Waste Isolation Pilot Plant

INTRODUCTION

The Waste Isolation Pilot Plant (WIPP) is designated as the world's first underground repository licensed to safely and permanently dispose of transuranic radioactive waste left from the research and production of nuclear weapons. The Department of Energy transports transuranic waste (TRU waste) from various sites throughout the United States to WIPP. It is important that you are familiar with the process for transporting this material should you have to respond to an accident involving material destined for WIPP.

In this module you will learn what WIPP is and about the material being transported to WIPP. You will learn about the packages used to transport material to WIPP and the safety measures in place to ensure that this material is moved safely throughout the United States.

PURPOSE

The purpose of this module is to increase your knowledge of the Waste Isolation Pilot Plant and its transportation system. Having an understanding of the material being transported to WIPP and how it is transported will increase your ability to quickly recognize, safely respond, and accurately relay information during an accident involving WIPP material.

MODULE OBJECTIVES

Upon completion of this module, you will be able to:

1. State the importance of the Waste Isolation Pilot Plant (WIPP).
2. Identify large quantity transuranic waste generator sites.
3. Identify waste verification techniques.
4. Identify the characteristics of the waste transported to WIPP.
5. Identify the packages used to transport waste to WIPP.
6. Identify the enhanced safety measures used to transport waste to WIPP.

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OVERVIEW OF WASTE ISOLATION PILOT PLANT (WIPP)

As early as the 1950s, the National Academy of Sciences recommended disposal of radioactive waste in stable geologic formations such as deep salt beds. Government scientists searched for an appropriate site during the 1960s, and tested the area of southeastern New Mexico in the 1970s. In 1979, Congress authorized WIPP. During the 1980s, the Department of Energy (DOE) constructed the facility 26 miles east of Carlsbad, New Mexico in the remote Chihuahuan Desert. After more than 20 years of scientific study, public input, and regulatory struggles, WIPP officially opened on March 26, 1999. Since the opening of WIPP more than 12,500 shipments and 16,000,000 loaded miles have been successfully completed.

DOE's Carlsbad Field Office (CBFO) coordinates DOE's National Transuranic Program. The program is an effective way to manage transuranic waste from generation to disposal and protect human health and the environment. WIPP is part of that system.

WIPP is the world's first underground repository licensed to safely and permanently dispose of transuranic radioactive waste left from the research and production of nuclear weapons. The DOE defines transuranic waste (TRU waste) as material contaminated with certain isotopes of plutonium and nuclides

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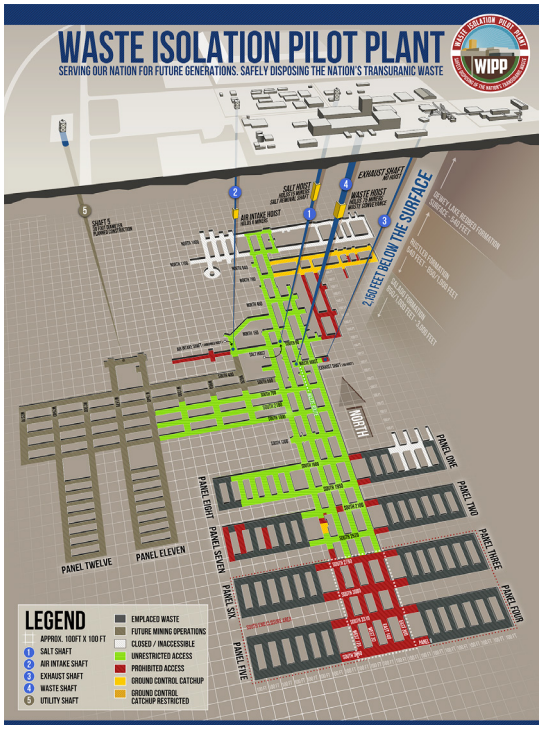
with atomic numbers greater than 92 (uranium), a half-life greater than 20 years, and concentrations greater than 100 nanocuries (100 billionths of a curie) per gram of waste material. The waste consists of such things as laboratory clothing, tools, glove boxes, leaded rubber gloves, glassware, air filters, ash, ceramic parts, plastics and solidified waste contaminated with man-made radioactive material including plutonium, americium, curium, and californium. It is not economically feasible to recover the transuranic material from the waste.

