This is the second article in a series on the transport of nuclear materials in the Southeast. Asheville, North Carolina (home of the NIRS regional office) is at the crossroads of I-26 and I-40. The first article, **The I-26 Nuclear Connection,** is available on this site.

Whistling In The (Radioactive) Dark?

by Michael Hopping
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Radioactive materials travel through Asheville and Western North Carolina on a daily basis. Last month's indie asked what sort and how often. The answers were surprising. In addition to small daily shipments of radioactive materials for medical use, I-40, I-26, and I-240 see significant traffic in defense and nuclear fuel industry cargoes. These include 10-12 tractor-trailer loads of "low-level" waste from nuclear power plants and other sources per week, weekly shipments of enriched uranium hexafluoride and uranium oxide, an unknown frequency of weapons-grade uranium, and solutions of uranyl nitrate. Nuclear weapons almost certainly traverse our highways. Tritium Producing Burnable Absorber Rods and loads of weapons-grade plutonium probably do too.

This road and rail traffic will increase if the US resumes nuclear weapons production, constructs new nuclear power plants, or ships spent nuclear fuel rods to Nevada for entombment. We may one day see casks of spent fuel, the most highly radioactive stuff of all, headed west through Biltmore Village on the Norfolk-Southern line.

Given our mountainous terrain and a pair of manmade prime accident locations, the Smoky Park Bridge and the junction of I-40 and I-26, it seems reasonable to ask how prepared we are for serious mishaps involving these shipments.

Hurry Up And Wait

Jerry VeHaun, Buncombe County Director of Emergency Management, is satisfied that Buncombe County is well prepared. The Asheville Fire Department is home to HAZMAT Regional Response Team 6. This is a specialized unit of responders available to assist with hazardous leaks and accidents in North Carolina's twenty western counties. More than a dozen other state, federal, and private response teams can also be brought to bear as needed. The gaggle of acronyms is boggling.

On June 25, 2004, a leak of uranyl nitrate on I-26 south of Asheville provided an opportunity to test the system on a small-scale event. A motorist had called the highway patrol after observing a leaking tanker truck. The tanker was pulled over at the weigh station south of Fletcher. There the truck driver patched a leaky seal and identified his cargo as uranyl nitrate. Emergency responders, including VeHaun, began to converge on the scene. "Something less than a pint" of uranyl nitrate leaked out at the weigh station, according to a Mountain Xpress report. Tony Treadway, spokesman for the shipper, Nuclear Fuel Services, told me that the total quantity lost in the entire event was approximately a gallon.

VeHaun remembers the scene as, "hurry up and wait." State officials drove in from

Raleigh and representatives of Nuclear Fuel Services, including a cleanup crew, made their way south from Erwin, Tennessee. Treadway said that radiation readings around the truck and in the few hundred yards behind it didn't exceed background levels. The weigh station cleanup was completed after about eight hours. No attempt was made to clean I-26. The tires of passing vehicles would long since have dispersed the uranium there. VeHaun told me that Regional Response Team 6 was notified of the spill but wasn't needed at the site. Neither was the federal Radiological Assistance Program based in Aiken, SC. Christina Atwood, Regional Response Coordinator for that agency, told me she wasn't even aware of the spill until I mentioned it to her last month. Grant Mills, a health physicist with the NC Department of Environment and Natural Resources, did hear about the incident and was on-site that day. He remembers calls coming in from the Regional Office of the EPA, the Nuclear Regulatory Commission, and the National Response Center.

The fact of this spill, the manner of its detection, questions about how many similar spills may have gone unreported, and potential risks to motorists from inhaling uranium kicked up from the roadway may give one pause. But the cleanup itself appears to have been well managed. Pro-nuclear interests, which often point to a decades-long record of no radiation leaks or fatalities associated with shipments of spent nuclear fuel, would read our uranyl nitrate incident as further evidence that the public need not be concerned about the transportation of radiological materials.

