuclear issues. Mayors and governors are prolific complaint-writers to Congress and DOE. Nevada officials have mobilized to protest transportation and thus impede a repository at Yucca Mountain. Tacoma Park, Maryland, has declared itself a nuclear-free zone, including transportation.

There is significant activist duplicity on nuclear power versus global warming. The worldwide protest over global warming and industrial nations= production of greenhouse gases is vigorous, Yet these same activists refuse to support nuclear power in spite of zero emissions of greenhouse gases and manageable nuclear waste. They continue to raise the specter of Three Mile Island (TMI) and Chernobyl. TMI was a fully contained accident and another Chernobyl-type reactor will never be built.

Not-in-my-back-yard (NIMBY) is not a U.S. invention. The NIMBY syndrome is used to block all types of activities from building churches to transportation of spent fuel. The “dangers” of transporting spent fuel past schools, playgrounds, hospitals, and other public facilities is used as a scare tactic. Spectacular accidents, fires, and emergencies with hazardous materials are frequently used to arouse nuclear fears. What if this incident involved spent nuclear fuel? One such spectacular hazardous materials accident occurred on July 18, 2001, in Baltimore, Maryland (9). A 60-car freight train carrying hazardous materials derailed in a narrow tunnel near downtown Baltimore. The ensuing fire and sooty smoke shut down much of the downtown area and caused evacuation of Camden Yards, home of the Baltimore Orioles, during an afternoon baseball game.

Nine cars carried hazardous chemicals including propylene glycol and hydrochloric acid. The train also carried plywood, pulpwood, and 10 cars of paper. Health officials found no evidence of toxic chemical release the night of the accident.

Linkage of nuclear transportation to the Baltimore tunnel fire was quick and quite predictable. A Washington, D.C., anti-nuclear activist group, Nuclear Information and Resource Service (NIRS), immediately began to further "fan the fire." NIRS members contacted the media and nuclear-unfriendly politicians. Reporters picked up on the issue; a Washington Post story on Sunday, July 29, 2001, headlined:

"Train Wreck Stirs Fear Over Nuclear Freight"

Actually, the fear was stirred by an anti-nuclear activist Kevin Kamps and the Washington Post reporter. The following text was included in the article (10):

> By Matthew Mosk
> Washington Post Staff Writer
> Sunday, July 29, 2001; Page C01
>
> For Baltimore, it was a colossal disaster.
>
> But for a band of lawmakers and anti-nuclear activists, the freakish train derailment in a tunnel beneath Maryland's most populous city has become a potent symbol for their message, as a pivotal moment in the debate about nuclear power.
>
> "The Baltimore accident is a poster for the dangers of transporting nuclear waste," said U.S. Senator Harry Reid (D-Nev.), who has led the fight in Congress to prevent a nuclear waste dump from opening in his home state and receiving thousands of train-loads of radioactive trash from power plants across the country.
>
> Imagine, Reid and others say,, if the CSX freight train that was engulfed in a blistering fire near Camden Yards had been carrying radioactive cargo.
>
> The notion is not entirely far-fetched. Preliminary routes suggested by the Department of Energy show the same rails under downtown Baltimore could one day carry flat cars loaded with spent radioactive fuel from the Calvert Cliffs Nuclear Power Plant in Southern Maryland.
>
> And when fire from the July 18 wreck burned for days, generating searing heat, conditions in the Baltimore tunnel may at times have exceeded the severity of test fires set to gauge the strength of the 200-ton steel casks the government approved for transporting nuclear waste.

> Although some activists call the Baltimore wreck a warning shot, others in Congress and in the nuclear power industry see only a crass attempt to capitalize on a calamity.
>
> "The fire in Baltimore shouldn't be used as a scare tactic in the debate H. Murkowski (R-Alaska), a leading backer of plans to open the Nevada nuclear waste site, said in a prepared statement.
>
> "Efforts to exploit situations like the Baltimore fire point up the fact that it's a political debate, not a technical one," said Steve Unglesbee, a spokesman for the Constellation Energy Group, which runs the Calvert Cliffs plant.
>
> In 3,000 nuclear fuel shipments since 1964, he said, there has never been a serious accident. And, he said, tests have proved that the specialized rail cars used in transporting nuclear materials are as solid as bank vaults....