Transuranic waste began accumulating in the 1940s with the beginning of the nation's nuclear weapons program. A byproduct of the nuclear weapons program, this waste remains radioactive for thousands of years. Sound environmental practice requires this material to be permanently isolated to protect future generations. Congress declared that DOE must not allow commercial low-level waste or high-level waste at WIPP. Only defense-related transuranic waste.

The project facilities include disposal rooms mined 2,150 feet underground in a 2,000-foot thick salt formation that has been stable for more than 250 million years. WIPP expects to receive shipments for at least 30 more years. Transuranic waste is currently stored at numerous locations nationwide.



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Numerous organizations are involved with the WIPP program and include the following:

- The U.S. Environmental Protection Agency (EPA) certifies whether radioactive and hazardous material disposal requirements are met
- The State of New Mexico regulates handling of the hazardous components of mixed waste (waste that contains both radioactive and hazardous material) under the authority of the Resource Conservation and Recovery Act (RCRA)
- The New Mexico Environmental Evaluation Group participates in and comments on various WIPP issues and activities
- Some two dozen other agencies, committees, and panels monitor the project's operations through regulation, review, and comment at the state and federal levels

WIPP trucks, operated by highly trained drivers, carry transuranic waste in U.S. Nuclear Regulatory Commission (NRC) certified packages. A satellite tracking system provides for monitoring of each shipment. The trucks meet the highest federal transportation standards and drivers follow procedures for inclement weather, safe parking, and notification to state, tribal and, in some cases, local governments. This WIPP-specific module provides training for state, tribal, and local emergency response personnel as a key element of WIPP's safe transportation system.

In July 1989, the National Academy of Science stated: "The system proposed for the transportation of TRU waste to the WIPP is safer than that employed for any other hazardous material in the United States today and will reduce the risk to very low levels."

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WASTE GENERATOR SITES

There are numerous DOE sites that generate and have waste designated for transport to WIPP. Four DOE sites have the majority of the waste and are referred to as "large quantity generator sites." These sites will ship for the life of the project. The sites are:

- Idaho National Laboratory
- Oak Ridge National Laboratory
- Savannah River Site
- Los Alamos National Laboratory

In May of 2005, the Rocky Flats Environmental Technology Site (RFETS) completed shipment of 15,061 cubic meters of transuranic waste. A total of 40,548 packages were sent to WIPP from RFETS. WIPP waste has also been completely removed from numerous other small generator sites across the United States.

The map above shows the major routes that are used to transport transuranic waste to WIPP. Routing through each state has been determined with direction from the effected states and appropriate Governors' Associations. Selected routes satisfy the requirements of the U.S. Department of Transportation (DOT) regulations in Title 49 of the Code of Federal Regulation (CFR) Part 397 (Transportation of Hazardous Materials; Driving and Parking Rules). Interstate highways and their alternate routes are used, when available, based on route safety and length.

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WASTE VERIFICATION TECHNIQUES

All waste destined for WIPP is required to be sampled and analyzed to determine the contents within each package. The contents must meet WIPP's stringent Waste Acceptance Criteria. Audits are conducted at the generator site (site where the waste is generated) to ensure compliance. These criteria require that the contents of each package be verified using the following methods:

Radioassay Device

This device is used to identify the radioactive contents of packages that are to be shipped to WIPP for disposal. This process also verifies the amount of radioactive material contained in the package.

Real-Time Radiography

Real-time radiography is also used to identify the waste package contents. This is conducted at the generator site and will assist in the characterization of package contents to ensure the WIPP Waste Acceptance Criteria is met. The process is very similar to the radiography (X-ray) used at the airport. The packages are placed on a machine that turns and tilts the package to determine the presence of liquids and any other prohibited items in the package. If prohibited items are found, they must be removed.

