Waste Isolation Pilot Plant

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Academic Setting

This unit is intended for use in a middle school as an overview of the topic of radioactive hazardous waste disposal and transportation. It is hoped that the result of this unit will build a better understanding of the complexity and fragility of the earth, and of us as stewards of the environment. My goals are to get my students interested in what is occurring around them, to make them aware of the problems they will face as adults, and to get them to think thoughtfully of possible consequences, not only to themselves, but to our planet as a whole. I want them to be good caretakers of all our natural resources.

The targeted audience for this unit will be eighth graders studying physical science. This particular student body is located in a semi-rural area of Albuquerque. The population of the school is mainly Hispanic, with about 40% of these students designated as Limited English Proficient (LEP). Over 75% of the student body qualifies for free or reduced lunch. This poverty creates, in turn, an instability in the school population with students leaving or coming to live with a relative, or leaving or coming because of a job opportunity. Attendance at school remains around 87%, the majority of the absentees are chronic offenders. The Terra Nova results put the eighth graders (1999-2000) overall in the 38th percentile, which showed a gain of about 6 percentile points over the 1998-1999 eighth graders. Some of these students are labeled as PHLOTE (First Home Language Other Than English), and the lack of vocabulary is a real stumbling block for them (APS).

I will be teaching all eighth graders, including A and B level special education students, so the classes are mixed ability, with the identified gifted right along with those of lesser ability. Occasionally, a student is enrolled in my class from a special education program; sometimes these students succeed and sometimes not. Inevitably, they cause a commotion while the sorting out process takes place. It is rare for one of these students to be returned to special education classes.

This unit will follow a chapter in the text on energy sources, water, wind, fossil fuels, nuclear, and alternate energy sources such as biomes, solar energy, hydroelectricity, geothermal energy, and tidal energy. It includes the topic of radiation, so the students will not be totally unfamiliar with this topic. The vocabulary list that follows near the close of this unit will reflect the knowledge already learned.

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Background Information

I am writing this unit in order to broaden my students knowledge of New Mexico. I find that anything I tell them about this state they live in is of immense interest to them. I am hoping to relate geography and geology to a small history of the inception of the atomic bomb, to the end repository of these natural elements. Sort of a round trip overview.

We need to begin with a brief reminder of the structure of the atom, and of how some atoms can emit radiation. The atom is made up of a nucleus, containing protons (positive charge) and neutrons (no charge) and an electron shell in which electrons move about (negative charge). Remember that atoms of the same element that have a different number of neutrons (but the same number of protons) are called isotopes. The clustering of protons and neutrons in the nucleus of some isotopes does not lead to a stable low-energy situation, but a high-energy unstable nucleus. When this occurs, the nucleus spontaneously emits excess energy in the form of radiation, and thus becomes more stable.

There are three common types of nuclear radiation — alpha, beta, and gamma radiation. Alpha radiation is given off when a nucleus releases two protons and two neutrons. These particles are the largest and also the slowest form of radiation, and can be stopped by a thin sheet of paper. Beta radiation is the spontaneous decay of a neutron inside the nucleus into a proton and an electron. The electron is ejected from the nucleus at high speed, and is called beta radiation. Even though it travels at a high speed, it can be stopped by a thin sheet of aluminum foil. Both alpha and beta particles undergo transmutation. Transmutation is the process of changing one element to another through nuclear decay. Gamma rays are electromagnetic waves — students should remember their study of the electromagnetic spectrum — with very high frequency and energy. Gamma rays travel at the speed of light and require thick lead or concrete to stop them. Certain radioactive isotopes decay within seconds, but some may linger for millions of years, as far as we know, creating a half-life, or the amount of time it takes for half the nuclides in a given sample to decay. With this background in mind we can now go on to the issue of low-level hazardous waste repositories, such as the WIPP.