In the past, Sandia National Laboratories has analyzed such accidents from a nuclear transport perspective. The authors recommended Sandia investigate this accident relative to spent nuclear fuel transport.

THE PERCEPTION CHALLENGE

The aftermath of the Baltimore tunnel fire demonstrate the importance of perception. Many argue "perception is reality." The visual images of a potentially dangerous fire when coupled with radioactive fear-mongering creates powerful perceptions. Transportation professionals need to engage the activists and the media in the nuclear transport debate. NRIS has been hauling its spent fuel cask, the "Mobile Chernobyl," across the country, attracting much media attention. Nuclear energy officials have been quoted (10) saying the trip is "fear-mongering at its finest." The NRIS assertions of risk simply ignore over 30 years of safe shipments.

Where are the transportation professionals at these events? The activists attract media attention and student groups. Media articles are heavily biased and reporters appear to be uninformed about the reality of an extraordinarily safe activity. The pro-nuclear forces need to get engaged.

The public policy debate on high-level waste disposal is heating up as DOE and presidential decisions on Yucca Mountain approach. Activists are organizing protests and letter-writing campaigns keyed to congressional districts along transportation routes. They provide talking points and congressional mailing addresses. These efforts are successful on shoestring budgets. Where are the pro-nuclear activists with their deep pockets and political connections? Again, the professionals must make themselves heard B the silent majority must no longer be silent.

The President's Energy Policy should result in a renewal of nuclear power. Activist groups across the country have been mobilizing as never before. They are challenging NRC's streamlined licensing

procedures, rulemaking, and hearing procedures. They are well organized, vocal, and visible. Where is the response?

There are myriad stakeholder interests surrounding things nuclear, including transportation. There is broad acceptance of nuclear power in parts of the country that depend on this source of electricity. The Cold War and nuclear weapons production is a decades-long cleanup program in the United States. Radioactive waste cannot be ignored. It is a fact of life, and transportation is a vital part of cleanup and closure. State, local, and tribal governments and their officials represent willing stakeholders with concerned constituents. DOE is dealing with these stakeholders effectively, but private sector participation is noticeably absent or very fragmented. Transportation and nuclear professionals from the private sector must become involved. One place to start could be supporting DOE activities.

A frequently seen bumper sticker highlights the theme: "Think Globally, Act Locally." Most transportation professionals do think globally. The regulatory framework is global with local (domestic) implementation. This concept should be taken to the next level. Professionals should seek opportunities to become engaged in their local communities. They should participate in public forums on critical science-based issues, not just nuclear issues. Do not allow emotion, half-truths, and fabrications to go unanswered. Write to your local newspaper. Counter the activist messages with fact and logic even though activists are not dissuaded by fact, logic, and truth. You aren't trying to convince the vocal minority -- the activists. You're bringing truth and perspective to the rest of the world by thinking globally and acting locally.

At the same time that our industry is addressing issues related to public perception, we must carry on with the day-to-day activities necessary to support continued international movements of radioactive cargoes. This work is challenging: the volume of shipments is increasing at the same time that political, logistical and regulatory pressures are likewise on the rise.

REGULATORY ISSUES

Within the regulatory framework, the following developments comprise some of the current challenges:

- New international regulations are coming into effect. As this audience well knows, these regulations impact the types of packages used for several classes of material and the relevant licensing time frames applicable to all packages.

- In many cases, both the regulators and the industry are unsure how new package performance criteria should be met; regulatory interpretations and guidance documents have not yet been agreed.
- Individual countries are adopting the 1996 international regulations on different time scales; not all countries intend to adopt the regulations in full. The potential exists for different rules to be applied in different countries, making it difficult to adopt standardized approaches.