Head Space Gas Sampling and Analysis

Waste packages will have gas sampling performed to check for the presence of volatile organic compounds (VOCs). In order to meet the WIPP Waste Acceptance Criteria, the total concentration in the headspace of each payload container must be <500 ppm.

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Radiological Surveys

Radiological surveys are conducted at both the generator site and upon arrival at WIPP. The surveys are conducted to ensure compliance with DOT packaging regulations. External radiation and contamination surveys are performed on each package and the transport vehicle.

Additional tests, in addition to those listed above, are performed to satisfy the WIPP Waste Acceptance Criteria. All of the tests listed above are designed to identify prohibited material. Some examples of prohibited material include:

- Explosives
- Corrosives
- Compressed gases
- Free liquids in excess of 1% total volume

In addition to the prohibited material above, hazardous waste exhibiting the characteristics of ignitability, corrosivity, or reactivity is not acceptable at WIPP.

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CHARACTERISTICS OF THE WASTE TRANSPORTED TO WIPP

TRU Waste

Transuranic waste is radioactive waste contaminated with transuranic elements such as plutonium (Pu), curium (Cm), americium (Am), and californium (Cf).

Contact Handled (CH) TRU Waste

96% of the waste destined for WIPP is Contact Handled TRU Waste (CH-TRU waste). In order to be characterized as CH-TRU waste, the maximum surface dose rate on the CH-TRU package must be less than 200 mrem/hour. The typical dose rate at the surface of a CH-TRU waste package is 3 to 10 mrem/hour. Because of the low dose rates, personnel can safely handle CH-TRU waste packages without the use of special equipment.

Remote Handled (RH) TRU Waste

Remote Handled TRU Waste (RH-TRU waste) will be transported in heavily shielded casks similar to the type used for spent nuclear fuel transport. RH-TRU waste will have a surface dose rate on the inner package (drum or RH canister) of less than or equal to 1,000 rem/hr. At least 95% of the RH-TRU waste packages will have an external dose rate less than or equal to 100 rem/hr. RH-TRU waste will contain the same material as CH-TRU waste. The only difference between CH and RH waste is the external dose rate. Remote handled material requires the use of special equipment and controls to move the inner packages. Personnel will not come in contact with this material during packaging, transport, or disposal.

Once RH-TRU waste is prepared for shipment, the radiation level will not exceed 200 mrem/hour at any point on the external surface of the shipping cask.

Mixed Waste

The majority of the waste destined for disposal at the Waste Isolation Pilot Plant will be Contact Handled TRU Mixed Waste. Mixed waste is waste that contains a hazardous waste component and a radioactive material component. Mixed waste disposal must meet the requirements of the Resource Conservation and Recovery Act as well as requirements in the Atomic Energy Act before disposal at WIPP.

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PACKAGING USED FOR WIPP TRU WASTE

WIPP Type A Packaging

WIPP uses Type A packaging to store transuranic waste. A few examples of these packagings include 55-gallon metal drums, standard waste boxes, or 10-drum overpack.

WIPP packages can be placed inside the TRUPACT-II, HalfPACT, TRUPACT-III, or the RH72B Canister, at the generator site for shipment. Once received at WIPP, the inner packages will be unloaded and then placed in the WIPP underground for permanent disposal.