Back in the 1940’s, when the United States was developing the atomic bomb, little consideration was given to the nuclear wastes they were generating, very little thought was given to what would be done with them or just how hazardous they were. By 1955, the U.S. Atomic Energy Commission (AEC) asked the National Academy of Sciences (NAS) to study ways for more permanent disposal methods for radioactive wastes generated from nuclear weapons production. Up to this point in time, wastes had been stored in 55-gallon containers, either above ground or buried rather shallowly in the ground. There they were left to chance the whims of temperature and pressure.

Twenty years later, in the 1970’s, geologists and other scientists selected by the NAS had tentatively selected a site in the salt deposits near Lyons, Kansas. Salt deposits were chosen for their geological stability, for the fact that they were easily

mined, and the fact that there would be no circulating water to erode the salt. However, the federal government withdrew its consideration of the site because of concerns that the necessary drilling in the vicinity had perhaps compromised the salt deposits' geologic integrity. In other words, the very testing the scientists were doing for safety reasons, was itself causing unsafe conditions. Then, in the mid-1970's, a salt formation was identified near Carlsbad, New Mexico, as a possible site. It meets all of the above conditions.

Environmental Considerations

As required by the government, environmental studies were made of the site, and presented to Congress. Since radioactive materials occur naturally in the environment, the first order of business was to determine the level of background radiation before the arrival of the first shipment of radioactive wastes. To that end soil samples, air samples, natural vegetation, ground and surface water, as well as wildlife and locally grown beef were tested (EPA). The only problem environmentalists discovered was the presence of two species of raptors, Harris' hawk and the Swainson's hawk, both rare in the United States, that seemed to be enjoying an unusual population explosion on the site of the proposed WIPP. This problem was solved by building platforms for the birds to nest and breed on, and also by altering work schedules of construction workers to accommodate the nesting habits of the raptors (EPA). It should be noted that monitoring of sensitive air, water, and environmental quality is an ongoing process. This study and the resolution of the problem accomplished, the WIPP plan was once again put before Congress.

In 1979, Congress mandated construction and development of the WIPP (Waste Isolation Pilot Plant) in Public Law 96-164, stating that the facility not only be developed to demonstrate safe methods for disposal of low level nuclear waste, but also as a research and development site(DOE). Congress also specified that only certain amounts and types of defense-generated waste could be disposed of at the WIPP site. The land for the proposed WIPP site was already owned by the federal government, so it was only a matter of taking the land out of public usage. This land is a 16-square-mile tract that consists of a thick layer of rock salt that was deposited about 225 million years ago (NSC/EHC).

While the WIPP site is in a remote area, located 26 miles east of Carlsbad, New Mexico, the location is not without controversy. Numerous rallies have been held protesting the site by the Sierra Club and other environmentally cautious persons and groups, in the hopes that nuclear weapons and thoughts of nuclear energy will come to an end. These groups and individuals are not only protesting this particular site, they are against any site, and any production using radioactive materials. The fact of the matter is, nuclear weapons and nuclear energy are with us today, and are not likely to be eliminated so easily.

Another controversy these activists were concerned about is the fact that these nuclear wastes seemed to be perfectly safe where they were. Why the sudden

change? Well, we know that the change was not sudden. It had taken 20 years from the idea's inception to the actual choosing of the site. As usually happens with activists and others, they wait until the proposed solution to the problem is just about a done deal before taking any action at all, and to be honest, many of us do not pay attention to the goings on in Congress on a day to day basis. Secondly, no one in the 1940's through the early 1950's, as previously mentioned, thought about possible consequences of nuclear waste, so when these radioactive materials were stored in situ, high and low-level wastes were mixed together. One thought to keep in mind, though, is the huge contract, worth millions of dollars, that Westinghouse Electric and its subsidiaries stood to gain by going forward with the WIPP project. And go forward it did, to the delight of some political leaders who saw the money flow into New Mexico.