- National regulators interpret international regulations differently, forcing adaptation of designs to address different – and often conflicting – regulatory desires. This results in longer and more costly package development activities.

- The process for design, testing, licensing, and fabrication of new designs is longer than licensing activities for new production facilities and or reactor operations. Based on a recent industry dialogue, some industry members report that as a general rule, 7 years may be required before a new design is available for service on an international basis.

- Regulatory agencies in many countries function with few support staff, resulting in longer licensing times. This effect will be exacerbated as countries struggle to manage the significant increases in applications associated with implementation of the 1996 regulations.

- Development of a viable system for continued safe use of existing packagings to the end of their useful lives is necessary to ensure the uninterrupted flow of fuel cycle materials and waste products. A lack of predictability in the application of transitional arrangements creates uncertainty about future operations.

- Related to the 1996 regulations, air transport of fissile material has been significantly curtailed as of July 1, 2001 pending completion of criticality assessments and regulator reviews.

- New regulations related to radiation protection impose what are perceived as burdensome requirements on carriers and other subcontractors, raising the potential for disruption among critical elements of the transport chain.

LOGISTICAL CONSIDERATIONS

The overall transportation sector is itself experiencing a period of dramatic change. Truck, ocean, air and rail carriers are undergoing intense competition as their industries are deregulated. Consolidations are commonplace, as unfortunately are the bankruptcies of small carriers, partly due to rising fuel costs. As an example, in the United States, the year 2000 saw the demise of more than 1,500 U.S. trucking operations, including Advanced Distribution System, previously one of the largest national carriers of radioactive materials.

Our industry is not immune to such changes in the broader transportation arena. Finding a stable carrier is tough for any industry, but it becomes significantly more difficult when the cargo is radioactive. The following pressures drive the manner in which radioactive materials are being moved:

- The industry is increasingly faced with complicated and often convoluted routings in response to licensing requirements and carrier availability. This can lead to increased transportation costs, shipment delays and indirect shipment paths.

- Shipments of radioactive material represent a low volume of trade but a large amount of

burden - perceived and/or actual. This reduces the ability to press carriers for cargo acceptance, changes in port rotations or the addition of new requirements.

- As a result of mergers or new ownership, new management may elect not to carry radioactive cargoes, especially fissile material. Fewer transport options can translate into longer transportation times, conflicting with the increased industry trends of last minute fuel design/fabrication and just-in-time deliveries.

- Competition for cargo space on remaining vessels is high, especially for fissile materials. This is a double-edged sword, as there are criticality control limits restricting the total amount of fissile material (especially for enriched UF_6) that may be shipped aboard a single vessel. The result can be a logjam, especially during peak shipment periods.

THE NEXT STEPS

Pressure is expected to continue on the transportation sector of our industry. Changes to the regulations, especially under the IAEA's new two-year revision cycle, will continue to be introduced. Anti-nuclear organizations are expected to maintain and likely increase their attacks on the transport of radioactive material. Unforeseen and unanticipated policy issues may inadvertently complicate movements of Class 7 commodities.

It is also expected that the industry will continue to be innovative in meeting these challenges, whether through development of new package designs, establishment of alternative shipment schemes such as chartered vessel operations, or consolidation of cargoes to increase transport efficiencies. As we move forward, the following recommendations are applicable:

- Shippers, carriers and regulators should actively strive for continuation of the superlative safety record in handling radioactive cargoes while simultaneously seeking viable means of further enhancing safe, secure transport.

- Genuine public and decision-maker concerns about transportation issues should be addressed with the goal of increasing understanding about the cargoes the regulatory framework, and existing safe practices.

- Harmonization of regulatory schemes and interpretations should be enhanced so a predictable, well-understood environment exists to support package design, licensing, and use. Such stability provides a necessary platform for transportation activities and further development of facility best practices.

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