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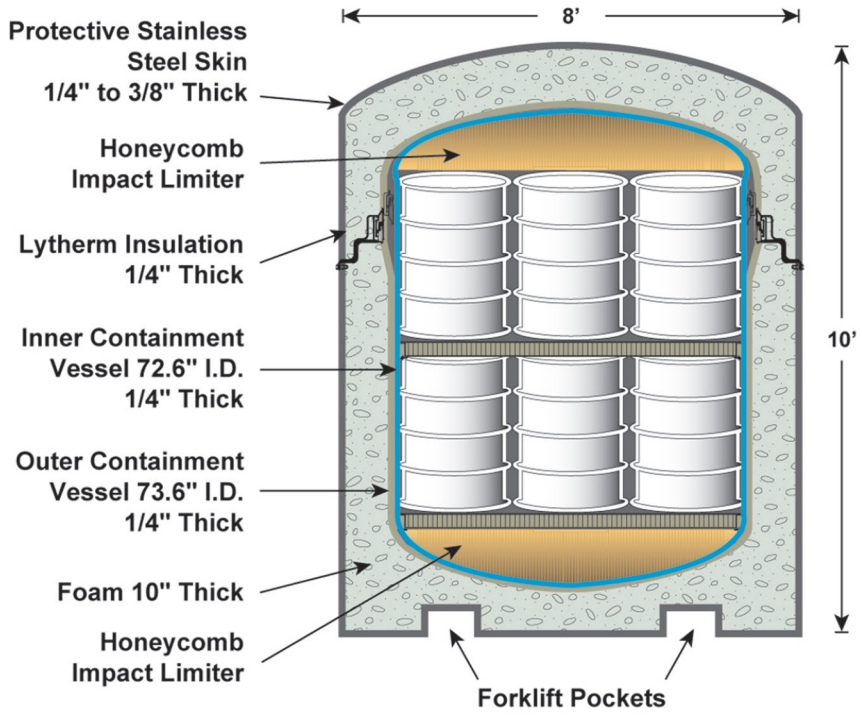
WIPP Type B Packaging

TRUPACT-II

The Transuranic Packaging Transporter Model 2, (TRUPACT-II) is a stainless steel package approximately 8 feet in diameter, 10 feet high, and constructed with leak-tight (non-vented) inner and outer containment vessels. The TRUPACT-II can hold up to 14 fifty-five gallon waste drums or two standard waste boxes. The 14 drums are configured into 2 packs containing 7 drums each. A fully loaded TRUPACT-II can weigh up to 19,250 pounds.

The TRUPACT-II underwent extensive testing at Sandia National Laboratories in Albuquerque, New Mexico. It is certified by the NRC and meets the DOT safety requirements for a Type B Package.



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HalfPACT

Some shipments to WIPP consist of 55-gallon drums of CH-TRU waste weighing as much as 1,000 pounds each. Although the TRUPACT-II transportation packages are designed to hold as many as 14 drums, the total shipment (including the truck and trailer) can weigh no more than 80,000 pounds under DOT weight restrictions. To comply with these restrictions, shippers of heavier-than-average drums of transuranic waste would have to reduce the number of drums per package below the TRUPACT-II's 14 drum capacity.

To improve shipment efficiency for heavier drums of transuranic waste, DOE designed the HalfPACT. It is constructed similar to that of the TRUPACT-II. However, 30 inches have been taken off of the height of the package. As a result, the HalfPACT is shorter, and therefore lighter, than the TRUPACT-II. Each HalfPACT is approximately 7 ½ feet high and 8 feet in diameter. The HalfPACT is designed to hold seven 55-gallon drums or a single standard waste box. Each WIPP transport truck can haul up to three packages. The photo below shows a HalfPACT on a trailer behind two TRUPACT-IIs.

The HalfPACT allows the transport of heavier waste in each drum. This will limit the number of shipments necessary and, therefore, the potential for accidents. It is certified by the NRC, and meets the DOT safety requirements for a Type B Package.

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TRUPACT-III

The Transuranic Packaging Transporter Model 3, (TRUPACT-III) is a rectangular container used to transport transuranic waste in a Standard Large Box by highway trucks. The TRUPACT-III is comprised of inner and outer stainless steel plates and polyurethane foam to protect against potential punctures and fire danger. It is approximately 8 feet wide, 9 feet high, and 14 feet long. A fully loaded TRUPACT-III can weigh up to 55,116 pounds.

The TRUPACT-III is certified by the NRC and meets the DOT safety requirements for a Type B Package.

