

ENVIRONMENTAL MONITORING AND COOPERATIVE RESOURCE MANAGEMENT AT THE WIPP SITE

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ABSTRACT

This poster session by the Environmental Monitoring Section of the U.S. Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) is to demonstrate that the DOE is committed to sound environmental management. This WIPP poster session will demonstrate radiological as well as nonradiological environmental monitoring activities conducted routinely at the WIPP. This session will also show how data collected prior to the WIPP being operational is used to establish a preoperational baseline for environmental studies that will be compared to the samples collected during the operational phase.

Cooperative Resource Management is a relatively new concept for government agencies. It gives two or more agencies the ability to share jointly in funding a program or project, and benefit from the outcome. These programs usually include biological studies. The WIPP cooperative agreement between the U.S. Bureau of Land Management (BLM), the DOE, and its contractors is to continue the ongoing documentation of the diversity of the Chihuahuan desert.

DESCRIPTION OF THE WIPP PROJECT

The WIPP site, located in southeastern New Mexico is a government owned and contractor operated facility. The Waste Isolation Division of Westinghouse Electric Corporation operates the WIPP for the DOE. The purpose of the WIPP is to provide a research and development facility to demonstrate the safe disposal of transuranic (TRU) wastes generated by the defense activities of the U.S. Government.

The WIPP facility is technically ready to receive waste, having met all readiness prerequisites to the satisfaction of the Secretary of Energy. However institutional issues preclude initiation of activities at this time. Therefore, this paper describes the status of the environmental monitoring activities for the WIPP in a preoperational mode.

If the WIPP is designated as an operational facility, TRU wastes will be transported from 10 generator/storage sites around the United States to the WIPP. During the test phase the waste will be transported from the Idaho National Engineering Laboratory and the Rocky Flats facility in Colorado. These waste materials are contaminated with alpha emitting radionuclides having atomic numbers greater than 92 and half lives longer than 20 years. Also, to be classified as a TRU waste, the specific activity of these radionuclides in TRU waste must be higher than 100 nCi/g. General criteria defining the various categories of radioactive waste, including TRU waste, appear in DOE Orders defining the various categories of radioactive waste. Isotopes of plutonium, americium, and curium will be the predominant radionuclides contained in the contaminated TRU waste shipped to the WIPP.

TRU will be transported to the WIPP via specially equipped tractor-trailer trucks. Each truck can haul up to three transuranic package transporters (TRUPACT-IIIs) each containing 14, 55 gallon drums or two standard waste boxes. The TRUPACT-II is a durable, reusable container whose design and use has been approved by the Nuclear Regulatory Commission (NRC) to transport the contact-handled transuranic waste to the WIPP. (The NRC is the nationally recognized governing agency that regulates safe handling and proper safety concerns pertaining to radiation exposure to the public and the environment).

Once these TRUPACT-IIIs have arrived at the WIPP and are brought into the Waste Handling Building the waste containers will be removed from the TRUPACT-II, placed on the waste handling hoist, and lowered to the repository level of 655 m (2150 feet) below the surface. Waste containers will then be removed from the hoist and emplaced in excavated storage rooms in the Salado formation, a thick sequence of salt beds deposited approximately 250 million years ago (Permian Age). After filling a storage area, specially designed seals and plugs will be placed in the excavated storage rooms and in the shafts. The plastic healing nature of the salt formation will result in gradual creep closure, causing encapsulation and isolation of the waste within the Salado formation. It is presently designated that the first five years of WIPP operations will be a test phase period, during which time tests will be performed to evaluate the WIPP design and help provide a sound basis for making the disposal decision.

DESCRIPTION OF THE ENVIRONMENT

The WIPP site is located in Eddy County in southeastern New Mexico. The site is approximately 40 kilometers (26 miles) east-southeast of Carlsbad in an area known as Los Medanos (the dunes), a sparsely inhabited plateau with little water and limited land uses. The land is owned by the BLM, and is leased to permittees for grazing livestock. Other land uses in the general area include potash mining; oil and natural gas exploration and/or extraction; and recreational use such as hunting, trapping, and birdwatching. The land must be transferred to the DOE before activities involving TRU waste can begin.

