



Feature

Nuclear road truckers

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For ten years the US Department of Energy has been transporting weapons-related transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. To date over 8,000 shipments have been delivered without a serious injury or release of radioactive material.

In about March 2010, the WIPP transportation system will pass a huge milestone: 10 million loaded miles driven, over the 11 years that the deep geologic repository has been open. The total number of miles driven is two times that, taking the unloaded journey into account. The WIPP programme is the safest shipping campaign in the history of the United States.

WIPP's transportation programme has always been a focus of concern for the public, who share highways with trucks hauling waste to the underground repository near Carlsbad. Consequently, WIPP's exemplary transportation record isn't just a cause for celebration – it's a cause for continued existence.

In a review of WIPP in 1994, the National Academy of Sciences projected that WIPP's planned shipping programme would be 'safer than that employed for any other hazardous material in the US.' An environmental impact statement developed before the underground repository estimated the frequency of impacts due to accidents. Route-specific commercial accident rates, applied to planned WIPP shipments over a 33-year project lifetime, predicted about 40 accidents.

During the first 10 years of WIPP shipments, however, the accident rate has been significantly lower than the predicted rate, at less than one per million miles. While traffic accidents are not always preventable, the low frequency of occurrence is minimized by WIPP's careful, comprehensive transportation programme.

The environmental impact statement developed for WIPP did not predict any accidents that resulted in the release of radioactive materials. There simply is not a credible accident that would cause a loss of containment from the robust shipping packages.

Route selection

Transuranic (TRU) waste that is waiting to be shipped to WIPP is stored retrievably at 23 sites, most of which have small quantities of waste. This waste contains artificially made, long-lived transuranic radioactive elements such as neptunium, plutonium and americium. TRU waste is primarily produced from recycling of spent fuel or from using plutonium to fabricate nuclear weapons. DOE sites with large quantities of TRU waste that have shipped to WIPP are: Rocky Flats Environmental Technology Site, Denver, Colorado; the Hanford Site, Richland, Washington; the Idaho National Laboratory in Idaho Falls; the Los Alamos National Laboratory, New Mexico; the Oak Ridge National Laboratory, Tennessee; and the Savannah River Site, near Aiken, South Carolina.

The initial process of selecting routes between TRU waste generator sites and WIPP began in the mid-1980s, well before the facility opened. The joint effort, involving states, native American tribal nations and the DOE, was to identify and select the safest and most acceptable routes for shipping to WIPP. The process has not changed much over the past two

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A lorry hauling three TRUPACT-II containers



An RH package shaped like a dumbbell arrives at WIPP

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decades, according to institutional affairs manager Bill Mackie, with the DOE's Carlsbad Field Office (CBFO). The DOE has committed to following conservative US Department of Transportation guidelines for routing shipments to the site. These regulations stipulate the use of interstate system highways, unless a state designates alternate preferred routes.

The DOE Secretary of Energy has memorandums of agreement with regions of the nation that lay the groundwork. For example, the DOE's agreement with the Western Governors' Association, an independent, nonprofit organization representing the governors of 19 states, stresses 'the safe and uneventful transportation of nuclear waste.'

Before shipments travel along a given route, CBFO and contractor employees spend weeks in the area. A step-by-step review of proposed WIPP transportation routes is conducted with area officials, and first responders along the route are trained to assure effective response to any WIPP-related transportation accident.

Since the 1980s, WIPP personnel have trained more than 28,000 emergency responders and emergency management professionals in 23 states and on 12 tribal lands. WIPP external management personnel have been instrumental in planning 39 full-scale emergency response exercises, conducted on five tribal lands, in nine states and on two US Air Force bases.

Additionally, public outreach campaigns have including a road show, where members of the public in communities along the route can view a WIPP truck and ask questions of members of WIPP's team, including truck drivers. Recently-trained local emergency response authorities often assist with these road shows.