The Sierra Club and other nuclear active organizations are concerned that because of human intervention, in the form of excavating the rock salt beds, the usually bone-dry salt beds may acquire water that will rust the metal drums and create havoc with the resulting gases and, they say, the inevitable fracturing of the metal drums leaving the radioactive wastes open to the atmosphere of the cave and somehow be able to seep into earth's atmosphere.

Costs of the WIPP

The WIPP started with a preliminary program, clearing land, siting, mining, in April of 1981, and is an ongoing project. Fifty-six (56) storage rooms are proposed, 13 of which have been built so far at a cost of $750,000,000. The economic value to the State of New Mexico and the Carlsbad area has not been calculated. However, it is estimated that 65% of the workforce at WIPP are from New Mexico. One can only guess at the final cost, somewhere in the billions (DOE).

What will the WIPP contain?

Excavation for the WIPP site began in 1981, after many more governmental regulations, and continued through the 1980's. When it is completed, which it still is not, it will be able to hold more that 6 million cubic feet of nuclear wastes, or to put this in terms of something more visual, about 850,000 55-gallon drums!

The WIPP site is designed to hold transuranic wastes (TRU), *trans* meaning beyond, and uranic meaning *uranium*, (think of beyond uranium on the periodic chart). Transuranic wastes may include such contaminated items as laboratory clothing, tools, plastics, rubber gloves, and any other disposable items that may come in contact with radioactive materials during the course of a normal workday. These materials are considered to be radioactive, but not to a high degree. They are not harmless. Many of these wastes contain other chemicals that may cause other adverse reactions to occur, which is why safe disposal is needed.

TRU wastes may emit alpha, beta, and gamma particles. Alpha particles are slow

moving, dangerous if inhaled or ingested; they can be stopped by a thin sheet of paper. Beta particles are fast moving, dangerous if inhaled or ingested; they can be stopped by a thin sheet of aluminum foil. Gamma rays travel at the speed of light, and are only stopped by a thick sheet of lead or concrete. So it is necessary to take all sorts of precautions in order to insure the safety and well being of the workers. Visualize Intel workers in their white suits, and you can see the same sort of safety precautions at the WIPP.

Transportation

TRU wastes are generated by numerous defense production facilities across the United States. These would include Hanford, Washington; Lawrence Livermore National Laboratories; Idaho National Engineering Laboratories; Rocky Flats at Golden, Colorado; Nevada; our own Los Alamos National Laboratory; Argonne National Laboratory; the Mound Facility in Ohio; Oak Ridge, Tennessee; and the Savannah, South Carolina facility are all contributors to the WIPP site in Carlsbad, New Mexico (DOE). The wastes generated by these plants are packaged in specialty built containers called TRUPACT-II. The first containers leaked, and so engineers went back to the drawing board and redesigned the packaging to make it leak proof. The basic TRUPACT-II container is a stainless steel vessel that is lined with several layers of insulation. It is designed to hold 14 55-gallon drums that are banded together in a seven-pack, and then stacked one on top of the other inside the stainless steel vessel. Only three TRUPACT-II containers are carried on a truck, allowing for 42 barrels of waste per truckload.

The US Department of Transportation (DOT) oversees the routes over which this hazardous material is carried. It took into consideration such factors as time of day, accident rates, amount of time to travel, population density and activities, as well as days of the week during which transportation will occur. These waste shipments are continuously monitored via satellite. In case of inclement weather, the haulers have safe, designated spots to pull over, and are required to stop every two hours to inspect the mechanical systems of their trucks. Interestingly enough, the

U.S. DOT had to step in with regulations because local municipalities, fearing their town would be on the transit list, started making their own rules governing transportation of radioactive wastes. A form of protest from the town fathers!

The DOT uses a satellite tracking system when shipments are being transported, and has trained hundreds of emergency responders, which I find mildly alarming, along the routes, in case of emergency. Should the worst case scenario occur, there is no way of telling the level of radiation danger because some of those drums have been in storage and sealed for years, hence the need for emergency responders.