The WIPP site consists of 16 sections (6.48 ha) of federal land in Township 22 South, Range 31 East. Except for the 5.83 square kilometers (2.25 square miles) (1,454 acres) encompassing the facility (known as the DOE Exclusive Use Area), surface land uses remain largely unchanged. Mining and drilling for purposes other than support of the WIPP project are restricted within this 16 section (6.48 ha) area.

RADIOLOGICAL BASELINE PROGRAM (RBP)

The primary goal of the RBP is to establish a statistically sound data base of radiological data against which operational

radiation measurements will be assessed. The RBP consists of five subprograms:

- **Atmospheric Radiation Baseline**

Low volume continuous airborne particulate samples are taken at eight locations: three within the WIPP boundary, two at area ranches, and three at nearby communities.

Filters are collected weekly and analyzed at the WIPP low level counting laboratory for gross alpha and gross beta counts. Quarterly composites from each location are analyzed at a contract laboratory by gamma spectroscopy. The filter composites then undergo destructive radiochemical analysis for the specific alpha and beta emitters.

- **Ambient Radiation Baseline**

Thermoluminescent dosimeter (TLD) packages were used to measure penetrating (gamma) radiation levels at numerous locations in and around the WIPP site. TLD packages were collected quarterly and evaluated by the contract laboratory.

The RBP included a network of 44 TLD locations. Seven of these dosimeters were at locations also monitored by Sandia National Laboratories (SNL) in order to determine the correlation between the SNL and WIPP RBP dosimetry data. The estimated annual averages of the TLD data has been about 36 mrem annually.

A high pressure ionization chamber designed to monitor low levels of gamma radiation in the environment average about 7.5 uR/h, indicating an estimated annual gamma exposure of approximately 66 mrem.

- **Terrestrial Radiation Baseline**

Soil samples have been collected at 28 TLD stations on three occasions. Samples were collected at three depths at each location (0 to 2, 2 to 5, and 5 to 10 cm). Radionuclide concentrations in soil samples fell within expected ranges and did not indicate unexpected environmental radioactivity.

- **Hydrologic Radiation Baseline**

This subprogram was designed to determine baseline radiation levels in surface bodies of water, bottom sediments, and groundwater. Surface water and sediments are sampled annually. Data from surface water sampling did not show unusual levels of environmental radioactivity. Sediment sample results indicated concentrations of cesium, radium, and uranium above that of the surface waters, but within expected environmental radioactivity ranges (NCRP, 1976). Groundwater sampling locations for the Water Quality Sampling Program (WQSP) were analyzed and include several privately owned wells that supply drinking water for livestock and two that supply water for human consumption. Sample splits were provided to a oversight agency for independent analyses.

- **Biotic Radiation Baseline**

This subprogram characterized background radiation levels in biotic organisms along possible pathways. Vegetation, rabbits, quail, beef, and fish are

potential exposure pathways and were sampled and analyzed for concentrations of transuranic and naturally occurring radionuclides. Analyses do not show concentrations of radionuclides in excess of those routinely encountered in environmental sampling (Banz et al., 1987; Flynn, 1988).

As required by the DOE, radiochemical analyses include not only those nuclides expected in the WIPP waste, but also the typical fallout nuclides and natural radioactivity. All major environmental media potentially affected by WIPP activities, not just those in the critical pathways, are sampled.

Data acquisition for the RBP began on June 30, 1985, in accordance with the RBP program plan (Reith and Daer, 1985). All materials (airborne particulates, water, sediments, soils, and biota) collected were analyzed for activities of naturally occurring and transuranic radionuclides by a contract analytical laboratory.

The principle basis for the RBP sampling strategy is a pathway analysis. As appropriate, sample splits were made available to other WIPP oversight agencies.