Packaging

The DOE considered numerous designs for safely and efficiently transporting TRU waste to WIPP. WIPP's current fleet of 112 packages consists of the Transuranic Package Transporter Model II (TRUPACT-II), the HalfPACT and the RH-72B. Also available for potential use is the CNS 10-160B.

The US Nuclear Regulatory Commission has approved all four packages, and NRC certification of these designs as Type B containers confirms that all applicable regulatory requirements are satisfied. A fifth package, the TRUPACT-III, is under development.

In order to be certified, Type B containers must be able to withstand normal transportation conditions, such as exposure to high and low temperatures; varying external pressure; heavy rainfall; vibration; drops, including onto each corner of the container; compression of approximately five times the weight of the container for 24 hours; and impact from debris. Also, testing is conducted to demonstrate the container's ability to withstand a series of hypothetical accidents, including free-drop, puncture, burn, and immersion tests.

The waste emplaced at WIPP consists of clothing, tools, rags, residues, debris, soil, and other items contaminated with transuranic radioactive elements. It must contain more than 100 nanocuries of alpha-emitting transuranic isotopes per gram, with half-lives greater than 20 years, according to the WIPP Land Withdrawal Act, which set aside land for WIPP.

As defined by the WIPP Land Withdrawal Act, contact-handled (CH) TRU waste has a radiation dose rate at the surface of the disposal container 'not greater than 200 millirem per hour.' So-called remote-handled (RH) TRU waste, which requires lead-shielded shipping containers, has a dose rate of 200 millirem per hour or greater. Only 4% of the waste to be emplaced at WIPP is expected to be RH TRU.

The workhorse of the WIPP transportation system, the TRUPACT-II, was the first package used to ship non-remotely handled, or contact-handled, TRU waste to WIPP in 1999. The TRUPACT-II is constructed with inner and outer containment vessels. It measures 2.4m (8ft) in diameter by 3m (10ft) high and holds up to fourteen 55-gallon drums, six 100-gallon drums, two standard waste boxes, or one 10-drum over-pack. The TRUPACT-II's closure configuration, used for both the inner and outer containment vessels, was designed to facilitate the large number of shipments that would be made to WIPP, along with minimizing package weight. The

overall design also maximizes payload weight capacity. Up to three TRUPACT-IIs are shipped at a time on a single trailer. Shipments are kept within highway legal weight limits of 35.7t (80,000 lbs).

The smaller HalfPACTS, certified in 2000, are more efficient when transporting more densely configured contact-handled TRU waste. A HalfPACT measures 2.4m (8ft) in diameter by 2.3m (7.5ft) high and holds up to seven 55-gallon drums, four 85-gallon drums, three 100-gallon drums, or one standard waste box. For weight management purposes, a typical shipping configuration consists of two TRUPACT-IIs and one HalfPACT.

Currently, WIPP receives RH TRU waste exclusively in one of 12 RH-72B packages. The lead-shielded RH-72B package is best identified by its impact limiters, which give it its 'barbell' appearance. One RH-72B, about 3.6m (12ft) long and 1m (3.5ft) in diameter, is shipped at a time on a specially designed trailer that allows up-righting of the cask while still on the trailer. An RH-72B holds up to three 30- or 55-gallon drums or is filled with loose waste.

The DOE also owns a single CNS 10-160B package. This steel- and lead-shielded cask could transport up to ten 30- or 55- gallon drums of RH TRU waste. With a gross weight of 32t (72,000 pounds) for the package itself, however, shipments made using the CNS 10-160B would exceed highway legal weight limits and require special permits. To date, the CNS-10-160B has not made any shipments to WIPP.



The new TRUPACT-III container, awaiting licensing, will reduce the number of shipments to WIPP by almost 3000

The TRUPACT-III will also be used for transporting CH TRU waste. The package's design is a shortened version of the International Atomic Energy Agency-certified TN-Gemini package. The rectangular package is designed to accommodate boxes of waste that are too large to fit in a TRUPACT-II. WIPP anticipates Type B certification of the TRUPACT-III in 2010.