Most of these TRUPACT-II trucks travel over the interstate highway system, with few exceptions, New Mexico being one of them. Instead of transporting down I-25 to Carlsbad, the truckers must travel State Route 285 to reach their destination. However, those wastes being transported from the east and the west will travel on

I-40 through the Albuquerque area until it reaches State Route 285 to continue their journey to Carlsbad. The regulations for hiring a driver to transport these wastes are pretty much standard for the industry: 25 years of age, 100,000 miles driving a big rig, a clean driving record for the last three years.

At the WIPP Site

Once at the WIPP site the trucks are unloaded and sent to the above-ground building to be uncrated, inventoried, sorted, and eventually shipped 2150 feet below the surface of the earth to one of the storage rooms.

There the drums containing the radioacitve wastes are place in tiers of three, with seven 55-gallon drums each. Bags of magnesium oxide are placed on top of the tiers, with smaller bags placed between the drums too absorb moisture and thereby reduce the possibility of water leaking in and dissolving the radioactive wastes. There the radioactive wastes will remain, safe and sound underground.

The sorting process involves separating the Remote Handled (RH) from the Contact Handled (CH). The reason for this is that some of these wastes have been stored for fifty years or more, and were not separated when they were originally stored. Remote Handled wastes are transuranic wastes with higher levels of penetrating radiation. Only about 3% of the wastes scheduled for the WIPP site are classified as RH wastes. These wastes are treated with a great deal of respect as to their contents. They are first isolated and inventoried and then pushed through a hole in the wall by a remote controlled boom to a separate isolation room for storage. Contact Handled wastes, remember these may include clothes and tools used in laboratories, are sorted and inventoried above ground in a secure room before being sent via elevator to one of the large storage rooms located 2150 feet below the surface of the earth. Vapor monitors will track the leakage of buildup of any errant gases that may form indicating a problem (DOE).

The WIPP site is equipped with their own health unit, fire department, and emergency generators in case of power failure. Continued monitoring by such groups as the Environmental Evaluation Group, the Radioactive Waste Consultation Task Force, and the Sierra Club ensure the safe operation of the WIPP for generations to come.

Implementation

Lesson Plans

Week One

I will open this unit with the reading of *The Watch on Patterick Fell,* by Fay Sampson, New York, Greenwillow Books, c1978. This book is about the lives of two top level scientists involved in nuclear waste disposal and their two teenage children who react so differently to their parents occupations. We will discuss differing opinions and the students will write a one page paper comparing and

contrasting the differing views of the Lowman children. This meets with NM State Department of Education standard 1 for language arts, students will understand and use language arts for communication, which states that the student will use the skills and strategies of the reading process to comprehend, interpret, evaluate, and appreciate what they have read. This should take four days. The next two days will be spent reviewing the structure of the atom, using manipulatives to model the atom, and each student will be building a given atom, some of them will have radioactive properties. This meets the NM State Department of Education standard 7 for Physical Science which states that students will know and understand the properties of matter. Specifically benchmark A. Identify the characteristic properties of elements and compounds such as density, boiling point, and solubility; 1) make a model of an atom and explain how the components are related. We will discuss their efforts, and hang the results about the room.

Week Two

This week we will take a look at the geologic formation of the WIPP site. The National Safety Council, Environmental Health Center has a wonderful geologic profile on their web site that can be downloaded and put on the overhead for classroom use. We will discuss the rock structure, age, formation of salt crystals and examine these under the microscope, noting the various properties, what happens when they are in solution, what about groundwater. WIPP will send you samples of this rock salt for the asking. This meets NM State Department of Education standard 7 for Physical Science. We will view the WIPP movie *Nuclear Waste* and discuss it in relationship to information or propaganda. This meets the NM State Department of Education standard 15 for Technology and the History of Science. The students will, after examining the available information on TRU-PAC, design and test their own crash-proof containers. This meets the NM State Department of Education standard 15 Technology and the History of Science.