ECOLOGICAL MONITORING PROGRAM (EMP)

It is required that characterization of ecological parameters during preoperational environmental monitoring efforts be evaluated and monitored to determine if any negative impacts from WIPP construction activities are impacting the environment in the WIPP vicinity. In 1975, the WIPP biology program was initiated to perform baseline nonradiological ecological studies before the start of WIPP construction. The EMP was the functional successor to the WIPP biology program. Sampling for the EMP focused on the vegetation and animal communities immediately surrounding the site and on the ecological parameters most likely to reflect the impact of construction and operational activities. The EMP primarily consists of ten subprograms:

- **Meteorological Monitoring**

Weather information is recorded to supplement characterization of the local environment and facilitate the interpretation of data from other environmental activities at WIPP. SNL monitored meteorological conditions around the WIPP site from 1975 through 1980.

Between 1984 and 1988, temperature, wind speed, wind direction, and precipitation were continuously monitored at a 10-meter (33 feet) mast at the northwest corner of the WIPP site. Weather data have been presented in the Annual Ecological Monitoring reports and summarized in the Annual Site Environmental Monitoring Report prepared at the end of each calendar year in accordance with DOE Order 5484.1B (DOE, 1986b). In 1987, barometric pressure and relative humidity were added to the monitoring program.

- **Air Quality**

This subprogram measured concentrations of airborne particulates and atmospheric gasses such as carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen oxides, and ozone. These parameters were measured by SNL between 1975 and 1980, and were monitored at the northwestern corner of the WIPP site. No long-term effects on air quality have been

recorded during the construction phase; however, occasional short-term gas concentrations above the state of New Mexico air quality standards have been recorded for ozone, sulfur dioxide, and hydrogen sulfide.

- **Water Quality**

This subprogram monitors both surface water and groundwater for impacts to water quality resulting from WIPP activities. Also, a data base of the chemical and physical conditions of surface water and groundwater was obtained to assist interpretation of data from other environmental monitoring programs such as the RBP. Surface water samples are collected annually. In addition to the radioanalysis, water samples from Red Tank, Hill Tank, Indian Tank and Laguna Grande were analyzed for the chemical constituents. Groundwater samples have been collected at 30 wells, and data have been summarized in the annual EMP reports (Reith et al., 1985; Fischer et al., 1985; Fischer, 1987 and 1988). In general, the water quality data have compared favorably from one sampling episode to the next.

- **Aerial Photography**

Semiannual low-level aerial photographs of the site and vicinity monitored visually detectable impacts of the facility and provide a chronological record of these impacts. Aerial photography of the facility reveals that approximately 66 hectares (163 acres) of land have been disturbed by WIPP construction. This is approximately 12 hectares (30 acres) less than the amount of disturbance predicted in the Final Environmental Impact Statement (DOE, 1980).

- **Vertebrate Census**

Selected wildlife populations are surveyed annually to determine the effects of WIPP construction activities and resultant habitat modifications on natural populations of wildlife species. Breeding densities are reported for each bird species in the annual EMP reports, as are the species densities for small mammals.

An increase in the number of bird species near the facility compared to the more distant control locations has been found. This increase was probably due to habitat changes, such as the greater availability of perches and nest sites from buildings, fences, and pipes, and to the greater availability of insect food attracted to the lights around the site.

- **Surface Photography**

A panoramic series of photographs are taken semi-annually from the center of the permanent ecological monitoring plots. These photographs provide a chronological record of the visual impacts of the overall WIPP project and especially the surface storage of salt.

- **Soil Chemistry**

The soil survey subprogram monitored soil changes at varying distances and directions from the two salt storage piles. Quarterly surface and annual subsurface samples were analyzed to monitor changes in electrical conductivity, pH, and cation concentra-

tions, which may indicate that salt is being transported from WIPP facilities. Results of this program are reported in the annual EMP reports. The studies have indicated that only limited dispersal of salt from the surface storage piles occurred. Concentrations of water-soluble ions (sodium, chloride, potassium, magnesium, and calcium) in the surface soil are seasonally elevated within 200 meters (660 feet) of the salt piles; however, intense rains flush these ions from the soil surface.