Driver qualification

To qualify to be a WIPP driver, a candidate must have a minimum of 200,000 logged miles: 100,000 miles a year for two of the past five years or 325,000 miles within the past five years. Both commercial and personal driving records are evaluated. Drivers cannot have moving violations (such as speeding) in a commercial vehicle or chargeable accidents for a minimum of five years and no convictions for driving while intoxicated.

Once assigned to WIPP, drivers receive training in the use of radiation detection instruments, public affairs, and emergency response and incident command. WIPP drivers are also subjected to rigorous frequent health examinations to ensure their fitness.

"Once they are employed with us, they have two and a half months of training before they

ever get a shipment," says WIPP spokesperson Bobby St. John.

WIPP drivers work in pairs, allowing one to drive while the other rests. Drivers are paid based on safe passage, not on miles travelled, and all trucks are governed not to exceed 55 miles per hour (88 km/hr). Along the routes, designated 'safe parking' areas have been noted for inclement weather or adverse conditions. State agencies are given two hours' prior notice that WIPP shipments will be travelling through their jurisdiction. Trucks are never left unattended en route.

WIPP contractors use conventional diesel tractors and trailers to transport the waste. Two companies, CAST Specialty Transportation Incorporated of Carlsbad and Visionary Solutions LLC, of Oak Ridge, Tennessee currently hold the WIPP transport contracts. WIPP employs two carriers so shipments would not be compromised if one of the companies were to face financial or operational problems.

A transportation, tracking and communication system (TRANSCOM) is used to track WIPP shipments around the clock and to maintain communication with drivers. TRANSCOM uses satellite-based global positioning systems to track shipments in real time to within a few hundred feet. Icons are displayed on computer-generated maps. Federal, state and tribal officials with access to the database can monitor shipments from their computers. TRANSCOM's control centre also houses a database that contains shipment schedules, routes, payloads and emergency response contacts.

The National Nuclear Security Administration's Global Threat Reduction Initiative (GTRI) is currently partnering with TRANSCOM to expand the capability of the TRANSCOM monitoring system, says Steve Casey, TRU waste data specialist for the Carlsbad Field Office. The initiative is looking for ways to better meet its mission of reducing and protecting vulnerable materials.

"TRANSCOM has a well-accepted infrastructure that we're hoping to be able to enhance," says Paul Singley, a project manager involved with GTRI transportation efforts with Oak Ridge National Laboratory.

As a first step, TRANSCOM is monitoring shipments made by GTRI's off-site source recovery project, which removes excess, unwanted or orphan radioactive sealed sources that pose a risk to health, safety and national security. The second phase of the expansion involves heightening the monitoring parameters for the TRANSCOM system. "We're assisting with a list of specific security options," Casey said. "NNSA is interested in more than just tracking the truck's movements."

Inspection

WIPP has selected the Commercial Vehicle Safety Alliance, an international organization dedicated to commercial motor vehicle safety and security, to develop WIPP's shipment inspection and enforcement programme. The alliance's Level VI inspections are performed at the point of origin on all WIPP shipments. They include inspections of the tractor unit from all sides, and the tractor and trailer wheels, axles and brakes.

Each state a shipment travels through en route to WIPP is also allowed to inspect the shipment to verify that the point-of-origin inspection was performed or even to perform another Level VI inspection.

The alliance maintains a statistical database on WIPP shipments and provides periodic reports for public review.

WIPP's drivers are also required to conduct a post-departure inspection 80km (50 miles) after setting off. After that inspection, drivers are required to stop and check their trucks and payload every 150 miles or three hours.

Although the US Transport Council recently recognized the WIPP transportation system with its special achievement award, the programme now attracts little interest. Perhaps the best news

is that there isn't any news. The safe and uneventful transport of nuclear waste does not sell papers.

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