Battalion Commander Mike Knisely of Regional Response Team 6 is less concerned about radioactive cargoes than he is about many non-nuclear hazardous substances. But that isn't to say he's unconcerned. To him, radioactive materials are the "X-factor", the unknown. Small commercial or medical packages can be the riskiest for first responders. "The big shipments are placarded [posted with external signage identifying the load]. But you never know what's in a UPS or FedEx truck." And lack of knowledge is one of his chief concerns about the big shipments as well. "I know why they don't want to tell us, but I'd sure like to know what's coming through and when." He wishes state and local officials would exert more pressure on shippers to disclose their activities. He'd also like to see reductions in the number of such hazardous cargoes on mountain roadways and tighter controls on the sale and possession of weapons capable of turning a radioactive shipment into a dirty bomb.

Preparedness

First responders in North Carolina receive classroom training on radiological emergencies. But that seems to be about the extent of recent HAZMAT preparedness training on radiologicals. Scott Galbraith of the NC Division of Emergency Management said, with the possible exception of exercises conducted in the vicinity of nuclear power stations, it has been years since a training scenario involved a highway event and radioactive cargo. Christina Atwood of the federal Radiological Assistance Program told me she didn't recall any requests for this type of training exercise in North Carolina. Lt. Mark Dalton, Hazardous Materials Coordinator for the NC Highway Patrol added, "Most of the training lately has been about WMD."

Periodic exercises would seem reasonable, if only because of the boatload of agencies potentially involved in a response. But the omission might be justified if the safety record for nuclear shipments is so good that the probability of incidents is remote. Is it? What's the national HAZMAT experience with radiological cargoes?

None of the numerous local, state, or federal HAZMAT, emergency response, and transportation officials I consulted receives statistical reports that answer this question. David McIntyre, Public Affairs Officer for the Nuclear Regulatory Commission (NRC) responded to my inquiry about a relevant database on highway accidents with, "I'm informed that we don't have a requirement for reporting traffic accidents - any event reports we have on them are because the incident triggered other criteria for filing a report with us. Therefore we would not have any systematic record." He suggested I file a Freedom Of Information Act request for whatever data may be found suitable for release from the restricted Nuclear Material Events Database.

Our uranyl nitrate spill isn't listed in the NRC reports available to the public. But I did discover NRC reports of two highway crashes in 2003 involving shipments of uranium hexafluoride, a compound that reacts violently with water and releases deadly fluorine gas. (Though the protective containment was damaged in at least one of these wrecks, the uranium was not exposed.) Armed with that knowledge and the uranyl nitrate spill, I went looking elsewhere.

The Bureau of Transportation Statistics doesn't characterize or distinguish radiological incidents from other HAZMAT categories. The National Highway Traffic Safety Administration only keeps track of fatal crashes involving "hazardous materials." The National Response Center maintains an incomplete database as well. According to Kevin Misenheimer, On-Scene Coordinator for the EPA in our region, only incidents involving hazardous releases in excess of specified amounts are entered into the National Response Center list.

None of the three events I was searching for qualified. North Carolina maintains a record of accidents that occur in the state but doesn't especially flag those with HAZMAT implications. These state reports are archived after a year to eighteen months. The uranyl nitrate spill report has been archived. It wasn't readily available to either of the two state response offices I called to check on it.

As noted, nuclear industry and some federal agency websites do supply accident stats. But most are so poorly characterized or referenced that it isn't possible to determine what sorts of shipments are covered or the time period involved. One exception is a statement that there were eight highway accidents involving spent nuclear fuel casks (containers) between 1971-95. Of these, four involved empty casks. There was no reported release of radiation from any of the eight. This information originated in a no-longer-available NRC report and was based on data supplied by carriers. No comparable overview of accidents since 1995 appears to be available.

It's The Package, Stupid

Such a scattered, mismatched, and incomplete assortment of data can't do much to assist regulatory or emergency training decision makers. But we might still be justified in dismissing concerns about radiological HAZMAT issues if it could be shown that such materials are only moved in containers proven to withstand expectable hazards.

We know that isn't always the case with commercial shipments of uranyl nitrate. Commander Knisely's concern about unexpected radiation sources in mixed loads of goods is also applicable here. But what about the most dangerous loads, the cylinders of uranium hexafluoride, shipments of tritium, weapons-grade materials, nuclear weapons themselves, and spent nuclear fuel rods? Hurricane Katrina reminds us that an absence of recent disaster can be a lousy excuse for complacence. Apart from the available accident/spill history, what evidence do we have that shipments of fuel rods and other high-grade nuclear materials are impervious to road hazards?