Week Three

This week we will discuss the environmental impacts of the WIPP site; transportation; and take a look at the site itself via overheads. The DOE has a map of all the waste generators and the routes from their origin to the WIPP site. This meets the NM State Department of Education standard 16 for Science in personal, social, and environmental perspectives. If time allows, I would like the students, working in pairs, to write their own stories involving radioactive wastes using the rubric found in the implementation section of this paper. These stories will be presented to the class. This meets the NM State Department of Education standard 1 for language arts and standard 3 for arts performance .

Assessment Strategies

The reading of *The Watch on Patterick Fell* by Fay Sampson will culminate with a one page paper comparing and contrasting the differing viewpoints of the Lowman children, plus the students' own opinions detailing to me where they stand on the

issue of radioactive wastes. These papers will be collected and graded. The atom modeling will be accompanied by a worksheet asking them to draw Bohr models of specific atoms (any will do), again to be graded. Some students will find this difficult, but will hopefully have a better understanding of the structure of the atom when it comes to making their own models of atoms from three-hole punch papers.

During week two, students will be asked to draw their own map of the geologic formation of the WIPP site, and to take notes as we discuss the rock salt beds and their age. I will grade their drawing and notes. The salt lab will include a work sheet that will ask for a drawing of what they see under the microscope from the WIPP formation salt sample versus a crystal of table salt. They will also be asked to time the reaction of each to a specified amount of water. These lab papers will be collected and graded. When we view the WIPP movie, the students will be asked to provide me with a one page written summary of the movie, for a grade. The students will also design and test their own crash proof containers, similar in style to the TRU-PAC containers after we have studied them. They will be required to defend their use of materials and why they thought these materials would or did work as they expected. These results will be presented to the class for a grade.

Week three, the students will be working on maps of the United States and New Mexico, working out alternate routes for the transportation of these radioactive wastes. They will be required to come up with alternative routes and be able to tell me why they feel they are safer. These maps will be graded. If time allows, I would like the students, working in pairs, to prepare a fiction story including: graphics, why or why not a nuclear repository, finding a site, transportation, and some environmental aspect that would show me which side they are on, for or against. If time does not allow, I will divide the class in two and have them prepare arguments for a debate including all of the above elements. This would be a culminating activity and therefore a substantial part of their grade for this unit.

Lesson Plans

Lesson Plan #1,2,3,4, four days
Reading of the book *The Watch on Patrick Fell*, Fay Samson, New York, Greenwillow Books, c1978, and the paper comparing and contrasting the two views of the Lowman children. This meets New Mexico standard 1 (5-8): Students will understand and use language arts for communication. Specifically, that they read and comprehend print and use the skills and strategies of the reading process to comprehend, interpret, evaluate, and appreciate what they have read.

Lesson Plan #5 ,6, two days
This will be a lecture on the structure of the atom. We will use overhead visuals and the chalkboard. Students will be required to take notes. The second day we will use manipulative to model atoms and make our own models using construction paper as background for the three hole punch dots representing the components of the atom. This meets the New Mexico standard 7 (5-8) for Physical

Science: Students will know and understand the properties of matter: A, Identify the characteristic properties of elements and compounds such as density, boiling point, and solubility. 1. Make a model of an atom and explain how the components are related.

Lesson Plan # 7, one day
We will discuss the geologic formation of the WIPP rock salt bed using the overhead and having students make their own drawing of this formation; take notes on the lecture. There is no standard clearly stated standard for the geologic strata.

Lesson Plan # 8, one day
This day we will do the salt lab, examining the salt structure of both the WIPP salt sample and the crystals of ordinary table salt; then what happens when they are put in solution. It may take a few days for the salt samples to dehydrate again. This meets the New Mexico state standard for Physical Science 7 (5-8), Students will know and understand the properties of matter. A. Identify the characteristic properties of elements and compounds such as density, boiling point, and solubility; 4. identify the components of a solution.