- **Soil Microbial Studies**

Soil microbial studies monitored the level of microbial activity as the rate of litter decomposition in the ecological monitoring plots. As reported in the annual ecological monitoring reports, no inhibition of microbial activity levels or microbial decomposition rates have been detected in the ecological monitoring plots.

- **Vegetation Studies**

Vegetation in the monitoring plots has been surveyed in the spring and fall to detect impacts of salt transport and the resultant changes in soil chemistry on vascular plants. This subprogram monitored foliar cover for all species, density of annual species, species richness, and the structure of the vegetation community in the ecological monitoring plots. The data presented in the annual ecological monitoring reports indicate that the impacts of WIPP construction and salt storage on the vegetation in the surrounding ecosystem are minimal (Fischer, 1988).

- **Salt Impact Studies**

Four subprograms were included as follows:

- **Surface Photography:** Surface photographs were taken semiannually in each permanent monitoring plot to document alteration of habitat structure.
- **Soil Chemistry:** Soil samples were collected at three depths (0 to 2 cm, 30 to 45 cm and 60 to 75 cm) and analyzed for direct evidence of salt-related chemical changes in the soil.
- **Soil Microbiota:** Microbial activity levels and decomposition rates were monitored in recognition of the role these organisms play in maintaining energy flow through the ecosystem and their sensitivity to chemical changes in the soil.
- **Vegetation Survey:** Foliar cover, species composition and the density of annuals were monitored for indications of salt impacts on native vegetation in the ecosystem.

RAPTOR RESEARCH AND MANAGEMENT PROGRAM

In 1985, the Los Medanos Cooperative Raptor Research and Management Program was initiated under the sponsorship of the DOE with support from the BLM and the Living Desert State Park. This program is independent of the Ecological and Environmental Monitoring Programs at the WIPP facility. Part of the goal of this study, conducted by researchers from the University of New Mexico, is to evaluate the impacts of WIPP activities on the breeding success of raptors (e.g.,

hawks and owls), which are found in unusual abundance in the vicinity. Experiments are also being conducted to determine how any impacts may be mitigated.

Results (Bednarz, 1987, 88, 89, 90) indicate that adverse impacts on nest success resulting from human intrusion during critical times in the nesting cycle are measurably reduced by slightly modifying field work schedules to accommodate nesting activities. When nests have been found in locations potentially threatened by a nearby work area (such as a well pad) the work schedules are modified to minimize impacts on the nest.

In 1986, 10 artificial nest platforms were constructed and installed near the site to determine the potential for improving nesting habitat in locations removed from areas of human activity and disturbance. Some of these structures were used successfully by Chihuahuan ravens during 1987. During the summer of 1987, one nest was used by a pair of great horned owls, which successfully fledged three young. Another nest was used by a pair of Harris' hawks and one young fledged.

Winter population estimates of diurnal raptors in the study area dropped substantially from the 1985-86 to the 1986-87 count periods. However, during the 1987-88 count period, the measured population increased beyond the 1985-86 levels (Bednarz and Hayden, 1988). The raptor population changes were attributed to changes in prey populations rather than to any direct influence of WIPP activities.

COOPERATIVE RESOURCE MANAGEMENT

Cooperative Resource Management at the WIPP involves interagency agreements between the DOE and its contractors, the BLM, various universities, and numerous public schools. This type of management approach accesses the expertise of a diversity of individuals who represent a multiplicity of interests, backgrounds, and technical skills, as well as providing an exceptional learning environment. Reclamation, range management, and raptor research are items of emphasis in the cooperative resource management design.

Calendar year 1992 targets the implementation of the first cooperative agreements between the BLM and Westinghouse Electric Corporation. This agreement outlines the establishment of an advisory board, which will serve as an oversight entity for proposed university research programs conducted in the WIPP vicinity, and provides moderate funding for work implemented outside the view of the proposed DOE land withdrawal. Employees of the WIPP, working in conjunction with their BLM counterparts, will be conducting plant and animal surveys, supervising graduate students, and surveying anthropogenic influences on the desert biome. Results from these activities will be used for future resource management strategies by all the agencies involved.