Tie-down Assembly

The TRUPACT-II and the HalfPACT currently use two types of package tie-downs. The first type is a "U"-shaped assembly, which consists of a U-bolt placed over the tie-down lug on the TRUPACT-II. The U-bolt is connected to a tensioning device fastened to the trailer (see photo below left). The second type of tie-down utilizes two bolts per assembly that go through a saddle and fit over the tie-down lug on the TRUPACT-II. The two bolts are connected to a tensioning device fastened to the trailer (see photos on following page.) There are four tie-down assemblies per TRUPACT-II.

The tie-downs are not designed to shear off; instead they will deform or break. This prevents damage to the outer skin of the packaging container. Each of the four tie-downs used on the package is load tested to 20,000 lbs. This gives the tie-down assembly on any given package a total capacity of 80,000 lbs.

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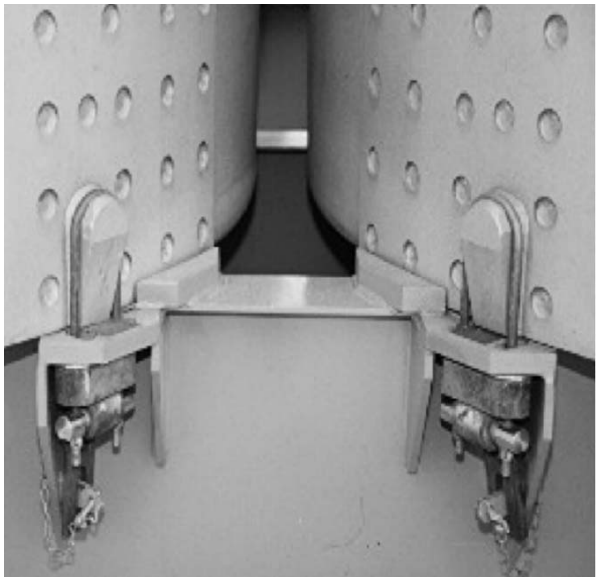
By Nuclear Regulatory Commission requirements, tie-down lugs, which are part of the package, must be able to withstand ten times the force of the package in the forward and aft direction. They must also be able to withstand five times the force in the lateral direction, and two times the force in the vertical direction.

At an incident scene, a visual check of the tie-downs should be made to ensure the tie-downs are still intact before allowing personnel into the area near the package(s). If any of the tie-downs are obviously broken, deformed, or missing, all personnel must remain clear. This is to prevent injury in case the TRUPACT-II or the HalfPACT should fall from the trailer.



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Remote Handled Transuranic Waste Shipping Cask

Since remote handled transuranic waste emits high levels of penetrating gamma radiation, it must be shipped in packages that provide additional shielding. The RH-72B was designed to safely transport these wastes. It is a large cylinder approximately 12 feet long and approximately 3½ feet in diameter weighing up to 45,000 pounds.

The RH-72B (pictured below) is a stainless steel, lead-shielded cask designed to provide double containment for shipments of transuranic waste material. The package consists of a cylindrical stainless steel and lead cask body and a separate inner stainless steel vessel. Additionally, impact limiters at each end of the cask body protect the package and its contents in the event of an accident.

The cask body is constructed of an outer shell of stainless steel approximately 1½ inches thick, 41⅛ inches in diameter, with approximately 2 inches of lead shielding between the outer and inner shell, and a 1 inch inner shell of stainless steel. This produces a package that is considered to be a double containment vessel (two vessels in one). The lid on the cask body is made of 6 inches of stainless steel held in place by 18 stainless steel bolts. The inner containment vessel has a 6½ inch thick lid held in place by 8 bolts. One RH canister, which holds three 30 or 55-gallon metal drums, will be placed inside the RH-72B cask. Additionally, there may be one-gallon pails containing waste placed inside the drums. The

canister can be loaded directly with items too large to fit inside drums. The canister is made of carbon steel approximately ⅜ inches thick. Once filled with waste and sealed, the canister will be disposed of in the WIPP underground along with the waste. Each shipment of RH-TRU waste will contain only one cask and canister weighing up to 45,000 pounds.