Lesson Plan # 9, one day
The students will view the WIPP movie, *"A Safe Way Out"*, (20) minutes, and write a summary and response to the movie. This meets New Mexico standard 3 for Arts Performance Standards (5-8), Integrate understanding of visual and performing arts by seeking connections and parallels among arts disciplines as well as all other content areas. Visual Arts B-1: Show ways in which principles and subject matter of other disciplines are interrelated with visual arts: Identify and explain the similarities and differences of concepts common to the visual arts and to other content areas.

Lesson Plan # 10, one day
At this point the teacher may wish to catch up with, depending on class interest and ability, the past two weeks. If every student is on the same page then a discussion of the environmental impacts of the WIPP is appropriate here. This meets New Mexico standard 16 (5-8), Science in personal, social, and environmental perspectives: Students will know and understand the relationship between natural hazards and environmental risks for organisms. Specifically, A. Analyze environmental risks for personal and social costs.

Lesson Plan #11, one day
We will discuss transportation routes, using maps we have downloaded from computer sites, finding larger population sites; regulations for the truck drivers; and seeing how the satellite tracking works. This meets New Mexico standard 15 for Technology and the History of Science; Students will know and understand the impace between Science and Technology in society. Specifically B, Demonstrate how the direction for scientific investigation is related to social issues and challenges; 3. investigate current local issues related to science and technology.

Lesson Plan #12, 13,14, 15, four days
Working in pairs, students will write their own stories regarding WIPP, incorporating graphics, the need for a low-level raadioactive repository, the geology of the site, transportation, and some environmental concern. These fiction stories will be read to the class. This meets New Mexico standard 1 for Language Arts (5-8): Students will understand and use language arts for communication. Specifically B, Use and expand vocabulary and linguistic skills to communicate effectively.

Documentation

Reading List for Students

Bradford, Richard. *Red Sky at Morning*. Lippincott, 1968.
Southerner Josh Arnold and his mother go to a little town in New Mexico, where they are to wait out World War II. While living there, Josh gains a little understanding of his Mexican-American neighbors, and of himself.

Forman, James D.. *Doomsday Plus Twelve*. New York. Scribner, 1984.
In the year 2000, twelve years after the world nuclear holocaust known as Doomsday, a group of Oregon teens take matters into their own hands to combat militarists and assure future peace.

Hall, Lynn. *If Winter Comes,* Atheneum, 1986.
As an escalating world crisis makes the threat of nuclear warfare imminent, two teens draw closer to each other and to their families.

Johnstone, Hugh. *Facts on Nuclear Waste and Radioactivity*: New York: F. Watts, 1990.
Examines the cause and effects of radioactive waste and nuclear contamination and what governments are doing to combat them.

Lawrence, Louise. *Children of the Dust.* New York: Harper and Row, 1985.
After a nuclear war devastates the earth, a small band of people struggles for survival. Children are born with strange mutations.

NMED/DOE Oversight Bureau, Waste Isolation Pilot Plant environmental surveillance report: groundwater, surface water, soil, sediment, biota/State of New Mexico, Environmental Department, DOE Oversight Bureau, Waste Isolationn Pilot Plant. Carlsbad, New Mexico: The Bureau, 1996.

Sampson, Fay. *The Watch on Patterick Fell.* New York: Greenwillow Books, c1978.
The lives of two top level scientists involved in nuclear waste disposal and their two teenage children are drastically altered by wide-spread public concern for nuclear safety.

Strieber, Whitley. *Wolf of Shadows*. New York: Knopf, 1985.

In the wake of a nuclear holocaust, a wolf and a human woman form a mysterious bond that brings each of them close to the spirits of the shattered earth.

Teacher Bibliography

Easterbrook, Gregg, *A Moment on the Earth*, New York, New York: Penguin Books, 1996.

Goldfarb, Theodore D. *Taking Sides, Clashing Views on Controversial Environmental Issues*. Guilford, Connecticut: Dushkin/McGraw Hill, 1999.