These loads travel in heavily shielded "Type B" casks, weighing 25-100 tons each, depending on whether the container is designed for highway or rail shipment. NRC certification requirements stipulate that a single Type B cask must be shown to survive a series of adverse events. These include high-speed impact, a thirty-foot drop, engulfment by fire, and immersion in water. The sequential tests would simulate an accident in which a cask hits something and is further stressed by fire, a fall from an overpass, or a fall into a body of water.

Because the NRC accepts scale model and computer simulation testing, none of the dozens of models of Type B cask in use have undergone this sequential testing in the real world. Few seem to have had a real-world test for compliance with even one of the standards. The exceptions occurred at the Sandia National Laboratory during the 1970s and '80s. Tests included high-speed front and side impact crashes, a drop from an airplane onto hard ground, and exposure to fire. The casks remained radiologically intact. Public concern about nuclear transportation safety led the NRC to reassess the adequacy of its cask certification practices within the past ten years.

In February 2003, the commission released a "Package Performance Study Test Protocols Report (NUREG-1768)" for public comment. The report recommended testing actual casks, but implementation of the recommendations remains uncertain. A March 28, 2005 update to the NRC commissioners indicates that the testing proposal has been reduced to a single rail cask of unspecified manufacture being hit at a 90° angle by a train traveling at 60 mph. Barring any delays, the test could be conducted in about three years.

Testing to failure is another potentially useful measure of container sturdiness. A cask could be exposed to fire, for example, with fire temperature and duration increasing until the cask fails. This would determine what margin of safety, if any, exists above NRC specifications. I was not able to find reports of any Type B cask being tested to failure for impact, fire, or immersion.

Bob Halstead of the State of Nevada Agency for Nuclear Projects has been an advocate of both sequential testing and testing to failure on actual casks. During the Clinton era, DOE estimates of latent (eventual) fatalities from a "maximum reasonably foreseeable rail accident in [sic] urban area" totaled thirty-one deaths. Under President Bush, the estimate was refigured downward to five. In a 2003 presentation to the National Academy of Sciences, Halstead reported that State of Nevada projections of latent fatalities from an urban rail accident involving a shipment of spent fuel could be far higher. Subjected to a fire similar to one that occurred in a Boston rail tunnel in 2001, a cask meeting NRC requirements was projected to rupture.

Fatalities over a fifty-year period were estimated at 4000-28,000. The area contaminated would be thirty-two square miles, and the cleanup price tag would exceed $13 billion.

How well are Type B casks expected to withstand terrorist weaponry? Once again, public reports of simulated or actual testing have been few. In 1982, Sandia National Laboratory subjected a 25-ton spent fuel cask (highway size) to an Army-issue M3A1 shaped charge explosion. The cask was holed through and through with release of radioactive material. More recent tests on simulated casks reported by J. L. Alvarez, <http://hps.org/hsc/documents/defining.pdf>, had similar results. In 1998, a portable TOW anti-tank missile punched a grapefruit-sized hole in the 15-inch thick iron wall of a top-of-the-line CASTOR V/21 spent fuel storage cask. A TOW missile cracked but didn't penetrate another V/21 cask jacketed in concrete. While this particular cask is not licensed for transport in the United States, it is used for that purpose in other countries.

Trust Me I'm From The Government

The United States has not experienced a catastrophic radiological HAZMAT incident on the highways or rails. There are significant security and package design safeguards in place to protect against at least some predictable accident and spill scenarios involving high-grade nuclear loads. The safety record for lesser grades of radiological materials is less clear and perhaps not knowable given current reporting and record keeping requirements.

In the context of heightened security concerns and rejuvenated nuclear industries, are current laxities in incident monitoring and an absence of real-world testing for nuclear materials shipping containers justified? Are government and industry safety claims more reliable now than they were prior to Three Mile Island? Unless federal policies change, only the occurrence of a catastrophe will let us know whether we've been whistling in the dark about another low-frequency but high-impact type of predictable accident waiting to happen.

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