The large cylindrical items on each end of the cask, giving it a "dumbbell" appearance, are impact limiters which are placed on each end of the RH-72B package for added protection in the event of an accident. The impact limiters are constructed of a fully welded steel shell filled with polyurethane foam. The foam deforms and provides energy absorption during impact.

ENHANCED SAFETY MEASURES

Carrier Requirements and Driver Training

The transportation contractors used to transport TRU waste to WIPP must have an approved equipment maintenance plan in place for their tractors and trailers and carry the required insurance for hazardous material transport. The equipment maintenance plan requires the transportation contractor to replace a used or defective tractor if it breaks down more than 2% of the time.

The tractor and trailer are equipped with anti-lock braking systems and are governed to a speed of 65 miles per hour. Comprehensive emergency response plans and a contingency plan are carried in the vehicle. The transportation contractor must have a remediation (hazardous material cleanup) contractor on standby at all times when material is in transport.

Each truck transporting TRU waste to WIPP will have two drivers who carry a cellular phone and a satellite phone. Each shipment also uses a satellite communications and tracking system called TRANSCOM. The WIPP Central Monitoring Room uses TRANSCOM to monitor the status of each shipment.

Once a shipment is en route, the drivers must stop within the first 25 miles to perform a load inspection. Load inspections must continue to be performed every three hours or every 150 miles (whichever occurs first) throughout the trip.

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Driver Qualifications

Like the vehicles used for transporting material to WIPP, the drivers are also subject to very strict standards and a stringent set of rules. Before employment, all drivers must pass a criminal background check. Some of the requirements for drivers transporting material to WIPP include:

- Having no convictions for DWI or DUI
- Must meet all U.S. Department of Transportation requirements for shipping a hazardous material
- Must be at least 21 years of age
- Must have 325,000 miles of documented semi-tractor trailer experience in the past five years or 200,000 miles in the last two years
- Must have no chargeable incidents or moving violations in a commercial motor vehicle in the last five years
- Must have two years uninterrupted semi-tractor commercial driving experience in the last five years
- Must have a commercial driver's license with the proper endorsements
- Must pass an annual physical and random drug screens
- Must go through peer review and have favorable results on interview for dual driver compatibility
- Must obtain Commercial Vehicle Safety Alliance (CVSA) vehicle inspector training
- Must successfully complete the MERRTT/WIPP First Responder Radiological Emergency course

The WIPP drivers carry radiological survey instruments and are well trained on the material they transport. Their training and the equipment they carry allows them to serve as a trained resource regarding the material being transported in the event of an accident.

Check Your Understanding

1. WIPP is the world's first underground repository licensed to safely and permanently dispose of _____ radioactive waste.

2. In accordance with the WIPP Waste Acceptance Criteria, which of the following is an example of a prohibited material?
   a. Any material containing gamma-emitting isotopes
   b. Transuranic isotopes
   c. Compressed gases
   d. Contaminated protective clothing

3. Contact Handled (CH) TRU Waste has a maximum surface radiation dose rate of:
   a. 5 mrem/hour
   b. 200 mrem/hour
   c. 1,000 mrem/hour
   d. There is no dose rate limit on CH TRU Waste

4. 96% of the waste destined for WIPP is CH-TRU Waste. True/False.

5. TRUPACT-II is a stainless steel package approximately 8 feet in diameter, 10 feet high, and constructed with leak-tight inner and outer containment vessels. True/False.

6. Which of the following is **not** true regarding the drivers used for transporting material to the WIPP site?
   a. Must pass a criminal background check
   b. Must have 325,000 miles of documented semi-tractor trailer experience in the past five years
   c. Must have no more than two moving violations in the past year
   d. Must pass an annual physical to include random drug screens

ANSWERS

1. transuranic
2. c
3. b
4. True
5. True
6. c