Houghton, John. *Global Warming: The Complete Briefing*. Cambridge, UK: Cambridge University Press, 1997.

Merrits, Dorothy, Andrew De Wet, and Kirsten Menking. Environmental Geology, An Earth System Science Approach. W. H. Freeman and Company, 1997.

Murray, Raymond L. *Understanding Radioactive Waste*, Columbus, Ohio: Battelle Memoriol Institute, 1994.

Web Sites

Concerned Citizens for Nuclear Safety <http://www.nuclearactive.org//>.

National Safety Council/Environmental Health Center <http://www.nsc.org/>.

National Transuranic Waste Program <http://www.wipp.carlsbad.nm.us/>.

New Mexico Environmental Evaluation Group <http://www.rt66.com/~eeg/>.

State of New Mexico's WIPP Contacts <http://www.emnrd.state.nm.us/wipp/workgrou.htm>.

State of New Mexico's Radioactive Waste Consultation Task Force <http://www.emnrd.state.nm.us/wipp/taskforc.htm>.

State of New Mexico's WIPP Transportation Safety Program <http://www.emnrd.state.nm.us/wipp>.

U.S. Department of Energy <http://www.doe.gov>.

U.S. Environmental Protection Agency <http://www.epa.gov/radiation/wipp>.

Waste Isolation Pilot Plant Information <http://www.wipp.carlsbad.nm.us/wipp.htm>.

Videos

A Safe Way Out. Westinghouse, Government Services Division, WIPP. Deals with the Trupact II and transportation. 20 minutes.

Atomic Cafe. First Run Features, 1982.
This movie combines archival footage from the 1940's and 1950's to show some aspects of the Cold War

Nuclear Waste. Altschul Group, 1997.
Tours the WIPP site. Includes interviews with scientists and local residents. 13 minutes. APS#10029413

Other Resources

Environmental Evaluation Group
7007 Wyoming Blvd. NE, Suite F-2
Albuquerque, New Mexico 87109

National Safety Council, Environmental Health Center
1025 Connecticut Avenue, NW, Suite 1200
Washington, DC 20036

New Mexico Radioactive Waste Consultation Task Force
Ms. Jennifer Salisbury, Task Force Chair and Cabinet Secretary
2040 S. Pacheco Street
Santa Fe, New Mexico 87505

New Mexico's WIPP Transportation Safety Program
Speakers and Presentations
c/o Bill Mackie
New Mexico Energy, Minerals and Natural Resources Department
2040 South Pacheco
Santa Fe, NM 87505

Parker-Stevens, Victoria. "WIPP gets 1st shipment." *Carlsbad Current-Argus 26* March, 1999,
Extra. 12 pages.
Taugher, Mike. "Buried in Controversy." *Albuquerque Journal* 28 March, 1999. 2 pages.

United States Government, Department of Energy
Waste Isolation Pilot Plant
Office of Public Affairs
PO Box 3090
Carlsbad, New Mexico 88221

United States Government, Environmental Protection Agency

United States Government, Department of Transportation

Westinghouse
Government Services Group

Waste Isolation Division
PO Box 2078
Carlsbad, New Mexico 88221

Student Vocabulary List

AEC - Abbreviation for the U.S. Atomic Energy Commission. It was disbanded in 1974, and its functions were assumed by the Energy Research and Development Administration (ERDA) and the Nuclear Regulatory Commission (NRC). ERDA later became part of the Department of Energy

Alpha particle - A positively charged particle, consisting of two neutrons and two protons, emitted by certain radioactive materials. Alpha particles can travel only a few inches in the air and lose their energy almost as soon as they collide with anything. They can be stopped by a sheet of paper or the outer layer of the skin. Contact-handled transuranic (CH-TRU) waste primarily emits alpha particles.

atom - The smallest particle of an element that still has the properties of that element. The nucleus consists of protons and neutroons and is surrounded by orbiting electrons.

beta particle - A negatively charged particle, emitted by certain radioactive materials. Beta particles have the same properties (mass and charge) as electrons. They can travel in the air for a distance of a few feet and can pass through a sheet of paper. They can be stopped by a sheet of aluminum foil or glass.

contact-handled transuranic waste (CH-TRU) - Transuranic waste with a surface radiation dose rate that does not exceed 200 millirems per hour. Contact-handled transuranic waste can be safely handled without any shielding other than that provided by the waste container itself. About 97% by volume of the waste scheduled to go to the WIPP is considered contact-handled.

defense-generated transuranic waste - Transuranic waste resulting from weapons research and development, the operation of naval reactors, the production of weapons material, the reprocessing of defense spent fuel, the dismantling of nuclear weapons, and the decommissioning of nuclear-powered ships and submarines.

DOE - Abbreviation for the United States Department of Energy. WIPP is a DOE-owned facility.

DOT - Abbreviation for the United States Department of Transportation. DOT regulates the transport of radioactive materials.

EPA - Abbreviation for the United States Environmental Protection Agency. EPA has responsibility for ensuring DOE’s compliance with the radioactive waste disposal regulations.

gamma rays - Waves of pure energy, similar to x-rays. Gamma rays travel at the

speed of light through air or open spaces. Concrete, lead, or steel will block gamma rays.

half-life - Measure of the amount of time it takes for half of the radioactive atoms in an element to decay to a more stable form. The half-life of plutonium-239, for example, is about 24,000 years. After on half-life, half the radioactive atoms in a sample remain radioactive; after two half-lives, one quarter remain radioactive; and so on. Half-lives range from a fraction of a second to billions of years.

hazardous waste - Highly radioactive material resulting from the reprocessing of spent nuclear fuel, or other highly radioactive material that is determined to require permanent isolation.

isotopes - Different forms of the same element. Isotopes of an element have different numbers of neutrons in the nuclei of their atoms, but the same number of protons. Some isotopes, called radioisotopes, are unstable and emit radiation.

low-level waste - Radioactive waste that consists of contaminated or industrial research waste. Mosst low-level waste is short-lived and has low levels of radioactivity.

millirem - one thousandth of a rem

NAS - Abbreviation for the National Academy of Sciences

radiation - Energy in the form of high-speed particles (ionizing) or electromagnetic waves (nonionizing).

radioactivity - The spontaneous emission of a radiation from the nucleus of an atom. Radioisotopes of elements lose particles and energy through the process of radioactive decay.

remote-handled transuranic waste (RH-TRU) - Transuranic waste with a surface dose rate of 200 millirems per hour or greater. Because of its higher level of radioactivity, remote-handled transuranic waste must be handled and transported in shielded casks.

rem (Roentgen equivalent man) - A measure of the actual biological effects of radiation absorbed in human tissue.

TRANSCOM - Abbreviation for the Transportation Tracking and Communication System developed by DOE. TRANSCOM is used too track and communicate with vehicles transporting radioactive and certainn other types of hazardous waste. All shipments to WIPP are to be tracked through TRANSCOM, which has a 24-hour control center in Oak Ridge, Tennessee, and uses satellite communications and computer networks to track shipments from beginning to end.

transuranic (TRU) waste - Waste that generally consists of protective clothing, tools glassware, equipment, soils and sludge that have been contaminated with

man-made radioactive elements heavier than uranium on the periodic table of the elements (atomic number of 92). These elements include plutonium, neptunium, americium, curium, and californium. Transuranic waste is produced during nuclear fuel assembly and during nuclear weapons research, production, and cleanup.

TRUPACT II - Abbreviation for Transuranic Packaging Transporter Model 2, a special container constructed to hold contact-handled transuranic waste. The container is designed to prevent radioactive releases, even in the event of an accident or other emergency.

WIPP - Abbreviation for the Waste Isolation Pilot Plant, a DOE facility located in southeastern New Mexico, 26 miles from Carlsbad.